NIRANTAR SCIENCE & TECHNOLOGY

Class 7

Author
Dinesh Yadav
Language Editor
Suprima Pandey

Nirantar Prakashan
www. nirantarprakashan.com.np

Book : Nirantar Science & Technology Book -7
Authors : Dinesh Yadav
Language Editor: Suprima Pandey
Publisher : Nirantar Prakashan
Putalisadak, Kathmandu-29, Nepal
Copyright : © Nirantar Prakashan

Contact : www.nirantarprakashan.com.np
Email: nirantaredu@gmail.com
facebook page: nirantar prakashan
Tel. 01-4546384

First Edition : 2077

Third Edition : 2079 (New Curriculum)

Design : Nirantar Desktop
Putalisadak, Kathmandu

Price : Rs.493/-

Printed in Nepal.

नेपाल सरकार
शिक्षा, विज्ञान तथा प्रविधि मन्त्रालय
पाठ्यक्रम विकास केन्द्र
सानोठिमी, भक्तपुर
(मान्यता, समकक्षता तथा सूल्याङ्कन शाखा)

फोन नं. ६६३०४८८
६६३४११९
६६३००८८
फ्याक्स : ६६३०७९७
नोटिस बोर्ड: १६१८०१६६३०७९७

सानोठिमी, भक्तपुर
www.moecdc.gov.np

पत्र संख्या:- २०७८/०७९

चलानी नं.:-९६५४

मिति: २०७८/१२/१४

विषय : पाठ्यसामग्री स्वीकृति सम्बन्धमा ।

श्री निरन्तर प्रकाशन,
काठमाडौं ।

प्रस्तुत विषयमा त्यस प्रकाशनबाट मूल्याङ्कन र स्वीकृतिका लागि तोकिएको अवधिभित्र पेस हुन आएका तपसिलबमोजिमका पाठ्यसामग्री आवश्यक निर्णयार्थ पाठ्यसामग्री व्यवस्थापन तथा मूल्याङ्कन समितिमा पेस हुँदा विद्यालय शिक्षाको राष्ट्रिय पाठ्यक्रम प्रारूप २०७५, आधारभूत शिक्षा (कक्षा १-८) पाठ्यक्रम २०७७, पाठ्यसामग्री विकाससम्बन्धी विद्यमान प्रावधान, ऐन, कानुन, निर्देशिका, कार्यविधि, प्रकाशन शैलीका प्रावधान, पाठ्यक्रम विकास केन्द्रले विभिन्न समयमा जारी गरेका र पाठ्यसामग्री सुधार/परिमार्जन/पुनर्लेखनका लागि दिइएका सुझाव र निर्देशनको परिपालना गरी स्वीकृति दिन सिफारिस भएअनुसार यस कार्यालयको मिति २०७८।१२।१४ गतेको निर्णयानुसार तपसिलमा उल्लिखित निर्देशनको पूर्ण परिपालना गरी शैक्षिक वर्ष २०७९, २०८० र २०८१ गरी तीन शैक्षिक वर्षका लागि गुणस्तरीय एवम् त्रुटिरहित पाठ्यसामग्री विकास गरी प्रकाशन गर्न स्वीकृति प्रदान गरिएको छ । विद्यमान संवैधानिक व्यवस्था, ऐन, कानुन, निर्देशिका, कार्यविधि, पाठ्यक्रम विकास केन्द्रले विभिन्न समयमा जारी गरेका निर्देशनलगायतका प्रावधानहरूको पूर्ण परिपालना नगरी गुणस्तरहीन पाठ्यसामग्रीको विकास, प्रकाशन र बिक्री वितरण गरेको पाइएमा, पाठ्यक्रम परिवर्तन भएमा वा यस केन्द्रबाट अन्य निर्णय भएमा यो स्वीकृति जुनसुकै बेला रद्द हुने छ ।

तपसिल

(क)पाठ्यसामग्रीको नाम

१	Science and Technology	आधारभूत तह/ कक्षा ७

तारा पाण्डे तिवारी
पाठ्यक्रम अधिकृत

(ख) निर्देशन

१.पाठ्यसामग्री विकाससम्बन्धी विद्यमान प्रावधान तथा पाठ्यसामग्री सुधार र परिमार्जनका लागि यस अघि दिइएका निर्देशनको पूर्ण परिपालना गर्ने ।

२.पाठ्यक्रमको मूल मर्म र भावनाअनुरूप पाठ्यक्रमका सम्पूर्ण पक्ष एवम् विषयवस्तु समावेश गरी पाठ्यसामग्रीलाई गुणस्तरीय बनाउने ।

३.आवरण पृष्ठको अघिल्लो (Front) भागको बायाँ (Verso) पृष्ठमा नेपालको आधिकारिक नक्सा र आवरण पृष्ठको पछिल्लो (Back) भागको दायाँ (Recto) पृष्ठमा कोभिड १९ सङ्क्रमण रोकथामसम्बन्धी सूचना यस केन्द्रको वेबसाइटबाट डाउनलोड गरी समावेश गर्ने । विषयवस्तुको प्रकृति र आवश्यकताका आधारमा पाठ्यसामग्री भित्रका विषयवस्तु र पाठमा समावेश गरिने तथ्यांक तथा नक्सा आधिकारिक र प्रामाणिक हुनुपर्ने ।

४.स्वीकृति पत्र स्क्यान गरी पाठ्यसामग्रीको शीर्षक पृष्ठभन्दा पछि दायाँ (Recto) पृष्ठमा समावेश गर्ने । पाठ्यसामग्रीको प्रत्येक पृष्ठको पुच्छर (Footer) मा पाठ्यक्रम विकास केन्द्रबाट स्वीकृत भन्ने व्यहोरा उल्लेख गरी प्रकाशन गरेका पाठ्यसामग्रीका तीन प्रति यस केन्द्रमा पेस गरेपछि मात्र बिक्री वितरण गर्ने । शिक्षा, विज्ञान तथा प्रविधि मन्त्रालयको निर्णयअनुसारको मूल्य कायम गर्ने तथा मूल्य र मुद्रण प्रतिको सङ्ख्या सर्वाधिकार पृष्ठमा अनिवार्यरूपमा राख्नुपर्ने । प्रतिलिपि अधिकार (Copy right) को सम्बन्धमा लेखक र प्रकाशक स्वयम् जिम्मेवार हुने ।

५.राष्ट्र, राष्ट्रिय एकता, सार्वभौमिकता, भौगोलिक अखण्डता, स्वाधीनता, राष्ट्रिय हित, पहिचान, सम्मान र समृद्धिमा आँच आउने तथा विभिन्न जातजाति, भाषा, धर्म, संस्कृति, सामाजिक सहिष्णुता, सद्भाव, सांस्कृतिक मूल्यमान्यता, रहनसहन आदिमा प्रतिकूल प्रभाव पार्ने कुनै पनि विषयवस्तु, उदाहरण, चित्र, अभ्यास, सिकाइ क्रियाकलाप समावेश नगर्ने ।

६.जातजाति, भाषा, धर्म, संस्कृति, वर्ण, क्षेत्र, लैङ्गिकता, अपाङ्गता, पेसा, व्यवसाय, सामाजिक सांस्कृतिक अवस्थाका आधारमा भावनात्मक रूपमा चोट पुऱ्याउने, आक्षेप लाग्ने, हीन्याउने र विभेदीकरण गर्ने किसिमका विषयवस्तु, उदाहरण, चित्र, अभ्यास, सिकाइ क्रियाकलाप समावेश नगर्ने ।

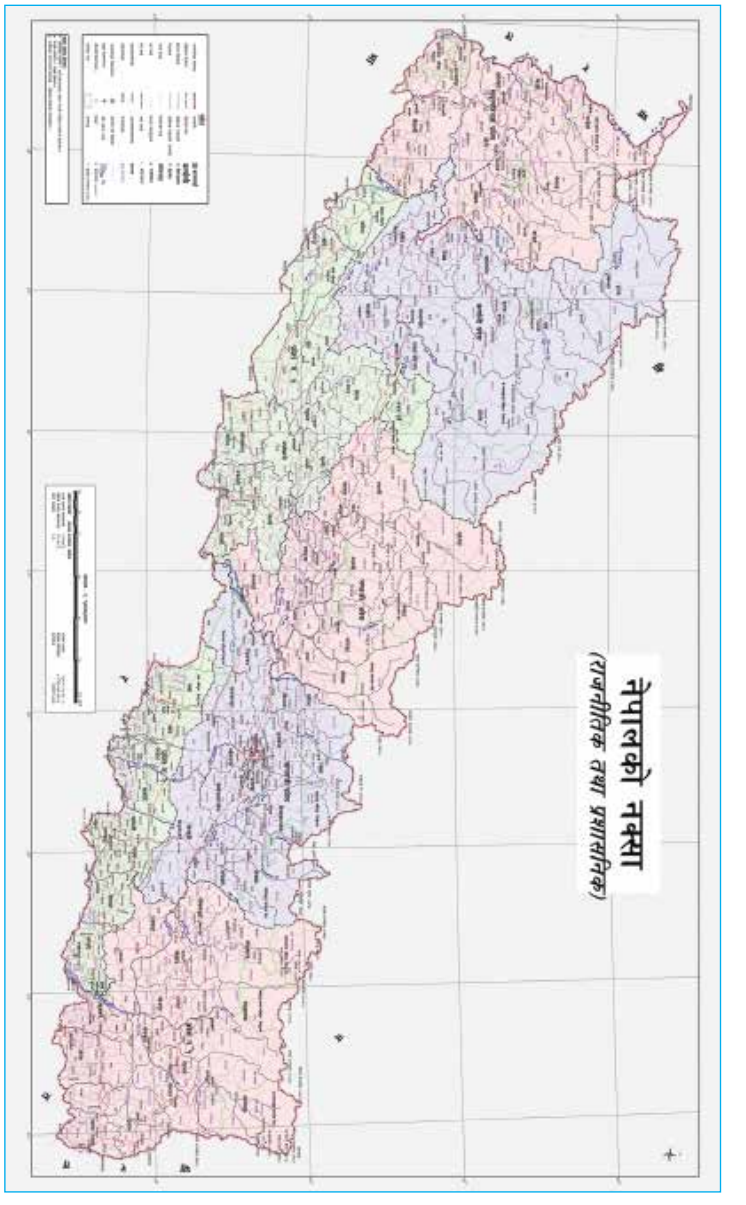
७.पाठ्यसामग्रीमा समावेश गरिएका चित्र, नक्सा, चिह्न, सङ्केत आदि शुद्ध, स्पष्ट र बोधगम्य हुनुपर्ने ।

८.विद्यार्थीलाई थप भार पर्ने गरी पाठ्यक्रममा समावेश नगरिएका विषयवस्तु, अभ्यास तथा सिकाइ क्रियाकलाप पाठ्यसामग्रीमा समावेश नगर्ने ।

९.पाठ्यक्रम एवम् दिइएका सुझाव र निर्देशनबमोजिम पूर्णरूप दिइएको त्रुटिरहित गुणस्तरीय पाठ्यसामग्री मात्र प्रकाशन र बिक्री वितरण गर्ने ।

पुनश्च : यो स्वीकृति शैक्षिक वर्ष २०७९, २०८० र २०८१ का लागि प्रदान गरिएकाले सोहीबमोजिम प्रकाशन, बिक्री वितरण र प्रयोग गर्नु गराउनहुन सम्बन्धित सरोकारवाला सबैमा अनुरोध छ ।

कोरोना भाइरस रोग
(कोभिड-१९)
हाल डिसेम्बरी चीनिरहेका नयाँ कोरोना भाइरसको संक्रमणबाट लागेको रोगलाई विश्व स्वास्थ्य संगठनले "कोभिड १९" को नाम दिएको छ र यसलाई विश्वव्यापी महामारीको रुपमा घोषणा गरिसकिएको छ ।
कोरोना भाइरस स्वासप्रश्वासको माध्यमबाट लाग्ने रोग हो । यो संक्रमित व्यक्तिले खोक्दा वा हाछ्युं गर्दा नाक वा मुखबाट निस्कने थिर्काको माध्यमबाट एक व्यक्तिबाट अर्को व्यक्तिमा सर्दछ ।
कोरोना भाइरस रोगको मुख्य लक्षणहरु
ज्वरो आउने
सोकि लाग्ने
स्वास फेर्न गाह्रो हुने
यस्ता लक्षणहरु देखा परेमा नजिकको तोकिएको स्वास्थ्य केन्द्रमा सम्पर्क गर्नु ।
यस रोगको संक्रमणको जोखिमबाट बच्नको लागि निम्न उपायहरु अपनाउनुपर्दछ ।
ज्वरो र खोकी लागेको व्यक्तिबाट टाढा रहने वा आफूलाई ज्वरो र खोकी लागेको छ भने पनि आफ व्यक्तिबाट टाढा रहने र मास्कको प्रयोग गर्ने ।
खोक्दा हाछ्युं गर्दा नाक मुख टिस्यु पेपर वा कुहिनाले छोप्ने र प्रयोग गरेको टिस्यु पेपरलाई फिको गाडने फोहर फाल्ने बाँडोमा फाल्ने र साबुन पानीले सिकिसिपि हात धुने वा अल्कोहल भएको स्यानिटाइजर प्रयोग गर्ने
भिडभाडमा नजाने र अत्यावश्यक परे मास्क लगाउने हात नियमितरुपमे साबुन पानीले धुने ।
हेरचाहगर्दा साबुन पानीले कम्तिमा २० सेकेण्ड सिकिसिपि हात धुने वा अल्कोहल भएको स्यानिटाइजर प्रयोग गर्ने
कोरोना प्रभावित देशबाट आएको व्यक्तिलाई नजिकका स्वास्थ्य संस्थामा रहेको स्वास्थ्य केन्द्रमा तुरुन्त जानुपर्दछ । घरैमा बसी परिवारका सदस्यबाट १४ दिन सम्म छुट्टै आईसोलेसनमा बस्नु पर्दछ ।
कोरोना भाइरस रोगका बारेमा थप जानकारीको लागि १११५ वा ९८५१२५५८३९, ९८५१२५५८३७, ९८५१२५५८३४ मा सम्पर्क गर्नु ।


नेपालको नक्सा
(राजनीतिक तथा प्रशासनिक)

PREFACE

Nirantar Science & Technology as a series I-X grade has been prepared strictly in a line to the recently upgraded syllabus and curricula issued by Curriculum Development Centre, Sanothimi, Bhaktapur, under the ministry of education, and the government of Nepal for the learners of basic level to secondary level with regard to educational framework 2063 B.S.

The series aims at providing both theoretical and practical cognitivity to the students of far and wide having some flair to science, scientific facts and processes with ample activities considering their needs, level, aptitude, intelligence and age factor by creating interest through proper selection and gradation of the subject matter to be taught and learnt. The entire desk of authors and editors claims that the series has come to adopt a thematic and activity centred approach, abundant illustrations and so on in order to make an understanding of science more effective and comprehensive.

The revised and updated version in your hand is solemnly dedicated to those scholars far and wide with a provision of richly sophisticated but only relevant pictures, diagrams, table, charts, fact files, reasons and logics, etc. as the soul of science. Apart from these, several other efforts have been put forward collectively in order to make the book more concise and student friendly so as to address the requirement of a perfect book to many students and teachers who like to culminate real practice in science in the days to come. Beside this, our another attempt through this presentation is to eradicate some misconceptions to science appeared in the growing mind of students especially in the classroom context by illuminating them in terms of these salient features incorporated within each book of the series.

Home Assignments/Worksheets: The revision exercises at the end of every chapter can be given as home assignments after teaching particular concepts.

Varieties of Questions: Objective type questions like, true or false, fill in the blanks, choose the correct answer, etc. are given in the exercises at the end of every chapter in this book, in order to fulfill the objectives of each lesson.

Activities : Numerous activities in the classroom can provide platform for active involvement of students in application of their theoretical knowledge and learning. Thus, interesting activities are given so as to arouse interest of the students in science.

Projects: Lots of activities in the book are dedicated to investigate research projects with information gathering and deducing. Some of these can be individual research projects and others assigned to group of students with an aim to make them more participatory.

Points to Remember: This section helps the students to understand the main points of each lesson.

Last, but not the least, our sincere thanks goes to **Nirantar Prakashan,** for their keen interest in publishing this series of books. We are also thankful to Mr. Shambhu Pd. Pokhrel (School Chairman), Mrs. Sujita Adhikari Pokhrel (Principal), Mr. Rudra Prashad Khanal (Vice Principal), Mr. Ram Shrestha (Science Teacher), Mr Badri Neupane (Science Teacher), Mr. Bishnu Bhattarai (English Teacher) at different institutions for their constructive suggestions and support.

Any constructive suggestions and recommendations for the betterment of this series will be highly acknowledged.

- Authors

Nirantar

Science & Technology

Class 7

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Unit 1 Scientific Learning

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- prepare a report on the experimental work in science.
- model construction of objects related to science and describe this process.

Look at the pictures and answer the questions below.

Fig. 1.1

i. What is depicted in the above pictures ?

ii. What kind of activities have you done in science class? What are those activities?

iii. Discuss with your friends the importance of modeling and report writing in scientific learning. Write the conclusion in the exercise book and show it to the teacher.

1.1 Introduction

In rainy season, we see lightning. We also hear sound of thunder. We might be curious to know about thunder and lightning. We ask question like,

What is lightning?

Why does lightning occur?

Why sound of thunder is heard after lightning?

What happens during lightning?

Fig. 1.2

Similarly, many other events happen around us? Let us consider another example.

We see different plants around us. We might be very familiar with these plants. Sometimes we notice unique characteristics about some plant which we had not known earlier. Then we want to know about such characteristics in detail. A lot of question arise in our mind. When you see a seed germinating, you might want to know about it. Then we ask some questions. Like,

What does a seed contain?

How does it germinate?

Which parts germinate first?

How do baby plants obtain food?

Fig. 1.3

The scientific learning skills start with a desire to know about unknown facts and events around us. The unknown events motivates us to know about such events by asking questions like what, why, when? The scientific learning process is an approach of finding the answers to any curiosity in a systematic and largest sequence.

The scientific learning process involves activities like asking questions, thinking about the event, reasons for its, finding solution to problems, etc. In scientific learning process, there is a sequence of act to be perfumed to know about an event. To obtain the correct information and to understand the event, scientific learning process is carried out following the given steps.

i. Ask a question related to problem
ii. Perform research about the problem
iii. Establish your hypothesis (Guess the probable answer/solution)
iv. Test your hypothesis by conducting an experiment
v. Make an observation
vi. Analyse the result and draw a conclusion
vii. Present the finding.

1.1.1Experimental Work in Science

Science Experiments are usually methodical procedures that are conducted to counter, support and justify the hypothesis. It illustrates the causes and effects through demonstration and detects the outcomes when a particular factors are employed.

Experiments may vary depending upon the scale and goals. But they are relevant depending upon the procedure and can rely on the logical analysis of the results.

General method of Experimental work

An experiment is a procedure carried out to support or refuse a hypothesis. Experiments provide insight into cause-and-effect by demonstrating what outcome occurs when a particular factor is manipulated. Experiments vary greatly in goal and scale but always rely on repeatable procedure and logical analysis of the results.

Experiments typically include controls, which are designed to minimize the effects of variables other than the single independent variable. This increases the reliability of the results, often through a comparison between control measurements and the other measurements. Scientific controls are a part of the scientific method. In the scientific method, an experiment is an empirical procedure that arbitrates competing models or hypotheses. Researchers also use experimentation to test existing theories or new hypotheses to support or disprove them.

An experiment usually tests a hypothesis, which is an expectation about how a particular process or phenomenon works.

Experiments are used to study causal relationships. You manipulate one or more independent variables and measure their effect on one or more dependent variables.

Experimental design means creating a set of procedures to systematically test a hypothesis. A good experimental design requires a strong understanding of the system you are studying.

There are five key steps in designing an experiment:

- Consider your **variables** and how they are related
- Write a specific, testable **hypothesis**
- Design experimental treatments to manipulate your **independent variable**
- Assign subjects to groups, either **between-subjects** or **within-subjects**
- Plan how you will measure your **dependent variable**

For valid conclusions, you also need to select a representative sample and control any extraneous variables that might influence your results.

Process of Experimental work

Observation is the process of closely and carefully watching someting to acquire information about it. It involves taking the note of informations.

Experiment is a scientific procedure taken to make discovery, test hypothesis or demonstrate a known fact.

Survey is the collection of information from a sample of population.

Project Work is a work focused on completing a tasking using all available means.

Model building is a preparation of model to give concept about the topic.

The practical work of science utilises the above mentioned methods of practical work according to the convenience and need of the problem. The practical importance of practical work can be highlighted as below:

i. Practical work helps in development of important skills required for research.
ii. It helps in improving understanding the problem and finding solution to it.
iii. It helps in discovering of new objects, rules or principles using the skills and constructive thinking.

Parts of the report on experimental work in science

Any time you have conducted a science experiment, you should write a lab report detailing why the experiment was performed, the results you expected, the process you used, the actual results, and a discussion of what the results mean. Lab reports often follow a very standard format starting with a title and purpose (an abstract and introduction), followed by a materials and methods section, the results and discussion, and finally a conclusion.

Title

To sum up your work in a single phrase or sentence. It needs to be clear, specific and brief; its meaning should be obvious to most readers.

- **Clear**: Technical terms and abbreviations should only be used if they will be familiar to the readers of your report.
- **Specific:** Give enough information to enable the reader to know if the research is likely to be of interest to their own fields.
- **Brief:** Avoid obvious phrases, like 'The role of', 'Studies of', 'An examination of", 'An investigation into', 'Research into', and 'An experiment on'. Titles with these words are often too long or not descriptive enough.

Purpose

To summarise the entire report for quick reading. It should include your reasons for doing the work, your methods, your findings, and your conclusions. It needs to be both interesting and easy to read.

- It is independent of the rest of the report - it is a mini-report, which needs to make sense completely on its own.
- References should not be included.
- Nothing should appear in the abstract that is not in the rest of the report.
- Usually between 200-300 words.
- Write in the past tense, in a single paragraph.

Hypothesis

To state the research problem, establish your hypothesis, provide justification and state the methods, results and conclusions.

- You must describe your research objectives clearly and simply. Explain and define your work and state why it is distinctive.
- Include a clear statement of your hypothesis, which states what you expect your experiment to reveal.
- If your work is not original, just give the current background information about the research/experiment problem. If it is original , you will need to provide a comprehensive literature review of work preceding or closely related to it to show the gap in the existing knowledge.
- Briefly describe how you intend to answer the problem and give your results. Detail is not needed here - leave that for the appropriate sections below.
- Write most of the introduction in the present tense, since you are describing a current problem and current conclusions. Details of methods and results given in the introduction should be in the past tense, and future implications based on the conclusions should be in the future tense.

list of required materials and method

Provide an extensive protocol for your experiment which can be repeated by others.

This is essentially an instruction manual, to enable reproduction of the work and should provide:

- details of the experimental design
- details of the controls used, including their purpose
- details of the data recording techniques
- exact quantities and purities of reagents
- technical specifications of the apparatus
- specific methods of the sample preparation
- accurate nomenclature
- precise details of any subjects/samples included in the study
- details of the sampling protocols

Pictures

Schematic, pictorial symbols in the design of scientific instruments and analysis of the perceptual and functional information that is being stored in those images have been areas of investigation in philosophy of scientific experimentation. Visual representations (i.e., photographs, diagrams, tables, charts, models) have been used in science over the years to enable scientists to interact with complex phenomena . We should use pictures in experimental work. Labelling drawings of materials required in any experimental

work should be made. Include an illustration, diagram, or science drawing with labels and descriptive captions.

Procedures:

The procedure is an established way of doing a practical. The Practical work should be done preforming different works in a sequence.

Results

To present your data in a manner that is easy to read and interpret.

- This is where the core of the work is presented – your experimental data. Clarity is essential since the rest of your report hinges on what you present here.
- The results section should be kept brief and repetition of methods or results should be avoided. Relationships between your data should be described in the text of your results section.
- Never discuss the implications of your results in the results section – save this for the discussion.
- Your results section may have subheadings which complement the headings in your materials and methods section.
- Don't be tempted to exclude results that don't fit.
- Do not present all your raw data – a pre-digested representative sample is usually adequate.
- Make sure tables, graphs and figures are numbered and labelled.

Conclusions

This summarizes the experiment and what your results told you about the problem the experiment addressed. Summarize the problem the experiment addressed and the researched questions which framed the analysis. Next, explain what the experiment shows your problem. Finally, briefly describe any pitfalls or challenges that occurred during the process and suggestions for further experiment or research.

- Be sure to link back to the introduction and whether or not the experiment addressed the goals of your analysis.

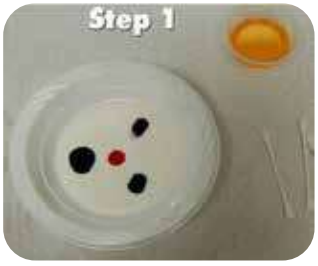
To discuss the relationships between your results and how they relate to your initial objectives and hypotheses. You should also describe the shortcomings and implications of your work. You should provide major conclusions, supported with evidence, and suggest future applications of your research findings.

- Do not recapitulate your results.
- Discuss how your results are similar to or different from published findings and attempt to explain the differences.
- If you cannot find a good explanation for your results, admit it. It is better to admit uncertainty, rather than make up poor excuses.

- State your conclusions and build on them with evidence from literature - making sure you are clear which findings belong to you.
- Discuss the significance of your findings and any future implications.
- Write in the present tense most of the time. When discussing your data, write in the past tense and when discussing future implications write in the future tense.

Activity 1.1

Pour the milk into the bowl. Be careful not to move the bowl, you want the milk as still as possible. Put one drop of each color in different places in the milk. Put just a tiny amount of soap on the end of the cotton swab, then touch it to one of the colors. WOW! Let the experimenting begin! To clean up, just pour the milk down the drain. (Do not drink it). Prepare a report on this experiment.



Activity 1.2

Report writing

1. How to Separate Salt from Water. Prepare a report on this experiment.
2. Place a few beans in a glass jar full of wet cotton. They will sprout within a few days, providing you with the material for some interesting botanic experiments: Can you make the sprouts grow faster if you place them in the sunlight? How about electric light? What if you keep one in the shadows, and what if you mash a vitamin tablet and add it to the water? You can use a ruler and keep a journal of the growth of the sprouts under different conditions. Prepare a report on this experiment.
3. You can create some beautiful patterns just by placing a magnet on a white sheet of paper and sprinkling some iron filings around it. The fillings will trace the invisible lines made by the magnetic fields, and you can use this to compare the power and the characteristics of different magnets. You can repeat this experiment using several magnets close to each other in order to see the interaction of their fields, but you will have to tape them to the table or they will simply stick to each other. Prepare a report on this experiment.

The practical work is also done to verify the facts studied. We study many principles and theories in our book. The practical work is done in laboratory at school to develop

skill, understand theory and test the principles. The practical work can be done inside or outside the laboratory. Some practical works that can be done inside or outside the laboratory are as mentioned below:

Practical Works performed inside laboratory

i. Studying the model of human heart.

ii. Verifying the laws of friction.

iii. Studying the cell using microscope.

iv. Verifying the law of floatation

vi. Identifying acid and base using indicator.

Practical work performed outside laboratory

i. Observation of parts of the plants

ii. Surveying about the solid waste management in your community

iii. Collecting the samples of different types of rocks and studying its properties.

iv. Preparing the model of structure of atom.

Precaution/Safety during practical work

We must be careful while performing practical work. In laboratory, there are different types of apparatus. They may break easily. Care must be taken while handling such apparatus. The apparatus made up of glass, porcelain and other brittle substances must be handled with care. There are many chemicals in laboratory. Some of these chemicals are corrosive and extremely harmful to us. The precaution adopted in laboratory saves us from danger of accidents. The precaution helps to minimize the risk of accident. The following precaution should be applied in laboratory.

i. The instruction given by teacher should be strictly followed.
ii. A proper appron should worn before entering into laboratory. Food stuff should not be taken inside laboratory.
iii. The unknown chemicals should not be smelled, touched or tasted.
iv. The brittle substances and other laboratory apparatus should be used with care.
v. The gas and burner should be put off after use.
vi. Know the location of water tap, fire extinguisher, emergency door etc and learn to use them.

Report Writing

A report is a document that contains actual description of the experiment. A report is prepared after the experiment. A report contains the objective of experiment, apparatus required, procedure, result and conclusion.

Need of Report

It is necessary to write a report because of the following reasons.

i. To explain and demonstrate the activities performed during experiment.

ii. To present the data and facts obtained from experiment in clear and comprehensive way.

iii. To compare the result of the experiment with the objectives, facts or to verify the principle and rules.

iv. To keep record of the challenges faced during the experiment.

v. To keep the record of the conclusion obtained from experiment.

This method can also be used in experimental report

a. Topic

A topic is a subject or issue about the practical work. It is the first part of the report. It gives information about the what practical work has been done.

b. Objective

Practical work is carried out to meet a certain objective. The practical work report must contain the objective for performing the practical work.

c. Materials required

The materials required to carry out practical work must be mentioned in a report. It helps other investigators to replicate such experiment.

The practical work may be carried out in several steps. The report must contain clear and well labelled diagram of the experimental setup of each step. It should show how data were obtained while performing the experiment.

d. Procedure:

It is an established way of doing a practical. The practical work should be done performing different works in a sequence. The steps followed while performing the practical should be numbered.

e. Observation:

The observation is careful monitoring of experimental setup. It helps in obtaining the data, and finds the result.

f. Analysis:

Analysis is a detailed examination of the data obtained from observation. Analysis of the data help in obtaining the result.

g. Calculation:

Calculation is using the data for mathematical operation. All practical may not contain calculation.

h. Result

The result is finding of the practical work. It helps in determining whether or not the practical work has achieved the objective.

i. Conclusion

Conclusion is inference drawn from the result. The conclusion is written towards the end of report.

j. Precaution

The precaution is written at the end of the report. It should contain ways of minimizing the risk and errors in practical work.

Experimental Project Work

An experimental project work is a series of activities carried out in step-by-step way using scientific methods to fin a answer about how something works or how things are related. It is the most widely used project work. It is also called investigative project work. It helps in drawing a conclusion by whether or not your hypothesis is correct.

Demonstration Project Work

This project work is carried out to re-test the facts and principles which has been already tested. The ideas necessary for the demonstration project is collected from practical books, journals or internet. The model prepared for the project work is demonstrated in science exhibition or classroom. It is used to remove suspicion and convert the concept into reality.

For Example : Showing that the increase in number of cells in series combination increases the brightness of the bulb.

Collection Project Work

It is project work carried out to clarify the concept about any fact or principle by using the collection of different types of materials. The materials collected over the different period of time gives us idea about the possible facts or incident.

For example: Observation of the phases of moon continuously for a fortnight and taking its picture. When the picture taken over different time are presented at once, it shows how the phases of moon changes.

Research Project Work

The research project work is carried out to discover new facts using the previously well established facts or principles. It is carried out by scientists or student studying at higher level. It needs an ample of knowledge about the work related to research project. It is a long term project.

For example: Research carried out to test the possibility of making artificial sun.

Experiment

An experiment is a scientific test done in laboratory. It is carried out following a procedure under the controlled condition and careful observation. It is necessary to be

prepared before doing experiment in laboratory. The objective of experiment, materials required, procedure and precaution should be known prior to experiment.

For example: to carry out experiment to see the cell in onion, we must follow the following steps:

a. Arrangement of Materials Required

We should arrangea thin onion membrane, glass slides, cover slips, needle, blotting paper, dropper, iodine solution, water as well as microscope prepare for to experiment.

b. Selection of Procedure

i. Add a drop of water at the center of the microscope slide.
ii. Lay a thin layer of onion layer on the slide.
iii. Add a drop of iodine solution on the onion membrane.
iv. Gently lay a cover slip over the membrane and press it down using needles to remove air bubbles.
v. Touch the blotting paper on the sides of slide to drain excess water/iodine.
vi. Place the slide on the microscope under the low power to observe.
vii. Adjust the focus for clarity to observe.
These steps should be followed strictly.

c. Precautions Applied during Experiment

i. The specimen should be well stained.
ii. Coverslip should be layed gently to avoid air bubbles.
iii. Too much pressure should not be applied to coverslip.

d. Observation should be noted

i. Large, rectangular interlocking cells
ii. Clearly visible distinct cell walls surrounding the cells.
iii. Dark stained nucleus.
iv. Large vacuole at the center.

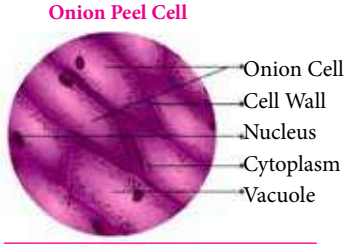


Fig. 1.4

e. Calculation should be done

In this experiment, calculation is not necessary. Observation is sufficient to find the result. However, in many experiments data obtained must be used for calculation to get result.

f. Result

From the above observation, it can be seen that plant cell (onion cells) are rectangular and contains a large vacuole. So, the result can be written as onion cells are rectangular and contain large cacuole.

The details and result of the experiment must be noted. The details noted during the experiment should be presented in a sequence. This sequential presentation

of the details of experiment is called report. The report is written to record and convey the information to the reader.

The students should prepare the report of all experimental work carried out within a year. A separate record file or practical cop should be maintained for record keeping. The report should be written in similar structure for uniformity.

1.2 Models in Scientific Learning

People often use models in their everyday lives. Maps are models of roads and locations. A globe is a model of Earth. Model cars, airplanes, and trains are tiny replicas of vehicles. All models are representations of something else—an idea, an object, an event, a process, a system—and act as substitutes for the real things. Models are used routinely in science classes to help explain scientific concepts. Modeling requires the user to make links between the model and the reality that is being modelled. This activity includes the assessment of the model itself and an evaluation of how the model maps to the scientific concepts represented. Models are useful tools in learning science which can be used to improve explanations, generate discussion, make predictions, provide visual representations of abstract concepts and generate mental models .

Models are a mentally visual way of linking theory with experiment, and they guide research by being simplified representations of an imagined reality that enable predictions to be developed and tested by experiment.

What Makes a Good Scientific Model?

A good model is:

- based on reliable observations.
- able to explain the characteristics of the observations used to formulate it.
- predictive.
- able to explain phenomena that were not used to develop the model.
- able to be refined when new, credible, conflicting observations arise.
- limited and simplifies a concept, theory, or object.
- physical (2-dimensional or 3-dimensional) or
- mathematical **(includes a single formula or many formulae) or**
- conceptual **(digital or print).**
- a computer or physical simulation of a natural phenomenon.

1.2.1 Model construction procedure

Model: A model is a thrice dimensional representation of thing or a structure. It is usually smaller in a size than the original structure. However, it may be larger for very small objects. It is a copy of the original structure prepared for enhancing the understanding about the subject. For example, a globe is a model of the earth.

Have you seen a globe? a globe is a three dimensional model of the earth. The globe is manufactured to represent the earth. We can study about the earth using the globe. We can easily know about the shape of the earth and location to sea, continents, oceans and countries from globe. We can know that the earth is tilted in its axis and it rotates around it. The globe makes it easier to study about the earth.

Fig. 1.5

A similar model of our solar system can be made using small balls, wool, glue and a card board.

Take a scissors and cut the different coloured papers to make fruits as shown in the figure. Paste them on a chart paper. It is called a collage. A collage is a piece of art made by sticking picture of different materials such as photographs, fabrics and pieces of papers on a surface.

Fig. 1.6

We can prepare collage about the parts of plants, ecosystem, solar system, structure of atoms, thermometer, phases of the moon, eclipse etc.

Model Construction Process

It is a process of constructing the model of different types of objects using the things available around us. We construct the model to study about the objects. It makes the study of facts and principles of science easier to understand. It also helps in visualizing the subject and memorising the fact for long time. So, model construction is an important part of scientific learning.

Some reasons for constructing models are as follows:

i. Model helps in demonstrating the different parts of a machine or organs of our body.
ii. It helps in explaining the position and working of the different facts of the body or a machine.
iii. It helps in explaining the different scientific principles.

Model Construction

Topic: Prepare the model of animal cell.

Objective: To demonstrate the different parts of cell contained in animal cell.

Materials required:

- Cardboard
- Scissors
- Chart paper
- Glue, wool, paints
- styrofoam balls

Procedure

1. Collect the materials required.
2. On a chart paper, draw the outline of animal cell. Draw a nucleus and other cell organelles inside the outline.
3. Measure the outline of the cell membrane. Cut a wool of length equal to the length of outline.
4. Apply the glue on wool and stick the wool over the outline.
5. Paint the inner inside the wool with light blue colour.
6. Again measure the outline of nucleus. Paste a different colour wool over the outline.
7. Paint the inner part of nucleus with brown colour and outer part with blue colour.
8. New take styrofoam balls and stick to different parts of the cytoplasm.
9. Label the parts of the cell represented by wool, styrofoam balls and painted colours.

Observation

i. Observe the structure of cell.
ii. Observe the different parts of the cell.

Conclusion :

From the model prepared, it can be seen that animal cell is oval in shape. It is surrounded by cell membrane. Inside cell membrane, it contains cytoplasm and nucleus. It contain parts like mitochondria which are rod shaped, small empty spaces called vacuoles, and golgi bodies.

a. Make your own lung model

MATERIALS TO COLLECT

- Clear plastic drink bottle (A Gatorade bottle is a good size)
- Two balloons
- Tape (masking tape or duct tape)
- Scissors

Procedure :

i. Measure an inch or two from the bottom of t off carefully.

ii. Take one balloon and put it inside the bottle. Then fold the bottom of the balloon around the rim of the bottle so the balloon hangs from the top. Wrap tape around the top if the balloon doesn't seem to snug around the bottle opening. You don't want any air escaping, so make sure it is nice and tight!

Fig. 1.7

iii. Tie a knot at the end of the remaining balloon and cut the large part of the balloon in half horizontally.

iv. Using the balloon half with the knot, stretch the open end over the bottom of the bottle. Again, this should be a tight fit. Use tape to secure if necessary.

v. Gently pull down on the balloon from the knot. This should cause air to flow into the balloons within your lung model.

vi. Release the balloon with the knot and watch as the air is expelled from your lung model.

b. Make a Pulley

Materials to collect

- Medium size plastic bottle
- Bamboo Stick
- DIY Knife
- Cardboard
- Rubber Tube
- String
- Scissor
- Cutting mat.

Procedure :

i. First of all take a plastic bottle and cut it into two half using diy knife and scissor.

ii. Top part of plastic bottle is our bucket. With the help of compass needle make two holes where we tie string.

iii. Base part of plastic bottle is our main body. Make two small holes according to size of bamboo stick.

iv. This bamboo stick is our axle and wheel is made with cardboard and rubber.

v. Now pass this wheel and axle inside plastic bottle and attach the bucket we have made earlier as in video. vi.After it is time to add water. So that it seems a well. Finally when we pull one end of string we can take water out from small bucket.

c. Make a Plant Cell Model

Materials to collect

- Large, empty shoebox
- Green paint
- Pink self-hardening clay: light and dark
- Pink plastic wrap
- Pale yellow or clear cellophane or plastic wrap
- Blue wire-edged ribbon
- Scissors
- Glue

- Purple seed beads
- Blue self-hardening clay
- Purple wire-edged ribbon
- Pink Swedish fish candies
- Green sour gummy candies
- Pink marbles
- Orange marbles
- Orange seed beads
- Green plastic wrap

Procedure :

i. Paint a large, empty shoebox green, inside and out. Let the paint dry overnight. This is the cell wall. Plant cells have a stiff, hard cell wall. Inside the box place pale yellow or clear cellophane, crumpled up. The cellophane represents the cytoplasm, which houses the organelles.

ii. Roll a piece of dark pink, self-hardening clay into a ball, about the size of your palm. Cut the ball in half, and glue one half into the center of your shoebox, with the rounded side down.

iii. Roll a ball of light pink clay about the size of a ping-pong ball. Cut this ball in half and press one half, flat side down, onto the flat side of your dark pink ball. The dark pink ball is the nucleus and the light one is the nucleolus. The nucleus is the cell brain and the nucleolus---inside the nucleus---is where DNA is converted to RNA.

iv. Wrap the underside of the nucleus in pink plastic wrap. This represents the nuclear membrane that helps the nucleus hold its shape. Since the top of the model is a cross-section, you do not need to show the membrane on top of the nucleus. Glue the nucleus to the bottom center of the box.

v. Mold a large, semi-square blob of blue self-hardening clay. Place it above the nucleus; it should fill the top half of the box, almost completely. This is a large vacuole. They store water which helps plant cells keep their shape.

vi. Cut two 10-inch lengths of blue wire-edged ribbon. Spread one out and smear it with glue. Sprinkle purple seed beads into the glue, and let the ribbon dry for 10 minutes. Fold both ribbons into accordions and glue them into your box, against the right side of the nucleus. The ribbons are rough and smooth endoplasmic reticulum (ER). Rough ER forms proteins and smooth ER forms lipids.

vii. Fold up a 10-inch length of purple, wire-edge ribbon. Glue it into the box, near the bottom. This is a Golgi body. Golgi bodies export proteins and carbohydrates from the cell.

viii. Glue pink Swedish fish candies, green sour gummy candies, pink marbles and purple seed beads over the bottom of the box, randomly. These are mitochondria, chloroplasts, amyloplasts (also called leucoplasts) and ribosomes, respectively. Mitochondria create energy, chloroplasts store green chlorophyll, amyloplasts form starch and ribosomes synthesize protein.

ix. Smear orange marbles with glue and roll them in orange seed beads. Glue a few of these beaded marbles into the box, near the nucleus. These marbles are centrosomes. They help the cells divide.

x. Line the inside of the edges of the box with green plastic wrap. Glue the plastic wrap into place loosely, so it crumples slightly. This represents the cell membrane. The cell membrane contains the organelles and innards of the cell.

xi. To help others understand your model, create a key to identify each part of your plant cell project. Glue a small piece of each element of the model onto a separate paper or poster. Neatly label to identify the plant cell model part represented by each sample

d. Make a Periscope

Materials

- 2 Circular mirrors
- two 12" sections of PVC pipe, one with a diameter slightly larger than the other so that they can slide up and down when fitted together
- 2 PVC elbow joints: one to fit the smaller pipe, one to fit the larger pipe
- Putty

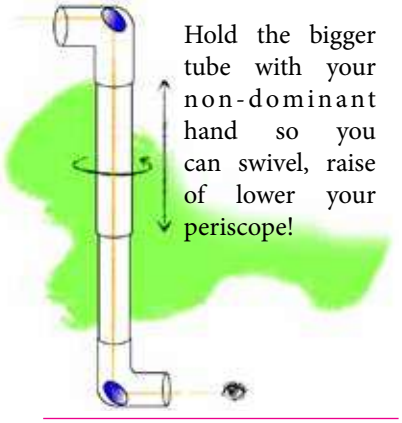


Fig. 1.8

Procedure:

i. Use the putty to stick the back of the mirrors to the inside of the PVC elbows at a 45° angle. *Why is this angle the best? What would happen if the angle was larger or smaller?*

ii. Attach the elbows to the pipe of the same size.

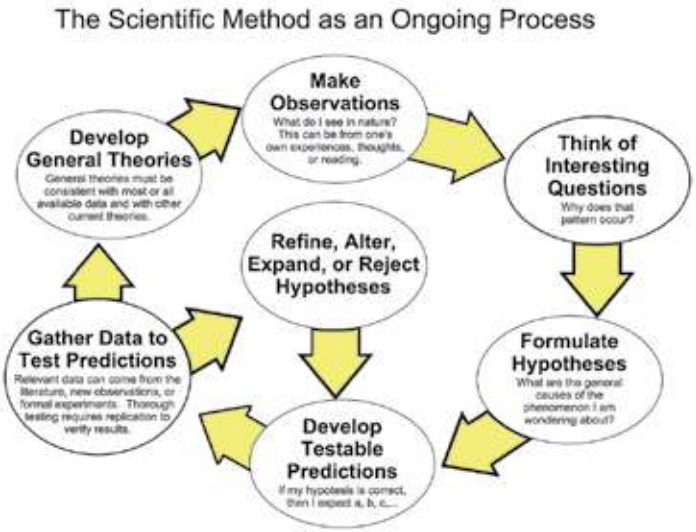
iii. Slide the larger pipe over the smaller pipe.

iv. Decorate! You can paint camouflage patterns to help you stay hidden.

v. Look through the elbow eye piece on the smaller pipe and explore! You can slide the larger pipe up and down to extend the periscope's length.

Points to Remember

- Experiments provide insight into cause-and-effect by demonstrating what outcome occurs when a particular factor is manipulated. Experiments vary greatly in goal and scale but always rely on repeatable procedure and logical analysis of the results.
- Experiments are used to study causal relationships. You manipulate one or more independent variables and measure their effect on one or more dependent variables.
- Experimental design means creating a set of procedures to systematically test a hypothesis. A good experimental design requires a strong understanding of the system you are studying.
- Visual representations (i.e., photographs, diagrams, tables, charts, models) have been used in science over the years to enable scientists to interact with complex phenomena . We should use pictures in experimental work. Labelling drawings of materials required in any experimental work should be made. Include an illustration, diagram, or science drawing with labels and descriptive captions.
- Summarize the problem the experiment addressed and the researched questions which framed the analysis. Next, explain what the experiment shows your problem. Finally, briefly describe any pitfalls or challenges that occurred during the process and suggestions for further research.
- To sum up your work in a single phrase or sentence. It needs to be clear, specific and brief; its meaning should be obvious to most readers.
- If you cannot find a good explanation for your results, admit it. It is better to admit uncertainty, rather than make up poor excuses.



Project Works

i. Make a model of the lung and present it in the classroom.
ii. Make a model of the animal and plant cell and present it in the classroom.
iii. Prepare a report in the prescribed format (title, purpose, prediction, required material, method, and conclusion) for the process of separating the components of the mixture by distillation and present it to the class.

A. Choose the best answer from the given alternatives.

i. Science Experiments are usually methodical procedures that are conducted to counter, support and justify the.....

a. hypothesis b. analysis
c. procedure d. conclusion

ii. Experiments may vary depending upon the .....and goals.

a. measurement b. individual
c. scale d. fact

iii. Experiments provide insight into cause-and-effect by .....what outcome occurs when a particular factor is manipulated.

a. demonstrating b. obseving
c. manipulating c. none of above

iv. Experiments vary greatly in goal and scale but always rely on repeatable procedure and logical analysis of the results.

a. method b. procedure
c. observe d. insight

v. A good experimental design requires a strong .....of the system you are studying.

a. understanding b. studying
c. manipulating d. none of above

vi. Photographs, diagrams, tables, charts, models etc. are..... representations

a. practical b. visual
c. observation d. experimental

vii. To sum up your .....work in a single phrase or sentence.

a. experiment b. study
c. observation d. none of above

viii. Models are a mentally visual way of linking ..... with experiment

a. study b. theory
c. observation d. research

B. Fill in the blanks with suitable words.

[Model, process, topic, globe, accident]

a. ..... is the first part of the report.

b. Precaution protects us from possible .....

c. ..... is replica of original.

d. Procedure is the ..... of doing experiment.

e. ..... model of the earth.

C. Write "T" for true and false " F" statements.

i. We should not use pictures in experimental work. ☐

ii. Include an illustration, diagram, or science drawing with labels and descriptive captions. ☐

iii. Your results section may have subheadings which complement the headings in your materials and methods section. ☐

iv. To present your data in a manner that is easy to read and interpret. ☐

v. If you cannot find a good explanation for your results, admit it ☐

D. Write differences between :

i. Scientific learning and experimental learning

ii. Experimental work and model making

iii. Project work and practical work

iv. Experimental work done inside laboratory and practical work done outside laboratory.

E. Answer these questions :

i. What is experimental work in science ?

ii. What do you mean by parts of experimental work in science .

iii. What is the definition of report writing?

iv. How do you write a science report?

v. What is model? Explain the significance of models in science.

vi. Write the important parts of report.

vii. A research report should be written in a fixed structure , Why ?

F. Diagrammatic questions

i. What model is shown in adjoining figure? You can make a similar model and write the names of the different parts.

ii. What model is shown in adjoining figure? You can make a similar model and write the names of the different parts. Identify the parts below the model and write the name.

iii. What model is shown below? You can make a similar model and write the names of the different parts.

Unit 2 Information and Communication Technology (ICT)

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- introduce and give examples of information and communication technology tools
- Introduce and use the Internet, email, and browser.
- do simple calculations and build graphs and charts in spreadsheet software.
- prepare a presentation with photos and text
- explain computer viruses, their diagnosis, and security measures.
- introduce the type of software
- explain and follow the Code of Conduct for Computer use.

2.1 Introduction to ICT

Technology is defined as the application of scientific knowledge for particular purpose. It refers to the knowledge and utilization of all kinds of tools, techniques, system, etc. in solving problems and making life easier. It holds a major significance in the life of every human as it helps them to adapt to the never changing environment.

You can find the answer of following questions:

a. How do you go from one place to another? (Surkhet to Kathmandu)
b. How could you make those big bridges?
c. How would you communicate with people from one place to another long distance?

All the above questions make one thing sure; life would be difficult without technology. It helps you in every situation. In fact, technology has given us the power to support our rapidly growing needs to survive. Life hasbeen easier and better with the use of technology.

Technology is a gift to mankind. Today every people use technology to perform every task. TV, Radio, Computer, Network, Internet, Aeroplane, Bus, Crain, Train, Fan, Mobile, Telephone, calculator, CT-scan machine, Video scan machine, Refrigerator, Oven, Printer, speaker, scanner, camera, vacuum cleaner and so on are the examples of technological devices or tools which make work easier, faster and accurate.

Multimedia Projector

A multimedia projector is an output device, high resolution, and full-color projector capable of presenting text, images, video content. Typically the projector will feature inputs for a computer, DVD player, VCR, CD player and storage device.

Fig. 2.1

Scanner

Scanner is also an input device where the user can take the images of the texts or photographs from the source. The image can be saved on to the disks for further processing. Basically, a scanner performs the following three functions. They are:

Fig. 2.2

Scan: It captures image and sends it to the printer to get a hard copy at the same application.

Copy: It scans the image and sends it to the printer to get a hard copy at the same time.

E-Mail: It scans the image and delivers it directly to the e-mail editor.

Digital Camera

Digital camera is used to captures video or still photographs both digitally by recording images on a light sensitive sensor. It has a feature to display an image and videos on the camera screen soon after it is recorded. It store thousands of images on a single small memory device and have the ability to record video with sound. Finally the image and videos can then be transferred to the computer with the help of data cable.

Fig. 2.3

e-Book

e-Book stands for electronic book. An ebook is a book presented in a format that allows you to read it on an electronic device like a computer or handheld device. Several books that are available in printed versions can be found as ebooks. EBook is a book publication made available in digital form, consisting of text, images, or both, readable on the flat-panel display of computers or other electronic devices.

Fig. 2.4

Video Tutorials

Video tutorials offer a multidimensional experience that may combine charts, slides, photos, graphics, narration, screenshots, on-screen captions, music and live video. This allows students with different learning abilities to retain information in a method more suited to them.

Digital Resources

Digital Resources can be defined as materials that have been conceived and created digitally or by converting analogue materials to a digital format. Digital resources are occupying an important part of world literature. They refer to information sources in electronic form. The different types of resources are electronic books, electronic magazines, databases and webpage, website, etc.

Web

The World Wide Web—commonly referred to as WWW, W3, or the Web—is an interconnected system of public webpages accessible through the internet. The Web is not the same as the Internet: the Web is one of many applications built on top of the Internet. WWW stands for World Wide Web. It is service of internet that supports special formatted documents. It is huge collection of hypertext document. It contains millions of files stored on the computers all over the world.

Web Browser

Fig. 2.5

A web Browser is special type of software that is used to access web page on the internet. A web browser lets you visit websites and do activities within them like login, view multimedia, link from one site to another, visit one page from another, print, send and receive email, among many other activities. The most common web browser software available on the market are: Microsoft internet explorer, Google's chrome, Mozilla Firefox, Rockmelt, maxthon, appe's safari, and opera. Brower availability depends on the operating system your computer is sing (for example Microsoft windows, Linux, Mac OS etc).

Search Engines

A search engines is a special types of a program that searches for all types of document on the web sites. It also searches files, document, audio, video and games and software on the internet. There are many types of search engines they are: www.yahoo.com, www.google.com, www.altavisita.com, www.lycos.com, www.msn.com, etc. instead of typing to guess where certain information may be located on the web site, search engines allow you to search both the web.

Search Engine window for a www.google.com

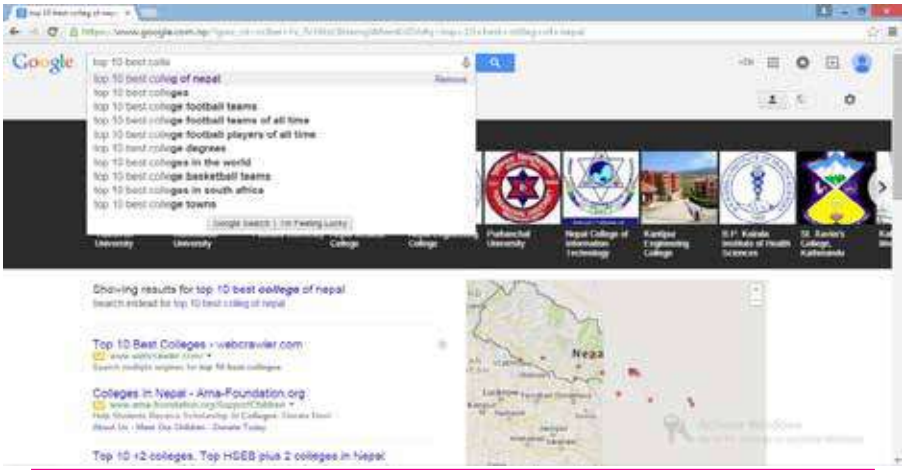


Fig. 2.6

Exploring the different websites

After knowing information about the internet, now you can open any website and get the required information from the website.
Opening a website require internet connection in your computer.

Step to open any website:

1. Open any web browser installed on your computer example internet explorer, Google chrome, Mozilla Firefox etc.
2. Type the website name on the address bar.
3. Click on go or press enter key.

Some popular websites are:

1. www.yahoo.com
2. www.google.com
3. www.psc.gov.np
4. www.tsc.gov.np
5. www.khullakitab.com
6. www.youtube.com
7. www.wikipedia.com

E-Mail

E-mail is a short form of electronic mail. It is a special or most popular service of internet. E-mail or email is text message that may contain files, images, or other attachments sent through a internet to a specified person or group of persons one place to another place of the world or anywhere. The first e-mail was sent by Ray Tomlinson in 1971. You also need E-mail account by which you can email anyone else who has an email address. Example of, E-mail ID is amritsagar@yahoo.com. Some e-mail service provider web sites are www.yahoo.com, www.gmail.com, www.hotmail.com etc.

Advantages of E-Mail

- The cost of sending an electronic message is very less.
- The message are sent and received instantly.
- E-mail allows you to be in touch with your relatives who are staying far away.
- Easy to read, print, forward, replay or delete the received message.
- It is more reliable than other means.

Disadvantages of E-Mail

- E – Mail is being the main route of virus transfer.
- The lightest error in the e – mail address or a failure in one of the links between the sender and receiver is enough to prevent a delivery.
- The recipient many not read the mail on time.
- E – Mail is depends on the electrically and telephone system so, failure of any one of them can prevent the user from sending or receiving e – mail.

E –Mail Address

E-mail address is like your name and postal address. It identifies you uniquely on the internet. An email address is issued by an internet service provider (ISP). They are always separated into two parts by the @ symbol. The first part of the email address usually identifies you in some way. You might have your real name for the first part of your email address, or you could use a handle or a nickname that your friends and family will recognize. For example of email address is bhandaridil@gmail.com.

Create Yahoo E-Mail Account

First connect your computer to internet and create an e-mail account for yourself with the following steps:

- First open any web browser like Mozilla Firefox.
- Type www.yahoo.com in the address bar and press ENTER Key by keyboard.
- The home page of www.yahoo.com will come on the screen.
- Click on mail.
- Click on create new account. Sign UP to open account information form.
- Fill of the registration form that appears on the screen.
- Click on create account.
- Flow the given instruction.

Send E-mail (Composes)

- First open any web browser like internet explorer or Mozilla Firefox.
- Type www.yahoo.com in the address bar and press **ENTER** Key by keyboard.
- The home page of www.yahoo.com will come on the screen.
- Click on sign up option or login option.
- Type your email address and password.

- Click on sign in option.
- Your email account is open.
- Click on compose mail.
- Than blank form appears.
- In the TO line, type the email address of a person you want to send your message. In the case you want to send the same message to a number of persons, type their email address in the Cc, Bcc.
- Type subject to the subject box.
- Attach the file you want to send any document and write a message in message box. Click on send option.

Component of compose E-mail

To : The recipient of the message

Cc : (Carbon Copy) the address of people is seen by all recipients who are mailed the copies of the message.

Bcc : (Blind Carbon Copy) the address of people isn't revealed to recipients who are mailed the copies of the message.

Subject : The subjects display the contents of the message.

Attach : Upload the file and information or document what you want to send

The Ten Commandments of Computer Ethics

The United States Institute of computer ethics has come out with Ten Commandments of computer ethics. In the computer ethics consider the effective use of information technology. The Ten Commandments of computer ethics are:

- You shall not use a computer to harm other people.
- You shall not snoop around in other people's computers files.
- You shall not interface with other people's computer work.
- You shall not use a computer to steal.
- You shall not use a computer to bear false witness.
- You shall not copy or use proprietary software for which you not paid.
- You shall not use other people's computer resources without permission or authorization or proper compensation.
- You shall not appropriate other people's intellectual output.

- You shall think about the social consequences of the program you are writing or the system you are designing.
- You shall always use a computer in ways that ensure consideration and respect for your fellow humans.

Introduction to Computer Virus

Computer virus is an illegal self-replicating small program which is designed to damage and destroy data, application programs and even the operating system and some hardware. There are many types computer virus some are harmful and some are not harmful. Some popular harmful computer viruses are Boot sector virus, File infector or parasitic virus, multipartite virus, Macro virus (Document infector virus), Script virus etc.

Purpose of creating virus

Computer programmers create viruses for many purposes. Some purposes are listed below:

- To prevent software piracy.
- To steal data and information.
- To destroy data, and information.
- To earn money.
- To show the ability of programming.
- To entertain the users by displaying interesting messages, picture etc.

Various symptoms / distractive activities of computer virus

You can see the following symptoms when the viruses infect the computer system.

- Unexpected messages or images are suddenly displayed.
- Change in file size.
- Missing of files or appearing of unexpected files.
- Slow to load program or fail to load program.
- Computer restarts itself.
- Displaying low memory message frequently.
- Displaying unusual error message.

Ways of virus transfer

A computer virus can spread from one computer to another computer in a number of ways. Some way are listed below:

- The sharing of infected floppy, hard disk, pen drive, compact disk.

- The virus infected e-mail message and attached files.
- The download file or program from the web or from the internet service.
- The exchange of data over a network.
- Use of pirated software.
- Download game or unknown file or program.

Preventive method against computer viruses

There are many ways to protect computer from computer viruses. Some are listed below:

- Do not use the pirated software.
- Install the latest security patch programs.
- Regular scan disks.
- Install good antivirus program.
- Do not exchange floppy disks, pen drive, and compact disk.
- Do not open e-mail and attached files sent by unknown persons.
- Update virus definition file regularly for new viruses.

Computer Software

Computer software is programming code executed on a computer processor. The code can be machine-level code, or code written for an operating system. An operating system is software intended to provide a predictable and dependable layer for other programmers to build other software on, which are known as applications. Operating systems can be found on all smartphones, tablets, and desktop computers. These systems give the device the functionality it needs. For example, Apple's iOS and Android's OS were developed specifically for portable devices.

Antivirus Software

Antivirus software is the software that can protect our computer from virus infection and eliminate virus so that the computer system runs smoothly.Someexamples of computer antivirus are given below:

a)	AVG	b)	MacAfee
c)	Scan utility	d)	Norton Anti-Virus
e)	PC–Cillin	f)	Panda Antivirus
g)	Kasperskey	h)	NOD -32
i)	Symantec	j)	DR. Solomon Antivirus toolkit

Points to Remember

- Technology is defined as the application of scientific knowledge for particular purpose.
- A multimedia projector is an output device, high resolution, and full-color projector capable of presenting text, images, video content.
- Scanner is an input device where the user can take the images of the texts or photographs from the source.
- Digital camera is used to capture video or still photographs both digitally by recording images on a light sensitive sensor.
- An ebook is a book presented in a format that allows you to read it on an electronic device like a computer or handheld device.
- Video tutorials offer a multidimensional experience that may combine charts, slides, photos, graphics, narration, screenshots, on-screen captions, music and live video.
- Digital Resources can be defined as materials that have been conceived and created digitally or by converting analogue materials to a digital format
- The World Wide Web—commonly referred to as WWW, W3, or the Web—is an interconnected system of public webpages accessible through the Internet.
- A web browser is special type of software that is used to access web page on the internet.
- A search engines is a special type of a program that searches for all types of document on the web sites.
- E-mail or email is text message that may contain files, images, or other attachments sent through an internet to a specified person or group of persons one place to another place of the world or anywhere.
- E-mail address is like your name and postal address.
- Technological literacy refers to the ability of an individual, working independently and with others, to responsibly appropriately and effectively use technology.
- Computer ethics is a moral principle that controls the social problems of the field of information and communication technology.
- A computer virus is nothing but small computer program that is designed to damage your computer system.
- Antivirus software is the software that can protect our computer form virus infection and eliminate virus so that the computer system runs smoothly.

Exercise

1. State whether the following statements are True or False:

a. Technology helps to perform any task easier and faster.

b. Mobile phone makes communication slower and more costly.

c. E-Mail is slower than traditional mail.

d. Google Chrome is the example of search engine.

e. Ebook is the digital resource which is read through digital devices.

2. Fill in the blanks with the suitable word:

a. ……is text message that may contain files, images, or other attachments sent through an internet to a specified person.

b. ……..software is the software that can protect our computer form virus infection and eliminate virus so that the computer system runs smoothly.

c. ……. can be defined as materials that have been conceived and created digitally.

d. ……is an input device where the user can take the images of the texts or photographs from the source.

e. A ……. is a special type of a program that searches for all types of document on the web sites.

3. Answer the following questions:

a. What is technology? Give some examples of modern technology.

b. What is computer virus? Explain with examples.

c. Write down the symptoms of computer virus.

d. Write down the ways to virus transfer.

e. Write down the method to protect computer from virus infection.

f. What is E-mail? Write down the advantages and disadvantages of E-mail.

g. Write down the difference between traditional mail and E-mail.

h. What is computer ethics?

i. Write any five computer ethics.

j. What is technology literacy? Write its importance.

Lab Activity

Visit computer lab, do the following activities:

- Run antivirus software, scan your computer system.
- Explore internet and search more information related to the computer virus.
- Create email account and send mail to your friend.
- Search information related to the science and technology by using any search engine.

2.2 Introduction to Software and Spreadsheet Program

You have known, Computer also consist two parts : hardware and software. Software is a set of instructions, data or programs used to operate computers and execute specific tasks. Computer cannot work without software. Software is a collection of many programs. Software is the most important part of a computer system, which manages all the hardware parts and create suitable working environment. For example: DOS, MS-DOS, Windows, office package, PageMaker, Graphic Package etc. Basically computer software is classified into two types. They are:

- **System Software**
- **Application Software**

System Software :

A type of computer program that is designed to run a computer's hardware and application program is system software. Computer works under the command and instruction for each and every task. So, it needs system software to perform any kind of task. System software is a software that manages the computer itself. It controls the inner working of a computer and actually runs the applications. Without system software computer cannot do any work. There are three types of system software. They are:

Fig. 2.2.1

- Operating System Software
- Language Processor Software
- Utility Software

Application Software

The software which is used to perform specific task is called application software. Application software is the software that is designed to satisfy a particular need of a particular environment. They are developed and supplied by a programmer, software development company, or computer manufacture. Application software may consist of a single program, such as a Microsoft's word processor, Spreadsheet, Web browsers, PageMaker, Adobe Photoshop and Accounting package. There are two types of application software. They are:

- **Custom or Tailored software**
- **Package Software**

Fig. 2.2.2

Introduction to Spreadsheet Program

A spreadsheet is an interactive computer application program for organization and analysis of data in tabular form. An electronic spreadsheet is a logical worksheet consisting of rows and columns in computer memory. Spreadsheets developed as computerized simulations of paper accounting worksheet. The program operates on data represented as cells of an array, organized in rows and columns. Modern spreadsheet software can have multiple interacting sheets, and can display data either as text and numerals, or in graphical form. Spreadsheets have now replaced paper based system throughout the business world. Today, there are various types of spreadsheet software such as Microsoft Excel, Lotus 1-2-3, Gnumeric.

Microsoft Excel

A Microsoft Excel is a spreadsheet application program offered in the Microsoft office software package. Ms-Excel is one of the most popular spreadsheet software. This program allows you to record organize, calculate, analyze and evaluates numbers. It can be used to perform mathematical calculations, prepare financial statements and worksheets. In addition, Excel can also be used to create chart and graphs. There are many version of Ms-Excel like Ms-Excel 98, 2000, 2001, 2003, 2007 and 2010. Here, we study Ms-Excel 2007 in this chapter.

The capacities of Excel are as follows:

- You can have 256 columns of informations.
- You can have up to 16384 rows.
- That comes out to over 4194000000 cells of information and that only on the first sheet.
- You can have 16 sheets of information in one workbook, and the number of sheets can be increased, if needed.

- Excel refers to each file as a workbook, because there can be multiple sheets (pages) in one file.

Starting Microsoft Excel

- ❖ Go to the **Start** Button on the Desktop and press it.
- ❖ Click on **All Programs.**
- ❖ Click on Microsoft Office, then finally chooseMicrosoft Office Excel 2007.
- ❖ This opens the Excel 2007 program.

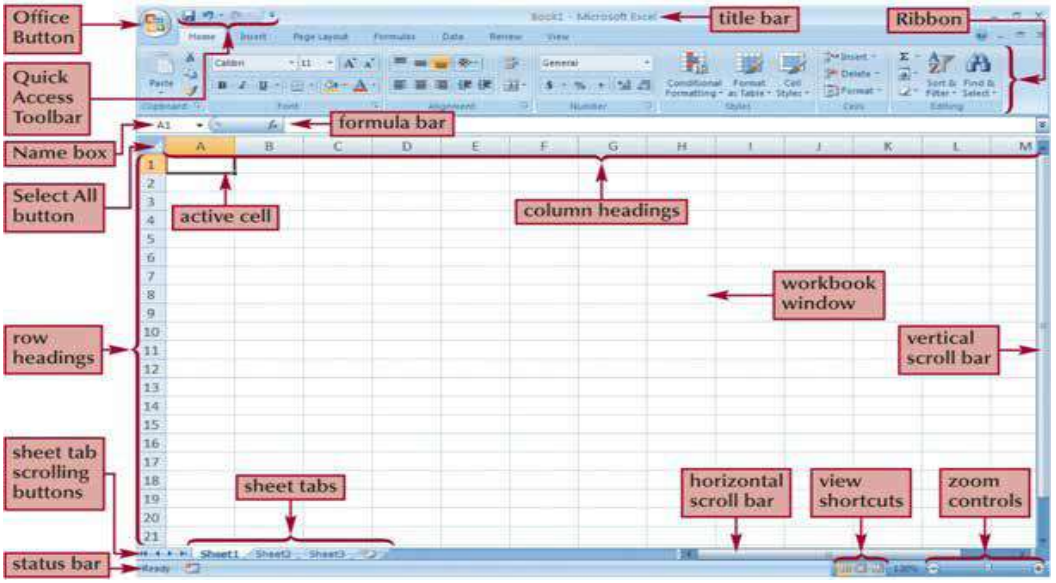


Fig. 2.2.3

Entering Data

To enter data is Excel, select a cell and begin typing. After you finish typing the data, press the enter key. You can follow the following instructions and enter data in the cell.

- Place the cursor in cell.

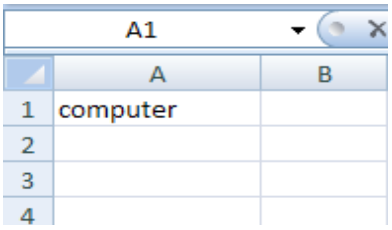


Fig. 2.2.4

- Type any text (character or number)
- Press the enter key, the information will be entered immediately, and the cursor will more down one cell.

Note: If you type any mistake in the cell, you can erase this word by using backspace key. The backspace key erases one character at a time.

	A	B	C	D
1	S.N	Name	Address	Age
2	1	Manisha Bhandari	Birendranagar Surkhet	12 Year
3	2	Mohan Sahai	NPJ	10 Year
4	3			
5	4			
6	5			

Editing Data

After you enter data into a cell, you can edit it by pressing F2 key on keyboard or by clicking on formula bar.

- Move the cursor to cell.
- Press F2 key and change the data.
  OR
- Click on cell.
- Click on formula bar and change it.

Operators

An operator is a symbol that performs an operation, such as a plus sign (+). The arithmetic operators for performing standard mathematical operations are: + for addition, - for subtraction, * for multiplication, / for division, ^ for exponentiation, and ( ) for grouping terms.

Example 1:

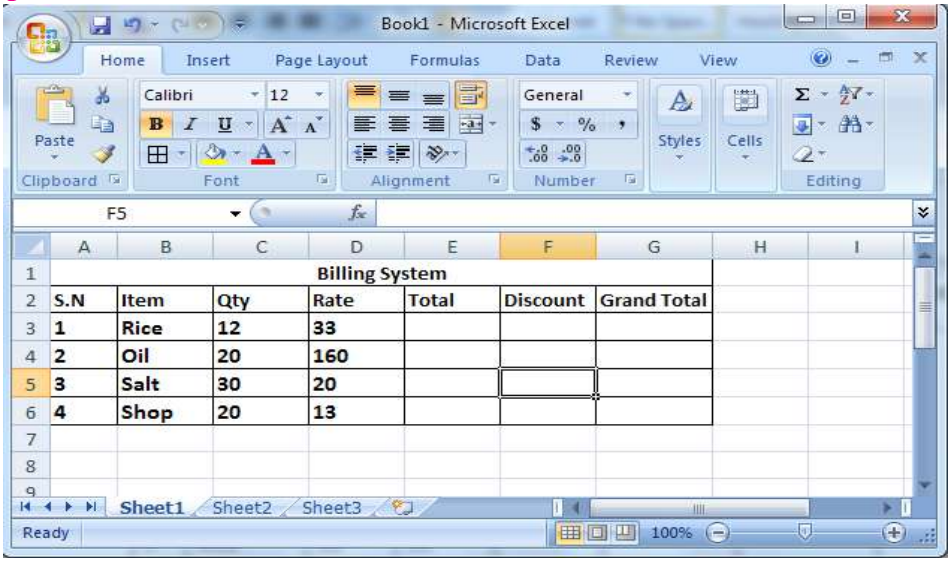


Fig. 2.2.6

Total= Qty * rate (C3*D3)

Discount= Total * discount % (E3* discount %)

Grand Total= Total – Discount (E3-F3)

CREATING CHARTS IN MS EXCEL

A chart is a pictorial or graphical representation of data. Charts make it easier for us to understand large volume of data. They also help us see the relationship between different parts of the data. Ms-excel provide various types of charts to make easier to understand large volume of data.

Types of charts

You can create different types of chart from the data entered in a worksheet. In the Ms-Excel you can create the following types of charts :

- Line chart
- Column chart
- Bar chart
- Scatter chart
- Pie Chart
- Doughnut Chart
- Area Chart
- Rader Chart
- 3-D Surface Chart

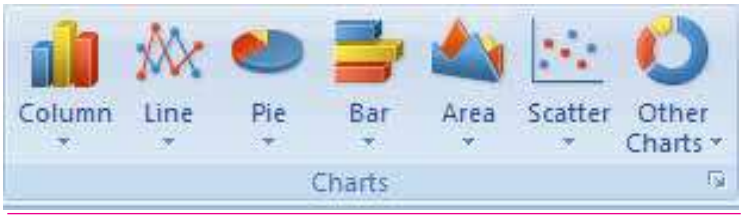


Fig. 2.2.7

Line Chart

A line chart compares trends in data at equal intervals. Line charts are useful fto show the change in a value over a period of time. A line chart is a best choice when you have many points to plot or when data trends are important.

Column chart

A column chart shows data change over a period of time or illustrates comparisons among items. Categories are organized horizontally and values vertically. In a column chart each data point in a series is represented by a column that rises from the x-axis.

Bar Chart

A bar chart also illustrates comparisons among individual items. In this chart data are organized vertically and values horizontally. A bar chart can be described as a column chart drawn sideways. A variation of the bar chart is the stacked bar chart.

Pie Chart

A pie chart is used to plot data for a single data series. In this chart each data point is represented by one slice of the circular pie chart.

Creating Chart

You can create chart in the Ms-Excel to perform the following steps:

- First open MS-Excel program.
- Create a data sheet.
- Select the data when you show the chart.
- Click Insert menu or tab.
- Click on Chart option and choose any one chart as you're required.

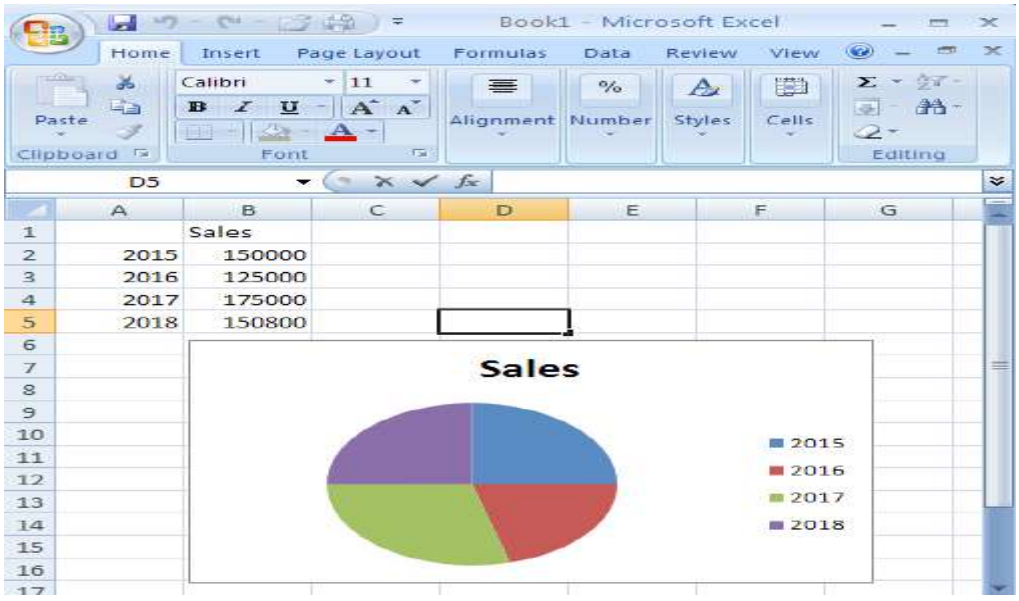


Fig. 2.2.8

Save or Save As

This save option is used to save new create document. And save as option is used to save to change another name or rename document.

Press (CTRL +S) by Keyboard)

- Click on Office Button.
- Click on Save or Save As.
- Then, Save Dialog Box will appear.
- Choose the location to save file.
  Ex: local disk E
- Give name to a document. Ex: Result Sheet
- Click on 'Save'.

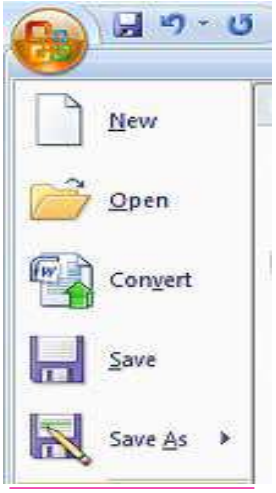


Fig. 2.2.9

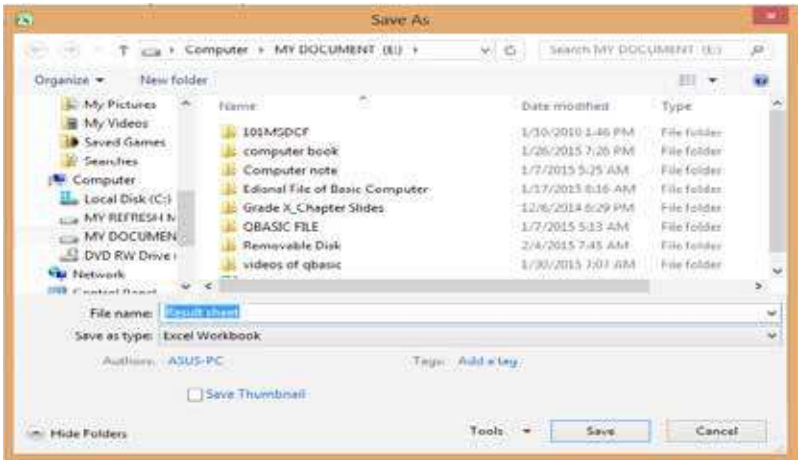


Fig. 2.2.10

Knowledge Bytes:

- Software is a main part of computer systemwhich consists set of instructions that tell a computer what to do when a number of instructions are strung together to tell a computer to carry out a specific task.
- System software is a cheap software that manages the computer itself. It controls the inner working of a computer and actually runs the applications.
- Application software is the software that is designed to satisfy a particular need of a particular environment.
- An electronic spreadsheet is a logical worksheet consisting of rows and columns in computer memory.
- A Microsoft Excel is one of the most popular spreadsheet software that allows you to record, organize, analyze, calculate and evaluate numbers.
- An operator is a symbol that performs an operation,
- A chart is a pictorial or graphical representation of data.

Exercise

1. State whether the following statements are true or false:

a. There are two types of software system and application.

b. System software is the collection of programs designed to run computer system.

c. Application software is used to solve the user problems.

d. Operating system is an example of application software.

e. Ms-Excel is an example of spreadsheet software.

2. Fill in the blanks with suitable word:

a. ……..short cut key is used to save document.
b. ……short cut key is used to print document.
c. A ……chart also illustrates comparisons among individual items.
d. A ……. chart is used to plot data for a single data series.
e. ……sign is used to add value.

3. Answer the following questions:

a. What is software? Mention the types of software.
b. What is system software? Write its types.
c. What is application software? Write its types.
d. What is spreadsheet software? Explain with examples.
e. What is Ms-Excel? Explain with examples.
f. Write down the step to save excel document.
g. What is chart? Write its types.

Lab Activity:

Visit computer lab, do the following activities with the help of your teacher:

- Open Ms-Excel program and create result sheet.

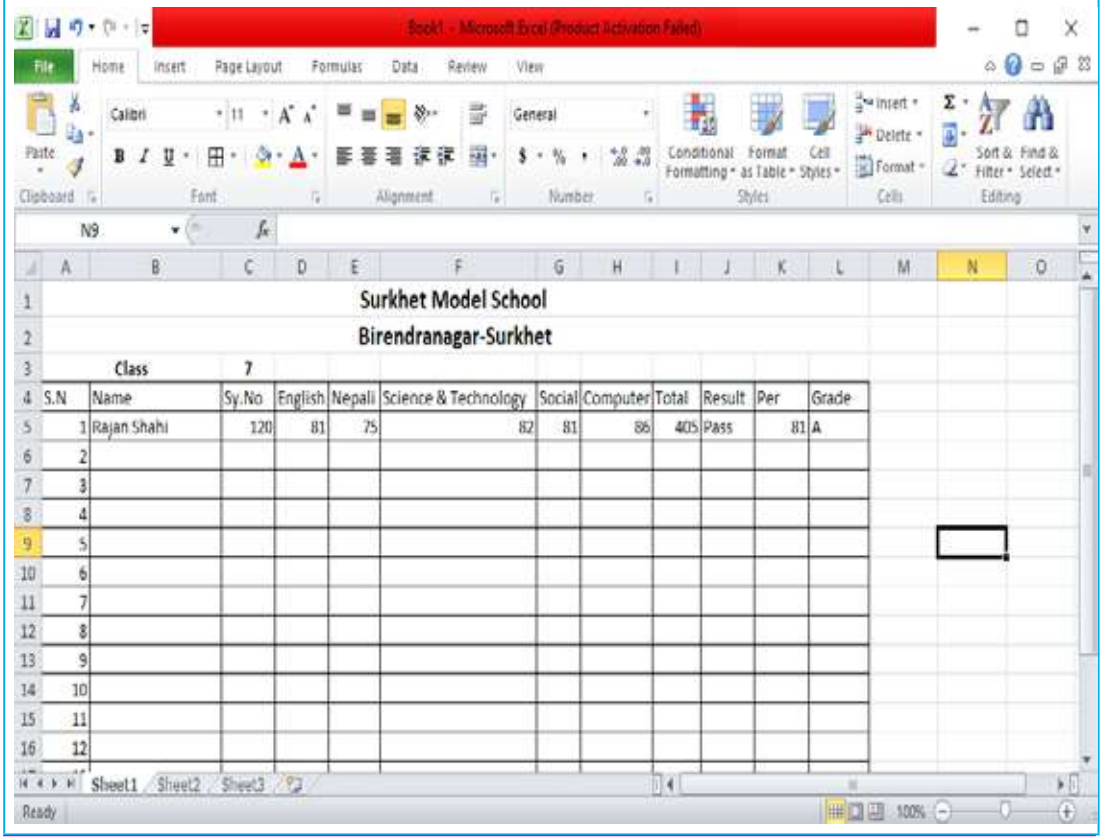


Fig. 2.2.11

2.3 Graphic Editing Software

Graphic software is the application software which is used to create different types of graphic objects. Graphic software refers to a program or set of program that enable a computer user to manipulate image or models visually on a computer screen. Graphics includes clip art, web graphics, logos, chart, image or digital photo or other types of digital images. Computer graphics can be classified into distinct categories: raster graphics and vector graphics, with further 2D and 3D variants.

There are many types of graphic software used to design graphics. They are:

- Paint
- Photoshop
- Illustrator
- CroelDRAW
- Adobe light room
- Digital image suite
- Canva
- Picase
- CAD (computer aided design) etc.

Adobe Photoshop

Adobe Photoshop is a one of the must popular types of graphic software. It was developed by Thomas and John Knoll in the summer of 1988. The license to distribute the program was purchased by Adobe Systems in September 1988. It is most popular graphic software today. Photoshop today is the most popular and profitable application that supports layers, filters, brushes, text, 3D objects, videos, etc.

Starting Adobe Photoshop

You can follow the following steps to start the Photoshop program:

- Click on 'Start' button.
- Click on 'All Program'.
- Click on 'Adobe Photoshop'.

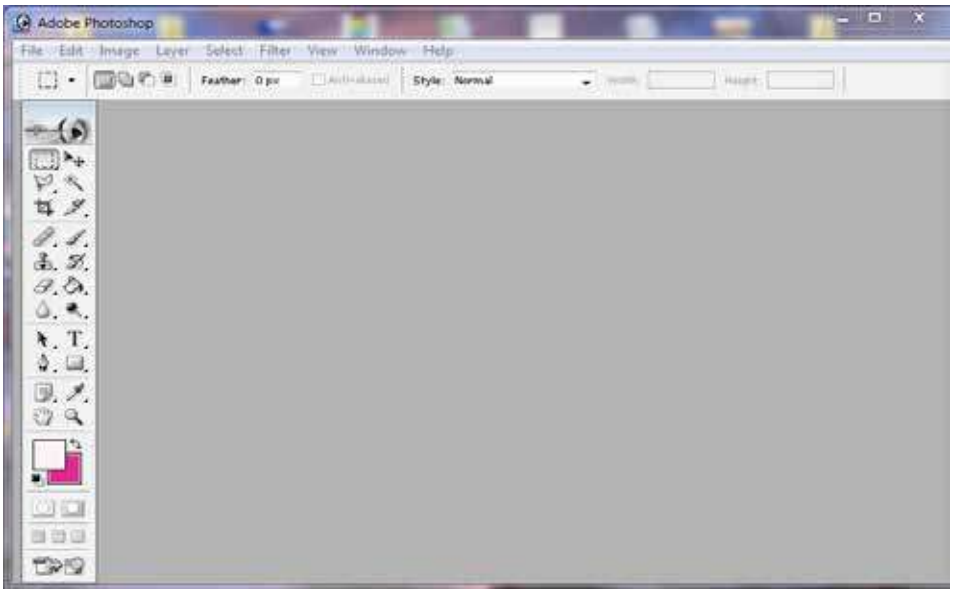


Fig. 2.3.1

Edit Image

Editing is the process of changing on improving the appearance of image. to get best image possible.

1. In the menu bar, choose file>Open to open existing in ages.
2. In the menu bar, choose File>New to create a new image from scratch.

Lasso Tool

The Lasso tool is useful for drawing freeform segments of a selection border.

1. Select the Lasso tool from the Tools panel.
2. Position the cursor somewhere on the edge of the element that you want to select.
3. Trace around the element and try to capture only what you want to retain in your selection.
4. Continue tracing until you return to your starting point; release the mouse button.

Fig. 2.3.2

Crop Tool

The Crop tool allows you to select an area of an image and discard everything outside this area.

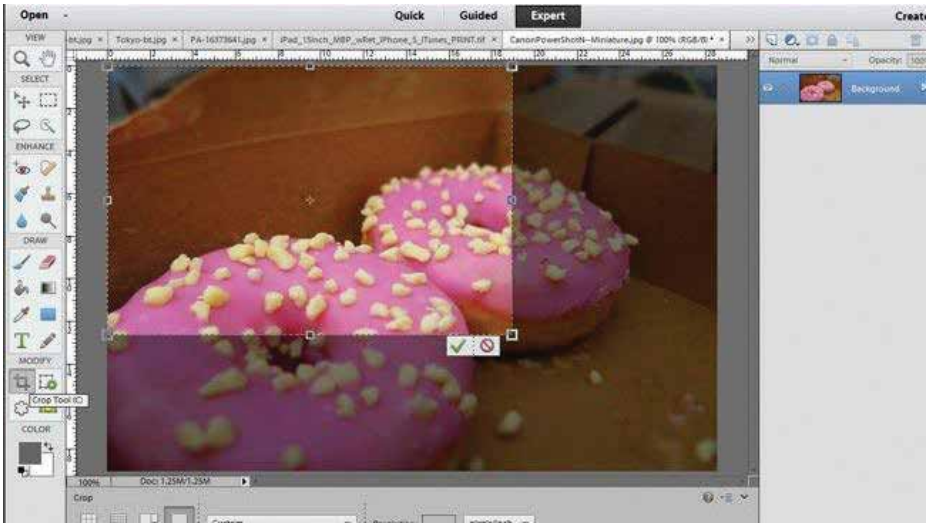


Fig. 2.3.3

1. From the tool box, select the Crop Tool .Crop borders display on the edges of the image.
2. Drag the crop handles outwards to enlarge the canvas.
3. Press Enter key to confirm the action.

Eraser Tool

Photoshop's eraser tool can be found in the second group of icons in the toolbox. It has three variations: Eraser, Background Eraser and Magic Eraser. The eraser is basically a brush which erases pixels as you drag it across the image. Pixels are erased to transparency or the background colour if the layer is locked.

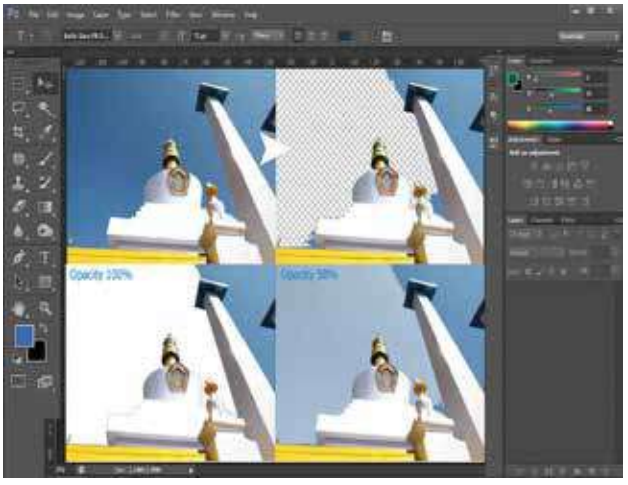


Fig. 2.3.4

1. Select the Eraser tool from the tool box.
2. Set the background color you want to apply if you are erasing in the background or a layer with locked transparency.
3. In the options bar, choose a Mode setting.
4. For Brush and Pencil modes, choose a brush preset, and set Opacity and Flow in the options bar.

Gradient Tool

The Photoshop gradient tool help to add some stunning effects to the photographs.

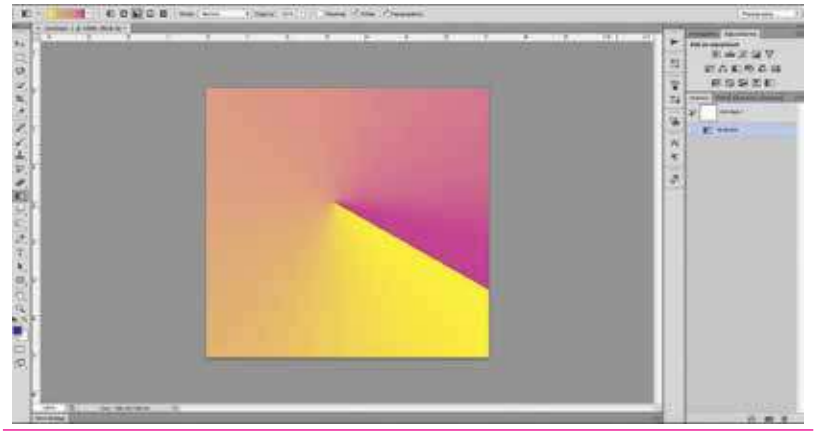


Fig. 2.3.5

- Choose the Gradient tool and click the Gradient Editor button on the Options bar.
- Click a stop and click the color swatch to the right of the word Color to open the Color Picker and assign a different color to the stop.
- Click anywhere below the gradient preview to add more color stops.

Text Tool

Text tool allows text to be typed onto the current layer using the Primary color. The Text Controls in the Tool Bar can be used to change the font, the size of the font, formatting, text rendering mode, justification, antialiasing and blend mode.

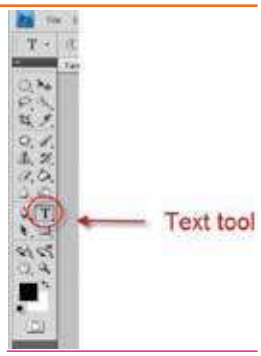


Fig. 2.3.6

1. Click on the Text tool in the toolbox.
2. Drag by clicking the pointer.
3. Start typing the text.

Dudge Tool

The Dudge tool and the Burn tool lighten or darken areas of the image.

1. Select the image to apply dudge tool.
2. Click on the dudge tool in thetool box.
3. Drag the mouse pointer to the required location for setting lightning.

Magic Wand Tool

The Magic Wand Tool is a go-to tool when you want to display a product in various settings by showing it against different backgrounds, or when you want to remove a background altogether so your product stands on its own.

Fig. 2.3.7

1. Open your product photo and duplicate the background layer.
2. Hide the background layer.
3. Configure the Photoshop Magic Wand Tool.
4. Make your selection.
5. Refine the edges of the selection.
6. Insert a new background into your image.

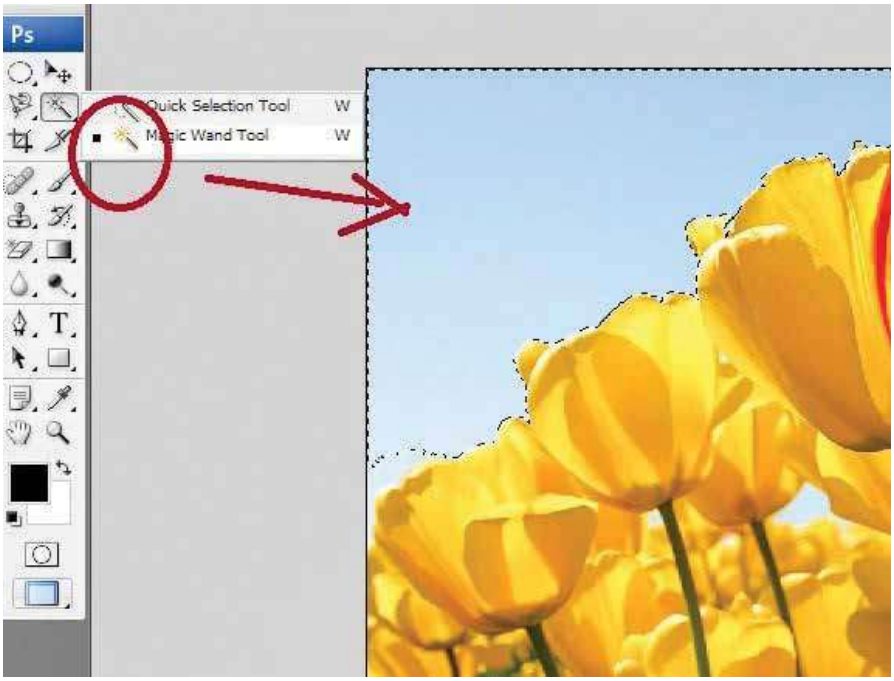


Fig. 2.3.8

Rotate or flip image

1. Click the "Image" menu to open the list of options.
2. Hover the mouse power over "Rotate" on the list to open the sub-menu and then click "Flip Horizontal" or "Flip Vertical" to flip your image.

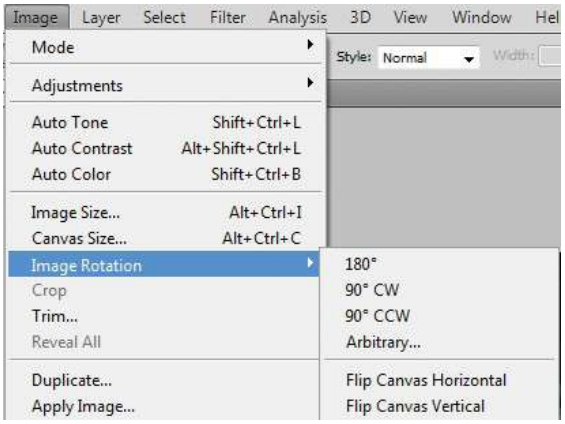


Fig. 2.3.9

Points to Remember

- Graphic is the most important data type in the computer system which represent drawing, image, chart or other objects.
- Graphic design is the art and practice of planning and projecting ideas and experiences with visual, image and textual contents.
- Graphic software are the any types of application software which is used to create any graphic objects.
- Adobe Photoshop is a one of the most popular types of graphic software which was developed by Thomas and John Knoll in the summer of 1988.
- Paint, Adobe Photoshop, CAD, CorelDraw, Image Suite, picasa etc. are the popular graphical software.
- Adobe Photoshop supports different file formats such as .PSD, .JPG, .GIF, .JPEG etc.
- Photoshop program provides many tools such *Select, Move, Magic Want, Paint, Eraser, Type* etc. to edit image.

Project Work

Capture your photo and cut, edit, adjust brightness, make it smaller and larger by using computer software, and then display it with a caption in the classroom.

Exercise

1. State whether the following statements are true (T) or false (F).

a. Adobe Photoshop is developed by Microsoft Corporation. ☐

b. The eraser tool is used to remove any part of image. ☐

c. Jpg, jpeg, gif etc. are the file format of the image. ☐

d. Pen tool is used to move the image horizontally or vertically. ☐

e. Gradient tool is used to fill the colour in the image file. ☐

f. CorelDraw is a spreadsheet software. ☐

g. Cropping means removing the unnecessary parts of the image. ☐

2. Answer the following questions.

a. What is graphics software? Write any four examples of graphics software.

b. Write the features of graphics software.

c. What is Adobe Photoshop?

Lab Activity:

1. Open the Photoshop program and do the activities as mentioned below.

a. Open the photo or the image that is saved in the computer.

b. Fill the different color to the photo.

c. Flip the photo horizontally and vertically.

d. Use different other tools to edit your photo and make it attractive.

e. Write remarks about the photo using note tool.

f. Increase the brightness of the photo as per the requirement.

g. Set proper size, margin and orientation of the photo.

h. Save the image on E drive.

i. Save the image for the web with GIF format.

j. Print the photo from the printer.

2. Design your school identity card in Photoshop with the help of your teacher.

3. Design a visiting card of your Principal in Photoshop with the help of your teacher.

Unit 3 Living Beings and Their Structure

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- describe the functions of different parts of flowering plants.
- identify the mutated organs (roots, stems, and leaves) of plants and to explain their structure and functions.
- classify the invertebrate animals and describe the general characteristics of each group.
- identify the components of animal and plant cells.

Answer the following question by looking at the picture below.

Fig. 3.1

i. What are shown in the pictures?
ii. Do they all have the same texture (structure)?
iii. How can they be categorized?

There are several plants and animals around us. These plants and animals differ from each other in many ways. Some plants and animals are very big whereas some of them are very small. The structure of living vary in shape, size and physical process. The structure of living beings is influenced by climate and habitat. The structure of terrestrial plants is different from aquatic plants. Similarly, the structures of animals are different in warm cold climate is. The structure of plants and animals help in adaptation. In this chapter, we shall study the structure of plants and animals.

3.1 PARTS OF PLANTS

Answer the following question by looking at the picture below.

Fig. 3.2

i. What are shown in the pictures? Write their nams and functions.
ii. Are these parts found in all plants?
iii. Do all plants have flowers and fruits?

Plants are one of the most essential living organisms on earth. They are immensely beneficial to both animals and human beings. They produce oxygen which is crucial for the survival of living organisms. Trees provide shelter to animals and are also known for their medicinal benefits. Overall, different parts of plants have different roles to perform. They act as a source of food and oxygen and maintain the ecological balance. A plant has many parts. Different parts perform different functionalities. The part of the plant that appears above the ground level is called the shoot system while the part of the plant which lies underneath the soil is called the root system.

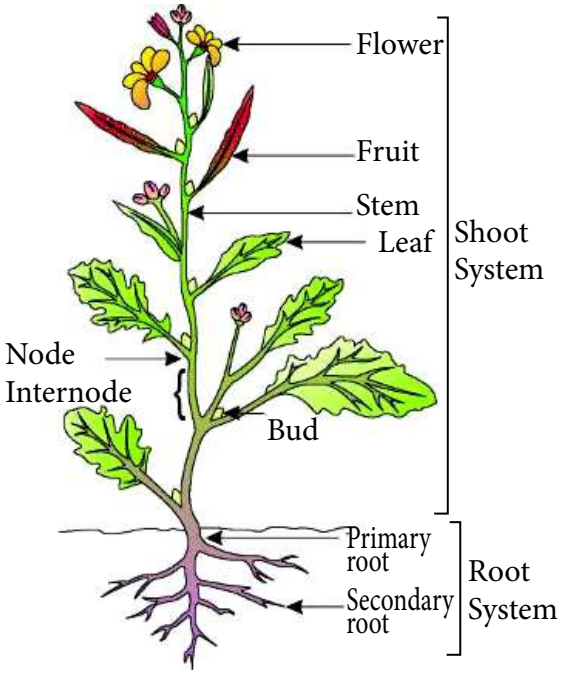


Fig. 3.3

The main parts of a plant include:

- Roots
- Stem
- Leaves
- Flowers
- Fruits

Activity 3.1

Answer the following questions by observing the plants in the garden of your school or home.

i. What parts of the plant did you see during the observation? Share in the classroom.

ii. What are the characteristics of all the plants ?

iii. What are the similarities and differences between the plants .? Write it in chart paper and demonstrate in class.

A. Structure and functions of roots

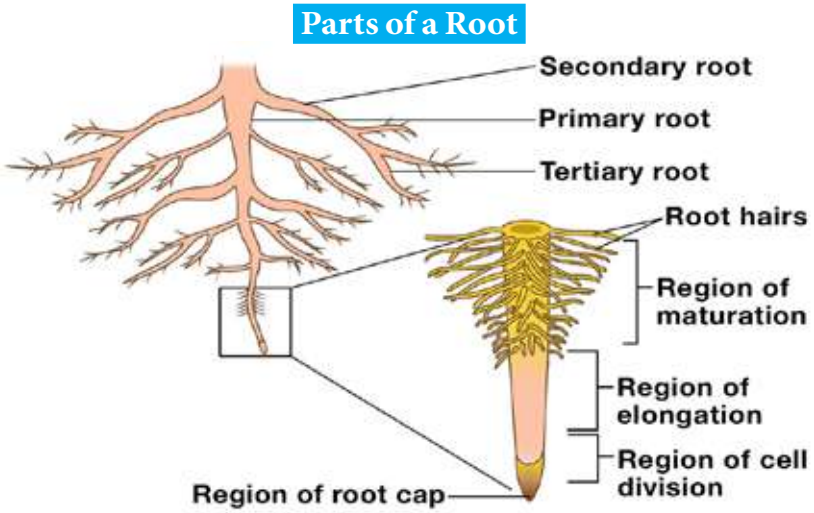


Fig. 3.4

Roots are the most important and underground part of a plant, which are collectively called the root system. They are the major part that anchors the plant firmly in the soil. They absorb water and minerals from the soil, synthesise plant growth regulators, and store reserve food material. The apical part of the root is covered by the root cap that protects the root apex.

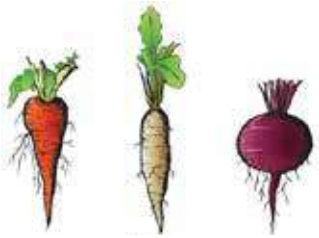
The direct elongation of radicle leads to the formation of primary roots that grow inside the soil in dicots. It bears lateral roots that are known as secondary and tertiary roots.

In monocots, the primary root is replaced by a large number of roots because it is short-lived. In some plants such as Banyan tree, the roots arise from the parts of the plant and not from the radical. Such roots are known as adventitious roots.

A few plants that grow in swampy areas have roots growing vertically upwards to get oxygen for respiration. Such roots are known as pneumatophores. Roots are mainly white, brown and light yellow colour.

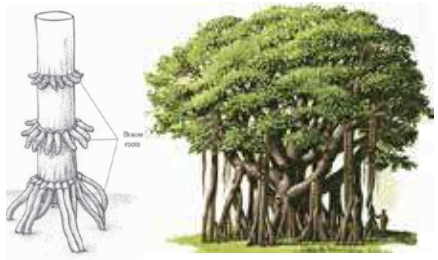
Activity 3.2

Below are the roots of various plants. Identify these roots.What would happen if the plant had no roots? You must have seen the roots of corn and Barpipal. How are these roots helping the plant even when they are visible from outside?



Storage roots

Parasitic roots



Aerial roots

Types of roots

i. Fibrous root

The fibrous root system is found in monocotyledonous plant plants like rice, wheat, onion, garlic, maize, banana etc. The fibrous root develops from stem in the firm of numerous thin and nearly equal size branching. They grow in cluster and move in all directions. They are shorter. They do not penetrate deep into the soil. They spread near the surface of soil. They do not have root cap. They cannot act as storage roots.

ii. Tap Root

The tap root system is found in dicotyledonous plants like mustard, pea, bean, mango, etc. The tap root system consists of primary root, secondary roots and tertiary root. The primary root grows from radicle of seed and grows downward into the soil. The secondary roots arise from the primary roots and it grows laterally. The tertiary roots are the thin branches of secondary roots.

They penetrate deep in the soil. They have root cap. Some tap root can act as storage roots like carrot, turnip, radish, etc.

Function of root

i. Roots provide mechanical support to the plants.
ii. It absorbs water and minerals from the soil.
iii. Some roots stores excess food materials.
iv. Aerial roots of maize work to hold the plant in the ground.
v. The aerial roots of the Bar-Pipal tree support the large branches of the tree
vi. The roots of carrots, radishes and saplings serve as food storage.
vii. New plants can be produced from some roots, such as sakharkhand. This kind of reproduction is called vegetative propagation from the roots.

Activity 3.3

Observe the stem of plants around your community and discuss.

i. Do all plants have same type of stem?
ii. Are stem of all plants green?
iii. Do stem help in reproduction?

B. Structure and functions of stems

The stem is the part of the plant which is found above the ground. The bark of trees are brown in colour and younger stems are green in colour. It forms the basis of the shoot system and bears leaves, fruits and flowers. The region where the leaves arise is known as the node and the region between the nodes is known as the internode.

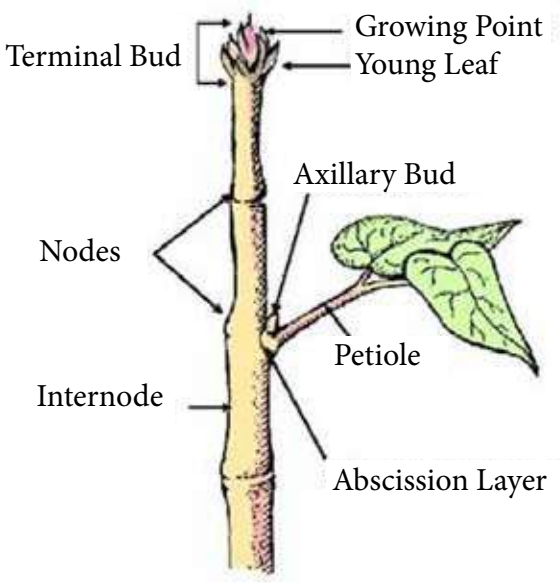


Fig. 3.5

Stems arise from the plumule, vertically upwards to the ground. Initially, stems are usually weak and cannot stand straight. It eventually grows to become the toughest part of the plant called the trunk. The trunk is covered by a thick outer covering known as the bark. Overall stem provides a definite framework and structure to a plant, which later develops into a tree.

The stem provides support to the plant. They also protect the plant and help in vegetative propagation. A few underground stems such as potato and ginger are modified to store food.

Activity 3. 4

Which of the plant stems are shown in the picture below? What happens if there is no stem on the plant? What is the work of the stem?

The important functions of a stem include:

- A stem carries out a number of functions essential for various processes such as photosynthesis.
- Provides a definite framework and structure to a plant which later develops into a tree.
- **Support:** Primary function of the stem is to hold up buds, flowers, leaves, and fruits to the plant. Along with the roots, a stem anchors the plants and helps them to stand upright and perpendicular to the ground.
- **Transportation:** It is the part which transports water and minerals from the root and prepared food from leaves to other parts of the plant.
- **Storage:** Stems are one of the storerooms of plants where the prepared food is stored in the form of starch. The stems of a few plants in the desert areas, such as Opuntia, get modified into thick, fleshy structures that store food and prevent excessive water loss due to transpiration.
- **Reproduction:** A few stems help in reproduction through vegetative propagation and also help to bear flowers and to produce fruits.
- **Guards**: Protects xylem and phloem allowing them to perform their functions. The stem tendrils are spirally coiled and help the plant to climb support. The axillary buds also get modified into thorns that protect the plant from grazing animals.

C. Structure and functions of leaves

Leaves are the most important part of a plant. They contain chlorophyll that helps the plants to prepare their food using sunlight, carbon dioxide and water. A leaf consists of three main parts- petiole, leaf base and lamina.

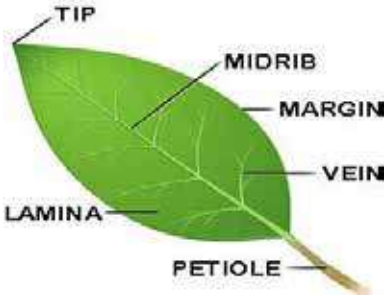


Fig. 3.6

- The petiole keeps the leaf blade exposed to wind and cools the leaf.
- The leaf base is a protruding part of a leaf.
- The lamina of the leaf contains veins and veinlets that provide rigidity to the leaf blade and help in the transport of mineral nutrients.

Activity 3.5

The leaves of which plants are shown below? Are the leaves of all plants the same? What usually causes the leaves to turn green? What would happen if the plant had no leaves? What is the main function of the leaf?

Primarily, leaves have three main functions:

- Photosynthesis: Green leaves prepare food for plants by using water and carbon dioxide in the presence of sunlight. This process is called photosynthesis.
- Transpiration: Other than photosynthesis, leaves play a crucial role in the removal of excess of water from plants through tiny pores called stomata. This is the process of transpiration.
- Reproduction: Leaves of some plants also help in reproduction also. For e.g. leaves of Bryophyllum give rise to a new Bryophyllum plant.

D. Structure and functions of flowers

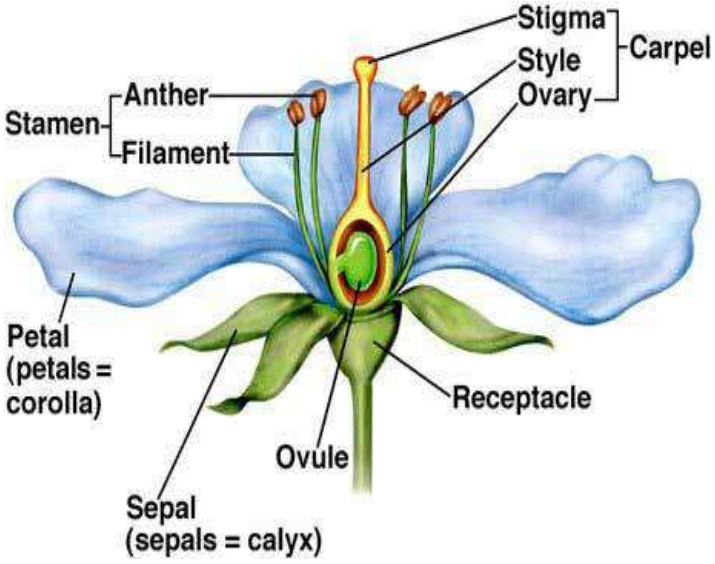


Fig. 3.7

Flowers are the most beautiful and colourful part of a plant. They are the reproductive part of a plant. A flower has four major parts, namely,

- Petals: It is the colourful part of a flower which attracts insects and birds.
- Sepals: Sepals are green leafy parts present under petals and protect the flower buds from damage.
- Stamens: This is the male part of the flower consisting of anther and filament.
- Pistil: This is the female part of the flower consisting of stigma, style and ovary.

Activity 3.6

Look at the flowers below or in the garden of your school or home. Answer the following questions after the observation:

i. What similarities and differences did you find in the flowers you observed?
ii. Are the different parts of the flowers the same number?
iii. Are all flowers colorful?
iv. What are the functions of flowers in a plant?

Functions of Flower

The important functions of flowers are mentioned below:

1. Gametophytes develop in the flowers.
2. The flowers can produce diaspores without fertilization.
3. After fertilization, the ovary of the flower develops into a fruit containing a seed.
4. The most important function of flowers is reproduction. They help in the union of male and female gametes.
5. Flowers provide nectar to certain birds and insects, which in turn help in the transfer of pollen from one flower to the other.
6. Flowers may promote selfing, i.e., the union of male gametes and female gametes from the same flower, or cross-fertilization, i.e., the union of male gametes and female gametes from different flowers.

E. Structure and functions of fruits

Fruits are the main features of a flowering plant. It is a matured ovary that develops after fertilisation. Some fruits are developed without fertilization and are known as parthenocarpic fruits and the process is known as Parthenocarpy.

A fruit is the part of a flowering plant that contains the seeds. The skin of a fruit may be thin, tough, or hard. Its insides are often sweet and juicy. But some fruits, including nuts, are dry. Fruits develop from a plant's flowers.

Some foods that people call vegetables are actually fruits. For example, cucumbers, squashes, and tomatoes are all fruits. They contain seeds, while true vegetables do not. True vegetables are the stems, leaves, or roots of plants.

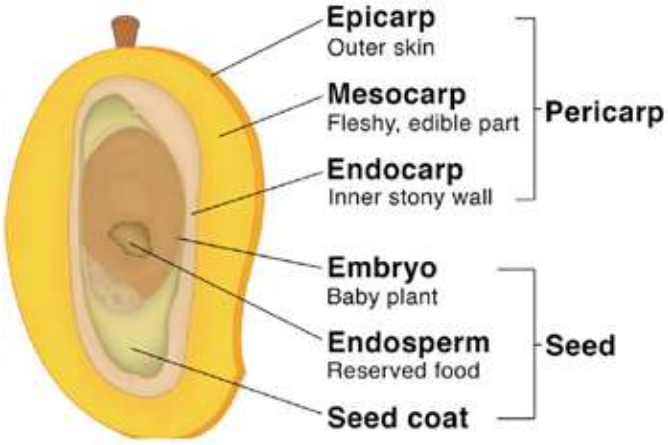
There are two main types of fruit: fleshy fruits and dry fruits. In fleshy fruits, the part of the fruit around the seeds is juicy and soft. Apples, berries, oranges, and other fleshy fruits contain many seeds. Some fleshy fruits—for example, cherries and peaches—contain only one seed, or pit. These are called stone fruits. Dry fruits are not as juicy as fleshy fruits. Dry fruits include beans and nuts.

People and many wild animals eat fresh fruits. Fruits are important sources of fiber and vitamins, especially vitamin C. They contain minerals and a large amount of water.

People also eat frozen, canned, and dried fruits. They make fruits into jams and jellies. They add fruits to a variety of desserts and main dishes. People also drink the juice of fruits.

Activity 3.7

Cut an apple or a tomato in half and study its inner texture. Did you recognize all the parts as shown in following picture?



Functions of Fruits

- Edible part of the fruit is a source of food, energy for animals.
- They are source of many chemicals like sugar, pectin, organic acids, vitamins and minerals.
- The fruit protects the seeds from unfavourable climatic conditions and animals.
- Both fleshy and dry fruits help in the dispersal of seeds to distant places.
- In certain cases, fruit may provide nutrition to the developing seedling.
- Fruits provide source of medicine to humans.

3.1.1 Modification of different parts of plants

There are different varieties of plants in earth. Plants are of different shape and size. Plants are terrestrial as well as aquatic. There are lots of similarities in plants. Root, stem and leaf are the vegetative parts of a plant and flower has a reproductive part. Functions of these parts in different places are different which is known as modification of plant parts.

Modification of roots

The part of a plant which develops under the ground is known as root. It is mainly white, grey or light yellow in colour. Roots are of mainly two types in their root system.

i. Tap Root System ii. Adventitious Root System

Plants change their body structure according to the surrounding environment for survival. Function of each part of a plant is also different in different environment. Modification of root in plants are mainly for three purpose.

i. For storage of food

Fig. 3.8

a. Centre portion is enlarged and tapering at both ends(base and apex). This type of roots help to store foods. For example: radish. This type of root is called fusiform root.

b. Upper portion is rounded, enlarged and the lower portion is tapering. This type of root is called napiform root. For example, Turnip.

c. Upper portion is enlarged but lower portion is sharply tapering till end. This type of root is called conical root. For example, carrot.

d. The root does not have a regular shape and it gets swollen and fleshy. This type of root is called tuberons root. For examples : sweet potato.

These plants have actually taproot system. Because of the storage of foods, they get swollen. Roots of some plants such as yam help in vegetative propagation.

ii. For mechanical support

Have you noticed the roots of Banyan tree which are developed from the tree branches? These types of roots can support a big Banyan tree. In banyan, maize, bamboo, sugarcane, etc, roots are found in air too. In maize, bamboo and sugarcane, prop roots are found. In money plants roots are modified for climbing. They grip the surface of wall, log, etc. Such roots are

Fig. 3.9

called climbing roots. Roots are also developed from the stem of bamboo and are attached with the ground. Maize, sugarcane like plants also have same type of roots. Roots in different pattern support plants.

iii. For vital function

According to the structure of plants to perform different functions, roots are modified. Some parasitic plants absorb food from other plants through roots. Plants of marshy land perform respiration through roots. Some plants have chlorophyll in their roots for photosynthesis. Roots of aquatic plants help them to float in water. They have air spaces in their roots. For examples, hydrilla, waterhyacint, etc. In dahlia, sweet potato, etc. tuber roots are found which participate in reproduction.

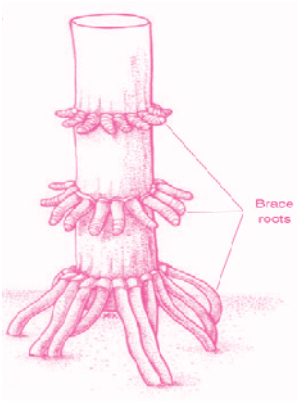


Fig. 3.10

Modification of stem

The part of a plant which is just above the ground is known as shoot. Stems are modified for specific functions. Stems are modified according to the surrounding environment. We can study the modification of the stem in the following three parts:

i. Underground modification

In some plants stems are underground and they are found in different forms. They show different shapes due to storage of food in them. Ginger is an example of rhizome. Potato is an example of tuber. Onion and garlic are found in the form of bulb and colocasia is an example of corm. Rhizome, bulb, corm and tuber are the modifications of underground stem.

Fig. 3.11

ii. Sub-aerial modification

Stem of these plants are soft, weak and develop parallel with land. Some part is above and others under the ground. The stem is modified for reproduction. All the modification of sub – aerial stem is for vegetative reproduction, eg. grasses.

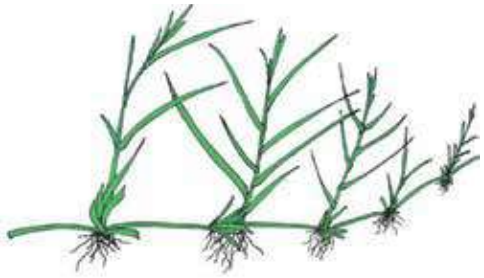


Fig. 3.12

iii. Aerial modification

Stem which is above the ground is of different shape and size. Some stems are like leaves and store food. Leaves of plants are developed into stems. Stems of some aerial plants are like wood, long cylindrical etc. Green stems can prepare food through photosynthesis and store food. Some stems store water in it. In some plants like climbers, the stems are modified in hairy structures called tendrils. They help the plants to grow up. In some plants like rose and bougainvillea, thorns are found on the stem and they save the plants from their enemies.

Fig. 3.13

Modification of leaf

Leaves are developed from stem and the branches of plants. Leaf is the site of photosynthesis. Leaves are modified into different structure to perform different work.

Tendrils are developed from the leaves in some plants. These tendrils are long thread like coil. In some plants leaves are modified into spines. Mainly in plants which are found in desert like cactus, leaves are modified into spines. Spines reduce the rate of transpiration in plants. Spines also protect plants. Some plants have dry and paper like leaves. In some plants leaves are like stems. In insectivorous plants leaves are developed into bladder for the digestion of insects.

Fig. 3.14

In this way, different parts of plants are modified for different functions. In Opuntia the leaves are modified into spines. In *Bignonia unguiscati* the terminal leaflets of leaf get modified into hook-like structures that help them in climbing. In Salvinia, one of the leaves present at the nodes get modified into adventitious roots which helps them to float over the water surface.

Points to Remember

- Plants are one of the most essential living organisms on earth. They are immensely beneficial to both animals and human beings.
- The part of the plant that appears above the ground level is called the shoot system while the part of the plant which lies underneath the soil is called the root system.
- The direct elongation of radicle leads to the formation of primary roots that grow inside the soil in dicots. It bears lateral roots that are known as secondary and tertiary roots.
- The stem is the part of the plant which is found above the ground. The bark of trees are brown in colour and younger stems are green in colour.
- Leaves are the most important part of a plant. They contain chlorophyll that helps the plants to prepare their food using sunlight, carbon dioxide and water. A leaf consists of three main parts- petiole, leaf base and lamina.
- Fruits are the main features of a flowering plant. It is a matured ovary that develops after fertilisation. Some fruits are developed without fertilization and are known as parthenocarpic fruits and the process is known as Parthenocarpy.
- Stem which is above the ground is of different shape and size. Some stems are like leaves and store food.
- Leaves are developed from stem and the branches of plants. Leaf is the site of photosynthesis. Leaves are modified into different structure to perform different work.

PROJECT WORK

i. Take a fresh potato. Observe the scars on it with the help of a magnifying glass. You may find bud(s) in them. These scars are also called "eyes". Cut the potato into small portions, each with an eye and bury them in the soil. Water the pieces regularly for a few days and observe their progress. What do you find?

Exercise

A. Choose the correct one and put the tick mark (√).

i. Which is not the main parts of a plant?

a. Roots b. Stem
c. Leaves d. Petiole

ii. Helps in reproduction

a. leaf b. flower
c. root d. stem

iii. Which part of the plant normally carries out photosynthesis?

a. leaf b. flower
c. root d. stem

iv. Supports the plant

a. leaf b. flower
c. root d. stem

v. What is the main function of the root?

a. Absorbing water and salt
b. Storing food
c. Delivering food to every part
d. Delivering food to the leaves

vi. Protect the seeds

a. leaf b. flower
c. root d. fruit

vii. Which part of the plant is transformed into photosynthetic?

a. Leaf b. Stalk
c. flower e. fruit

viii. What happens in pollination process?

a. Pollen formation
b. The act of pollen reaching the egg
c. The act of pollination from pollen grains
d. Pollen reaches the ovary

B. Fill in the blanks with suitable word.

mesocarp, seed, epicarp, shoot, embryo

i. Outer skin of a fruit is .....
ii. Fleshy, edible part of a fruit is .....
iii. .....is baby plant
iv. Embryo, endosperm and seed coat are parts of .....
v. Flower,leaf, fruit and stem are .....system.

C. Give the reason :

i. Roots are the most important and underground part of a plant.
ii. The stem provides support to the plant.
iii. The flowers can produce diaspores without fertilization.
iv. The roots of carrots, radishes and saplings serve as food storage
v . Edible part of the fruit is a source of food, energy for animals.
vi. Leaves of plants are green in colour.

D. Differentiate with examples

i. Root and stem
ii. Shoot system and Root system
iii. Mesocarp and Epicarp
iv. Nodes and Internode

E. Answer the following questions :

i. Write down the name of the part of a plant
ii. Describes the functions of roots and leaves.
iii. What are the functions of fruit?
iv. What are the three main divisions of fruit?
v. What are the major parts of a fruit?
vi. How do fruit develop?
vii. What are the functions of flowers. ?
viii. What are the functions of stem?
ix. What do you mean by modification of plants.
x. What is modification of root ?
xi. Define the modification of stem and leaf?
xii The leaves of plants that grow in mostly dry places are modified into thorns. How do they benefit from it?
xiii. Monika buy carrots and Subita buy potatoes in the nearby market.
    a. What did Monika buy from the roots, leaves, fruits, or seeds of the plant? Explain.
    b. What did Subita buy from the roots, leaves, fruits, or seeds of the plant? Explain.
    c. What is the function of carrot after it has been transformed?
    d. What is the function of the potato in such a way?

F. Draw a picture with the names of the different parts:

i Plant
ii. Root

iii. Leaf

iv. Stem

v. Fruit

G. Diagrammatic questions

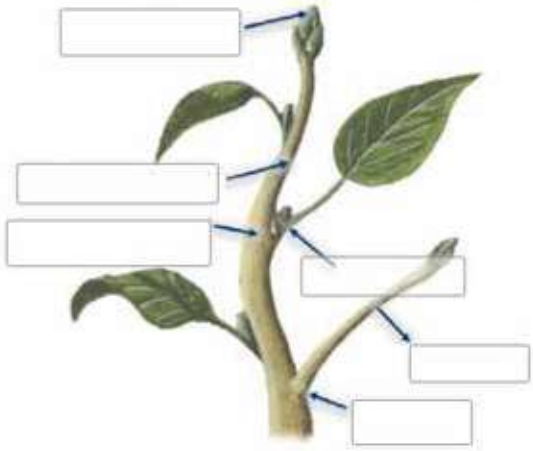
i. Match each picture with the name of the type of root.

Tubercular Roots

Prop Roots

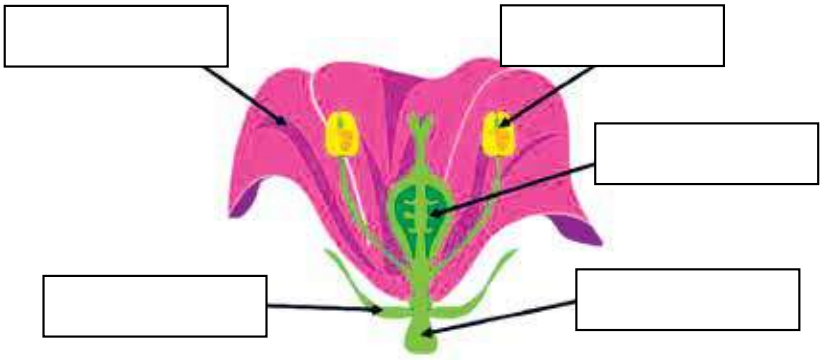
Fibrous Roots

ii. Write the names of the parts of a stem

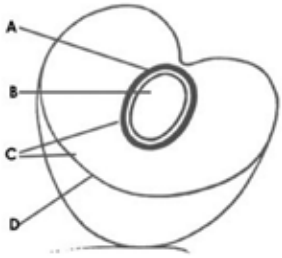


iii. Write the parts of a leaf.

iv. Write the name of the parts of a flower.

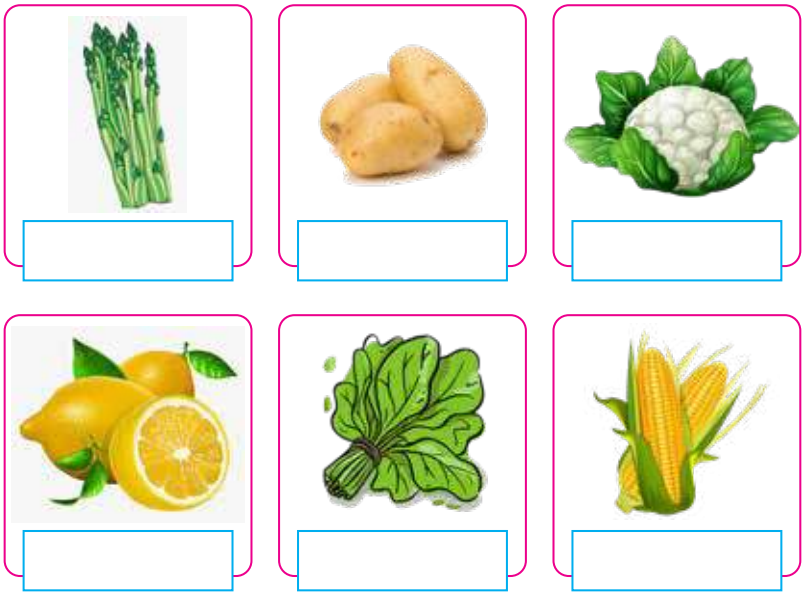


v. Label the following diagram of a nectrarine and identify what type of simple fruit it is :

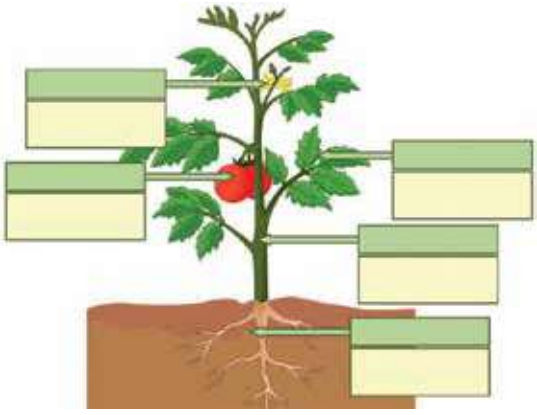


vi. Fill in the boxes with suitable word .

Roots - Stem - Flower - Fruit - Seed - Leaves



vii. Drag and drop the parts of the plant and their functions to the right place .



ROOTS
FRUIT
LEAVES
STEM
FLOWERS

Contains and protects the seed	Catch energy from sunlight and produce food for the plant.
Soak up water and minerals from the ground.	Make seeds for the plant.
Supports the plant and carries water and minerals through the plant.	

viii. Parts of a Plant

Seeds

Roots

Stem

Leaf

Flower

Name the part of the plant in the pictures.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

3.2 Invertebrate Animals

Answer the following questions by looking at the given pictures.

Fig. 3.2.1

i. What kind of animals are shown in the picture?
ii. What could be their common characteristics ?
iii. Do all living things have backbone?
iv. What is the name given to the creature that has a backbone? What about the creature that doesn't have it?

There are different types of animals around us. Some of them have backbones whereas some of them do not have backbone. The animals like cat, dog, cow, fish, hen, etc. have backbone. They are called vertebrate. The animals like butterfly, snail, housefly, cockroach, etc. do not have backbone. They are called invertebrates. The invertebrates vary in shape, size and structure. Some invertebrates are very small whereas some of them are very big. They live in different types of habitat and they have different distinguishing characters. The invertebrates can be divided into 9 phylums.

1. Unicellular animals (Protozoa)

The protozoa have following characteristics.

i. They are unicellular.
ii. They are mostly aquatic.
iii. Their body shape can be irregular, spherical, oval,

Paramecium Amoeba Euglena

Fig. 3.2.2

elongated or flattened.

iv. They move with the help of pseudopodia, flagella or cilia.

v. The cytoplasm is differentiated into ectoplasm and endoplasm.
Reproduction occurs asexually by binary fission or multiple fission and sexually by conjugation.
For example : amoeba, paramecium, euglena, plasmodium, etc.

Activity 3.2.1

Observe and draw amoeba with the help of a microscope. Make a list of the characteristics of an amoeba with a picture. You can get help from your teacher on this work.

2. Porous animals (Porifera)

i. They are multicellular animals.

ii. They have pores in their body. These pores are called ostia. The upper part of the body consists of a large opening called osculum.

iii. Water enters into the body through ostia and comes out through osculum.

iv. They remain attached to substratum.

v. Their body is asymmetrical.

vi. They are diploblastic animals.

vii. They regenerate lost or separated part.
eg. sponge, sycon, spongilla

Sponge

Fig. 3.2.3

Activity 3.2.2

Observe the sponge specimen with the help of a teacher and make a list of its characteristics with a picture.

3. Hollow bodied animals (Coelenterata)

i. They have hollow body.

ii. Their mouth is surrounded by tentacles.

iii. Ingestion and egestion take place by mouth.

iv. They capture prey with the help of tentacles. Tentacles also help in locomotion.

v. They reproduce by budding.

vi. They are diploblastic animals. They have 2 layer in their body : ectoderm and endoderm.

Hydra

Jellyfisgh

Fig. 3.2.4

Activity 3.2.3

Observe the slide of hydra with the help of a teacher and make a list of it's characteristics with a picture .

4. Flat bodied animals (Platyhelminthes)

i. They have flat body.

ii. They are triploblastic animals. ie. their body have 3 layers ectoderm, mesoderm and endoderm.

Liver fluke Tapeworm

Fig. 3.2.5

iii. They are parasites.

iv. Their are hermaphrodite i.e. both male and female organs are present in the same body.

v. They do not have anus and circulatory system but they have mouth.

vi. They reproduce sexually by fusion of gamete and asexually by regeneration, by fission and regeneration.

for example: tapeworm, liver fluke, planeria, etc.

Activity 3.2.4

Observe the tapeworm specimen with the help of a teacher and make a list of its characteristics with a picture.

5. Unsegmented cylindrical animals (Nemathelminthes)

i. Their body is cylindrical and unsegmented.

ii. Their body is bilaterally symmetrical.

iii. They are triplobastic animals.

iv. Their body has a cavity or pseudocoelom.

Roundworm Hookworm

Fig. 3.2.6

v. The alimentary canal is distinct with mouth and anus.

vi. They are free living or parasitic.

vii. They are unisexual organism.

for example : *ascaris*, hookworm

Activity 3.2.5

Observe the hookworm specimen with the help of a teacher and make a list of its characteristics with a picture.

6. Segmented cylindrical animals (Annelida)

The animals belonging to annelida phylum have following characteristics.

i. Their body is long, round and segmented.
ii. They are triploblastic.
iii. The body is covered with a thin cuticle.
iv. They live in moist environments.
v. They respire through the general body surface.
vi. The digestive system is complete and developed.
vii. They are bilaterally symmetrical.

For example: earthwork, leech.

Earthworm Leech

Fig. 3.2.7

Activity 3.2.6

Observe a cochroach and make a list of its characteristics with a picture.

7. Animals with jointed legs (Arthropoda)

This is the phylum with largest number of animals. The features of arthropoda are as following:

i. They have jointed legs.
ii. Their body is divided into head, thorax and abdomen.
iii. The outer surface of body is made up of chitin.
iv. They are triploblastic and bilaterally symmetrical.
v. They have compound eyes.
vi. Sexes are separate i.e. they are unisexual.
viii. They are found in all types of habitat land, water and soil.

eg. ants, butterfly, crab, prawn, cockroach, mosquito, spider, etc.

Butterfly Spider

Fig. 3.2.8

Activity 3.2.6

Observe a butterfly and make a list of its characteristics with a picture.

8. Soft bodied animals (Mollusca)

The animals belonging to phylum mollusca have following characteristics.

i. They have soft and unsegmented body.

ii. Their body is divisible into three parts - head, a visceral mass and ventral foot.

iii. Their body is covered by shell.

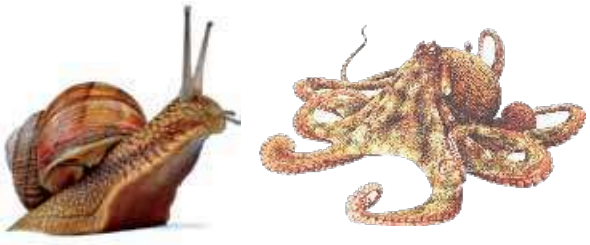
iv. Head bears tentacles.

v. Sexes are separate

vi. They are found in both land and water.

vii. They are triploblastic.

eg. Snail, Octopus



Snail Octopus

Fig. 3.2.9

Activity 3.2.8

Observe a snail and make a list of its characteristics with a picture.

9. Spiny animals (Echinodermata)

The characteristics of animals belonging to echinodermata phylum are as follows:

i. The body surface is covered with calcareous spicules.

ii. They are marine animals.

iii. They do not have head.

iv. Tube feet helps in locomotion.

v. They are star shaped, elongated or spherical.

vi. Sexes are separate.

vii. They can generate lost parts.

viii. They are triploblastic.

For example : starfish, sea urchin, sea cucumber

Starfish Sea Urchin

Fig. 3.2.10

Activity 3.2.9

Observe the starfish specimen with the help of a teacher and make a list of its characteristics with a picture.

Exercise

A. Choose the correct one and put the tick mark (√).

i. Vertebrates are-

a. animals with backbone b. animals without backbone
c. animal with fur d. animal without fur

ii. The invertebrates can be divided into-

a. Seven phylums b. Nine phylums
c. Eight phylums d. Five phylums

iii. Unicellular animals are-

a. annelida b. mollusca
c. arthopoda d. protozoa

iv. Spiny animals are-

a. mollusca b. echinodermata
c. nemathelminthes d. platyhelminthes

v. Porous animals are-

a. porifera b. echinodermata
c. nemathelminthes d. platyhelminthes

vi. Animal with jointed legs

a. roundworm b. hookworm
c. tapeworm d. prawn

vii. Which animal does not have a head?

a. sea archin b. octopus
c. spider d. sycon

viii. Unicellular animals are

a. mostly aquatic b. mostly terrestrial
c. mostly aerial d. aqautic and terrestrial

ix. .....body is long,round and segmented.

a. annelida b. protozoa
c. arthropoda c. porifera

x. Spongilla is an example of

a. porifera b. echinodermata
c. nemathelminthes d. platyhelminthes

xi What happens to arthropods during molting?

a. it sheds it exoskeleton
b. it grows a new appendage
c. it replaces cartilage with bone
d. it contracts its muscles

B. Fill in the blanks with suitable word

pseudopodia, triploblastic, echinodermata, locomotion, ascaris

i. .....are free living or parasitic.
ii. Amoeba move with help of .....
iii. Annelida are .....
iv. Tube feet helps in.....
v. Marine animals are.....

C. Urmila and her family have been to an invertebrate animal exhibition. Look at the animals from the exhibition. Drag the name and the group they belongs to

Molluscs	Insect	warms	sponges	jellyfish	molluscs	insect
Grasshopper	snail	ladybird	sponge	squid	earthwarm	jellyfish

	name	group
It has jointed legs		
It has soft body and an outer shell		
It has a colourful exoskeleton		
It has a body full of spores		
It has a long, soft segmented body		
It has poisonous tentacles		
It is soft with an internal shell		

D. Write differences

i. jellyfish and starfish
ii. roundworm and tapeworm
iii. ascaris and leech
iv. Platyhelminthes and Nemathelminthes

E. Draw a clear picture of the following animals.

i. Amoeba
ii. Earthworm
iii. Snail
iv. Hydra
v. Leech
vi. Starfish

F. Answer the following questions :

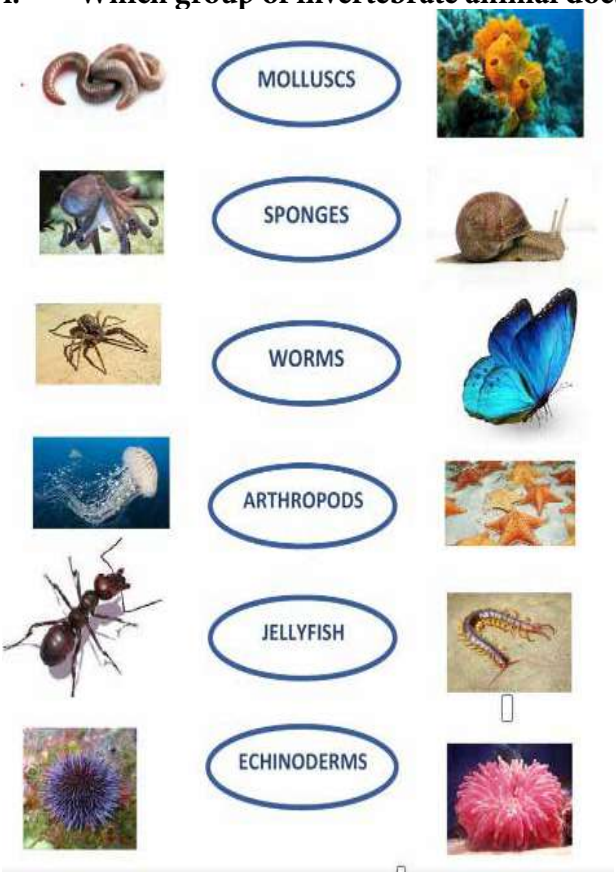
i. Write down the name of the phylum of the given organism.

a. sea-cucumber,
b. prawns,
c. snail,
d. planeria,
e. euglena,
f. sycon

ii. Write down any three characteristics of the phylum arthropoda.
iii. Write down any three characteristics of the phylum protozoa.
iv. List three characteristics of the phylum Porifera.
v. Write down any three characteristics of the phylum echinodermata.
vi. Write down any two similarities and dissimilarities between tapeworm and roundworm.
vii. Write down any three characteristics of the organism found in the phylum mollusca.

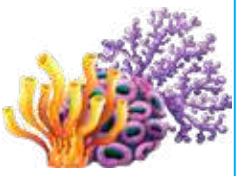
G. Diagrammatic questions

i. Which group of invertebrate animal does it belong to?



ii. Find the words in the wordsearch

jellyfish	crab	caterpillor	snail	fly
butterfly	ant	centipede	sponge	crawfish



C	A	T	E	R	P	I	L	L	A	R
R	E	D	P	O	A	K	L	H	B	Y
A	S	N	L	L	I	A	N	S	C	L
B	Z	B	T	S	P	Z	V	I	R	F
A	B	T	Y	I	S	U	Q	F	A	R
A	N	T	D	N	P	L	H	Y	W	E
M	Z	F	T	Y	O	E	U	L	F	T
L	A	Y	I	O	N	A	D	L	I	T
C	M	L	D	F	G	L	M	E	S	U
X	B	F	A	O	E	R	W	J	H	B

iii. Fill in the blanks with the words from the box:

- Bee are _____ They have a thorax with six _____ and two _____, an _____, and a head with _____ and _____ .
- Bee are _____ . They eat nectar from flowers.
- Bee have a thin _____ for portection.

wings	exoskeleton	eyes	legs
antennas	insects	abdomen	herbivores

- Crabs are _____. They have eight _____ and two _____. They have a _____ with _____ and _____.
- Most crabs are _____.
- Crabs have a thick _____.

pincers	exoskeleton	eyes	legs
antennas	enustaceans	body	amnivores

- Butterflies are _____. They have a _____ with six legs and wings, an _____. and a _____ with _____and two _____.
- They have a thin _____ for protection.
- Butterflies are _____.

head	exoskeleton	eyes	thorax
antennas	insects	abdomen	herbivores

- Spiders are _____. They have eight _____. They have a _____. an _____, and a _____ with eyes and _____.
- They are _____. They eat insects.
- They have a thin _____ for protection.

head	exoskeleton	abdomen	legs
mouth	arochnids	thorox	carnivores

- Dragonflies are _____. They havea with six _____ and four _____ , an _____, and a _____ with _____and _____.
- Dragonflies are amnivores.
- Dragonflies have a thin _____ for protection.

3.3 The Cells

Below are cells of different shapes and sizes. What causes cell differences in size? What is a cell? Do plants and living cells have the same structure?

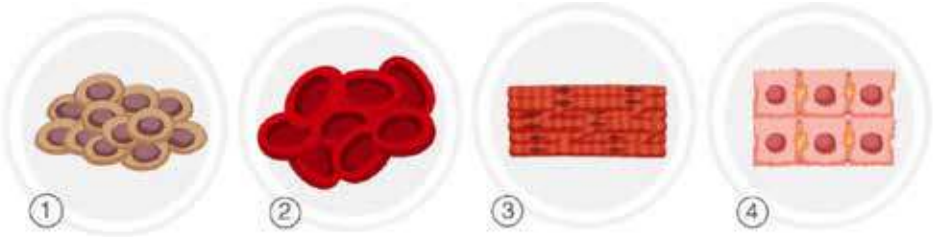


Fig. 3.3.1

The body of all living things is made up of cells. Cells come in different shapes and sizes because they have to perform different functions in the body. The picture above shows: (1) stem cell, (2) blood cells, (3) muscle cells and (4) intestinal cells. The body of some living things is made up of a single cell called an unicellular organism and an organism made up of many cells is called a multicellular organism.

Activity 3.3.1

Peel a thin layer of epidermal cell from inside of an onion. Place a cell on a microscope slide. Add a drop of water or iodine. Gently put a cover slip on to the onion cell. Observe the slide under microscope. Discuss what you see with your friends and teacher.

Activity 3.3.2

Smear cells from the inside of your check using a cotton bud. Smear the cotton bud into microscope slide. Add a drop of methylene blue. Cover it with coverslip. Observe it under the microscope. Discuss what you see with your friend and teacher.

Cell

The structural and functional unit of life is known as cell. All the living beings from plants to animals are made up of cells. Cells can not be seen through our naked eyes. Microscope helps us to see the cells. The cells of plants are different from animal cells.

The branch of biology that helps us to study the cell is known as cytology.

Usually, it is observed that plant cells are rectangular and animal cells are oval in shape. However, there occurs great variation in their cubical, elongated etc. depending on the type of living organisms. Cells show great variation in their sizes. Mostly cells are tiny and microscopic whereas some cells might be larger and macroscopic. The smallest known cell is mycoplasma. Its size is 0.5µm to 5µm. The largest cell is the egg of ostrich. Its size is about 170×135mm. Optical instrument called microscope is used to observe the internal structure of the cell.

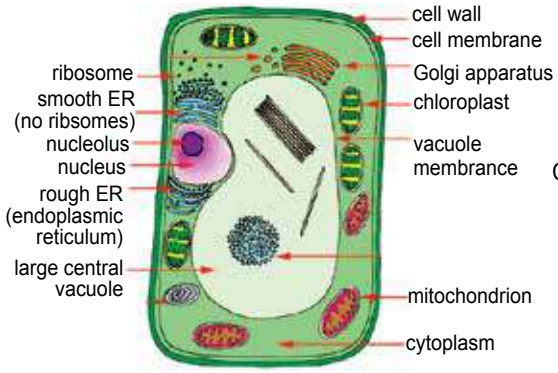


Fig. 3.3.2 Plant Cell

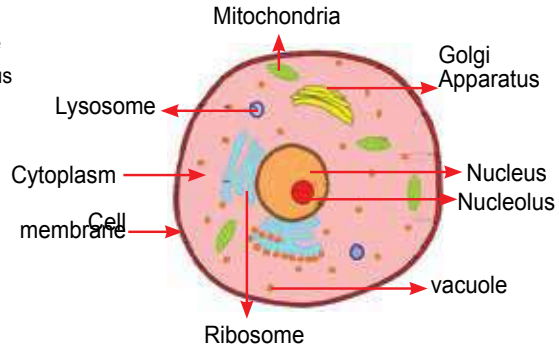


Fig. 3.3.3 Animal Cell

All living organisms are made up of cell. Some organisms consist of a single cell. They are called unicellular organisms, e.g. amoeba, euglena, yeast etc. Mostly plants consist of many cells and hence, they are called multicellular organisms.

[Note : Nucleoplasm is a ground substance of the nucleus which is transparent and semi-fluid. Chromatin fibres and nucleus are suspended in it. Chromatin fibres are the network of a coiled thread like structure. During cell division, chromatin fibres change into chromosomes. Chromosomes contain DNA (Deoxyribonucleic Acid) and RNA (Ribonucleic Acid)].

Types of Cell

On the basis of the nuclear organizations, there are two types of cells namely: prokaryotic cell and eukaryotic cell.

Prokaryotic cell

The cell which lacks well defined nucleus is called prokaryotic cell. Prokaryotic cell lacks different membrane bounded cell organanelles such as endophlasmic reticulam (ER), mitochondria, golgi bodies lysosome etc. i.e. bacteria, cynobacteria (blue green algae) etc.

Eukaryotic cell

The cell which consists of well defined nucleus is called eukaryotic cell. It consists of membrane bounded cell organelles like nucleus, mitochondria etc. These type of cells are found in higher living organisms (plants and animals).

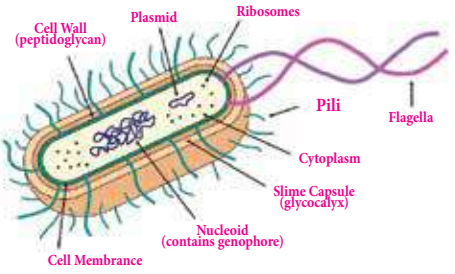


Fig. 3.3.5 bacteria

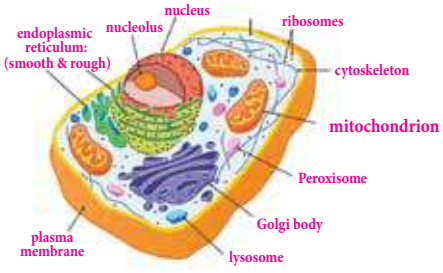


Fig. 3.3.5 developed animal cell

Parts of Cell

The cell is composed of living substances called protoplasm. Protoplasm is of two types i.e. cytoplasm and nucleoplasm.

A cell has many smaller living cytoplasmic units suspended in the liquid protoplasm. Such parts of a cell are called the cell organelles. Some of the components of a cell are as follows.

i. Cell wall

The outermost thick and strong covering of plant cell is known as cell wall. It is made up of non-living component which is known as cellulose. It is absent in animal cells.

Functions

- It gives proper shape to plant cells.
- It protects cell membrane and other cell organelles.

ii. Cell membrane

It is a living layer which is also known as plasma membrane. The outermost layer that encloses the cytoplasm and the nucleus within is called the cell membrane. It is present in both plant and animal cells.Plasma membrane regulates the entry of substances inside the cell. It selects substances and does not allow everything to enter the cell. It is semi-permeable.

Functions

- It gives shape to the cell and protects cell organelles.
- It takes essential things from outside and removes waste products outside.

iii. Cytoplasm

The fluid surrounding the nucleus and situated below cell membrane is known as cytoplasm. It is made up of compounds of basic elements carbon, hydrogen, nitrogen and oxygen like sugars, fats and proteins. The major solvent is water. All the metabolic activities take place inside the cytoplasm. Cytoplasm contains many organelles (living) and inclusions (nonliving) in it. Different vital activities take place inside its mitochondria, golgi bodies, endoplasmic reticulum, ribosome, lysomes, plastids, etc. are some examples of organelles found in cytoplasm.

a. Endoplasmic Reticulum

It is a membranous tubular structure found connection in between the nucleus and cell membrane. It may or may not contain ribosomes on it.

Function

- It gives mechanical support to cells.
- It increases the area for the metabolism of a cell.
- It helps to form cell plate during cell division in plant cells.

b. Ribosomes

Ribosomes are small, round structure found on endoplasmic reticulam or in cytoplasm. They are also called as protein factories as they synthesize protein in the cell.

c. Golgi body

Golgibodies are made of biconcave plate like structures. There is a single golgi body near the nucleus. It is mainly concerned with excretion and secretion.

Function

- It is involved in secretion of different types of juice.
- It also forms cell plate during cell division.
- It forms lysosomes and stores protein, fats, etc.

d. Lysosome

It is an irregular structure found in cells. It is considered as the suicidal bag of the cell because it digests cell organelles. It digests the unnecessary materials of the cell. It also kills old cells.

e. Mitochondria

Mitochondria are rod shaped structures. They have foldings inside. They are large in number in a cell. They are found in both plant and animal cells. They are commonly called the powerhouse of the cell because they store and produce energy inside the cell.

f. Centrosome

Centrosome is found in animal cells only. It is situated close to the nucleus. It consists of two centrioles. It forms spindle fibres in animal cells during cell division.

g. Plastid

Plastids are found only in plant cells. They prepare and store food. They also provide attractive colours to flowers and fruits. They are found in different shapes. They are of three types :

i. Chloroplast

Chloroplast is found in leaves and other green parts of plants. It contains a green pigment called chlorophyll which helps in the process of photosynthesis. i.e. it helps to convert CO_2 and water using sunlight, into oxygen and glucose.

ii. Chromoplast

Chromoplast are found in flowers and fruits which are colourful in nature. They provide attractive colours to flowers and fruits. They help in the pollination.

iii. Leucoplast

Leucoplast is found in root and stem of a plant. It is colourless i.e. white in colour. It helps to store food in the plants body.

h. Granules

There are many minute non- living components in the cytoplasm which are known as granules. Granules consist of starch, glycogen and fat.

i. Vacuole

Vacuoles are tiny cavities which are found in both plants and animals cell. Vacuoles are large in size and permanent in plant cells but smaller and temporary in animals cell. Each vacuole is filled with fluid (water and minerals) which is known as cell sap. Plants may also use vacuoles to store water.

Functions

- Vacuoles help to make cells strong.
- It balances the amount of water.
- It balances the amount of glucose in cells.
- It stores and removes waste products.

j. Nucleus

It is the most important organ of the cell. It is oval or spherical in shape and covered by a membrane called the nuclear membrane. The nucleus contains one or more dense rounded bodies which is known as nucleolus. A nucleus also contains chromosomes in it. Chromosomes contain genetic information.

Function

- It plays a vital role in cell division and in reproduction.
- It carries heriditary characters from parents to off- springs.
- It controls all the activities of a cell.

Structure of Plant Cell and Animal Cell

The plant cell and animal cell are different from each other. The plant cells are usually rectangular. They contain cell wall, large vacuole and plastids. The animal cells are usually oval. They are surrounded by cell membrane and contain small vacuole. They do not have plastid. However, many components of cell like nucleus, cytoplasm, mitochondria are found in both plant and animal cell.

The animal cell and plant cell are different from each other. The plant cell is rectangular and surrounded by cell wall. The animal cell is oval and surrounded by cell membrane. Both plant cell and animal cell contain cell membrane, cytoplasm and nucleus. The cytoplasm contains many cell organelles like ribosomes, golgi body, lysosome, mitochondria, centrosome, plastid, etc.

Differences between plant cell and animal cell

Plant Cell	Animal Cell
i. Usually plant cells are larger.	i. Usually animal cells are smaller.

ii.	They are rectangular.	ii.	They are oval
iii.	They contain cell wall.	iii.	They do not contain cell wall.
iv.	They contain single large vacuole.	iv.	They contain many small vacuoles.
v.	They contain plastid.	v.	They do not contain plastids.
vi.	Centrosome is absent.	vi.	Centrosome is present.

Cell: The basic structural and functional unit of all living organisms.

Cell number

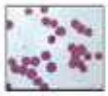
Unicellular Organisms: are made up of single cell, e.g. amoeba, bacteria, chlamydomonas

Multicelluar organisms: are made up of millions of cells e.g. plants, animals

Cell Size

Cells are extremely small, therefore they can only be observed under microscope.

Cells are measured in micrometers or microns.



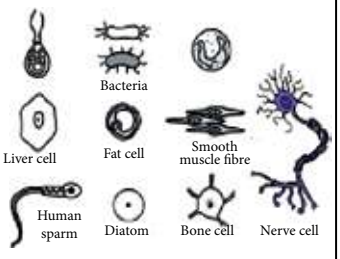
Microplasma- smallest cell

Nerve cell - longest cell

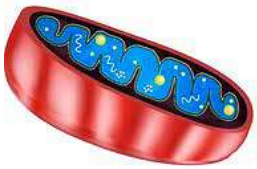
Ostrich egg - largest cell

Cell Shape

The shape of the cell varies in different organisms. The shape of plant cell is different from that of an animal cell. They may be spherical, oval, elliptical, spindle-shaped, cuboidal, polygonal, columnar, or flat plate-like.



mitochondria

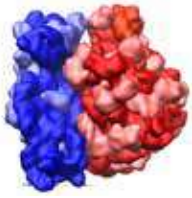


- tumblr famous
- only drink gatorade
- powerhouse of the cell

nucleus

- control freak
- "everyone is important uwu"
- unofficial squad leader

ribosome

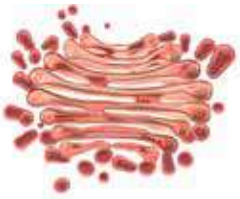


- actually works for a living
- always making things for their friends
- Highkey wants to be nucleus's bff

nucleolus

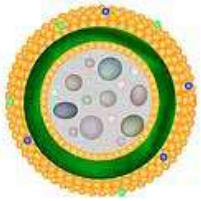
- nucleus's actual bff
- superiority complex
- basically 12 years old

golgi apparatus



- loves duct tape
- gives great advice
- unproblematic fave

lysosome



- always salty
- loves dogs
- will fight anyone

ER

- total mom friend
- better than you at literally everything
- only one who can drive

vacuole

- really quiet except when they're not
- v dependable
- does crossfit

chloroplast

- super elitist
- only wears green except on st patricks day
- lowkey hippie

Points to Remember

- All living organisms - plants, animals and human beings are made of small structures called **cells**.
- Many cells together makes a **tissue**.
- Tissues of the same kind make an **organ** e.g. Liver, heart, stomach
- Organs together make an organ system, for example: digestive system, respiratory system and these together form the whole body.
- The structural and functional unit of life is known as cell. All the living beings from plants to animals are made up of cells. Cells can not be seen through our naked eyes.
- All living organisms are made up of cell. Some organisms consist of a single cell. They are called unicellular organisms, e.g. amoeba, euglena, yeast etc.
- The cell which lacks well defined nucleus is called prokaryotic cell. Prokaryotic cell lacks different membrane bounded cell organanelles such as endophlasmic reticulam (ER), mitochondria, golgi bodies lysosome etc. i.e. bacteria, cynobacteria (bule green algae) etc.

- The fluid surrounding the nucleus and situated below cell membrane is known as cytoplasm.
- Ribosomes are small, round structure found on endoplasmic reticulam or in cytoplasm.
- Golgibodies are made of biconcave plate like structures. There is a single golgi body near the nucleus.
- Centrosome is found in animal cells only. It is situated close to the nucleus.
- Plastids are found only in plant cells. They prepare and store food.
- The plant cell and animal cell are different from each other. The plant cells are usually rectangular.

Project Works

i. Collect various plants found around the house or school. Separate the different parts of the plant, such as roots, stems, leaves, and flowers. Now draw a clear picture of one of the collected plants and present it in the classroom with the description.

ii. Make a model of an animal or plant cell by using different materials (such as clay) and demonstrate that model in the classroom.

iii. Make a model of the plants, roots, and leaves using different local materials (such as thread) and name their different parts.

A. Choose the correct one and put the tick mark (√).

i. A cell is defined as the fundamental, structural and functional ..... of all life.

a. group b. unit
c. joint d. multi-cellular

ii. Which is not the characteristics of cells.

a. Cells provide the necessary structural support for an organism.
b. The genetic information necessary for reproduction is present within the nucleus.
c. Structurally, the cell has cell organelles which are suspended in the cytoplasm.
d. Mitochondria is not the organelle responsible for fulfilling the cell's energy requirements.

iii. ..... are known as the powerhouse of the cells.

a. Cell Wall b. Cytoplasm
c. Nucleus d. Mitochondria

iv. Which is not the essential functions of the cell

a. The cell provides support and structure to the body.
b. Facilitates growth by mitosis
c. Helps in reproduction
d. Provides a lot of food .

v. Golgi bodies package, and sort the .....for secretion.

a. proteins b. carbohydrate
c. cytoplasm d. minerals

vi. Name the outermost layer of plant cell

a. cell wall b. cell membrane
c. cytoplasm d. nucleus

vii. Which of the following is not found in plant cell ?

a. plastid b. nucleus
c. centrosome d. vacuole

viii. Which is suicidal bag of the cell ?

a. lysosome b. ribosome
c. plastid d. vacuole

B. Fill in the blanks with suitable word.

Cellulose, Cell membrane, Protien, Nucleus, Chloroplast

a. .....is semi-permeable membrane.
b. Ribosomes synthesize .....in cell.
c. Cell wall is made of .....
d. .....is called the..... functional unit of the life .
e. .....controls all the activities of the cell .

C. Give the reason :

i. The cell is also called the structural and functional unit of life.
ii. Cells come in a variety of shapes and sizes.
iii. The mitochondria are called the power house of the cell.
iv. Plant cells are much more rigid and rectangular in shape.

D. Differentiate with example

i. Plant cell and animal cell.
ii. Cell membrane and Cell wall
iii. Animal vacuole and Plant vacuole
iv. Nucleolus and Nucleus
v. Lysosome and Centrosome

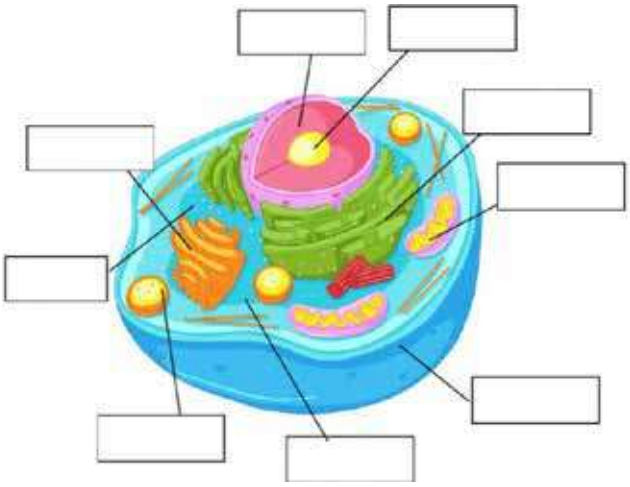
E. Answer the following questions :

i. What is a Cell?
ii. State the characteristics of cells.
iii. State the types of cells.
iv. What is the function of mitochondria in the cells?

v. What are the functions of the cell?
vi. What is the function of Golgi bodies?
vii Name the cell organelle that contains hydrolytic enzymes capable of breaking down organic matter.
viii. Which cellular structure regulates the entry and exit of molecules to and from the cell?
ix. Sketch and describe in your own words, the plant cell and animal cell.

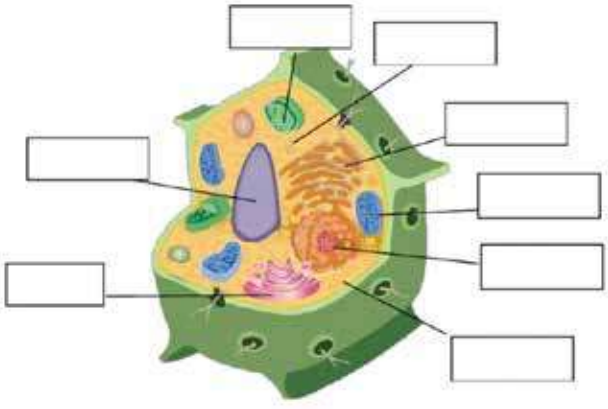
F. Diagrammatic questions

i. Fill in the boxes with suitable words.



1. Nucleus
2. Nucleous
3. Cytoplasm
4. Cell membrane
5. Lysosome
6. Endoplasmic Reticulum
7. Golgi Apparatus
8. Mitochondria
9. Ribosome

ii. Fill in the boxes with suitable words.



1. Ribosome
2. Cytoplasm
3. Golgi Apparatus
4. Mitochondria
5. Chloroplasts
6. Endoplasmic Reticulum
7. Vacuole
8. Nucleus

Unit 4 BIODIVERSITY AND ENVIRONMENT

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- introduce, emphasize and classify natural resources.
- introduce water resources, reservoirs and wetlands and their importance.
- explain the causes and effects of destruction of natural resources.
- manage solid waste.

Answer the following question by looking at the picture below.

Fig. 4.1

i. Can the creatures mentioned in the picture be found everywhere?
ii. Is yak found in both the Terai and the Himalayas?Why ?
iii. Are the climates of the Terai and Himalaya similar?
iv. Why is there diversity in the environment?

4.1 Environment and its balance

Different species of animals and plants are found in different environments. The various kinds of animals and plants in the world are components of our environment. Even though our country is small, due to the diversity of the environment, even a small part of the country has a wide variety of flora and fauna. The animals and plants found in the hills and mountains are different from those found in the Terai. The discovery of different species of animals and plants in this way is called biodiversity. There is a close relationship between biodiversity and the environment.

Biodiversity

Have you travelled to different places? Have you seen the same types of plants and animals everywhere? Is the climate of every place same on the earth? Is there any relationship between climate and living thing found in such climate? Think and discuss.

The animals and plants found in different environment are different. We find polar bear and yak in very cold climate. We find buffalo, camel and chameleon etc. in warm climate. Similarly, there are different types of plants found in different region. The animals and plants vary from other plants and animals in many ways. The variation of plants and animals is called biodiversity. The biodiversity also refers to the variation in ecosystem. The biodiversity and environment are closely interrelated. The plants and animals vary according to environment. In this chapter, we shall discuss about the environment and its balance, destruction of natural resources, solid waste management.

Environment

The surrounding in which plants and animals live is called environment. It is the collection of all living and non-living things found around us. We use different types of resources from environment for our survival. We use air, water, soil and sunlight. Similarly, we use different plants and animals for different purpose. The living and non-living things found in our environment are called component of environment. The air, water, soil, heat, light, plants, micro-organisms, animals, insects etc. are components of environment. The number and amount of components of environment must be in balance. The shortage or scarcity of any components brings imbalance in environment. We cannot survive in imbalanced environment.

Activity 4.1

Imagine there is a forest in a limited area. There are some animals living in the forest. They obtain all their needs for survival from forest. Suppose the number of animals increase rapidly in that forest. Will they get sufficient food and shelter for their survival? Discuss.

The human population is increasing day by day. Human can utilize the resources present in environment easily. Due to increased population, the natural resources is utilized

more and more. This brings imbalance in environment. We should try to maintain environmental balance and conserve the environment.

4.1.1 Natural Resources

The natural resources are the components of environment that human beings can use for their benefit and survival. The air, water, soil, rocks, forest, animals, herbs, minerals etc. are natural resources. The use of natural resources helps us to survive. They make our life convenient. We use air and water. We obtain food from plants and animals. We obtain natural gas, minerals, fossil fuels etc from nature. They are natural resources. Human beings utilize natural resources for production of goods, operate industries, agriculture etc.

4.1.2 Classification of Natural Resources

The natural resources can be classified into different types on different basis.

On the basis of origin, they can be classified as

- biotic natural resources
- abiotic natural resources

Biotic Natural Resources: It includes living resources like plants and animals. It also includes resources obtained from plant and animal products. The forest, fossil fuel, animals are biotic natural resources.

Abiotic Natural Resources: It includes non-living components of environment that are formed by inorganic substances. They are air, water, rocks, minerals etc.

On the basis of regeneration, the natural resources are classified as:

i. Renewable natural resources
ii. Non-renewable natural resources

i. Renewable Natural Resources

The natural resources like air, water, sunlight do not exhaust on using to any extent. They can be used again and again. Such natural resources that does not exhaust on using are called renewable natural resources. The natural resources like forest, rubber, leather, timber, biomass can be replenished quickly in short time. They are also renewable natural resources. Therefore, renewable natural resources are those natural resources which are found in unlimited amount in nature or which can be replenished quickly when exhausted.

ii. Non-renewable Natural Resources

Some natural resources like coal, natural gas, metals, minerals, rocks etc. are found in limited amount on earth. Such natural resources can exhaust on using for indiscriminately. It takes millions of year to form such natural resources. So,

once they get exhausted, they cannot be regenerated for use within our life time. Therefore, the natural resources which takes very long time to be regenerated so that they cannot be used again and again within our life time are called non-renewable natural resources.

Importance of natural resources

The most important natural resources are land, water, forest, sun, wildlife, air, mountain and minerals. People use these resources for their survival. Natural resources are found in various area in different amount. The amount of natural resources determine the wealth. Some importance of natural resources are as follows .

i. Source of food

The land and forest are important natural resources which provide food to human beings. We get meat, milk, etc. from animals. We get medicinal herbs from forest. All herbivorous animals get food from plants. We also get different vegetables and fruits from the plants as food.

ii. Shelter

The land, forest and water, etc. are the shelters of various living organisms. Human beings use land for various purposes such as building houses, roads, garden, etc. Land is also shelter of many animals. Rivers ponds, wetland, sea, etc. are the shelter for aquatic animals.

iii. Sources of fresh air and water

Natural environment is the sources of air, water, etc. All the living things such as human beings, animals and plants can not survive without them. All living organisms will be badly affected due to dirty air and water. Nature always purifies air and water through natural processes.

iv. Natural beauty

Natural resources create natural beauty which is the most valuable resources of the country. The natural resources like Mt. Everest, high mountains, river, small streams and different type of animals, birds and plants add natural beauty of the country.

v. Tourism development

Natural resources give natural beauty for the country. Tourists are attracted by high snow - capped mountains, hills, wild birds and other animals, lakes etc. It helps to develop tourism industry. It provides employment opportunity to the people. It is the main source of income generation in many countrys.

vi. Economic development

We need natural resources for several developmental activities. We need natural resources such as forest products, minerals, animals products, etc.

These resources are essential for the economic developments of the country. Employment opportunities will be increased. Economic development helps the nation to become more stronger.

Water resources

Fig. 4.2

The sources of water which are available in this earth is known as water resources. There are mainly three sources of water i.e. rainfall, surface water and underground water.

Surface water is the main source of water. About two-third of the earth's land is covered with water. There are many water resources in Nepal. Pond, lake, spring, river and under ground water are the resources of Nepal. In Nepal all the rivers are flowing from the Himalayas. Rivers are flowing from the north towards the south of Nepal from the Himalayas. The hydroelectricity can be generated from these flowing river. Nepal is rich in flowing river after Brazil. Huge quantity of electricity can be produced from these rivers of Nepal.

Distribution of Earth's Water

About 97.4 of water is present in oceans. It's salty hence it can't be used.	Of the balance 2.6%, 2% is fozen in forms of ice caps and glaciers. Its not available for human consumption.	Only 0.6% is pure water in liquid form, of this 0.59 is present as groundwater.	Balance 0.01% is available as fresh water on earth surface.

Fig. 4.3

Importance and necessity of water resources

Water resources is the main resource of the nature. Some importance of water resources are as follows.

- Lots of hydroelectricity can be produced from the water resources of Nepal. Electricity is used in industries and houses.
- High yield of crops can be obtained from the irrigation in the agricultural field.
- Drinking water can be supplied to the people of villages and cities.
- Motor boat can be used as a means of transportation.
- Hydroelectricity can also be used for other purposes like running cable car, bus, train. etc.
- It helps to protect forests, animals and wild animals.

Conservation of water resources

Water resources can be used extensively for the increasing demand. Excessive use of water resources bring the scarcity of water in future. Now a days in cities water resources are used in unplanned manner. This can decrease the water level of underground water and damage the land. Dams which are built in lakes can damage lakes. Conservation of water resources is very important to protect plants and animals.

Watershed

The area from where the water runs in different regions such as river and stream is called watershed.

Fig. 4.4

The watershed is an area where there is a run- off water towards the major rivers, streams or lakes. In the watershed all running water of stream flows in different directions. It is called river system. There are different watersheds in Nepal like Trisuli watershed, Kulekhani watershed, Shivapuri watershed, Marshyangdi watershed and Arun watershed.

Importance of watersheds

- The proper management of watersheds helps to check the natural calamities like floods, land slide, soil erosion, etc.
- It helps to balance the environment. It increases the fertility of soil. Such types of fertile land gives more yield of crops.

- Conservation and protection of watersheds protect natural resources .
- The management of watersheds helps to raise the living standard of people through economic development.

Conservation of watersheds

Natural resources are extensively used by human beings to fulfill their requirements. Growing population has adverse effect on forest geography and water sources. Due to adverse effects of human generated activities we have to give importance to the conservation of water resources. Terrace farming, tree plantation, grass plantation, etc. are some of the methods which can help in the conservation of watershed. Public awareness and education about the importance of watershed to the community people is another importance of watershed. Thus, our environment is protected by conserving watersheds.

Wetland

A wetland is an area of very moist damp land with aquatic and terrestrial plants. It takes the characteristics of a distinct ecosystem. Wetland supports aquatic plants to grow. The depth of water in wetland is less than 6 meters. This type of land is also very good for the aquatic birds habitat and other aquatic animals. Ponds, lakes and swamp lands are good examples of wetland. *Koshi Tappu* wild life reserve is one of the wetlands of Nepal. According to the study done by IUCN, there are 163 wetlands in terai, 164 wetland in mountains and 78 wetlands in himalayan regions in Nepal. Nepal is rich in wetlands.

Importance of wetlands

- Wetlands are suitable habitats of birds and other animals.
- Wetland helps to maintain the environmental balance.
- Wetland helps in agricultural development.
- It provides shelter for different animals and plants.
- We can use water of wetland in different ways.
- They also help in tourism development.

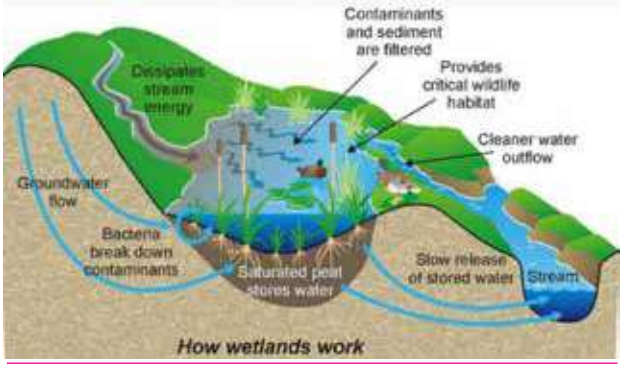


Fig. 4.5

Conservation of wetland

Different activities of human beings destroy wetland. Wetlands can be damaged by excessive use of water for agriculture, to clear area for settlements, throwing waste materials from industries, etc. It is very important to protect the wetlands.

In 1971, international convention in Ramshar, Iran decided to take steps to protect wetlands. The agreements which were made there is called as Ramshar agreement. Koshi Tappu Wildlife Reserves, Bishajari tall of Chitwan, Jagadishpur pond of Kapilbastu are declared as wetlands of Nepal. Wetlands protection is also important to balance the ecosystem, community development and conservation of bio- diversity. Management of wetlands should be done to protect the environment.

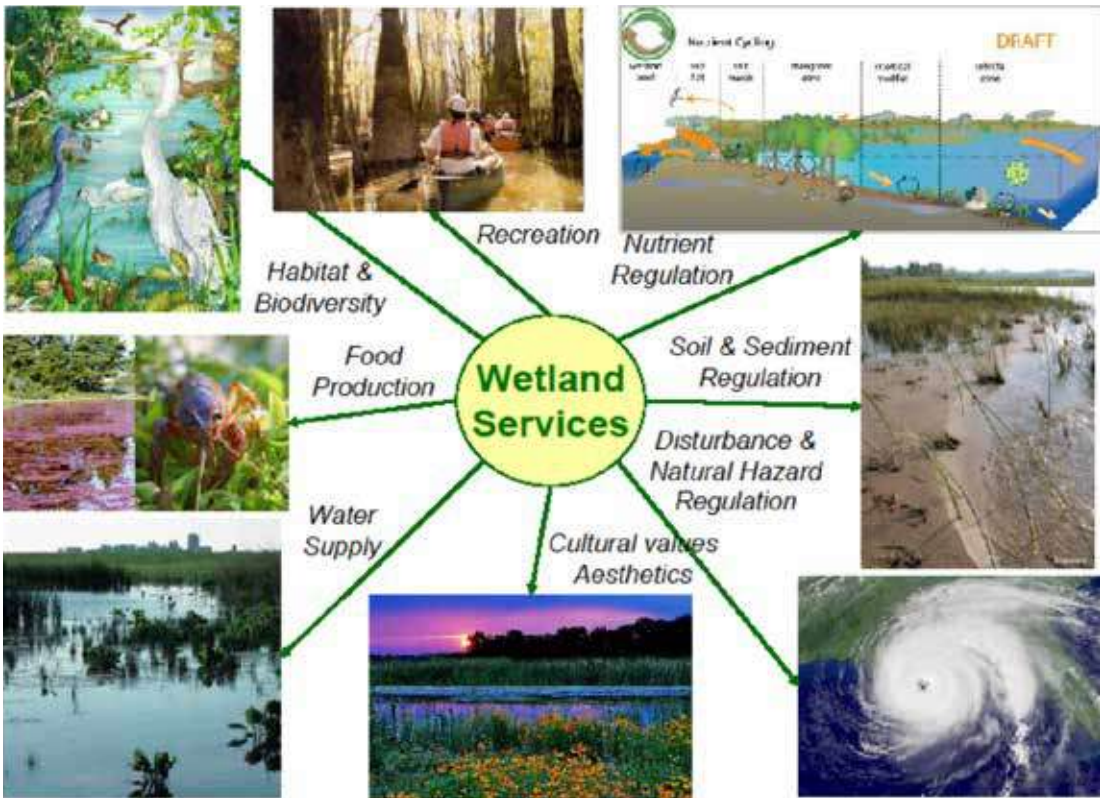


Fig. 4.6

4.2 Destruction of natural resources and their effects

Human beings are fulfilling their requirements by utilizing the natural resources. Increase in the natural resources by excessive utilization of the natural resources. Decrease in the amount of the natural resources causes adverse effects on the environment. Living beings can not survive in a worse environmental condition. Human beings are fully dependent on these natural resources. Air, water, soil, minerals, plants, fossil fuel, animals, etc. are the natural resources of the earth.

Fig. 4.7

Vegetation

Plants around us are our natural resources. We obtain many things like timber, medicinal plants, fodders, food, etc. from plants. Grass land is used for the grazing by catles. Excessive use of forest can reduce the area of plants. Deforestation shows the following effects.

- Decrease in the amount of oxygen in the atmosphere.
- Valuable plants and medicinal herbs are damaged.
- Shelters of animals can be damaged and wild animals disappear.
- Desertification takes place in the area.
- Flood landslide, soil, erosion, etc. takes place.
- Food chain gets disturbed.

Animals and Birds

Human beings depend upon animals and birds for their survival. Man uses these animals and birds for several purposes. Cow, buffalo, horse, donkey, goat, sheep, etc. like domestic animals are used for meat, milk or carrying loads. Animals are another important natural resource which is essential for human beings. Some wild animals are being disappeared from the forest due to the destruction of shelters, destruction of forest also decrease the number of herbivores. This also put all carnivores in danger condition. Food chains are also badly affected. Decrease in the number of herbivores also decreases the number of carnivores of the environment. These imbalances may cause disappearance of some animals.

Water Resources

Fig. 4.8

Water is one of the most important natural resources. Living beings can not survive without water. The water resources are used by human beings in different ways. The excessive use of water resources such as lakes, ponds, river and streams have badly affected. The excessive use of water resources has direct effect on the aquatic animals which can not survive in poor water resources. The wastes are also being released in the riverside. These wastes pollute water and the aquatic animals can not get enough oxygen. Aquatic animals may die due to this condition. Life of human beings also become difficult due to polluted water resources.

Fuel

The main source of energy is the sun. Plants prepare food materials with the help of sun- energy. We get timber, fire wood from plants. Fossil fuels are formed due to deposition of dead and decaying plants under soil. These fossil fuels like wood, petrol, kerosene, coal, etc. are found under the ground. Now a days, these fuels are being used in maximum quantity. Life of human beings would become difficult due to the scarcity of fuels. Excessive use of these fossil fuels and forest can ultimately bring adverse effects in the environment like flood, landslide, soil erosion, etc.

Air

All living organisms depend upon air for survival. Living organisms take oxygen gas and release out carbon dioxide during respiration. Pure air is needed to all the living organisms. Addition of harmful gases in air causes air pollution. Air pollution causes different diseases like heart disease, respiration allergy, etc. Air becomes polluted from different means like vehicles industries etc. Industries and vehicles produce carbon dioxide, carbon monoxide, etc. mixes with air causes acid rain. Acid rain damages houses, temple, roof, etc. Polluted air also causes global warming.

Land

Land is the shelter of all type of animals. Land is made up of rocks and soil. Land help all living organisms to provide shelter and food materials. Men also obtain all types of food from the land. We might get less yields from the plants due to decrease in the quality of the soil. This also changes the condition of plants, agricultural production, weather, etc.

Minerals

Non-metals, metals and their compounds are known as minerals. Minerals are non-renewable natural resources of the earth. Excessive use of these minerals causes end of these minerals from the earth.

4.3 Solid Waste Management

Solid Waste

Fig. 4.9

We consume different types of things. We buy food products, clothes, electronic items, machines etc. These product are wrapped or packed in something. Do you use everything when you purchase something? What do you do with the wrapper of noodles and chocolates? We abandon them. We see a lot of such abandoned things around us like plastics, paper, old clothes, cans, aluminium foil, old tyres, damaged electronic items etc. They are called solid waste. Solid waste is the unwanted or useless solid materials generated from human activities in residential industrial or commercial areas.

The solid waste degrade environment. They cause different types of pollution. The solid waste must be managed to reduce pollution and its harmful effect on environment.

Proper management procedures of the solid wastes is also important. Besides proper managements of soil wastes, We can apply 3 - R principal i.e. Reduction, Reuse and Recycle.

Reduction

The emission of smoke by burning fuels should be reduced. In old vehicles and industries machines can be changed into less harmful by different treatments. It will help to reduce air and water pollution. The dependence on fossil fuels also should be replaced by perpetual sources of energy. Use of chemical fertilizers and insecticides also become the cause of the death of domestic animals. It also pollutes our food, water and land. Cotton or jute bags can be used instead of plastics.

Reuse

Using the same item for various purposes is known as reuse. Reuse is another way of minimizing pollution. The empty glass and plastic bottles can be used to store different things. Plastic bags can be used to make mats, cushion, etc. which help to minimize the environmental pollution. The waste water of kitchen and bathroom can be used for

Fig. 4.10

flower pots and for kitchen garden. Plastic cans can be used as containers and as flower pots too. Old metals can be made in to new shapes. We can make the habit of collecting such things and sell to collectors for dual benefits keeping the environment clean and making money.

Recycle

The process of collecting, processing and reusing the materials by changing their form is known as recycle. Recycling is the third principle of sanitation. Peels of vegetables and fruits can be recycled to form compost fertilizers. Plastic can be recycled to make new plastic materials. Metals, broken glasses, newspaper and other type of papers, plastic bags, shoes, etc. can be recycled by recycling these wastes. We can use them again for other purposes. It helps to reduce pollution and land needed for dumping.

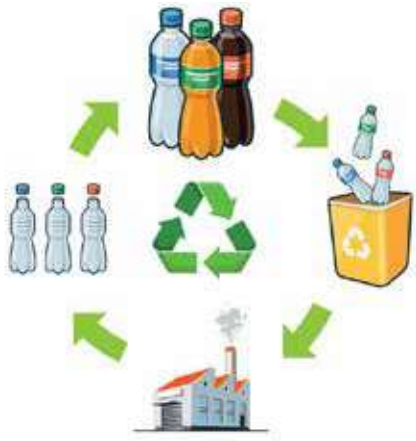


Fig. 4.11

Points to Remember

- The surrounding in which plants and animals live is called environment. It is the collection of all living and non-living things found around us.
- The natural resources are the components of environment that human beings can use for their benefit and survival.
- The natural resources like air, water, sunlight do not exhaust on using to any extent. They can be used again and again. Such natural resources that does not exhaust on using are called renewable natural resources.
- The natural resources which takes very long time to be regenerated so that they cannot be used again and again within our life time are called non-renewable natural resources.
- The sources of water which are available in this earth is known as water resources. There are mainly three sources of water i.e. rainfall, surface water and underground water.
- Water resources can be used extensively for the increasing demand. Excessive use of water resources bring the scarcity of water in future.
- The area from where the water runs in different regions such as river and stream is called watershed.
- Natural resources are extensively used by human beings to fulfill their requirements. Growing population has adverse effect on forest geography and water sources.

- A wetland is an area of very moist damp land with aquatic and terrestrial plants. It takes the characteristics of a distinct ecosystem. Wetland supports aquatic plants to grow.
- Grass land is used for the grazing by catles. Excessive use of forest can reduce the area of plants.
- Human beings depend upon animals and birds for their survival. Man uses these animals and birds for several purposes. Cow, buffalo, horse, donkey, goat, sheep, etc. like domestic animals are used for meat, milk or carrying loads.
- The main source of energy is the sun. Plants prepare food materials with the help of sun- energy.
- All living organisms depend upon air for survival. Living organisms take oxygen gas and release out carbon dioxide during respiration. Pure air is needed to all the living organisms.
- Land is the shelter of all type of animals. Land is made up of rocks and soil. Land help all living organisms to provide shelter and food materials.
- Non-metals, metals and their compounds are known as minerals.
- Using the same item for various purposes is known as reuse. Reuse is another way of minimizing pollution.

Project Works

i. Whenever possible, you should have a group visit the garbage dump. Observe the soil conditions there and prepare a report based on the following headings and present it to the class:

(A) Location (b) Purpose (c) Pollution Causes and Effects (d) Preventive Measures (e) Summary

ii. Prepare a report under the heading of Solid Waste Management on the school premises with the following subheadings and present it to the class. (A) the study's background (b) the objectives (c) the data collection method (d) the statistical analysis (e) conclusion

A. Choose the correct one and put the tick mark (√).

i. The variation of plants and animals are called

a. environment b. biodiversity
c. variation d. ecosystem

ii. The plants and animals vary according to-

a. environment b. biodiversity
c. variation d. ecosystem

iii. The surrounding in which plants and animals live is called-

a. environment b. biodiversity
c. variation d. ecosystem

iv. The natural .....are the components of environment that human beings can use for their benefit and survival.

a. resources b. biodiversity
c. variation d. ecosystem

v. The use of natural resources helps us to .....

a. life b. survive
c. variation d. benefit

vi. Biotic natural resources-

a. plants b. water
c. air d. minerals

vii. Abiotic natural resources-

a. plant b. animal
c. forest d. water

viii. Coal and natural gas are-

a. renewable resource b. non-renewable resource
c. natural matter d. artificial matter

ix. The sources of water are available in this earth is known as .....resources.

a. water b. wildlife
c. land d. air

x. A.....is an area of very moist damp land with aquatic and terrestrial plant

a. watershed b. wetland
c. land d. pond

xi. What does this picture mean?

a. environment b. biodiversity
c. watershed d. wetland

B. Fill in the blanks

recycle, shelter, energy, mats, habitats, compost

i. Peels of vegetables and fruits can be recyled to form .....fertilizers.

ii. Plastic bags can be used to make.....

iii. Reduction, reuse and.....

iv. Land is the ..... of all type of animals.

v. The main source of .....is the sun.

vi. Wetlands are suitable .....of birds and other animals.

C. Give the reason :

i. Wetland helps in agricultural development.
ii. Conservation and protection of watersheds protect natural resources
iii. Water helps to protect forests.
iv. Natural resources can be used for the benefit of all living organisms.
v. We cannot survive in imbalanced environment.

D. Differentiate with examples

i. Biotic resources and abiotic resources
ii. Renewable and Non-rewewable resources
iii. Watershed and Wetland
iv. Biodiversity and Environment
v. Biomass and fossile fuel
vi. Reuse and recycle

E. Answer the following questions :

i. What is natural resource ?
ii. What is the importance of natural resources?
iii. How many types of natural resources ?
iv. What is biodiversity?
v. What is a water resource? Write down the importance and nesessity of it .
vi. Define watersheds and waterland areas. Write down the importance of them.
vii. What is the depletion of natural resources?
viii. How is solid waste management done?
ix. What is ecological balance?
x. Write down the main ways to manage solid waste.
xi. Explain the causes of environmental imbalances.
xii. What are the 3Rs ?
xiii. Complete the flow chart below :
xiv. Categorise each resource below as either a renewable or non-renewable resource

tree, wind energy, coal, animal, water, wood, oil, natural gas, wheat, sun energy, air, biomass energy, petroleum.

Renewable	Non-renewable

F. Diagrammatic questions

i. Answer the questions based on the picture.

a. What effect does this activity have on the agricultural sector?
b. What effect does it have on water resources?
c. How does this activity affect wildlife?
d. What natural resources are present here?
e. What could be your role in controlling it?

ii. Look at each of the pictures below and determine whether the items can go in the recycling bin, cospost bin, or general garbage. Cut around each and place in the correct column.

Paste the item in the correct category below.

Recycling	Compost	Garbage

iii. Drag the name and put it under the correct natural resource.

Wildlife Sun Wind rain plant tree

rocks soil sandy beach blue water water mineral

iv. Label the words from the box with the pictures

Global warming, Pollution, Deforestation, Extinction, Invasive species, Overpolution

v. The image below show two different places. Explain which one may have more biodiversity and why.

Unit 5 LIFE PROCESS

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- explain the transportation process in plants and animals,
- compare and explain the excretion process of animals and plants,
- introduce the respiratory process in plants and animals and to explain its importance

The picture below shows some of the life processes that take place in living things. By studying it and discussing the question below–

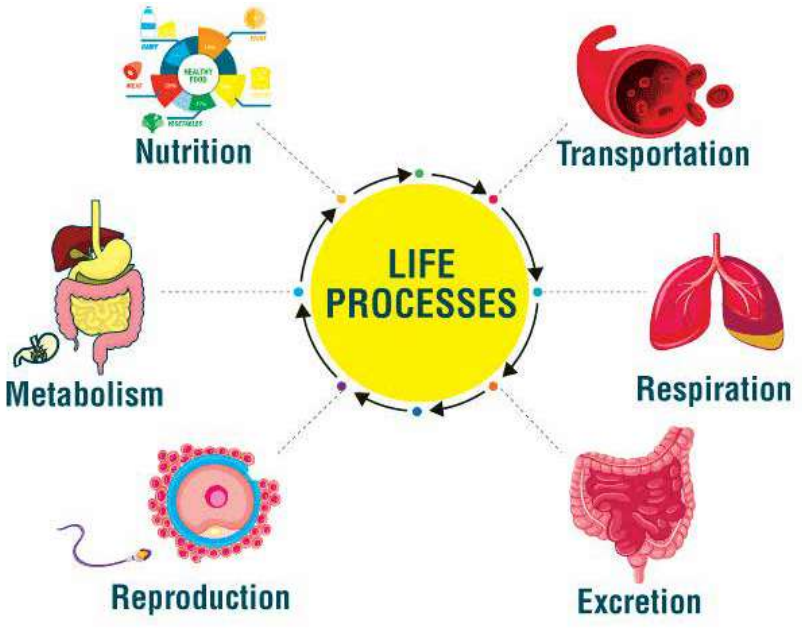


Fig. 5.1

i. What are the life processes of both animals and plants?

ii. What will be the effect on the organism if there is an imbalance in any one of these life processes?

iii. From which life process do nutrients reach every cell in the body?

iv. What is the process by which animals absorb nutrients from food?

5.1 Introduction

The living things carry out several functions like breathing, digestion, excretion growth, reproduction etc. These functions help living things to remain alive. The functions occuring on the body of living things that keep them alive are called life processes. Several life processes occur in the body of living organism at the same time. The process of breathing, respiration, secretion, digestion, transportation, excretion, growth etc. occur in the body of living thing simultaneously. The failure of any life process affects the living organism and they die ultimately. The life process occuring in body of living organism are interrelated to each other. The failure in one process affects the other process.

Roots of plants absorb water and minerals. How does water from root reach upto the leaves of plants? How does nutrients in our food reach to each and every cells in our body? How does the injection injected in shoulder cure the wound in leg? What happens to oxygen when it goes to lungs? What happens when we apply cream over our skin? Discuss.

The body of living organism is made up of cells. Every cell in the body requires nutrients and oxygen. The cell can produce energy necessary for several functions from nutrients and oxygen. The cells also produce some waste inside them. The accumulation of such wastes inside the cell is harmful. So, cell excretes such wastes from it. The nutrients and oxygen necessary for the cell can be carried upto cells by different processes. Similarly, wastes can be removed in many ways. The process of carrying essential substances upto the cell and removal of unwanted substance from it is called transportation. The transportation and absorption in plants and animals are different.

5.1.1 Transportation and Absorption

Transportation is the characteristic property of living beings. Transportation can be defined as the movement of any substance from one place to another. Water and

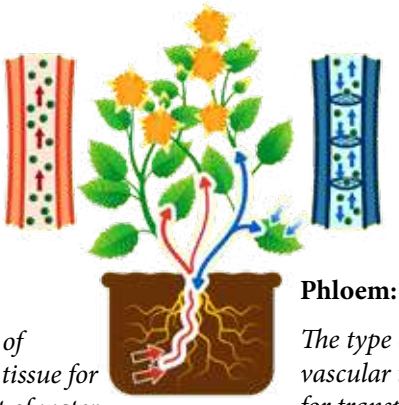
nutrients required for all metabolic activities should be transported in the body of plants and animals.

Plants prepare food by the process of photosynthesis. Plants need water, mineral and carbondioxide to prepare food. The food is prepared in green parts and leaves. The root absorb the water and mineral from soil. The absorbed water and minerals is carried upto leaves by a special tissue called xylem. Similarly, the food prepared in leaves is carried upto different parts of the plant body by tissue called phloem. The xylem and phloem are called conducting tissue. The conducting tissues help in transportation of water, minerals and food in plants. Similarly, the leaves contain stomata and lenticels that help in exchange of oxygen and carbon dioxide. The stomata is opening (pore) in leaves. The lenticels is a porous cell present in stem of woody plants.

Activity 5.1

Place a stem of a plant containing flower in a vase filled with red coloured water. Leave it for 4 hours. Then observe the changes in plants. What changes did you notice. Mention them. Discuss the reason.

The blood circulatory system is made up of blood, heart and blood vessels. The blood can carry oxygen and nutrients to the cell. Similarly, they can also carry carbon dioxide and wastes out of the cell. The blood vessel help in carrying blood to the different parts of the body. The cells absorb the useful nutrients and oxygen from blood by the process of diffusion. The waste is released from cell to blood by process is diffusion. The heart pumps the blood. So, blood can circulate all over the body. The transportation and absorption occurs with the help of blood circulatory system in human body and other vertebrates.



Xylem:

The type of vascular tissue for transport of water and minerals from roots to other parts of plants.

Phloem:

The type of vascular tissue for transport of food from leaves to other parts of plants.

Transpiration:

Process of removal of excess water in the form of water vapour from the leaves of plants

Fig. 5.2

5.1.2 Transportation and Absorption in Animals

The blood circulatory system is made up of blood, heart and blood vessels. The blood can carry oxygen and nutrients to the cell. Similarly, they can also carry carbon dioxide and wastes out of the cell. The blood vessel help in carrying blood to the different parts of the body. The cells absorb the useful nutrients and oxygen from blood by the process of diffusion. The waste is released from cell to blood by diffusion. The heart pumps the blood. So, blood can circulate all over the body. The transportation and absorption occurs with the help of blood circulatory system in human body and other vertebrates.

5.2 Excretion of Animals and Plants

The process of removing the waste materials produced during various activities of a body through some special organs is called excretion. Different organs of a body are responsible for the removal of these waste products.

i. Excretion in plants

Fig. 5.3

During photosynthesis process, plants take in carbon dioxide and release oxygen. Plants take oxygen during respiration and release out carbon dioxide as a waste products. Protein breaks down and liberates ammonia. Plants take ammonia to prepare other compounds. Waste products like gum, resin latex, oil, etc. are removed from plant as waste, products. Removal of excessive amount of water from the leaves of plant in the form of water vapour from the stomata is known as transpiration.

ii. Excretion in animals

Small animals like amoeba and hydra remove their waste products through their body surface. These organisms do not have special excretory organs. Other higher animals have special organs for excreting different substances. The skin, lungs, large intestine, liver and kidneys, etc. are the main excretory organs and the toxic waste products are expelled from the body.

iii. Excretion in human body

Different organs are responsible for the excretion in human body. They are discussed below.

Skin

Skin helps in exertion by separating and removing sweat through the pores on them. They have sweat glands for this purpose. Excessive water, mineral, salts, urea, etc. are expelled in small scale by the skin.

Lungs

Lungs are not only respiratory organs but also excretory organs. They remove carbon dioxide from the blood. We have a pair of lungs inside the rib cage.

Liver

A simple liver is found in the right side inside our thoracic cage which is of three lobes. It is the largest gland in our body. It helps in excretion by changing more harmful materials into less harmful and they are removed through urinary system.

Fig. 5.4 liver

Large intestine

After the digestion and absorption of food the remaining substances are expelled out from the body through large intestine.

Fig. 5.5 large intestine

Kidneys

These are reddish brown bean-shaped structures found at the dorsal abdominal cavity one on each side of the vertebral column. Each kidney consists of millions of functional structures called as nephron.It filters nitrogenous waste materials like urea, uric acid and excess water from the blood. These materials are removed in the form of urine through urinary system. The organs of the urinary system are kidneys, a pair of ureters, urinary bladder and urethra.

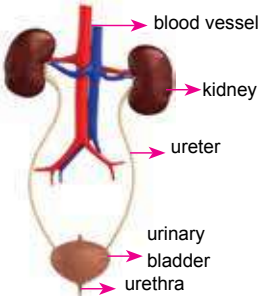


Fig. 5.6 kidney of human body

5.3 Respiration of Animals and Plants

Respiratory system, the system in living organisms that takes up oxygen and discharges carbon dioxide in order to satisfy energy requirements. In the living organism, energy is liberated, along with carbon dioxide, through the oxidation of molecules containing carbon. The term respiration denotes the exchange of the respiratory gases (oxygen and carbon dioxide) between the organism and the medium in which it lives and between the cells of the body and the tissue fluid that bathes them.

With the exception of energy used by animal life in the deep ocean, all energy used by animals is ultimately derived from the energy of sunlight. The carbon dioxide in the atmosphere in conjunction with the energy of sunlight is used by plants to synthesize sugars and other components. Animals consume plants or other organic material to obtain chemical compounds, which are then oxidized to sustain vital processes.

Respiration process in plants is very simple. There is no any specialized respiration organs in plants. Mainly respiration in plants takes place through the tiny pores (stomata), which are mainly found in the ventral region of leaves. Stomata are made by two bean shaped guard cells. Exchange of gases takes place due to opening and closing of guard cells. In unicellular plants, exchange of gases takes place from the cell wall only.

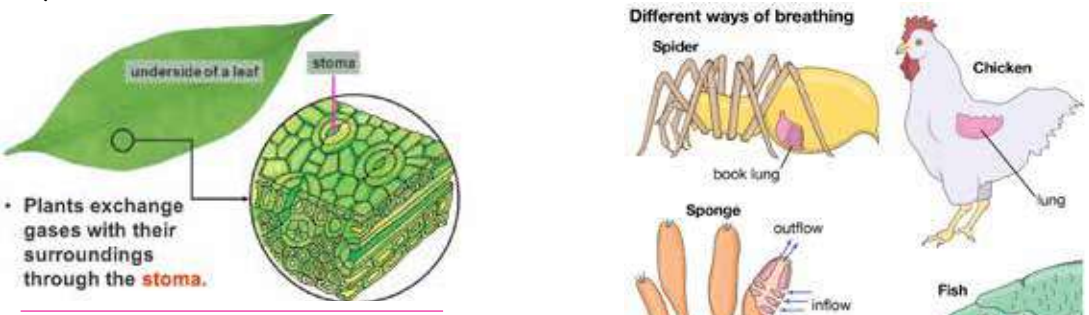


Fig. 5.7

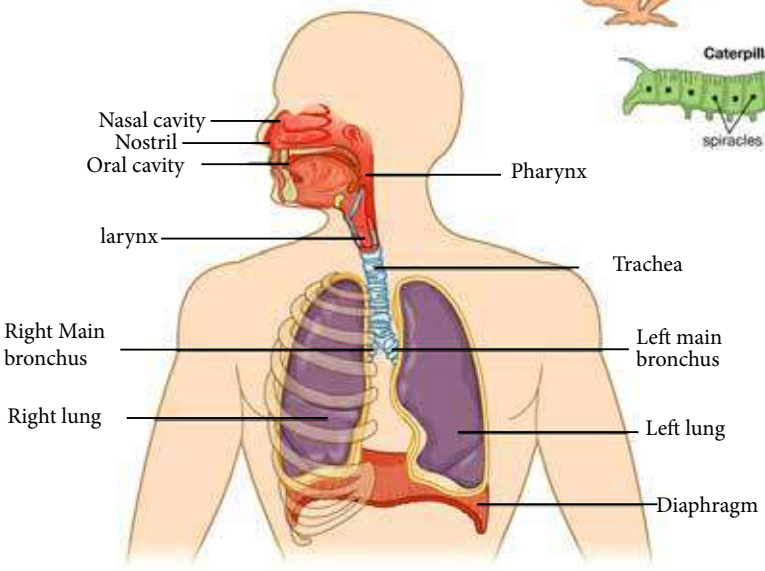


Fig. 5.8

Project Work

By using local items like thread, paint, coated paper, plastic pipe, rubber, balloons, etc., make a model of the respiratory system and present it in the classroom.

Points to Remember

- The living things carry out several functions like breathing, digestion, excretion growth, reproduction etc.
- Roots of plants absorb water and minerals.
- Transportation can be defined as the movement of any substance from one place to another.
- The process of absorption means that a substance captures and transforms energy.
- Plants prepare food by the process of photosynthesis.
- The blood circulatory system is made up of blood, heart and blood vessels.
- The process of removing the waste materials produced during various activities of a body through some special organs is called excretion.
- During photosynthesis process, plants take in carbon dioxide and release oxygen.
- Skin helps in exertion by separating and removing sweat through the pores on them. They have sweat glands for this purpose. Excessive water, mineral, salts, urea, etc. are expelled in small scale by the skin.
- Lungs are not only respiratory organs but also excretory organs.
- A simple liver is found in the right side inside our thoracic cage which is of three lobes.
- Each kidney consists of millions of functional structures called as nephron.It filters nitrogenous waste materials like urea, uric acid and excess water from the blood.

Exercise

A. Choose the correct one and put the tick mark (√).

i. Several life processes occur in the body of .....at the same time.

a. living organism b. non-living things
d. body c. dry wooden

ii. Every cell in the body requires .....

a. food b. meat
c. carbohidrates d. nutrients

iii. All animals and plants take oxygen and release out .....

a. carbon b. carbon mono-oxide
c. carbon dioxide d. water

iv. In which process the waste products come out of the cell to the excretory organ?

a. Respiration b. Blood circulation
c. Excretion d. Reproduction

v. In which part of the body do oxygen and carbon dioxide exchange?

A. Kidney b. Lenticel
c. Xylem d. Alveolus

vi. What is the respiratory organ of insects?

A. Stomata b. Spiracle
C. lenticel d. skin

vii. What is the hole-like part found in the fruit of plants?

a. Stomato b. Spiracle
c. lenticel d. alveolus

viii. Arthopoda use for breathing

a. air tube b. gills
c. skin d. lungs

ix. It is also excretory organs

a. liver b. skin
c. lungs d. kidney

x. Part of kidney

a. intestine b. rib cage
c. urethra d. diaphragm

xi. What is reseased out during respiration :

a. Oxygen b. Carbon dioxide
c. Urea d. Carbon

xii. Which organ takes part in respiration in human being ?

a. Lungs b. Liver
c. Heart d. Skin

B. Fill in the blanks

alveoli, breathing, sweat, nephron, life process , oxygen

i. Roots of plants absorb .....and minerals
ii. Fish like aquatic animals have gills for.....
iii. Blood capillaries are surrounded around the .....
iv. Each kidney consists of millions of functional structures called as .....
v. Skin have .....gland .
vi. The action found only in the body of living beings is called .....

C. Give the reason :

i. Respiration is called cellular process.
ii. Leaves have stomata.
iii. Cells need energy
iv. Fish can survive inside water.
v. We should drink more water in summer.

D. Differentiate with examples

i. Transportation and Absorption

ii. Internal respiration and External respiration

iii. Trachea and Gills

iv. Blood vessels and Blood capillaries

E. Answer the following questions :

i. Describe the process of excretion in the human body in brief.

ii. Name the excretory organs of human beings

iii. Highlight the importance of breathing.

iv. How is the excretion of unicellular animals done?

v. Describe the process of plant excretion

vi. Describe briefly human respiratory function.

vii. How does plant respire ? Draw a diagram of plant respiration process.

viii. Distinguish between the respiratory functions of insects and fish.

ix. What is the difference between the excretion of animals and plants?

x. When we run, we get short of breath and our heart rate also increases. Elaborate it .

xi. Describe human urinary syatem with a labelled diagram.

xii Define the following :

a. Life process

b. Stomata

c. Excretion

d. Digestion

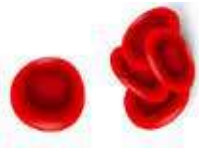
e. villi

F. Match structures given in Column I with functions given in Column II.

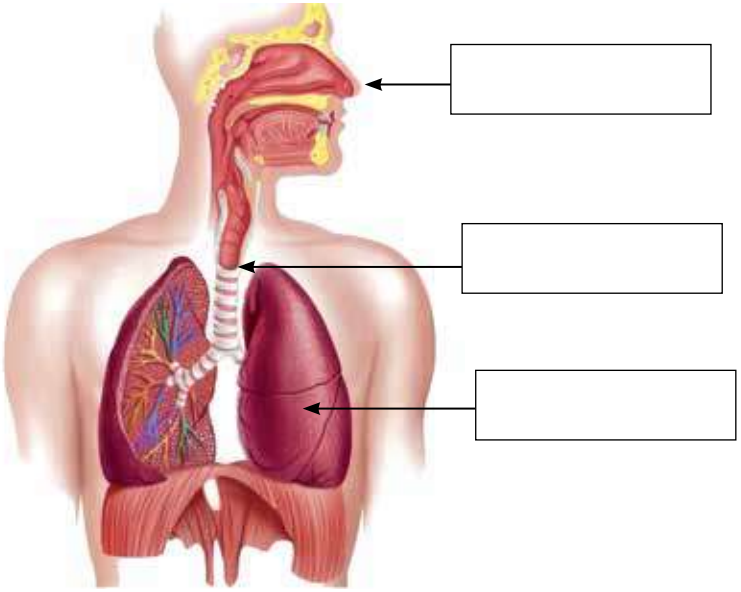
Column I	Column II
i. Stomata	a. Absorption of water
ii. Xylem	b. Transpiration
iii. Root hairs	c. Transport of food
iv. Phloem	d. Transport of water
	e. Synthesis of carbohydrates

G. Diagrammatic questions

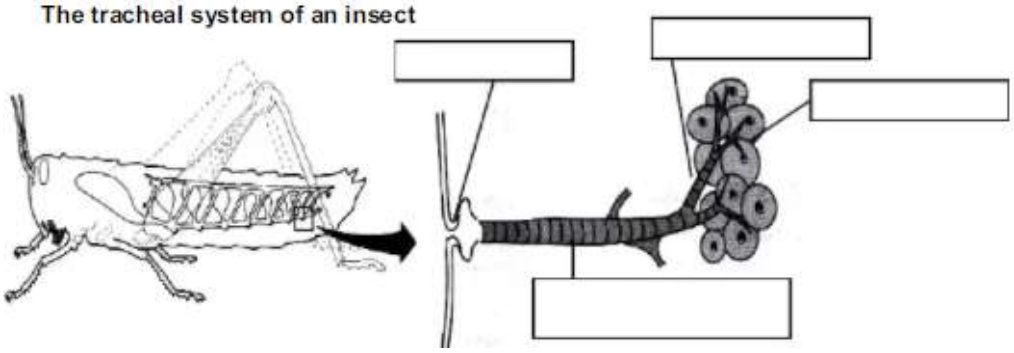
i. Match the column

	Column A		Column B
A.		i.	White blood cells
B.		ii.	Blood platelets
C.		iii.	Red blood cells
D.		iv.	Capillaries
E.		v.	Phloem
F.		vi.	Xylem
G.		vii.	Stethoscope

ii. Label the following diagrams:



iii. The tracheal system of an insect



a. The respiratory system of insects is known as the _____ system, which is composed of air tubes called _____

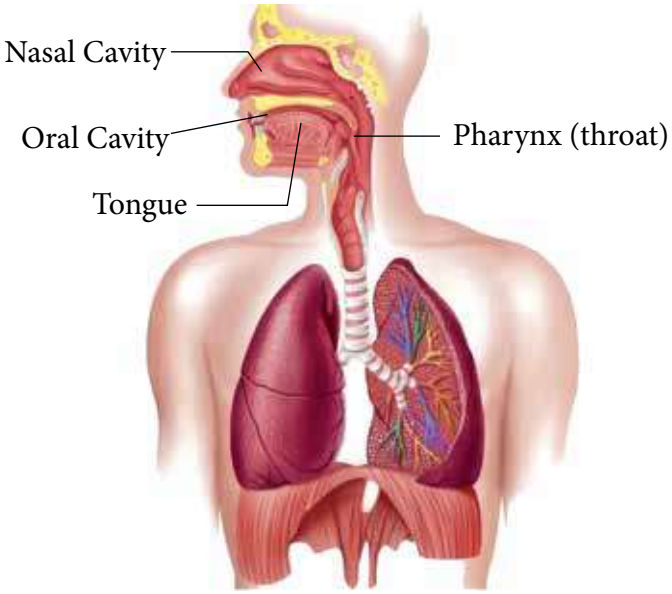
b. Air enters the tracheae through _____ which have _____

c. The trachea is reinforced with rings of _____ to prevent it from _____

d. The trachea branches into _____ which provide a large surface area for the _____ of gases.

iv. a. Complete the diagram of the breathing system using the words below:

Diaphragm
Epiglottis
Lung
Bronchioles
Bronchi
larynx (voice box)
Trachea (wind pipe)
Ribs
Intercostal Muscles



b. Complete the sentences below by choosing from the words in brackets:

When you brathe in:

Your diaphragm goes _____ (down/up)

Your _____ (epiglottis/intercostal muscles) contract causing your ribs to _____ (expand/move inwards).

Your lungs get _____ (bigger/smaller).

When you breathe out:

Your diaphragm goes _____ (down/up)

Your _____ (epiglottis/intercostal muscles) contract causing your ribs to _____ (expand/move inwards).

Your lungs get _____ (bigger/smaller).

Unit 6 FORCE AND MOTION

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- define distance, displacement, velocity, and speed and to distinguish between distance, displacement, velocity, and speed.
- solve simple mathematical problems of distance, displacement, velocity, and motion, and to explain and demonstrate the fact that the earth pulls all objects towards its center due to gravity.
- measure the weight of an object using a spring balance and to calculate the weight according to the mass of the object.
- define friction to show the amount of friction depending on the weight of the object, the nature of the contact surface, and the size of the object.
- explain the ways in which friction occurs and the examples of its use in daily life, including its advantages and disadvantages.
- solving simple mathematical problems related to work and power.

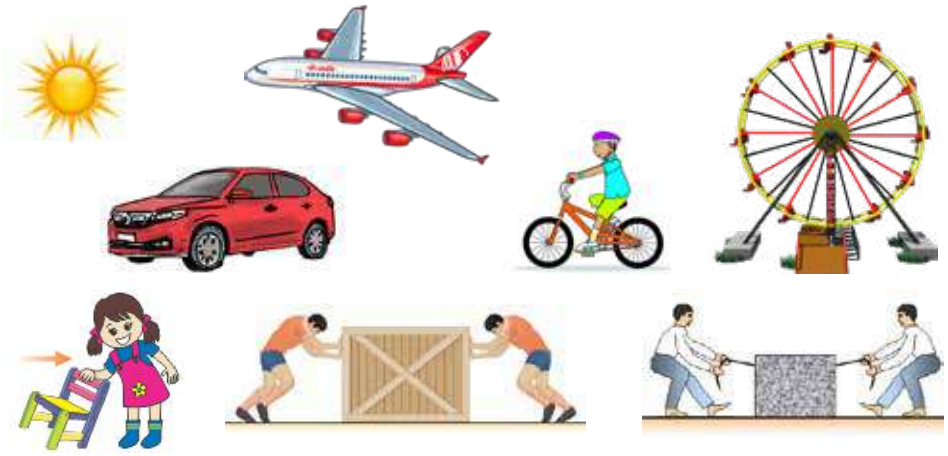


Fig. 6.1

i. What happens when an object is pulled or pushed?
ii. What is the effort to pull or push an object?
iii. What happens when you put too much or too little force on an object?
iv. In what condition can the object move?
v. How can a car move ?

We perform different types of work in our daily life. We open the door, lift a bag, move from one place to another, catch a ball, etc. We apply force to do any work. The body at rest may come in motion on applying force. Similarly, on applying force in a moving body, it may come to rest.

Motion makes the world go 'round'. When we think of motion we often think of cars, bicycles, kids running, basketballs bouncing and airplanes flying. But motion is so much more. A body is said to be in motion if it changes its position with respect to fixed point or objects around it.

Explore the different types of motions in your daily life - e.g.

- oscillatory motion-motion of swing
- rectilinear motion-motion of car on straight road
- rotational motion-motion of merry-go-round.

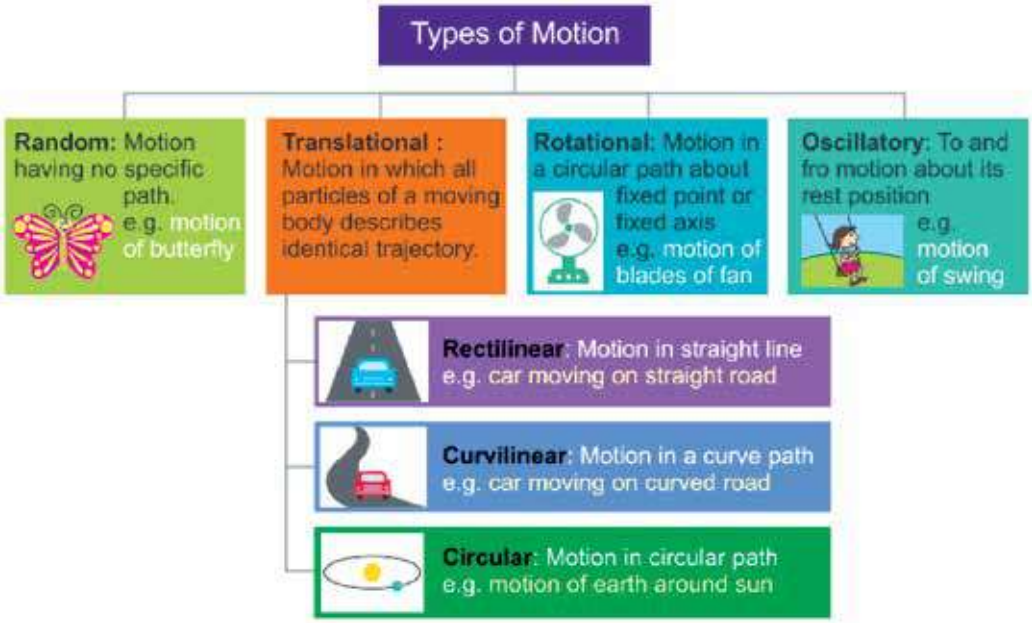


Fig. 6.2

6.1 Distance and Displacement

Distance and displacement are two quantities that seem to mean the same but are distinctly different with different meanings and definitions. Distance is the measure of "how much ground an object has covered during its motion" while displacement refers to the measure of "how far out of place is an object."

Distance

The distance is the length of the path between any two points. The path between any two point may not have a fixed direction. Distance has magnitude but not fixed direction.

Hence distance is a scalar quantity. The distance is denoted by 'd'. Its S.I. unit is meter (m). The distance travelled by a body is calculated as

Let's understand the concept of distance with the help of the following diagram:

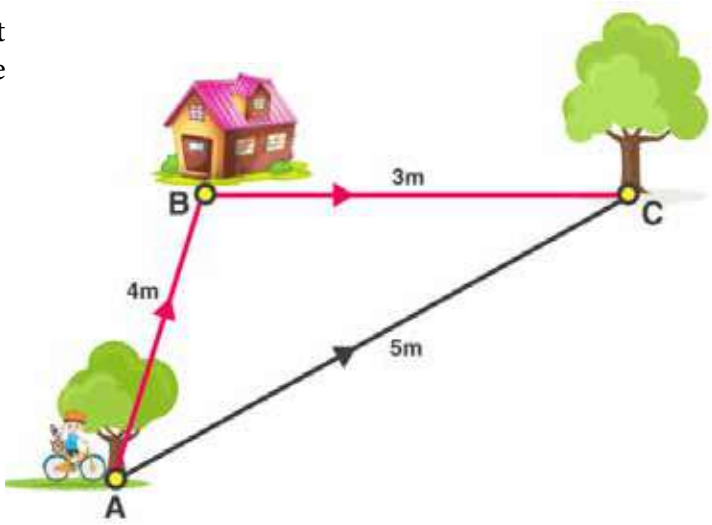


Fig. 6.4

Distance here will be

= AB+BC+CA

= 4m + 3m + 5m = 12 m

Distance Formula

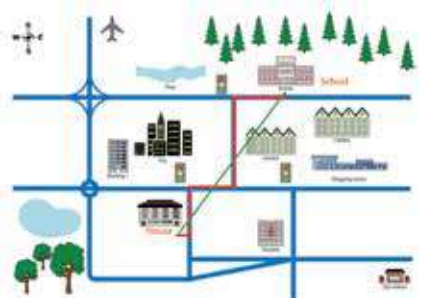
$\Delta d = d_1 + d_2$

If you know the time and speed of an object traveling a distance, you can calculate the distance by using the following formula:-

distance = speed × time

Activity 6.1

Draw a map showing the path from your home to school. Observe the map and answer the following question.



a. Is the path from your home to school straight or it has turnings?

b. Measure the length of path from your home to school using a scale on the map. How long is it?

c. Now connect your school and home on map by dotted line and measure the length of the dotted line. How long is it?

d. Which is shorter - the dotted line or actual path?

e. Do you change direction while coming to school?

f. If the path is straight like dotted line connecting your home and school, will you have to change direction while coming to school?

Displacement

The displacement is the shortest distance between any two points. It has a fixed direction. It is denoted by 'S'. The displacement is specified using both magnitude and direction. Hence, it is a vector quantity. Its S.I. unit is meter (m). The displacement is calculated as:

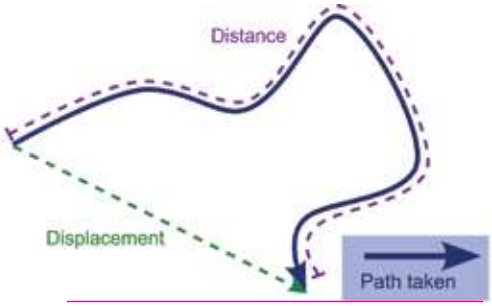


Fig. 6.5

For example- If an object moves from A position to B, then the object's position changes. This change in position of an object is known as Displacement.

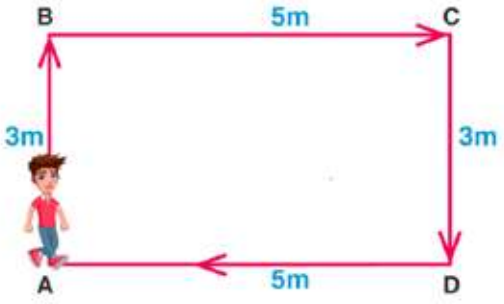


Fig. 6.6

Displacement at point A =0

Distance travelled at point A=0

Displacement Formula

If final position = x_f

Initial Position = x_i

and displacement = D = Δx

then,

Displacement= Final Position–Initial Position

Therefore,

$$\Delta x = x_f - x_i$$

If you know the time and velocity of an object traveling a displacement, you can calculate the displacemeny by using the following formula:-

displacement = velocity × time

Examples of Distance and Displacement

Question 1. Murali travels 250 miles to North but then back-tracks to South for 105 miles to pick up a friend. What is Murali's total displacement?

Answer: Murali's starting position $X_i = 0$.

His final position X_f is the distance travelled N minus the distance South.
Calculating displacement, i.e.D.
$D = \Delta_X = (X_f - X_i)$
D = (250 mi N – 105 mi S) – 0
D = 145 mi N

Question 2. An object moves along the grid through points A, B, C, D, E, and F as shown below. The side of square tiles measures 0.5 km.

a. Calculate the distance covered by the moving object.

b. Find the magnitude of the displacement of the object.

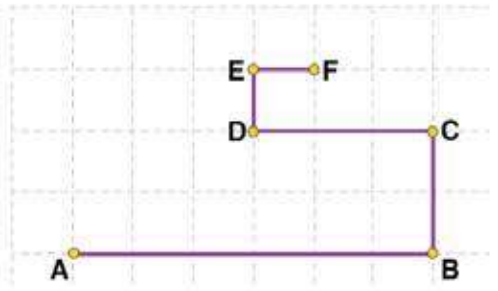


Fig. 6.7

a. The distance covered by the moving object is calculated as follows:

AB + BC + CD + DE + EF

3 + 1 + 1.5 + 0.5 + 0.5 = 6.5 km

The distance covered by the moving object is 6.5 km.

b. The initial point is A and the final point is F, hence the magnitude of the displacement is equal to the distance AF which is calculated by applying Pythagoras's theorem to the triangle AHF as shown in the figure below.

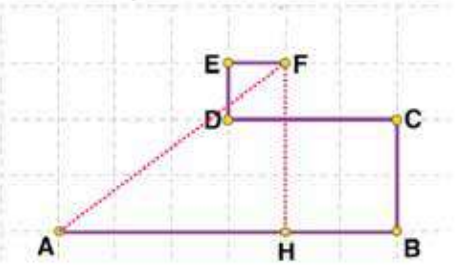


Fig. 6.8

Applying the Pythagorean formula, we get

$AF^2=AH^2+HF^2$

Substituting the formula, we get

$AF^2=(0.5\times4)^2+(0.5\times3)^2=6.25$

$AF=\sqrt{6.25}km=2.5km$

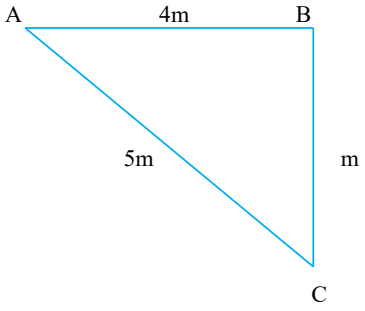
The magnitude of displacement is 2.5 km.

Distance vs Displacement

Distance	Displacement
The complete length of the path between any two points is called distance	Displacement is the direct length between any two points when measured along the minimum path between them
Distance is a scalar quantity as it only depends upon the magnitude and not the direction	Displacement is a vector quantity as it depends upon both magnitude and direction
Distance can only have positive values	Displacement can be positive, negative and even zero

Activity 6.2

As shown in the figure, Ram starts to walk from point A. He travels to point B and then reaches to point C from B. Again, he starts walking from point C and reaches to point A.



Answer the following question

i. How much distance does Ram travel?
ii. Find the displacement when Ram reaches back to point A.
iii. Does distance travelled by Ram become zero when upon reaching point A again? Why?
iv. What is the value of distance and displacement when Ram travels from point A to B? Why?

Speed and Velocity

Some animals run faster and some run slower. Similarly, some men can run fast but some cannot. A man runs 5 meter per second means he runs 5m distance in each second. Similarly, speed of sound is 330 m/s means sound travels 330 meter in one second.

The distance travelled by a body per unit time is called speed. It is measured in meter per second (m/s) unit.

Mathematically,

$$\text{Speed} = \frac{\text{Distance travelled (s)}}{\text{Time taken (t)}}$$

Fast runner has more speed and slow one has less speed. Speed has only magnitude but not direction. So, it is scalar quantity.

Solved Numerical Problem

i. A bus covers 1000 meter distance in 50 seconds. Find its speed?

Solution,

Distance covered (s) = 1000 m

Time taken (t) = 50 s

Speed = ?

According to formula,

$$\text{Speed} = \frac{\text{Distance travelled (s)}}{\text{Time taken (t)}}$$

$$= \frac{100}{50}$$

$$= 20 \text{ m/s}$$

\ Speed of bus is 20 m/s

Velocity

An object is moving with speed of 15 m/s, we are not sure whether it is moving forwards east-west, north or south, upwards or downwards. Thus, it is necessary to specify the direction in velocity.

The displacement travelled by a body per unit time in a particular direction is called velocity or the displacement per unit time is called velocity.

By definition,

$$\text{velocity} = \frac{\text{Displacement covered (s)}}{\text{Time taken (t)}}$$

It has magnitude and direction both. So, it is vector quantity. In SI unit, it is measured in metre per second (m/s).

Difference between Speed and Velocity

Speed	Velocity
1) The distance travelled by a body in unit time interval.	1) The distance travelled by a body in a specified direction in a unit time interval. It is the displacement per unit time.
2) Speed = $\frac{\text{distance}}{\text{time}}$	2) Velocity = $\frac{\text{displacement}}{\text{time}}$
3) It is a scalar quantity.	3) It is a vector quantity. It gives direction .
4) SI unit of speed = $\frac{\text{SI unit of distance}}{\text{SI unit of time}}$ = metre/second	4) SI unit of velocity = $\frac{\text{SI unit of displacement}}{\text{SI unit of time}}$ = metre/second

The car covers a distance of 20 km due east in two hours and truck covers 60 km in 3 hours due west. What is their speed and velocity?

Speed of car = $\frac{20}{2}$ = 10km/hr
Speed of truck = $\frac{60}{3}$ = 20km/hr

Velocity of car = $\frac{20}{2}$ = 10km/hr due east
Velocity of truck = $\frac{60}{3}$ = 20km/hr due west

Truck moves faster than car. Hence speed and velocity decides how fast a body is moving.

Examples of speed and Velocity

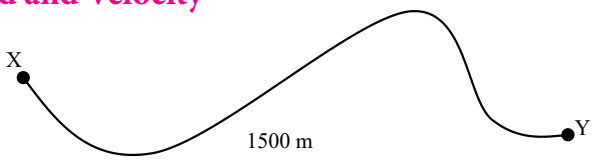


Fig. 6.9

Jyoti travels along a road 1500 m long as shown in figure. She changes her direction at different places. It takes her 5 minutes to reach from point X to Y. So,

Total distance travelled (d) = 1500 m

Total time taken (t) = 5 minute = 5 × 60 sec. = 300 sec.

It means, she takes 300s to travel 1500m

i.e., she takes 1s to travel $\frac{1500}{300}$ m

or, she takes 2s to travel 5m.

That is to say, her speed is 5m/s.

Hence, speed = $\frac{\text{distance}}{\text{time}}$

or, speed = $\frac{1500\text{m}}{300\text{s}}$

= 5m/s

Speed is the rate of change of distance travelled by a body per unit time. Its SI unit is m/s.

As direction is not considered while measuring distance, it is a scalar quantity.

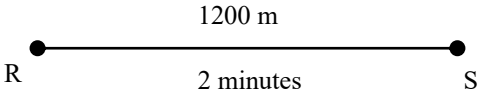


Fig. 6.10

Suppose Kalpana travels along a straight road of length 1200m as shown in figure. She takes 2 minutes to reach from point R to S. She does not change her direction.

Hence,

displacement (s) = 1200m

total time taken (t) = 2 minute = 2 × 60s = 120s

It means,

Kalpana takes 120s to travel 1200m along S

i.e., Kalpana takes 1s to travel $\frac{1200}{120\text{m}}$ along S

i.e., Kalpana takes 1s to travel 10m along S.

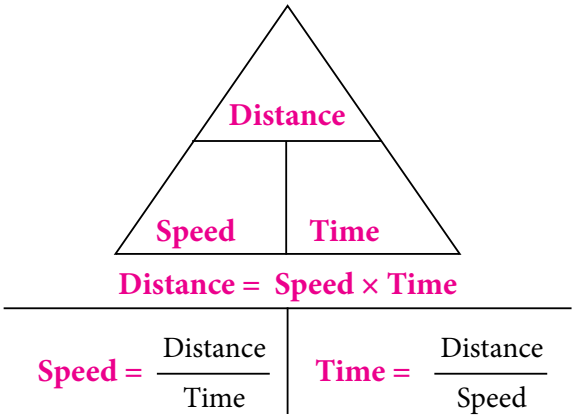


Fig. 6.11

Speed

1. John travels 300 km in 3 hours. What was his average speed in km/h?

Speed = Distance = Time =

Speed = _____ ÷ _____ = _____ km/h

2. Pratyashi runs 100 m in 12s. What is her average speed in m/s. Round your answer to the nearest m/s?

Speed = Distance = Time =

Speed = _____ ÷ _____ = _____ m/s

3. A soccer ball travels 10 m in 1.2s. What is the average speed of the soccer ball in m/s. Round your answer to the nearest m/s?

Speed = Distance = Time =

Speed = _____ ÷ _____ = _____ m/s

Distance

1. Ram drives 120km/h for 5 hours. How far does he drive?

Speed = Distance = Time =

Distance = _____ × _____ = _____ km

2. Karuna runs at a speed of 15km/h for 2 hours and 30 minutes. How fard did she run?

Speed = Distance = Time =

Distance = _____ × _____ = _____ km

3. A plane flies 800km/h for 19 hours. How far did the plane travel?

Speed = Distance = Time =

Distance = _____ × _____ = _____ km

Time

1. Jeanette rows at an average speed of 2m/s. How long does it take her to row 70m?

Speed = Distance = Time =

Time = _____ ÷ _____ = _____ min _____ s.

2. Jeanette rows at an average speed of 2m/s. How long does it take her to row 800m?

Speed = Distance = Time =

Time = _____ ÷ _____ = _____ min _____ s.

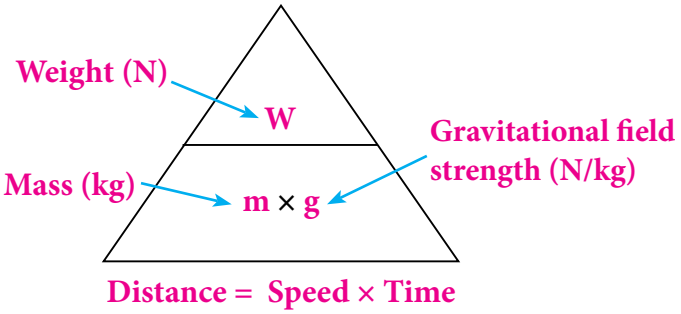
3. Jeanette rows at an average speed of 2m/s. How long does it take her to row 1.5 km?

Speed = Distance = Time =

Time = _____ ÷ _____ = _____ h _____ min _____ s.

6.2 Gravity and Weight

Gravity is the force the earth exerts on you. The force of gravity changes with location. Weight is a measure of the force of gravity acting on a mass . Mass is a measure of how much matter an object contains.



Distance = Speed × Time

Weight (N) = Mass (kg) × Gravitational field strength (N/kg)

The Gravitational field strength is the measure of the force of gravity in a particular location. It is also called gravitational acceleration.

Gravity

We have seen ripened fruits falling towards the earth. When a stone is released from hand, it falls down. The raindrops fall towards the earth. A stone thrown upward returns bock to earth. Why does these thing fall towards the earth?

The earth attracts every object towards its center. This force is called gravity of the earth. The apples fall towards the earth due to gravity of the earth. According to Newton, everybody in the universe attracts other body towards its center. This force of attraction

between any two bodies is called gravitation. There is gravitational force between the earth and sun, between earth and moon, between any two heavenly bodies. The earth revolves round the sun due to gravitational force.

Earth pulls every object near it towards its center. So, river flows downwards, rain and snow fall towards the earth. The objects have weight due to gravity. The force of gravity is different at different places on the earth. So, objects have different weight at different places on the earth. When objects fall towards the earth due to gravity, its velocity increases. The rate of change of velocity of a falling body is called acceleration due to gravity. It is denoted by 'g'. The average value of g is 9.8 m/s^2.

Weight and its Measurement

The force with which earth attracts anybody towards its center is called weight. A body having more mass has more weight. The weight of the body is measured by using a spring balance. Its SI unit is Newton (N).

The weight of a body can be calculated by using formula :
weight = mass × acceleration due to gravity

or, $W = m \times g$

Numerical,

1. A body has mass 10kg. Calculate its weight. [g = 9.8m/s^2]

Sol^{n}-

Mass (m) = 10kg

acceleration due to gravity (g) = 9.8m/s^2

weight (W) = ?

According to formula,

$W = m \times g$

or, $W = 10 \times 9.8$

$\therefore$ $W = 98$ N

Therefore, the weight of the body is 98N.

2. The mass of Hari is 45kg. Find his weight. (g = 9.8m/s^2)

Sol^{n}

Mass (m) = 45kg

acceleration due to gravity (g) = 9.8m/s^2

weight (W) = ?

According to formula,

$W = m \times g$

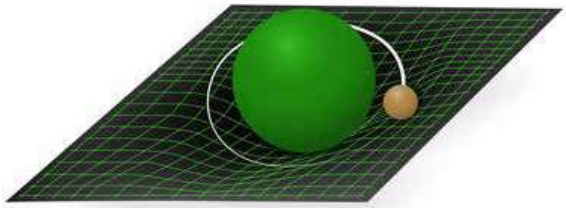
or, $W = 45 \times 9.8$

$\therefore$ $W = 441N$

Therefore weight of Hari is 441N.

Activity 6.2.1

Have 4 friends tightly hold a pillowcase at the corners. Place a tennis ball in the center. What happens ? Now roll a ping pong ball or golf ball into the fabric. What happens ?



Weight

Weight is gravitational force of attraction on an object, caused by the presence of a massive second object, such as the Earth or Moon. Weight is a consequence of the universal law of gravitation: any two objects, because of their masses, attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. Thus more massive objects, of course, weigh more in the same location; the farther an object is from the Earth, the smaller is its weight. The weight of an object at the Earth's South Pole is slightly more than its weight at the Equator because the polar radius of the Earth is slightly less than the equatorial radius. Though the mass of an object remains constant, its weight varies according to its location. The smaller mass and radius of the Moon compared with those of the Earth combine to make the same object on the Moon's surface weigh one-sixth the value of its weight on Earth.The force with which earth attracts anybody towards its center is called weight. A body having more mass has more weight. The weight of the body is measured by using a spring balance. Its SI unit is Newton (N).

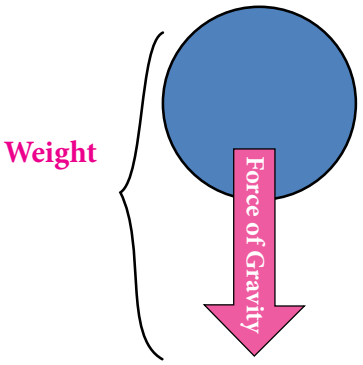


Fig. 6.12 Weight is the force of gravity pulling on the object

Relation between gravity, weight and mass

The terms "mass" and "weight" are used interchangeably in ordinary conversation, but the two words don't mean the same thing. The difference between mass and weight is that mass is the amount of matter in a material, while weight is a measure of how the force of gravity acts upon that mass.

- Mass is the measure of the amount of matter in a body. Mass is denoted using m or M.
- Weight is the measure of the amount of force acting on a mass due to the acceleration due to gravity. Weight usually is denoted by W. Weight is mass multiplied by the acceleration of gravity (g).

e.i, Weight = Mass × Acceleration due to gravity

W = m × g

Activity 6.2.2

How much would I weigh if I lived with Martians?

1. **Use the scoles to measure your mass:**
   My mass is _____ kg.
2. **Gravity on Earth in 10 N/kg. This means that every kilogram = 10 newtons on earth**
   mass × gravity = weight
3. **Gravity is different on different planets. On Mars gravity is 4 N/kg.**
   If I lived on Mars my Mass would be _____ kg.
   If i lived on Mars my Weight would be _____ N.
4. **Fill in the table for all planets (you've already done Earth and Mars).**

Planet	My mass ×	Gravity =	My weight
Mercury	kg	4 N/kg	N
Venus	kg	9 N/kg	N
Earth	kg	10 N/kg	N
Mars	kg	4 N/kg	N
Jupiter	kg	25 N/kg	N
Saturn	kg	10 N/kg	N
Uranus	kg	9 N/kg	N
Neptune	kg	11 N/kg	N

4. **Does your mars change? _____ Does your weight change _____**
6. **Where would you weigh more than you do on Earth?**
   _____
7. **Where would you weigh less then you do on Earth**
   _____

Numerical

1. Calculate the speed of a cyclist as shown in figure.

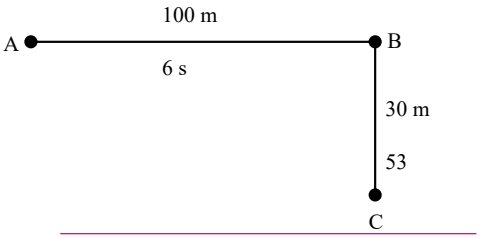


Fig. 6.13

Sol^{n}

total distance travelled (d) = 100m + 30m = 130m

total time taken (t) = 6s + 5s = 11s

speed = ?

According to formula,

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{130\text{m}}{11\text{s}}$$

$\therefore$ speed = 11.82 m/s

2. Light always travels in a straight path. Calculate the velocity of light if it can travel 90,00,00,000m in 3 seconds.

Sol^{n}

displacement (S) = 90,00,00,000m

time taken (t) = 3s

velocity (V) = ?

According to formula,

$$\text{Velocity} = \frac{\text{displacement}}{\text{time}}$$

$$V = St$$

or, $$V = \frac{900000000\text{m}}{3\text{s}}$$

$\therefore$ V = 30,00,00,000 m/s

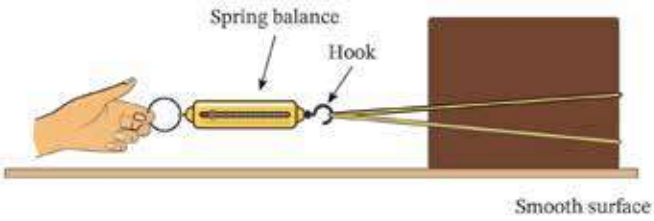
6.3 Friction

Have you rubbed your hands in winter? What will happen if you rub your oily hands? When any object is rolled on ground, it stops after sometime, why? Why tyres of vehicles have grip? Discuss.

When two surfaces come in contact, a resistive force is produced between them. This force is called friction. The friction opposes the movement of surfaces in contact with each other. The frictional force between any two surface depends on surface tenture, adhesion property and weight of the body. The rough surface offers more frictional force than a smooth surface. The frictional force does not depend upon the surface area and velocity of the body.

Activity 6.3.1

Take a block of wood. Tre the block with the spring balance. Slowly drag the block over rough surface and note the force in spring balance. Now drag the same block in a smooth surface and note the force in spring balance. Discuss the result with your friends.



Types of Friction

The friction can be classified as dry friction and fluid friction.

Fig. 6.14

- Static friction and kinetic friction
- Sliding friction and rolling friction

The friction between the surface of solid object is called dry friction.

For example, Friction between ground and shoes. Friction between table and book

Fluid Friction : The friction offered by gases or liquid is called fluid friction.

e.g. Friction between boat and water
Friction in flow of honey

Sliding Friction : The friction produced between the surface when one surface slides over another is called sliding friction.

e.g dragging a log, rubbing hands

Rolling Friction : The friction produced when a body rolls any surface is called rolling friction.

e.g Friction between wheel and road

Rolling friction is less than sliding friction. So, it is better to roll an object than sliding it.

Advantages and Disadvantages of Friction

Friction is necessary to do different activities in our daily life. It is possible to walk on ground due to friction. The moving vehicles can be stopped due to friction. Nails and screw can join two surfaces due to friction. Match stick can be lighted due to friction.

Friction is useful to us. However, it makes our work difficult in many situations. Friction reduces the efficiency of machine. Friction produces heat in machines and it causes wear and tear of the parts of machine. Friction between the branches of trees causes forest fire.

Activity 6.3.2

Imagine a world without friction. Note down the advantages and disadvantages of the world without friction.

Measures of minimising friction

Friction reduces the efficiency of machines. We should waste our energy to overcome friction. The energy wasted in overcoming friction can be minimized in many ways.

Activity 6.3.3

Place a block of wood on a table. Now gently push the wood. Then take four round pencils. Place it below the block of wood as shown in figure. Now push the wood gently. Which one is easier to move? Discuss.

Since the friction reduces the efficiency of a machine, it must be minimized to increase the efficiency of a simple machine. For this, following methods are used.

Lubricants used in bicycle gears

Rolling motion in ball bearings

Fig. 6.15

i. Polishing

Friction can be reduced by polishing the sliding surfaces so as to make a rough surface a smooth one.

ii. Using lubricants

Oils and greases are called lubricants which are generally used to reduce the frictional force in a machine. They work by making sliding or rolling surface smooth and therby less friction is produced during working of simple machine.

iii. Rolling instead of sliding

Rolling a body is actually easier than sliding it over the surface of another body. For this, ball bearings can be used in the moving parts of simple machine which reduces friction to a great extent.

iv. Streamlining

The body of boat, aeroplane, fishes and birds are steamlined. The streamlined body helps in reducing friction. So, birds and aeroplane can fly easily whereas boats and fish can move easily in water.

Fig. 6.16

Think about it

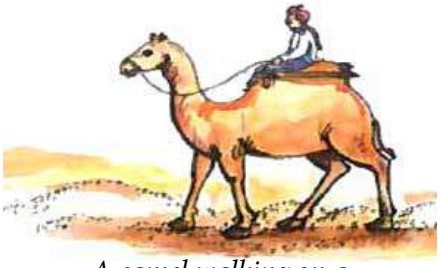
1. We slide down when we step on smooth surface, why ?
2. Lubricants or oil is used in sewing machine, why ?

Activity 6.3.4

Take an empty wooden chalk box, tie one end of a string around it. Holding another end of the string, pull the box slowly on a smooth surface of a floor. Do you feel any friction? Try pulling the same box on the different fixed surfaces over the floor, such as a thick sheet of cloth, a sheet of coir mat, a sheet of rubber, a sheet of greasy paper and finally on a sand bed. What do you observe?

Repeat the same activity using a heavily filled box. Observe the difference. What might be the reason for this difference?

A boy pulling a wooden box on a sand bed.



A camel walking on a desert feels friction

6.4 Work and Power

Work

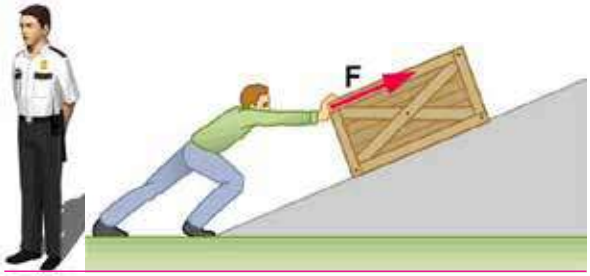


Fig. 6.17

We perform different types of activities in our daily life. We study books, watch movie, climb staircase, pull water from well, move from one place to another, etc. Similarly, a security guard stands infront of a gate and porter carries load on his head. We say act of moving, standing, carrying load, climbing staircase etc is work in our daily life. It requires some force (energy) to do their work. But in science work is only when displacement occurs due to application of force. So, a security guard standing infront of gate does not do any work.

Work is said to be done if a force causes displacement of the object. Mathematically, work is the product of force and displacement.

$$\text{Work} = \text{Force} \times \text{displacement}$$

$$W = F \times d$$

The SI unit of work is Joule (J).

$$1\text{Joule} = \frac{1\text{N}}{1\text{m}}$$

The work done is said to be 1 joule if a force of 1N displaces a body by 1m.

1. A force of 50N is applied to move a body through a distance of 10 m. Calculate the work done.

Sol^{n}

Force (F) = 50N

displacement (d) = 10 m

Work (W) = ?

According to formula,

$W = F \times d$

or, $W = 50 \times 10$

$\therefore \quad W = 500$ N

Therefore, work done = 500 N

2. Calculate the work done when a body of mass 30 kg is lifted upto height of 15 m. ($g = 9.8\ m/s^2$)

Solⁿ

mass (m) = 30 kg

height (h) = 15 m

acceleration due to gravity (g) = 9.8 m/s^2

Work done (W) = ?

According to formula

$W = F \times d$

or, $W = m \times g \times h$ [$F = m \times g$ and $d = h$]

or, $W = 30 \times 9.8 \times 15$

$\therefore$ $W = 4410$ Joule

Therefore, work done = 4410 Joule

Types of Work

The work done can be classified as

i) Work against friction
ii) Work against gravity

Work against friction : The work is done against friction if force is applied to overcome the friction for displacement of the object.

For example, sliding window pane, dragging a box, pushing a vehicle, walking on ground, etc.

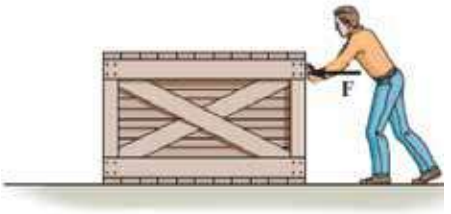


Fig. 6.18

Work against gravity : The work is done against gravity if fc force is applied in object against direction of gravity. The work done in lifting an object is work against gravity. For example, pulling out water from well, climbing staircase, launching rocket, etc.

Fig. 6.19

1. A force of 50N is applied to move a body through a distance of 10 m. Calculate the work done.

Solⁿ

Force (F) = 50N

displacement (d) = 10 m

Work (W) = ?

According to formula,

$W = F \times d$

or, $W = 50 \times 10$

$\therefore$ $W = 500$ N

Therefore, work done = 500 N

2. Calculate the work done when a body of mass 30 kg is lifted upto height of 15 m. ($g = 9.8$ m/s^2)

Sol^n

mass (m) = 30 kg

height (h) = 15 m

acceleration due to gravity (g) = 9.8 m/s^2

Work done (W) = ?

According to formula

$W = F \times d$

or, $W = m \times g \times h$ [$F = m \times g$ and $d = h$]

or, $W = 30 \times 9.8 \times 15$

$\therefore$ $W = 4410$ Joule

Therefore, work done = 4410 Joule

Power

Ram and Hari climb a staircase of height 20m. Ram takes 30 seconds and Hari takes 40 second to climb it. They do equal work but takes different time. Who is more capable of climbing the staircase? Who is move powerful? Discuss.

Consider two water pumps X and Y. Pump X can be draw 1000 lt. water in 5 minutes. Pump Y can draw 500 lt. water in 5 minutes. Which water pump is more efficient? Discuss.

Power is rate of doing work.

Mathematically,

$$\text{Power} = \frac{\text{Work done}}{\text{time taken}}$$

$$P = \frac{W}{t}$$

The SI unit of power is watt or J/s.

$$1 \text{ watt} = \frac{1 \text{ Joule}}{1 \text{ second}}$$

The power is said to be 1 watt if 1 Joule work is done in one second.

The power is also measured in other units like horse power.

1 Horse power (H.P.) = 746 Watt

1000 W = 10^3W = 1 KW 9kilowatt)

1,000,000 W = 10^6W = 1 MW (Megawatt)

The machine which takes less time to do a work is more powerful. Similarly, a machine which can do more work in the same time is more powerful.

Numericals

1. Shyam does 80J work in 5 second. Calculate his power.

Solⁿ

Work (W) = 80J

time (t) = 5s

power (P) = ?

According to formula,

$$P = \frac{W}{t}$$

or, $P = 80J/5s$

or, $P = 16J/s$

$\therefore$ $P = 16$ Watt

$\therefore$ Power of Shyam is 16 Watt.

2. Sita is 45 kg. She climbs a pole of height 10 m in 2 minute. Calculate her power. ($g = 9.8 \text{ m/s}^2$)

Solⁿ

Mass (m) = 45 kg

height (h) = 10 m

time (t) = 2 minute = 2 × 60s = 120s

Acceleration due to gravity (g) = 9.8 m/s^2

Work done (W) = ?

Power (P) = ?

Work done (W) = m × g × h

= 45 × 9.8 × 10

∴ W = 4410 J

Now, $\text{Power (P)} = \frac{\text{Work (W)}}{\text{time (t)}}$

or, $P = \frac{W}{t}$

or, $P = \frac{4410}{120}$

∴ P = 36.75 Watt

Project Work

1. What role does friction play in the sport of your choice? Collect some pictures of that sport in action where friction is either supporting it or opposing it. Display these pictures with proper captions on the bulletin board of your classroom.
2. Imagine that friction suddenly vanishes. How would life be affected. List ten such situations.
3. Visit a shop which sells sports shoes. Observe the soles of shoes meant for various sports. Describe your observations.
4. A toy to play with: Take an empty match box. Take out its tray. Cut a used refill of a ball pen of the same width as the tray as shown in the figure below. Fix the refill with two pins on the top of the tray as shown in Figure below. Make two holes on the opposite sides of the tray. Make sure that the holes are large enough to allow a thread to pass through them easily. Take a thread about a metre long and pass it through the holes as shown. Fix beads at the two ends of the thread so that it does not come out. Insert the tray in the outer cover of the matchbox. Suspend the match box by the thread. Leave the thread loose. The match box will start falling down due to gravity. Tighten the thread now and observe what happens. Explain your observation. Can you relate it to friction?

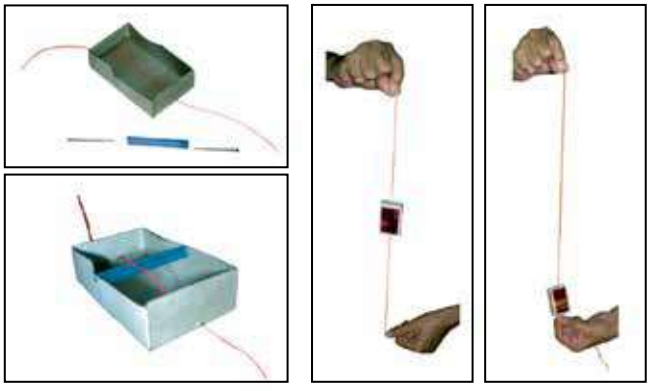


Fig. 6.20

Points to Remember

- A body is said to be in motion if it changes its position with respect to fixed point or objects around it.
- Weight is gravitational force of attraction on an object, caused by the presence of a massive second object, such as the Earth or Moon.
- Friction is necessary to do different activities in our daily life. It is possible to walk on ground due to friction. The moving vehicles can be stopped due to friction. Nails and screw can join two surfaces due to friction.
- Work is said to be done if a force causes displacement of the object.
- he work is done against friction if force is applied to overcome the friction for displacement of the object.
- The work is done against gravity if force is applied to move object against gravity.

Project Work

Make a list of examples of force, motion, and friction in daily life. Write down the working principles of any two of these and present them in the classroom.

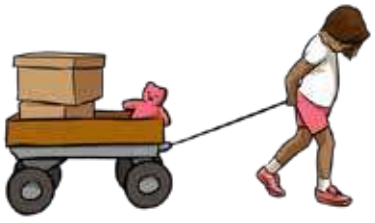
Exercise

A. Choose the correct one and put the tick mark (√).

i. Which is a push or a pull?

a. A force b. Friction
c. Speed d. Velocity

ii. Look at the picture. Which force is moving the wagon.



a. friction b. a pull
c. a push d. gravity

iii. Look at the picture. Which force makes the rain fall to the ground ?

a. Friction b. Gravity
c. Magnetic d. Applied

iv. A measure of how fast or slow something is moving

a. direction b. force
c. pull d. speed

v. The measure of length. How far.

a. motion b. smooth
c. distance d. push

vi. A force away from you

a. gravity b. speed
c. push d. magnet

vii. Where an object moves from one moment to the next.

a. speed b. direction
c. friction d. position

viii. The measure of the force of gravity on an object

a. weight b. pull
c. gravity d. motion

ix. A nail is fixed in the wall

a. due to friction b. due to gravity
c. due to power d. due to force

x. What is the unit of work?

a. Watt b. Newton
c. Joule d. Horse power

xi. What is the product of force and displacement called?

a. work b. power
c. displacement d. friction

xii. What is the example of displacement ?

a. Distance crossed in a circular path
b. Distance crossed in a rectangular path
c. Distance crossed on zigzag road
d. Distance crossed in a straight path

B. Fill in the blanks

force, work, gravity, motion, friction, rest, newton, spring scale

i Any push or pull.....

ii. A force that resists motion when objects touch.....

iii. A force that pulls two objects toward each other.....

iv. Any change of position.....

v. When an object is not in motion.....

vi. A tool used to measure force .....

vii. The result of a force moving an object a distance.....

viii. The metric unit of measure for force .....

C. Give the reason :

i. we slip when we step on a banana peel.

ii. A nail is fixed in the wall

iii. Stricking a matchstick produces fire .

iv. The soles of our shoes wear out gradually.

v. The use of Grinding Mill wheel in the village to grind oil is not considered work done in science.

vi. When an object is thrown into the sky, it falls down again.

vii. A spring balance is used to measure the gravitational force exerted by the earth on any object.

viii. Birds, airplanes, boats, ships, etc. are streamline shaped.

D. Differentiate

i. Write the difference in distance and displacement on the basis of following factors.

Distinguishing factors	Distance	Displacement
Definition		
Direction		
A scalar or a vector.		
A relationship to velocity or motion.		

ii. Write the difference in speed and velocity on the basis fo following factors..

Distinguishing factors	Speed	Velocity
Definition		
Direction		
A scalar or a vector.		
A relationship to velocity or motion.		

iii. **Work and Power**

iv. **Work against friction and Work against gravity**

E. Answer the following questions :

i. What is distance ?

ii. What is displacement ?

iii. A bird sitting on a wire, flies, circles around and comes back to its perch. Explain the total distance it traversed during its flight and its eventual displacement.

iv. What is speed ? Write down its formula and SI unit .

v. What is velocity ? Write down its formula and SI unit .

vi. What is meant by gravity and weight?

vii. Explore the difference between mass and weight.

viii. How to calculate weight using mass and gravitational field strength?

ix. Explore how the weight of an object depends on its location.

x. What is friction ? Mention any three advantages of frictions.

xi. In which condition work is said to be done ? Explain with example .

xii. Explain the relationship between work and power .

xiii. Confirm the saying, "Friction is our enemy and our friend."

xiv. "Friction also plays a supportive role for us," explain with examples.

xv. Explain the reason for reducing friction.

xvi. Write down the definition, formula, and unit of the following physical quantities:

xvii. Distance, displacement, work, power, velocity, speed use the equation triangle on the left to help you answer the following questions. Be mindful of the units you are working in , and the units required of your answer.

Planet	Acceleration due to gravity N/kg
Mercury	kg
Venus	kg
Earth	kg
Mars	kg
Jupiter	kg
Saturn	kg
Uranus	kg
Neptune	kg

1. The mars rover has a mass of 1025kg. How much will it weight on Earth?

   Answer in N. ☐

2. How much will the Mars rover weight on Mars? Answer in N. ☐

3. The Galileo probe was a probe sent by NASA to crash into a planet in our solar system. The probe had a mass of 2223kg and weighed 57798N when it crashed. Which planet did it crash into to? [ ]

4. Neil Armstrong was the first man to walk on the moon. If he had a mass of 90kg and weighed 144N when on the moon, what is the gravitational field strength on the moon? Answer in N/kg. [ ]

5. Buzz aldrin was the second man to walk on the moon. If weighed 850N on earth, what was his mass? Answer in kg. [ ]

6. Laika was the first dog in space. They had a mass of 5000g. What was Laika's weight on Earth in Newtons? Answer in kg. [ ]

7. The Apollo 11 rocket had a weight of 288kN while on Earth. What was its mass? Give your answer in kg. [ ]

8. A Falcon heavy rocket has a weight of 14207880N when on Earth. What is its mass? Answer in kg. [ ]

9. What will the Falcon Heavy weigh on mars? [ ]

10. While on the moon, Buzz and Neil dropped a feather and a hammer to show they accelerate to the floor at the same rate in the absence of air resistance. The feather weighed 13.1mN while on the moon. What was the feathers mass? Answer in g to 1 decimal place. [ ]

F. Numerical Problems

i. Nishant runs in a straight line and takes 30 seconds to cover a distance of 450 meters. Then, find out his speed.

ii. If an object crosses a distance of 100 meters in 5 seconds, what is its velocity?

iii. How far is a car traveling at a speed of 30 m/s in 10 seconds?

iv. A crane can lift a 2000 kg jeep for 120 min. It takes 20 seconds to find out the work done by the crane and its power.

v. Two people of the same mass climb the same flight of stairs. The first person climbs the stairs in 25 seconds. The second person takes 35 seconds. Which person does the most work? Which person expends the most power? Explain your answers.

vi. A box that weighs 1000 Newtons is lifted a distance of 20.0 meters straight up by a rope and pulley system. The work is done in 10.0 seconds. What is the power developed in watts and kilowatts?

vii. A person of mass 64 kg climbs up a ladder to a height of 5.0 meters. What work does the person do? Calculate the work done by person.

viii. A load is displaced to a distance of 20m by applying an effort of 450 N. Find the amount of work done.

ix. A motorcycle can travel 50 km in 30 minute. Calculate the speed of the motorcycle.

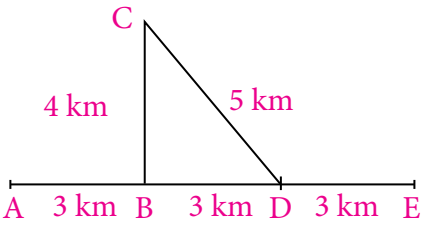
x. Calculate the weight of the body having mass 75 kg. ($g = 9.8\ m/s^2$)

xi. An engine can carry a load of 6000 N upto a distance of 20m in 5 second. Calculate the work done and power of the machine.

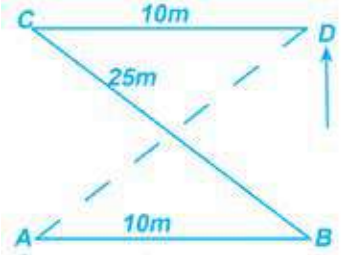
xii. Suresh can carry a load of 120 kg upto height of 60m. What is the amount of work done by Suresh? Calculate his power if he can do that work in 2 minutes.

G. Diagrammatic questions

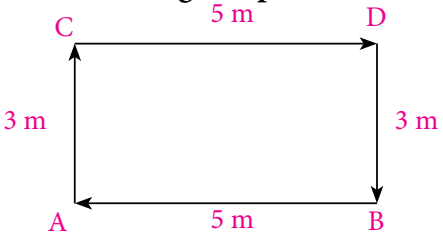
i. **Prashant and Sushant started on a motorbike from place A, took the turn at B, did a task at C, travelled by the route CD to D and then went on to E. Altogether, they took one hour for this journey. Find out the actual distance traversed by them and the displacement from A to E. From this, deduce their speed. What was their velocity from A to E in the direction AE? Can this velocity be called average velocity?**



ii. **Budhan started walking from A to B and C and completed the journey to D. Find the total distance covered by Budhan.**



iii. **The picture shows the path of Suresh, A, B, C, and D. If he starts walking from point A and returns to that point . Discuss the following questions based on the given picture and draw conclusions.**

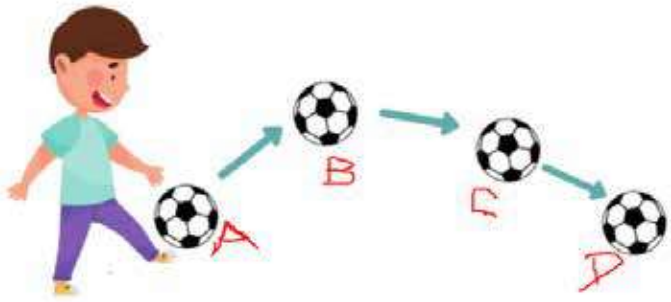


a. In which case the value of distance is not zero, but the value of displacement is zero?

b. In which case the value of distance and displacement is equal?

c. In which case the value of displacement is negative?

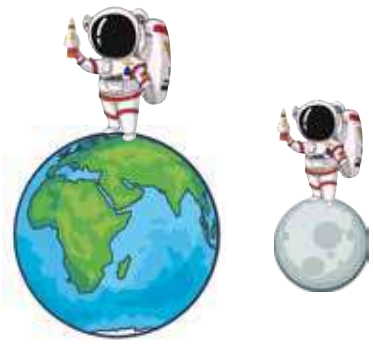
iv. Ram is shown in the photo playing football.Answer the question below.



a. What are the initial and final position of football?
b. What would happen to football if friction was not counted?
c. Why did the football go up and down?
d. While falling to the ground, the football traveled 5–5 meters from A, B, C, and D. The length from A to D is 12 meters. What is the total distance and displacement the football has crossed?

V. Weight varies with the strength of gravitational force. Imagine your older brother weight 47 kg. Calculate his weight on different places in the solar system Use the equation W = mg to fill in the table below.

Write only on digit decimals. For example 4.8 or 11.2 or 500.1 Don't write 4.800172638



Location	Earth	Moon	Marse	Jupiter
Mass (Kg)	47			
Gravity (g)	9.8	1.7	4	25
Weight (N_				

vi. Fill in the table with the following sentences:

Only noticeable with very large masses	Mass x Gravity	It's a force

non-contact force	Measured in Newtons (N)	Measured in kilograms (kg)
tha larger it is, the stronger the pull	the amount of matter of an object	Stronger on the earth

Mass	Weight	Gravity

vii. Use the value of Earth's acceleration due to gravity (g)=9.8 m/s^2 and formula for weight(N)=Mass (kg) x Acceleration due to gravity (m/s^2) i.e, (W=mg) to solve the following problem .Begin each problem by writing the formula, then make substitutions, and solve for the final answer with units .

1. Calculate the weight of this lunchbox if its mass is 1.2kg.

2. Pratyashi experiences an average downward force of 441 N anywhere she goes on Earth. Calculate her mass.

3. Calculate the acceleration due to gravity on the planet where this 80 kg astronaut weighs only 304N.

4. This bird has a mass of 0.8 kg. Calculate the weight of the bird acting downward as it flies.

5. Joe is carring a load of building supplies and likely injuring his back by supporting 882N of weight calculate the mass of what he is carring.

6. This armed rover weighs 1900 N and has a mass of 340 kg. What is the acceleration due to gravity on its current planet?

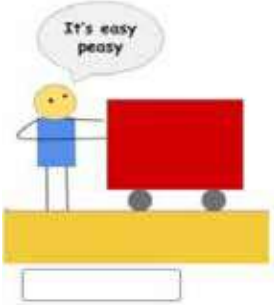
7. This feather experiences 0.075 N of downward force. Assuming it is on earth, what is its mass?

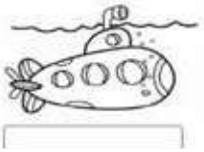
8. Java the alien has a mass of 50 kg. How much would he weigh on earth?

9. This 200 kg stag that weighs 1960 N on earth would only weigh 324 N on the moon. Calculate the moon's acceleration due to gravity.

viii. Identify the types of Friction. Use the word bank:

static, sliding, fluid , rolling





Unit 7 Energy in Daily Life

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- categorize the sources of energy used in daily life with examples.
- introduce fossil fuels and explain the advantages and disadvantages of using them.
- explain the importance of conserving energy sources and the measures to be taken to protect them.
- give a definition of temperature as well as its units.
- identify and convert the units of temperature (degrees Celsius and Kelvin) used in science.
- introduce a thermometer and use it to measure the temperature.
- explain the design and operation of laboratory thermometers
- describe the temperature of melting ice and boiling water on the surface of the sea and the temperature of a healthy human body,
- An experiment to show the fact that heat is transferred from an object with a high temperature to an object with a low temperature
- demonstrate the fact that the temperature of an object increases after receiving heat and decreases after losing heat,
- introduce the wave and to specify the type of wave
- demonstrate the practical activities of wave origin,
- define wavelength, amplitude, frequency, and velocity.
- define the reflection of light and to identify its usefulness and effect in daily life,
- state and verify the laws of reflection,
- a ray line drawing is used to depict the reflection of light in a plane mirror.
- describe the periscope specimen, to demonstrate its operation using a line diagram, and to determine its utility.

Fig. 7.1

i. What energy sources are shown in the picture?
ii. What other energy sources are used in daily life?
iii. What are the sources of energy and equipment you use in your daily life?
iv. What are the sources of renewable and non-renewable energy in the picture?

INTRODUCTION

We do different types of work in our daily life. We cook food, wash our clothes, watch television, iron our clothes, ride vehicles, listen to music, glow light, etc. To do all these activities we need energy. Similarly, plant also need energy to grow and manufacture food. Plants obtain energy from sunlight. We can light electric bulb with the help of electrical energy. We need energy to cook food, iron clothes, charge our mobile phone, run vehicles and to do other works. There are several forms of energy. There are several sources of energy. The wise use of energy makes our life convenient and easy.

Activity 7.1

Complete the table below by copying it in your note book.

Sources of Energy	Form of Energy	Uses	Renewable/ Non-renewable
Sun			

Biogas		• It is commonly used in rural areas as cooking gas. • It can be used for the production of electricity. • It can be used in instruments used for water heating, space (room) heating etc. • It can replace compressed natural gas for use in vehicles.	
Biomass	Light and Heat		
Fuel			
Hydropower			Renewable
Wind			
Geothermal			
Wave/Tidal			
Coal			
Nuclear			

7.1 Energy

Energy is the capacity of doing work. We obtain energy to do work from different sources. We obtain energy from food. Similarly, plant obtain energy from sunlight. The vehicles obtain energy from fuels and petrol and diesel. We also obtain energy from coal, wood and natural gas. The energy can be obtained from moving water and air. Energy is also obtained radioactive substances like uranium, polonium etc.

The energy obtained from these sources are used to do our daily works.

Activity 7.2

Make a list of fuels and types energy obtained from them. Also mention the uses of such energy.

S.N.	Fuel	Types of energy	Uses
1			

Sources of Energy

The objects from which energy is obtained are called sources of energy. For example : wood, petrol, diesel, kerosene oil, LP gas, sun, wind, water, etc.

Activity 7.3

Make a list of sources of energy around you. Which sources of energy is found abundantly in your community? Which sources of energy can be produced again and again? Which sources of energy cannot be produced? Discuss.

The sources of energy can be classified as renewable and non renewable source.

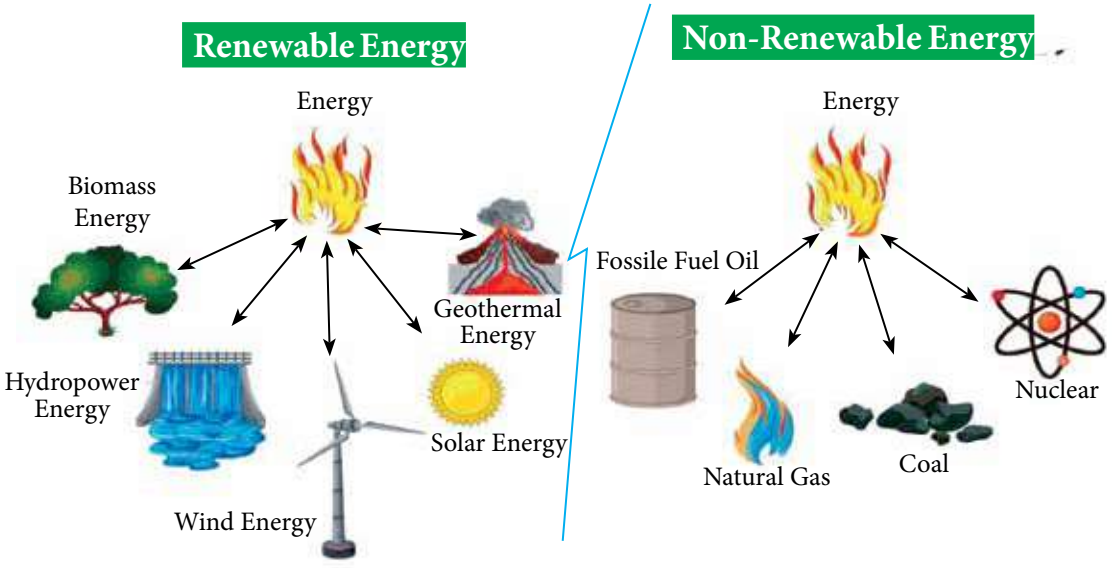


Fig. 7.2

Renewable Source of Energy

The sources of energy which can be produced within a short time period and used again and again during our life time are called renewable sources of energy. For example: wood, biogas, solar energy, wind energy, etc. These energy can be generated within a short time period when exhausted. So, there is no permanent shortage of renewable sources of energy. We should use renewable source of energy.

Non Renewable Sources of Energy

The sources of energy which cannot be regenerated in short time period and cannot be re-used within our life time are called non-renewable sources of energy. It takes millions of years to regenerate non-renewable energy. So, it leads to energy crisis when it gets exhausted. For example : petrol, diesel, coal, nuclear fuel, natural gas (LPG) are non-renewable sources of energy. We should use non-renewable energy wisely.

Fossil Fuels

Fossil fuel is formed from remains of plant and animals that were burned under the earth crust or sea-bed millions of years ago. They are formed by deposition of plants and animal remnants piled up in layers over the long period of time. Due to high pressure and extreme temperature, they change into fossil fuels. Fossil fuels are found under the earth crust in the form of coal, natural gas and crude oil. The crude oil is refined to obtain petrol, diesel, kerosene oil, asphalt, etc.

Fossil fuel is found in limited amount. It cannot be regenerated immediately. But, the demand of fossil fuel is growing day by day. Hence, it may finish in near future.

Fig. 7.3

Advantage of fossil fuels

i. It is easily available.
ii. It can be transported from one place to another easily.
iii. They are cost effective.
iv. Coal is abundantly available and it is cheap.
v. It is multipurpose source of energy. It can be used for operating different types of machines for many purposes.

Disadvantages of fossil fuels

i. Fossil fuels produce harmful gas. It pollutes environment.
ii. It is non-renewable source of energy. Hence, it may exhaust due to excessive use.
iii. It cannot be regenerated immediately.

Energy Crisis

The fossil fuels is widely used nowadays. However, fossil fuel is non-renewable source of energy. It will exhaust some day in future. It cannot be regenerated immediately. So, it will lead to shortage of energy in future.

Energy crisis is the shortage of energy in future due to excessive use of non-renewable energy.

To solve the issue of energy crisis, we should -

i. use energy wisely.
ii. use renewable energy sources instead of non-renewable sources of energy.
iii. reduce the use of non-renewable source of energy.
iv. use energy efficient devices.
v. raise public awareness about conservation of energy.

vi. use solar energy and electric energy.
vii. focus on developing alternative sources of energy.

7.1.3 Alternative Energy

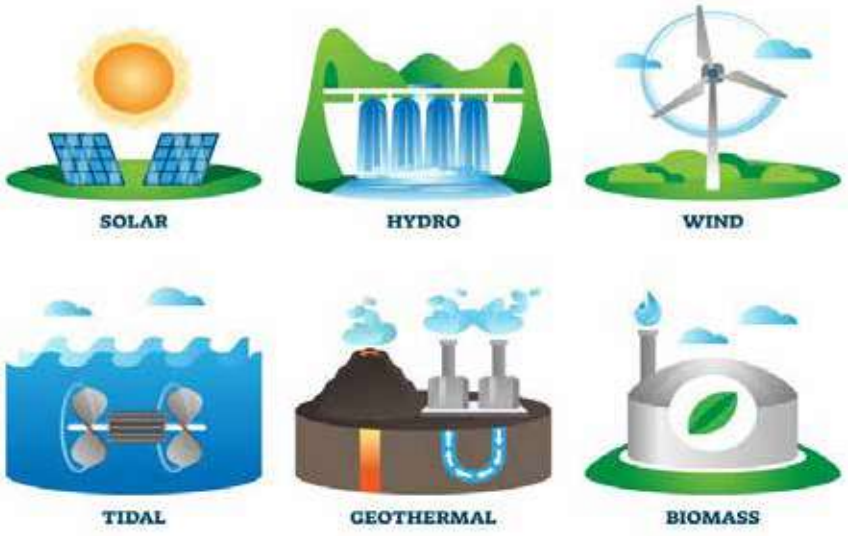


Fig. 7.4

The source of energy used to reduce the use of non-renewable sources of energy is called alternative source of energy. Hydroelectricity, wind energy, solar energy, biogas etc. are alternative sources of energy. The use of alternative energy reduces the demand of non-renewable energy. Moreover, the alternative sources of energy are cheap and pollution free sources of energy. In context of Nepal, huge amount of hydroelectricity can be produced. It can be easily supplied to remote areas. Similarly, Nepal is an agricultural country, we can use the biomasses like remnants of plants, crops and excrete of cattles to produce biogas. It can be used for cooking food and lighting. The solar panels are light and cheap. They can be easily transported to any part of the country to produce electricity. The government of Nepal has been facilitating and promoting the use of alternative source of energy. The government of Nepal provides grants and subsidies for installing alternative source of energy.

Activity 7.4

Find 3 objects in your house and write where they get their energy from:

Example:

OBJECT: Television. It gets its energy from electricity.

OBJECT: 1 _____. It gets its energy from _____

OBJECT: 2 _____. It gets its energy from _____

OBJECT: 3 _____. It gets its energy from _____

Activity 7.5

NON-RENEWABLE RESOURCES

Complete these sentences, using the words in the box below. You may need to use some words more than once.

animal	Chemical	coal	fell	fossil	heat	millions
mud	natural gas	oil	plants	rock	rotting	

Fuels contain a store of energy called _____ energy.
When fuels are burned the _____ energy is changed into _____ energy. some fuels, called _____ fuels where formed from the remains of plants or _____.
Coal was formed from dead _____ . The plants were buried in _____, which stopped them _____ away.
More mud buried and squashed them. The mud turned into _____ and the dead plants turned into _____ .
Oil and gas were formed from plants and _____ that lived in the sea. When they died they _____ to the sea bed and were buried. Over _____ of years they were squashed and heated. and turned into _____ and _____ .

Activity 7.6

Drag and Drop to compare between the types of fossil fuels:

Cooking, heating and manufacturing	The chemical processes that produce petroleum but less dense.	Compound are hydrocarbons
Generating electricity	formed from the decay of ancient organisms such as (microscopic plankton and algae	Methane, hydro-carbon compounds (propane and butane
Plastic, cosmetics, medicines wax, asphalt and grease	Solid fossil fuel that can be found in mines. Remines of plants in ancient swamp	Hydrocarbons, sulfur and nitrogen based compounds

Fossil Fuel	**Petrolem**	**Natural Gas**	**Coal**
Definition			
Composed of			
Uses			

Points to Remember

- Plants obtain energy from sunlight. We can light electric bulb with the help of electrical energy. We need energy to cook food, iron clothes, charge our mobile phone, run vehicles and to do other works.
- The energy can be obtained from moving water and air. Energy is also obtained from radioactive substances like uranium, polonium etc.
- The sources of energy which can be produced within a short time period and used again and again during our life time are called renewable sources of energy.
- The sources of energy which cannot be regenerated in short time period and cannot be re-used within our life time are called non-renewable sources of energy.
- The fossil fuels is widely used nowadays. However, fossil fuel is non-renewable source of energy.
- The source of energy used to reduce the use of non-renewable sources of energy is called alternative source of energy.

Exercise

A. Choose the correct one and put the tick mark (√).

a. Which of the following is non-renewable energy?

i. LPG ii. wind energy
iii. electricity iv. solar energy

b. Select the odd one.

i. LPG ii. Petrol
iii. Coal iv. biogas

c. Which is the most suitable form of energy for Nepal?

i. fossil fuel ii. solar energy
iii. hydro electricity iv. nuclear energy

d. Which is pollution free source of energy.

i. Coal ii. hydroelectricity
iii. petrol iv. diesel

e. Which of the following statement is false?

a. Alternative energy is renewable source of energy.
b. Energy crisis occurs due to excessive use of non-renewable energy.
c. Fossil fuels can be regenerated.
d. Biogas is alternative source of energy.

B. Fill in the blanks with suitable words:

[shortage, fossil fuel, petrol, regenerated, biogas]

a. ..... is fossil fuel.

b. ..... sources of energy can be ..... within short time.

c. Energy crisis is ..... of energy.

d. ..... causes air pollution.

e. ..... is alternative source of energy.

C. Write differences between:

a. Renewable and non-renewable source of energy

b. Energy crisis and alternative energy

D. Answer the following questions.

i. What is fossil fuel? How is it formed?

ii. Write the advantages of renewable sources of energy.

iii. What is energy crisis? Write the way to conserve energy.

iv. What do you mean by alternative source of energy? Give examples.

v. Why government is promoting the use of alternative energy?

vi. Why hydroelectricity and biogas is suitable for Nepal? Explain.

E. Diagrammatic questions

i. Match each energy source to the way we use it.

sun

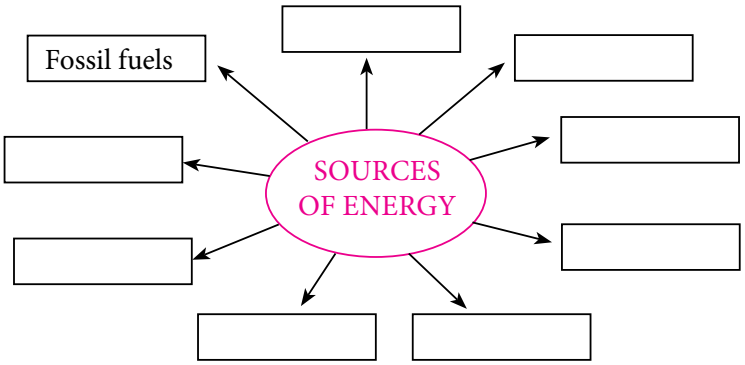
oil

water

wind

wood

ii. Write the sources of energy by completing the bubble map.



iii. Diagram below shows two types of objects that use energy.

a. State the sources of energy for R and S

R: _____

S: _____

iv. Which types of sources of energy are given below? Write down the name of the form of the energy.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ _____ _____

v. What can do to save energy ? Match the sentences with the pictures :

- Open this to let a cool breeze in the house
- You can read a book instead of watching this
- This machine keeps you cool and uses less energy tan an air conditioner
- You can eat this for lunch instead of cooking
- You can wear these instead of shoes to stay cool
- This is a place where you can go swimming
- You can use this instead of the car.

vi. For each picture write what the source of energy is:

_____ _____ _____ _____

_____ _____ _____ _____

vii. Label the resources on the diagram, choosing the appropriate words from the box below . You will not need to use all of the labels .

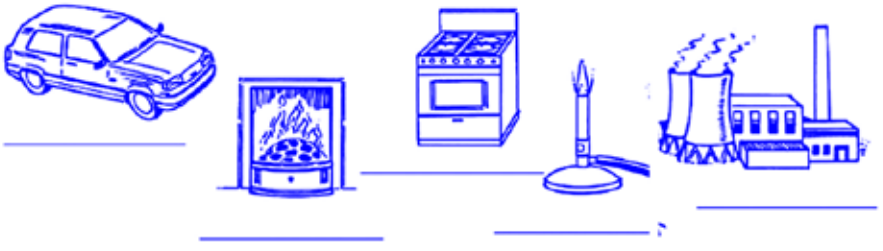
biomas energy, hydroelectricity, wind energy, solar power,coal mine, natural gas, electricity pylons, hydrogen fuel, oil platform, power station, geothermal energy, wave energy.

a.

b. Sort each of the energy resources into the table below .

Renewable		Non-Renewable	

viii. Write "coal", "oil", "natural gas" or "nuclear energy".



7.2 Heat

Answer the questions by looking at the picture below.

Fig. 7.2.1

i. What activities are shown in the picture?
ii. What does it take for these activities to happen?
iii. What types of energy can it be defined as?
iv. What type of energy is required to dry the food? What could be the source of that energy?
v. What is the name of the energy source used to keep the body warm in winter?
vi Which energy does fire generate when a rocket is fired?

We cook food. We dry our clothes. We boil water. Goldsmith makes ornament by melting gold. These processes require heat. Heat is useful in carrying out several works. It is used in welding, extraction of metals, crystallization, etc. Heat causes natural phenomena like rainfall, movement of air, water currents in oceans etc. Heat keep our body warm.

Heat is a form of energy. It is produced due to kinetic energy of the molecules of the body. Heat is a form of energy that can flow from a body at higher temperature to a body at lower temperature. We obtain heat from fuel, firewood, electricity, sunlight, friction, fossil fuel, oxidation of food in our body etc.

The SI unit of heat is Joule (J). Heat is measured by using an instrument called calorimeter.

Sources of Heat

The major source of heat is the sun. Other sources of heat are: fuels, firewood, electricity, coal, kerosene, cooking gas, diesel, petrol, friction, oxidation of food (in our body) etc.

Activity 7.2.1

Rub two hands for sometime. What do you feel ? Rub iron knife or iron rod on stone or on hard object for some time. Do they become hot ?

All substances are made up of small molecules. Due to friction, molecules come in motion. The produced energy due to motion of molecules in a body is called heat energy. Heat is the form of energy which gives us sensation of warmth.

Think about

What is the cause behind the burning of match stick, when it rubs on side of match box ?

Effects of Heat

When body is heated, we can observe the following effects.

i. Heat changes the state of a body.
ii. Heat increases the volume of a body (i.e. heat causes expansion of a body).
iii. Heat increases the temperature of a body.
iv. Heat helps to dissolve a solute in a solvent during the formation of a solution.
v. Heat changes the colour of a body .
vi. Heat causes chemical change.

7.2.1 Temperature

Sushant was on his way home after office. The sun was beating down and he was sweaty and uncomfortable. As soon as he reached home, he sat down for a while. Then, he went straight to the refrigerator for a bottle of cool water.

Fig. 7.2.2

Why did the bottle of water feel cool while it was so hot outside? The answer lies in the concept of temperature.

Temperature is the degree of hotness or coldness of a body. It gives idea about how hot or cold a body is.

The temperature of boiling water is greater than the temperature of our body. When we touch boiling water, heat flows from boiling water to our body. So, we feel it is hot. Similarly, the temperature of ice is less than the temperature of our body. So, heat flows from our body to ice when we touch it. So, we feel ice is cold. It means, heat flows from the body having higher temperature to lower temperature. So, temperature is a physical quantity that determines the direction of flow of heat.
The temperature of a body is measured by thermometer.

Temperature indicates the degree of 'hotness' or 'coldness' of a body or a place.

An Experiment

Hot & Cold are relative

Aim: To show that the terms 'hot' and 'cold' as we feel they are only relative terms.

Materials needed: Three glasses, hot water (as hot as you can bear to dip your finger in), ice-cold water, and water at room temperature.

Fig. 7.2.3

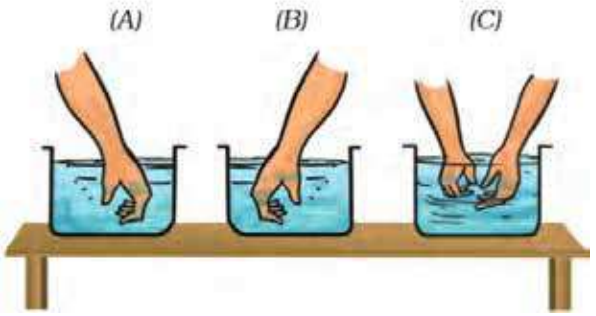
Method

i. Pour hot water, water at room temperature, and the ice-cold water into three separate glasses.
ii. Keep the three glasses side by side on a table with the glass containing water at room temperature in the middle.
iii. Dip the index finger of one hand in the ice-cold water and that of the other hand in the hot water. Hold the finger in the water for some time (for about a minute).
iv. Then, dip both the index finger into the water at room temperature.

Observation: You will find that to one finger, the water feels hot and to the other it feels cold.
Conclusion: This is because the finger that was in ice-cold water has become cold, and when it was placed in the water at room temperature, it felt that the water was warm, relative to the earlier experience of ice-cold water. Similarly, the finger that was first in hot water will feel the water at room temperature to be relatively cold. So you see the terms 'hot' and 'cold' are only relative terms. There always has to be a reference body with respect to which we can say whether a given body is hot or cold. Therefore, it is important that we use an instrument, rather than our own judgment to measure temperature.

Activity 7.2.2

Take three large mugs A, B and C. Put cold water in mug A and hot water in mug B. Mix some cold and hot water in mug C.Now dip your hand in mug A and right hand in mug B for 2-3 minutes. Put both the hands in mug C. After few minutes our left hand felt cold while our right hand felt hot. But , we don't know exact coldness and hotness of our hand . Temperature is a reliable measure of the hotness of an object.



Activity 7.2.3

Take three glasses. Fill them with normal, lukewarm and cold water. Put ice cubes in them and observe for 5 minutes. Write the changes you noticed in your own words.

Normal water

Lukwarm water

Cold water

7.2.2 Units of Temperature

The SI unit of temperature is kelvin (K). However, the other units of temperature like degree Celsius (^{0}C) and degree Fahrenheit (^{0}F) is widely used.

Kelvin is used in scientific measurement. Degree centigrade is the most commonly used temperature scale. Fahrenheit is commonly used in thermometer to indicate the temperature of the human body.

Generally, there are three scales of temperature. They are centigrade (celsius) scale, fahrenheit scale, and kelvin scale.

i. Centigrade scale

In a centigrade scale, the lower fixed point is 0°C and the upper fixed point is 100°C. The interval between these two points is divided into 100 equal divisions. Each division is called 1°C.

ii. Fahrenheit scale

In a fahrenheit scale, the lower fixed point is 32°F and the upper fixed point is 212°F. The interval between these two points is divided into 180 equal division. Each division is called 1°F.

iii. Kelvin scale

In a Kelvin scale, the lower fixed point 273K and the upper fixed point is 373K. The interval between these two points is divided into 100 equal divisions. Each division is called 1K.

Relation among units of temperature

If °C, °F and 'K' are Celsius, Fahrenheit and Kelvin scales, then the relation among them can be expressed as :

$$\frac{C-O}{100} = \frac{F-32}{180} = \frac{K-273}{100}$$

Temperature scales: Fahrenheit and Celsius

1. The temperature of a typical summer day is

a. 30^0C b. 5^0C c. 30^0F

2. The temperature of a snowy day should be below

a. 32^0C b. 0^0F c. 32^0F

3. The water in a hot bubble bath be around

a. 100^0C b. 98^0F c. 40^0F

4. The soup served in a restaurant should be around

a. 10^0C b. 100^0F c. 50^0F

5. The temperature of boiling water is

a. 212^0F b. 212^0C c. 100^0F

6. If your body temperature is at _____. you are having a fever.

a. 10^0C b. 23^0C c. 103^0F

7. The water turns to ice when the temperature is lower than

a. -10^0C b. 0^0C c. 32^0F

7.2.3 Thermometer

Fig. 7.2.4

Write the names and functions of the devices in the above picture. What device is used to measure body temperature when we have a fever? Which of the devices is suitable for measuring body temperature as shown in the picture? Which of these is a laboratory device? Which is the most frequently used device in coronaviruses? Write the proper name of all these devices.

Thermometer

The instrument used to measure temperature is called thermometer. There are different types of thermometer. Clinical thermometer is used to measure the temperature of human body. Laboratory thermometer is used to measure the temperature of chemicals in laboratory.

Laboratory Thermometer

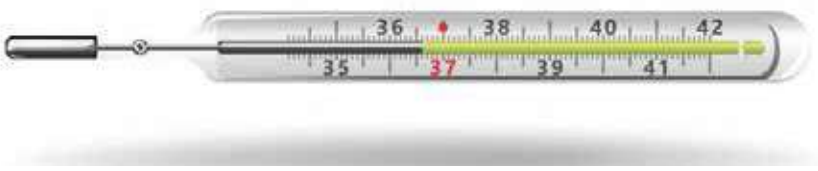


Fig. 7.2.5

Laboratory thermometer is a simple type of mercury thermometer used in a laboratory. It measures the temperature of bodies ranging between -10°C to 110°C. It consists of a thick - walled glass capillary tube. It has a thin walled cylindrical bulb at one end of the capillary tube and another end is sealed. The glass stem is calibrated in degree celsius from -10°C to 110°C, when the bulb is kept in contact with a body, the mercury level rise or fall depending upon the temperature of that body. Therefore, we can read the temperature of a body by keeping its bulb in touch with the body.

Working: When the bulb comes in contact with a body whose temperature is to be measured, there may be rise or fall of the level of the mercury or alcohol in the capillary tube. After some time, the level of the mercury remains fixed. The level of the mercury indicates the temperature of the object.

Activity 7.2.2

1. **Measure the temperatures of tap water, our bodies, the air in the room, sunny places, etc., and present them in class on the table.**

Places	Temperature(^{0}C)
Tap Water	
Your body	
Air in the room	
Sunny Place	
Ground of School	

2. **Measure the temperature of your place at a certain time (7:30 o'clock in the morning) for a week. If a thermometer is not available, use the weather app on your mobile phone to calculate the temperature. Fill in the table below by converting the values of temperature from the Celsius scale to the Fahrenheit scale and from the Fahrenheit scale to the Celsius scale, and Kelvin scale too:**

Days	Temperature (^{0} C)	Temperature (^{0} F)	Temperature (^{0} K)
Sunday			
Monday			
.....			
.....			
.....			
.....			
.....			

3. **Put boiling hot water in a beaker and measure its temperature every minute. Fill in the table with your reading . Using a spreadsheet on a computer or plain graph paper, draw a graph of the water temperature on the Y-axis and the time on the X-axis. Join the points in the graphs.**

Time (in minute)	Temperature(^{0}C)
.....	
.....	
.....	

7.2.4 Relation between Temperature and Heat

Why do hot foods like tea and coffee melt away all at once? Why is the tap water so cold in the winter? Have you ever thought about these questions? Tea or coffee is made by boiling milk or water. So, the temperature of tea or coffee is higher than the temperature around us. The heat in tea or coffee dissipates quickly as it circulates around. In the winter, the temperature around us is very low. The temperature of the tap water is also equal to that of the atmosphere.

The normal human body temperature is always 98.6^0F. As a result, in the winter, the tap water is extremely cold.Due to the heat energy in the object itself, its temperature tends to increase or decrease. Heat is the cause of temperature, while temperature is the effect of heat.

Heat is the total energy of the motion of the molecules of a substance, whereas the temperature refers to the measure of the average energy of the motions of the molecules in the substance. The heat is dependent on factors like the speed of the particles, the size of the particles and the number of particles, etc.

The temperature, on the other hand, is independent of these factors. For example, let's compare a tub of water with a cup of water. The water in the tub and the cup can be at the same temperature but by the virtue of the number of particles in the tub, the water in the tub has more thermal energy in it and thereby more heat even though they have the same temperature.

A temperature is a number that relates to the energy possessed by the molecules of a substance, which directly relates to the kinetic energy possessed by the particles of the substance.

Let's take a closer look at heat and temperature now. When you add heat to a substance you are giving it energy. There are two things that can happen when you heat a substance;

- The substances undergo a rise in temperature corresponding to the increase in the kinetic energy of the molecules; i.e. the heat gives the molecules extra energy to move around with more speed, and this increase in speed implies an increase in temperature. The molecules now travel faster than before the heat was supplied.
- The substance can also undergo a change in phase or state; for example, at a certain temperature i.e. 100°C or 373K, on an addition of further heat, the water molecules begin to leave in a vapour state. This is called the *change of phase*. One thing we should remember is that the energy added to change the state of a substance does not result in an increase in temperature, i.e, if we have a cup of water at 90° C, addition of heat will cause this temperature to rise to 100° C, if we still add heat, the water turns into water vapour with a temperature of 100° C The absorbed energy in phase changes is not used to increase temperature but is used to change the phase and it is called the latent heat of vaporization.

Comparison Chart

Quantity Unit to Compare	Heat	Temperature
Definition	The heat of an object is the total energy of all the molecular motion inside that object.	Temperature is the measure of the thermal energy or average heat of the molecules in a substance.
SI Unit	Joule	Kelvin
Unit	Joules, Calories	Fahrenheit, Celsius, Kelvin
Symbol	Q	T
Particles	It's a measure of the number of atoms multiplied by the energy possessed by each atom.	It is like a level which determines the direction in which the heat will flow. It is related to how fast the molecule within a substance are moving.
Ability to do work	It has the ability to do work.	It can be used to measure the degree of heat.

Points to Remember

- Heat is a form of energy. It is produced due to kinetic energy of the molecules of the body.
- Temperature is the degree of hotness or coldness of a body. It gives idea about how hot or cold a body is.
- The SI unit of temperature is kelvin (K). However, the other units of temperature like degree Celsius (^{0}C) and degree Fahrenheit (^{0}F) also widely used.
- The instrument used to measure temperature is called thermometer.
- Laboratory thermometer is a simple type of mercury thermometer used in a laboratory. It measures the temperature of bodies ranging between -10°C to 110°C.
- The normal human body temperature is always 98.6^{0}F. As a result, in the winter, the tap water is extremely cold.Due to the heat energy in the object itself, its temperature tends to increase or decrease. Heat is the cause of temperature, while temperature is the effect of heat.

Exercise

A. Choose the correct one and put the tick mark (√).

I. Which is SI unit of temperature?

a. ^{0}C b. K
c. ^{0}F d. Joule

ii. Which is SI unit of heat?

a. J b. K
c. Calorie d. ^{0}C

iii. What is the lower fixed point of Kelvin scale?

a. O K b. 212 K
c. 273 K d. 373 K

iv. What is the range of temperature scale in laboratory thermometer?

a. -10^{0}C - 110^{0}C b. 35^{0}C - 42^{0}C
c. 10^{0}C - 110^{0}C d. 32^{0}F - 212^{0}F

v. Tick the correct statement.

a. Heat flows from cold body to hot body.
b. Temperature is measured by caloriemeter.
c. Clinical thermometer is used in laboratory.
d. Temperature determines the direction of flow of heat.

B. Fill in the blanks.

[temperature, mercury, thermometer, warmth, expand]

1. Heat is a form of energy that gives sensation of .....
2. The upper fixed point is the ..... of boiling water.
3. Laboratory thermometer contains.....
4. Substances ..... on heating.
5. ..... is used to measure temperature.

3. Write differences between heat and temperature?
4. What is heat? Write its effects.
5. Why do we feel cold when we touch ice?
6. Draw the diagram of laboratory thermometer and label its part.
7. Numericals
   a. Convert 37^{0}C in ^{0}F.
   b. Convert 272 K in ^{0}C.
   c. Convert -40^{0}C into K

C. Match the words to their meanings

joule	how hot or cold something is
degrees Celsius (^{0}C)	the units for measuring energy
temperature	another name of heat energy
thermal energy	the units for measuring temperature

D. Give reasons.

i. After receiving heat, the temperature of the object increases, and after losing heat, the temperature decreases.

ii. When you wash your hands and mouth with tap water in the winter, you feel cold.

iii. It feels hot in a sunny place.

iv. Putting water in a pot and lighting a fire under it raises the temperature of the water.

v. The tea in the glass cools down after a while.

vi. It feels cold when you touch the ice.

E. Answer the following questions :

i. What is heat?

ii. What do you mean by temperature?

iii. Which device is used to measure temperature?

iv. What is the unit of temperature as adopted by Nepal?

v. What is the normal temperature of a human being?

vi. How does heat flow from one object to another?

vii. Define Laboratory Thermometer.

viii. What is the range of a laboratory thermometer?

ix. What is the use of the kink in clinical thermometer?

x. Draw diagram of the laboratory thermometer. Mark the lower and upper fixed temperatures on a Celsius scale and indicate the values in Kelvin scale also.

F. Digrammatic Questions

i. Look at the diagrams below and tick the one of each pair that has the most heat energy in it . Explain your answers .

Large bowl of porridge at 30^0C

small bowl of porridge at 30^0C

Small pan of soup at 80^0C

the same size pan of soup at 50^0C

ii. Look at these two bowls of food.

300g ice cream 2^0C

300g soup 80^0C

a. Will heat flow into the soup or out of it?

Explain your answer. _____

b. Will heat flow into the ice cream or out of it?

Explain your answer. _____

iii. The drawing show a kettle and a hot water tank.

Container A

Temperature of water 60^0c

Container B

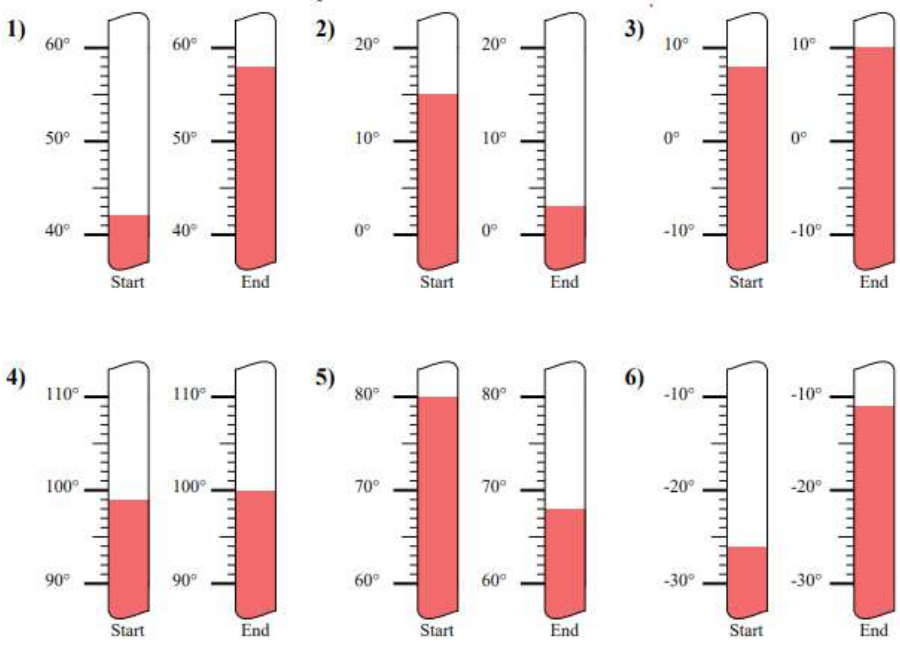
Temperature of water 60^0c

a. Which one contains the greatest mass of water when it is full?

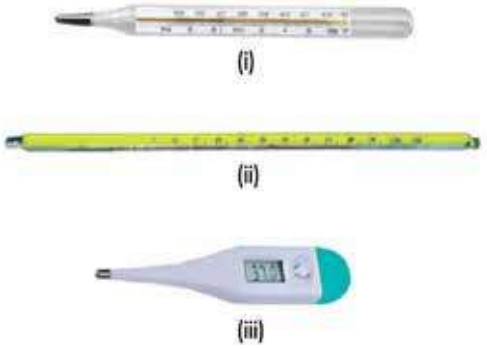
b. Which will heat up the quickest?

c. Which is storing the most energy.

iv. Determine the difference in temperature for following thermometers .

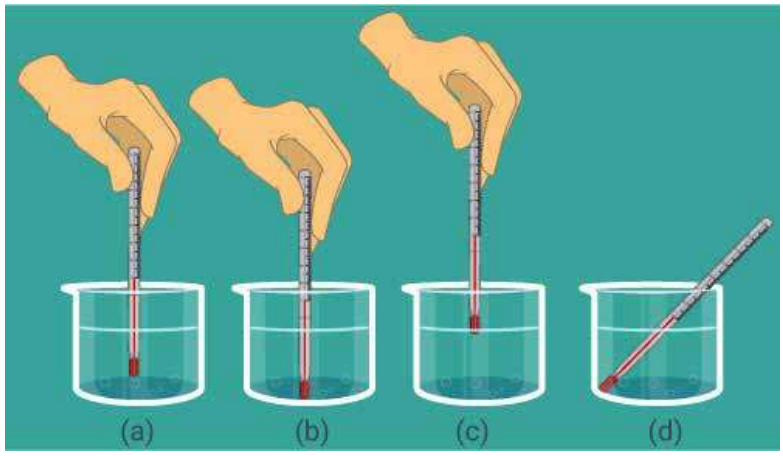


v. **Ram Hari has three thermometers as shown in Figure. He wants to measure the temperature of his body and that of boiling water . Which thermometer(s) should he choose ? Explain your answer .**

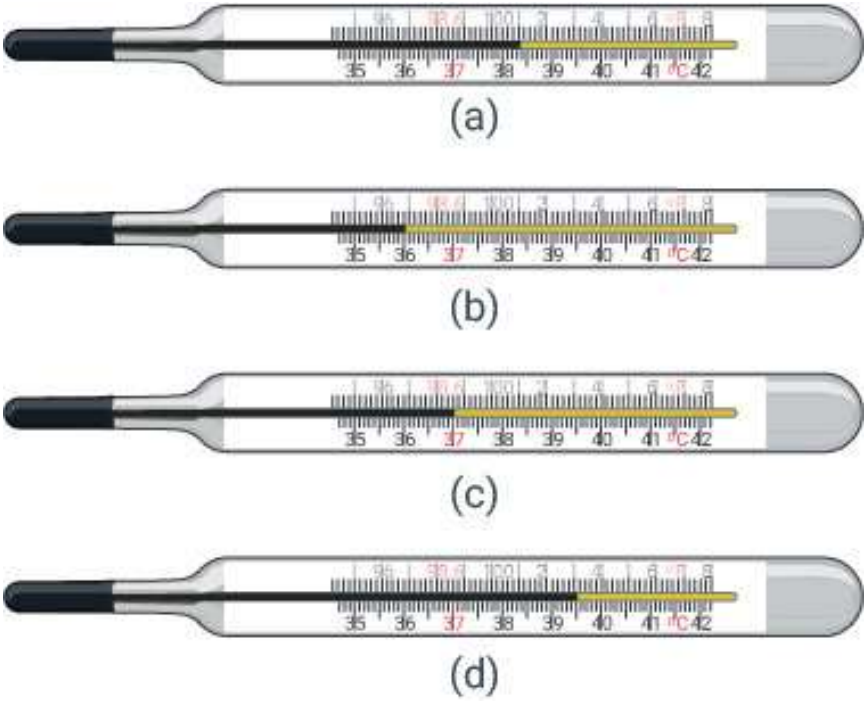


vi. **A marble tile would feel cold as compared to a wooden tile on a winter morning . Why ? Explain your answer .**

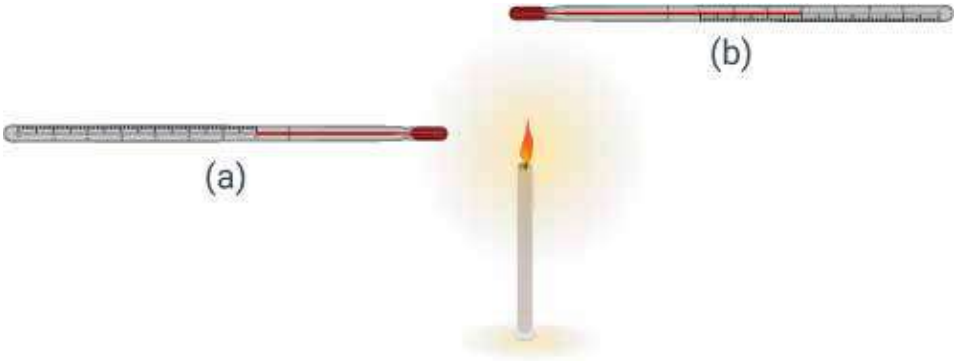
vii. **Four arrangements to measure temperature of ice in beaker with laboratory thermometer are shown in Figure a, b, c and d. Which one of them shows the correct arrangement for accurate measurement of temperature? Explain your answer .**



viii. **Figures a, b, c and d shows the readings on four different thermometers. Indicate which of the reading shows the normal human body temperature? Explain your answer.**



ix. **A laboratory thermometer A is kept 7 cm away on the side of the flame while a similar thermometer B is kept 7cm above the flame of a candle as shown in Figure below .**



7.3 Sound

Fig. 7.3.1

Study and discuss the activity going on in the pictures above.

i. What are these activities related to?
ii. By what energy can we hear the sound from any source?
iii. What are the sources of sound? How is the sound transmitted?
iv. What is the medium of sound transmission?
v. When a teacher teaches a subject in the classroom, how do you know that the period is over?

Everyday we hear different kind of sounds like barking of dogs, chirping of birds, the sound of automobiles running on the road, tinkling of dishes while washing, voice of people, etc. How these sound are produced ? Vibrations that travel through the air or another medium and can be heard when they reach to a person's or animal's ear is called sound.

Sources of Sound

Substances which produce sound are called sources of sound. Generally, all vibrating bodies/substances are the sources of sound. Flowing of stream river, flowing waterfalls, thunderstorms, radio, loudspeaker, television, guitar, harmonium, flute and other musical instruments are some examples of sources of sound. It should be noted that every vibrating body is the source of sound and every source of sound is vibrating body. A rapid back and forth motion of a particle or molecules of a body about their

mean position is called vibration. A body can be vibrated by striking, hitting, ringing, plucking, blowing etc.

Sounds that occur in nature, such as flowing water, thunder storms, chirping of birds, sound produced by people and animals are the natural sources of sound. The sounds produced by artificial things or instruments such as radio, mobile phones, television, musical instruments, automobiles, fire crackers, machine etc. are the artificial sources of sound.

Activity 7.3.1

Take a scale. Place it on the table in such a way that its half part lies outside the table and fix the scale on the table pressing it by hands. Press the free end of scale and leave it suddenly. What happens ? Discuss it.

In this condition, scale produce sound and decreases sound gradually and finally stops. How is this sound produced ?

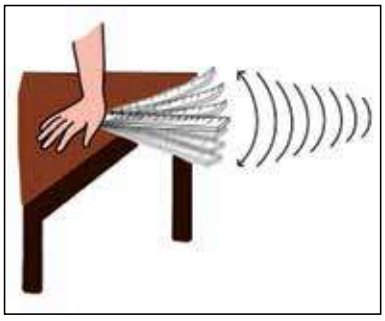


Fig. vibration from ruler

Activity 7.3.2

Take a disc and strike it with spoon. When disc is touched slowly, we feel vibration. When it is touched, it stops vibration and sound produced from it also stops.

Sound is a form of energy. Sound is produced due to vibration of body. When a body is vibrated, it produces wave. The wave transfers sound energy.

Wave

Throw a small stone into a silent pond. What do you observe ? You will see that a disturbance is created and with a result of formation of a number of circular ripples. These ripples move forward like expanding rings. These ripples move continuously towards the edge of the pond with time. The movement of ripples with time is called wave motion.

Thus wave motion is defined as the periodic disturbance which is travelling through a material medium which is produced by a vibration of a body. The disturbance in a medium is called wave. A wave motion travels in all directions through the medium in a constant

Fig.7.3.2 waves produced from pond

speed however, the particles of the medium do not move from one place to another place. Here, only particles vibrate passing on energy that they pass from one particle to another. During a wave motion, the medium actually does not move as a whole however, only the disturbances travel through the medium.

Types of sound wave

There are two types of wave:

i. Transverse wave and ii. Longitudinal wave

i. Transverse wave

The wave in which the particles of medium vibrate about mean position in perpendicular to the direction of propagation of wave are called transverse wave.

In this type of wave, the particles of a medium vibrate up and down to the direction of wave as shown in the figure.

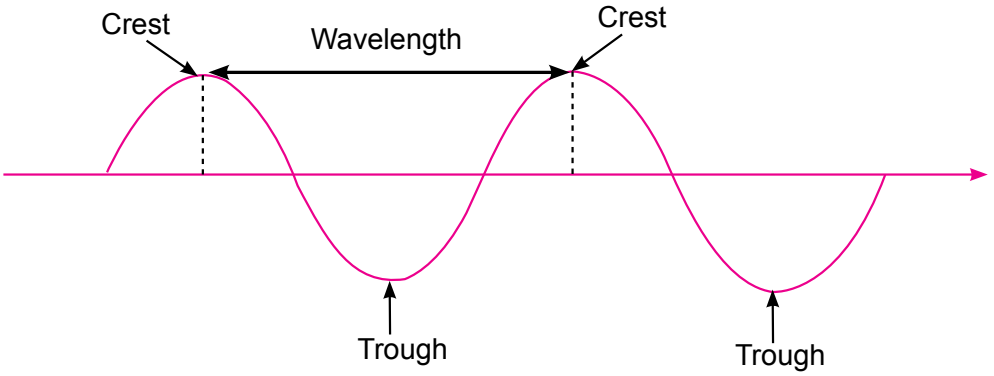


Fig. 7.3.3 direction of particles of medium

The upper most point of the wave is called crest and lowest point of the wave is called a trough. Water wave, vibration of string etc. are the examples of transverse wave.

ii. Longitudinal wave

The wave in which the particles of medium vibrate about their mean position in parallel to direction of propagation of a wave is called a longitudinal wave.

In this type of wave, particles move to and fro the direction of the wave.

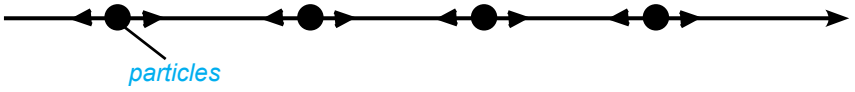


Fig. 7.3.4 direction of particles of medium

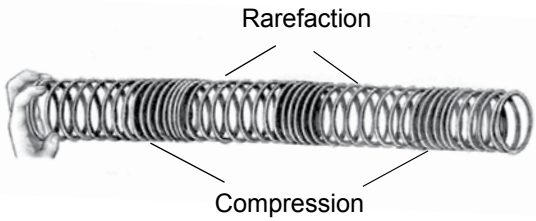
Difference between Transverse Wave and Longitudinal Wave

Transverse Wave	Longitudinal Wave
i. The wave in which the particles of the medium vibrate up and down perpendicularly to the direction of the wave is called a transverse wave.	i. The wave in which the particles of the medium vibrate to and fro in the direction of the wave is called a longitudinal wave.
ii. A complete wave consists of a crest and trough.	ii. A complete wave consists of a compression and rarefactions
iii. A transverse wave can be produced in solid and liquid.	iii. A longitudinal wave can be produced in solid, liquid and gas.
iv. For examples, waves produced in a still pond when a stone is dropped in it.	iv. For example, sound wave.

Activity 7.3.3

Take spring coil of one metre in length and fix its one end in a hook of a table. Now, hold freely in your hand, move it freely to and fro continuously.

What do you observe ? You can see a certain region, the waves of spring come closer which is called compression. Whereas at certain region, the wires of the spring go farther away which is called rarefaction.



Thus, longitudinal waves travel along a medium in the form of compression and rarefaction in figure.

Propagation (Transmission) of Sound Wave

Sound is produced by a vibrating body and it can travel in all directions from the source. Sound wave requires a material medium (solid, liquid or gas) for its transmission. The waves coming from a vibrating body propagates through air and reaches to our ears. As a result, we are able to hear the sound.

The distance travelled by a sound wave in unit time is called its speed. Its SI unit is m/s. The speed of sound is different in different media.

The speed of sound in air is about 332 m/s. Similarly, speed of sound in water is about 1500m/s. Whereas, the speed of sound in glass is about 5500m/s.

Sound waves travel faster in solid than in liquid or gases. It is because of compactness of molecules in solids is more than in liquids and gases.

[Note: Sound wave cannot travel in the absence of material medium (e.g. air). As there is no air on the surface of the moon, therefore, sound cannot transmit (or propagate) on the surface of the moon unlike on the surface of the earth].

We can hear sound with our ears. Have you seen a hanging bell in the temple? When a person rings the bell at the temple, we can hear the sound of the bell even outside the temple. Sound travels in all direction in the form of longitudinal wave.

The process of travelling of sound from the source to reach our ear is called propagation of sound.

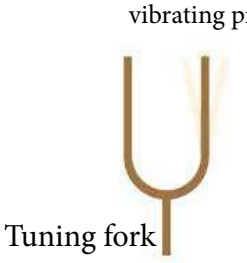
Sound requires material medium to travel. So, sound wave travels through liquid, solid and gas medium. When sound wave travels in a medium, the molecules of the medium execute longitudinal wave motion, It means they move back and forth along the direction in which the wave is travelling. So, sound wave travels in medium in the form of compression and rarefaction. The propagation of sound wave depends upon density, temperature and humidity of the material medium.

Sound is a from of energy. It is carried in the form of waves.

Necessary condition to produce sound = vibration of a particle
Vibration : To and fro motion of a particle about its mean position.

When we hit the drum, membrane of drum vibrates producing sound.

When we play a guitar, the string on it makes to and fro motion and produces sound.



Sound produced by vibrating prong of tuning fork.

Fig. 7.3.5

Activity 7.3.4

Take a large beaker. Fill the beaker with water. Let the water remain still. Now drop a small pebble at the centre of the beaker. What do you see? What water molecules rise up and sink down in the surface. The ring like structure formed moves towards the edge. This type of wave is transverse wave.

In water waves, the water molecules proves up and down from the surface level. But the energy moves along the surface.

The water wave is transverse wave. The wave in which the particles of the medium vibrate perpendicular to the direction of propagation of wave is called transverse wave. A transverse wave is formed by alternatively arranged crest and trough.

Some terms related to waves

Crest

A crest is a point on the wave where the displacement of the medium is maximum above the mean position.

Trough

A trough is a point on the wave where the displacement of the medium is maximum below the mean position.

Amplitude

The maximum displacement of the medium above or below its mean position is called amplitude. It is denoted by A. Its SI unit is m.

Wavelength (λ)

The distance between two consecutive crest or trough is called wavelength. It is denoted by λ. Its SI unit is m.

Frequency (f)

The number of complete wave formed per second is called frequency. The complete wave consists of a consecutive crest and trough. It is denoted by 'f'. The SI unit of frequency is Hertz.

Wave Velocity (V)

The distance travelled by a wave in unit time is called wave velocity. It is denoted by V. Its SI unit is m/s.

Mathematically,

wave velocity (V) = Frequency (f) × wave length (λ)

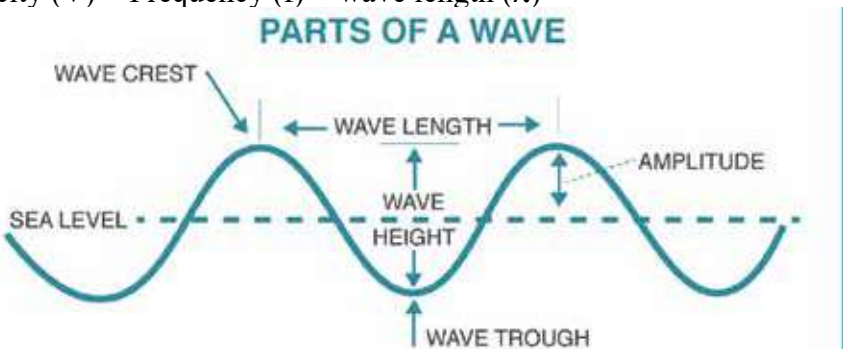


Fig. 7.3.6

Activity 7.3.5

Key terms			
term	**symbol**	**definition**	**unit**
amplitude		The _____ displacement of the medium from is _____ (equilibrium) position	
wavelength		The spatial period of the wave in the direction of motion: the distance between any two successive points with the _____ phase (e.g. _____ to _____)	
crest		the _____ point on a wave	
trough		the _____ point on a wave	
frequency		the _____ of waves passing a point per _____	
period		the _____ taken for _____ complete wave to pass	

Sound as a wave

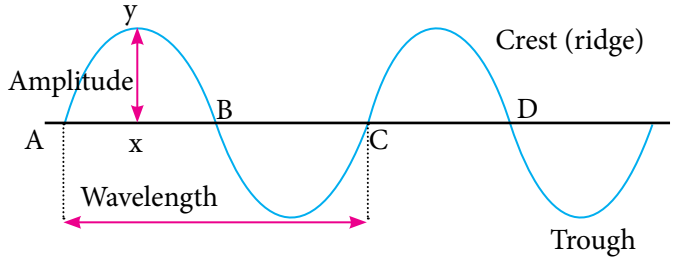


Fig. 7.3.7

Terms related to a wave:

Oscillation	Wavelength	Amplitude	The period	Frequency
One complete to and fro motion, where one full wave is constituted. From fig, if a wave starts from 'A', it completes full wave at 'C' making one oscillation.	Length of wave along x-axis represented by 'λ' (lambda). From fig, AC is the wave length. It is measured in Angstrom unit (A). $1A = 10^{-10}$ m	The maximum displacement of a wave on either side of its mean position. From fig, XY is the amplitude of the wave	The time taken by a wave to complete one oscillation. It is denoted by 'T'.	The number of oscillations made by wave in one second. It is denoted by 'n' or 'f'. Its unit is hertz (Hz)

Relation between Time period and Frequency

Time period = 1/Frequency
Frequency = 1/Time period

Points to Remember

- Substances which produce sound are called sources of sound. Generally, all vibrating bodies/substances are the sources of sound.
- The sounds which produce pleasant effect on our ear while listening are called pleasant sound (or musical sound) and sound which produces unpleasant (or disturbing) effect on our ears while listening are called unpleasant sound (or Noise).
- Sound is produced by a vibrating body and it can travel in all directions from the source.
- The distance travelled by a sound wave in unit time is called its speed. Its SI unit is m/s. The speed of sound is different in different media.
- A crest is a point on the wave where the displacement of the medium is maximum above the mean position.
- The maximum displacement of the medium above or below its mean position is called amplitude.
- The number of complete wave formed per second is called frequency.

Project Work

i. Take a general thermometer and a clinical thermometer. You first observe and discuss their structures with your classmates, then draw a clean picture with a label. Write down some conclusions about the working function.

ii. Prepare a report by observing and researching studies on the sources of noise pollution, its effects, and prevention measures in your home, school, or other area.

iii. Make a model of a periscope from two flat mirrors, a cartoon of noodles or biscuits, or a piece of wood.

Exercise

A. Choose the correct one and put the tick mark (√).

i. What SI unit of amplitude?

a. meter b. m/s^2

c. Hertz d. Joule

ii. Sound wave cannot travel in .....

a. air b. metal

c. water c. vacuum

iii. What is the distance between two consecutive crest called?

a. wave velocity b. frequency

c. wave length d. amplitude

iv. What is the region of longitudinal wave having compressed air molecules called?

a. compression b. rarefaction

c. crest d. trough

v. The longitudinal wave

a. has crest and trough

b. has compression and rarefaction

c. is produced in water surface.

d. can travel through vacuum.

vi. A sound wave is produced when an object

a. accelerates b. decelerates

c. vibrates d. remains stationary

vii. The wavelength of a wave is measured in

a. metre b. second

c. hertz d. decibel

viii. An echo occurs when a sound wave is

a. absorbed b. transmitted

c. refracted d. reflected

ix. Another name for the unit hertz is

a. cycles per second b. seconds per cycle

c. metres per second d. decibels

x. Sound travels fastest in

a. a vacuum b. the sea

c. the atmosphere d. a broom stick

B. Fill in the blanks

i. The number of complete wave produced per second is called.....

ii. Sound is produced by ..... of the body.

iii. The direction of propagation of ..... is perpendicular to the vibration of molecules in transverse wave.

iv. ..... is necessary for propagation of sound.

v. Wave velocity (V) = ... × wave length

C. Write differences between

i. longitudinal wave and transverse wave

ii. compression and rarefaction

iii. wave length and frequency

D. Answer the following questions

i. What is sound? How is it produced?

ii. Why sound cannot travel in vacuum?

iii. What is amplitude?

iv. Define frequency. Write its unit.

v. Calculate the velocity of a wave that have wave length 1m and frequency 1000 Hz.

vi. What is trough and crest on a transverse wave?

vii. What is crest in sound?

viii. Using the equation (Wave speed (v) =frequency (f) x wavelength (λ)) can you fill in the table to calculate the different wave speeds ? Remember to change units of wavelength into meters if they are in cm.

Frequency (Hz)	Wavelength (cm)	Wavelength (m)	wave speed (m/s)
10 Hz	10 cm	0.1	
2.5 Hz	10 cm		
30 Hz	2 cm		
50 Hz	1 cm		

E. Idendify the following statements as being either true (T) or false (F)

i. Sound waves are longitudinal waves.

ii. As the teacher talks, students hear the voice because particles of air move from the mouth of the teacher to the ear of the student.

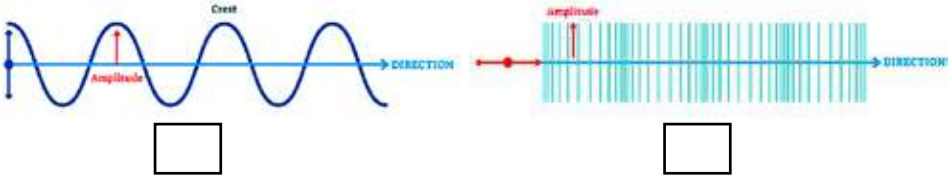
iii. Sound wave are mechanical waves.

iv. All sound waves are produced by a vibrating object.

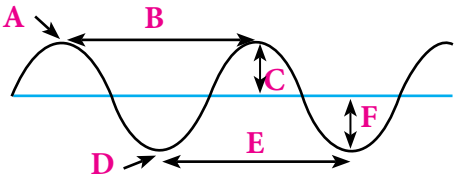
v. A sound wave does not consist of crests and troughs.

F. Diagrammatic questions

i. There are two basic types of wave motion (choose the right option)



ii. Label the wave below:



A: _____

B: _____

C: _____

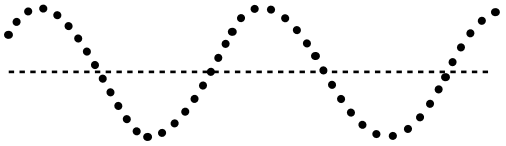
D: _____

E: _____

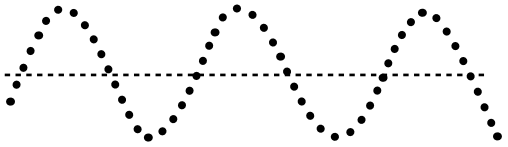
F: _____

iii. Take a rular and determine the wavelengths of following waves :

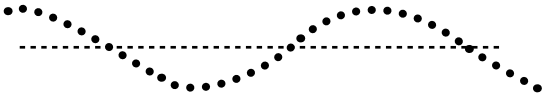
Wave 1



Wave 2



Wave 3



a. How many wavelengths long is Wave 1?

b. How many wavelengths long is Wave 2?

c. How many wavelengths long is Wave 3?

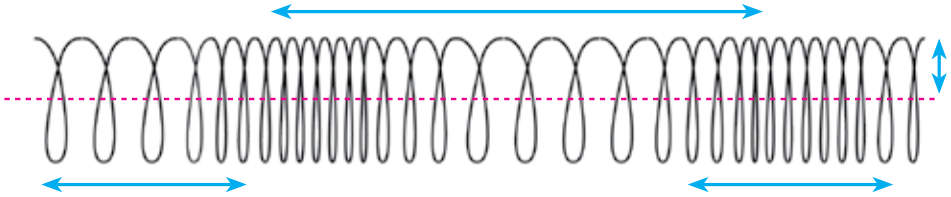
d. Which wave has the highest frequency?

e. Which wave has the lowest frequency?

f. Which is the definition frequency?

h. How can you tell by looking at it if a wave has high or low frequency?

iv. Label the wave below:



Amplitude	Wave length	Rerefaction	compression

v. A kid on a playground swing makes 6 complete to -and-fro swings each 30 seconds

a. The frequency of the swinging is _____.

b. The period of the swinging is _____.

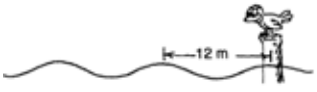
vi. A machine gun fires 10 rounds per second. The speed of the bullets is 300 m/s

a. What is the distance in the air between the flying bullet?

vii. The bird below watches the wave crests.

a. If four crests pass the pole each second

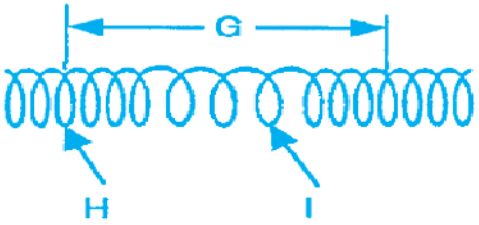
What is the speed of the wave?



viii. Obtain a ruler and determine the wavelength of the wave to the right.

Wavelength = _____

ix. Look at the digagram and answer the following questions:

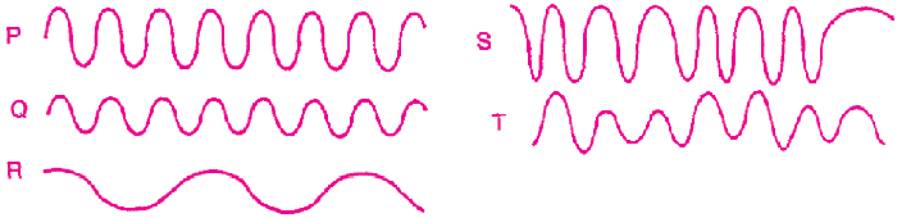


a. Is this wave transverse or longitudinal?

b. Letter H represents a _____ and Letter I represents a _____

c. Letter G represents a _____ .

x. Use the five illustrations of waves drawn below to answer the following questions.



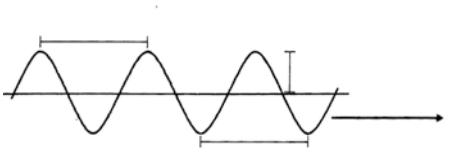
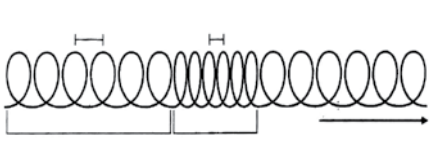
a. Waves P qnd Q have the same _____, but wave P has twice the _____ of wave Q.

b. Waves Q qnd R have the same _____, but wave R has twice the _____ of wave Q.

c. Wave _____ shows a steady frequency but changing amplitude.

d. Wave _____ shows steady amplitude but changing frequency.

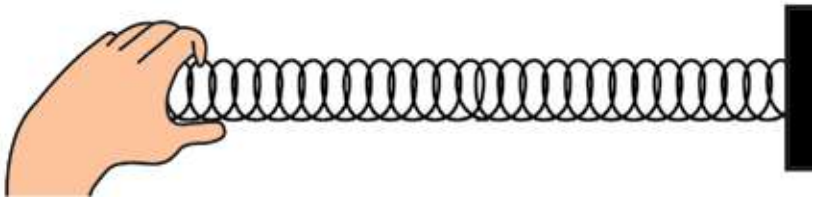
xi. Answer the questions about waves

	
a. What kind of wave is shown in picture above?	d. What kind of wave is shown in picture above?

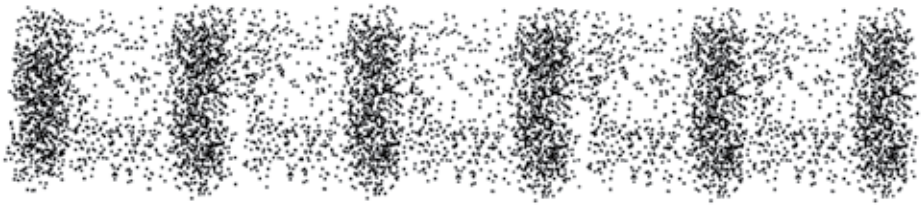
b. Label the following on the wave above: crest, trough, wavelength, amplitude, direction or travel.	e. Label the following on the wave above: compression, rarefaction, wavelength, direction or travel.
c. In what direction would the particles in this wave move, relation to the direction of wave travel?	f. In what direction would the particles in this wave move, with relation to the direction of wave travel?

xii. Abhishek is talking to Subita. The dot at A represents a particle of air. Describe the motion that this particle must undergo in order for Abhishek to hear Subita . Then show the motion by placing arrows on the diagram.

xiii. Umesh is holding one end of a slinky; the opposite end is attached to a wall. Umesh wishes to produce a longitudinal wave in the slinky. Describe how Umesh must move his hand in order to produce a longitudinal wave. Then place arrow on diagram to show the way in which Umesh must move his hand.



xiv. A sound wave is moving through air . The diagram below represents a snapshot of the air particles at a given instant in time . Several regions are labeled with a letter. Use the letters to identify the compressions and rarefactions.



A B C D E F G H I J K

Compression : _____ Rerefaction: _____

7.4 Light

What kind of energy is required to see the various objects around us? What do you see in a room without a light or flashlight on a dark night? Which light sources are shown in the below picture? Which are Natural or Artificial Source of light? What are the sources of light other than those shown in the picture?

Fig. 7.4.1

We cannot see the objects in our surrounding in the absence of light. We cannot see objects in a dark room. We are able to see objects in our surrounding due to presence of sunlight. Any object can be seen only in the presence of light. For example, when we enter in a dark room, we cannot see anything inside the room. But when we switch on a bulb or use a torch light, objects lying in the room can be visible or seen. Therefore, it is obvious that objects can be seen only in the presence of light. Hence, light is a form of energy which provides us a sensation of vision or sight. Light can also be defined as the form of energy which makes objects visible.

The light travels very fast. The speed of light in vacuum (or air) is about 300,000 km/s or 3×10^8m/s. No any object can travel as fast as light. The sun light takes about 8 minutes and 20 sec to come reach on the earth surface. The distance between the earth and

sun is about 15×10^7km. Light travels in a straight line while it propagates in the same medium. This phenomenon of light is called rectilinear propagation of light.

When light falls on an object, it absorbs some part of light. Some parts of it transmits and some parts returns back. The returning of light is called reflection of light.

Sources of Light

The sun is the major source of light energy and heat energy. The sun is also called the ultimate source of energy on the earth. It is because all other sources of light are directly or indirectly obtained from the sun.

Some other sources of light are the moon, glass, fire, torch light, glowing bulb, a burning candle etc.

Some Terms Related to Light

a. Ray of light :

A narrow straight path along which light travels is called a ray of light. A ray of light is represented by a straight line with an arrow head. The arrow head indicates the direction of propagation of light.

Fig. 7.4.2 ray of light

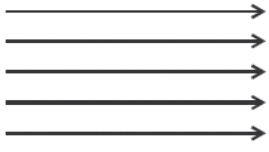
b. Beam of light :

A collection of rays of light is called a beam of light. There are three type of beam of light. They are:

i. Parallel beam ii. Convergent beam, and iii. Divergent beam.

i. Parallel beam :

A beam of light in which the rays are parallel to each other is called parallel beam. For example, beams of light coming from the sun, rays of light from a distant source of light etc. are the examples of parallel beams.

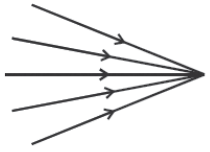


(a) Parallel beam

Fig. 7.4.3

ii. Convergent beam :

A beam of light in which the scattered rays of light come to meet at a point is called convergent beam. For example, rays of light converged by a hand lens on a piece of paper forms a convergent beam.

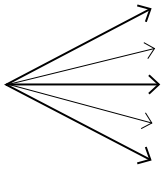


(b) Convergent Beam

Fig. 7.4.4

iii. Divergent beam

A beam of light in which the rays of light get scattered away from a source is called divergent beam. For example, rays of light coming from a burning candle, a glowing bulb, a burning lantern etc.

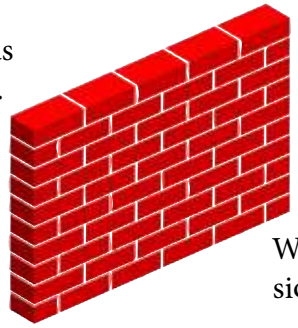


(c) Divergent Beam

Fig. 7.4.5

Activity 7.4.1

A lit candle was placed behid a wall.



Why could it not be seen on this side of the wall?

.....

.....

At the end of a long field, a man was hammering a stake into the ground. From the other side of the field, people could see him hit the stake before they heard the sound of the hammer. Explain why this happened.

.....

.....

Science investigation

Write your name backward and look at its reflection in a mirror. Explain what you see. Draw a simple line maze with right and left turns. Place the maze in front of a mirror and try to do the maze without crossing a line. Is it hard? Explain.

7.4.1 Reflection of light

When light falls on the surface of a body, some of it returns back from it. The returned light when falls on our eye, the object can be seen. The objects from which maximum amount of light returns back shines. The objects from which light spreads out does not shine. Plane and smooth surface shines whereas rough surface does not shine.

The process or phenomenon of returning back of light in the same medium after striking on a certain surface is known as the reflection of light.

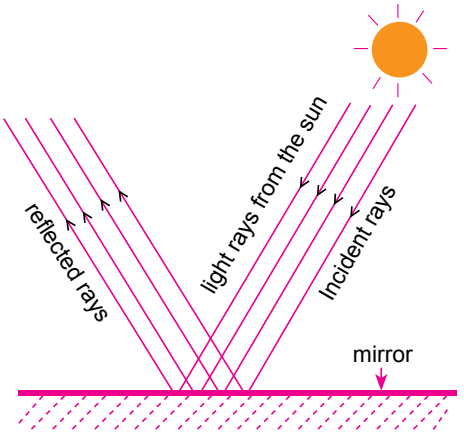


Fig. 7.4.6 reflection of light

In adjoining figure, reflection of sun light from plane mirror is shown. Here,

The ray coming from the source and falls on the surface of body is called incident ray. The returning ray from the surface of body is called reflected ray.

There are two types of reflections which are given below.

1. Regular reflection

Take a plane mirror and go outside the home at a sunny place. Make sun light fall on the plane mirror and make reflected light fall on the wall of the room. We can see only the brightest part of wall in the same shape of the mirror. If we move the mirror, the brighter part is also shifted like mirror.

This shows that the reflected light from the mirror travels in particular direction. This type of reflection is called a regular reflection.

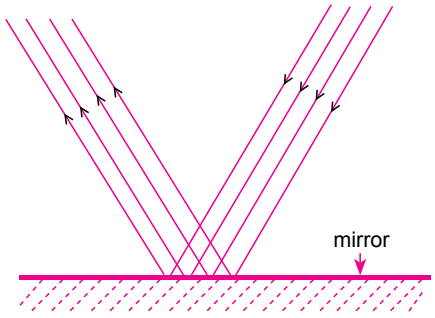


Fig. 7.4.7 regular reflection of light

When a parallel beam of light is incident on smooth surface such as a plane mirror, the reflected rays are parallel to each other.

The reflection of light from smooth surface is called regular reflection.

Plane water surface, glass, polished smooth metal surface, etc. are some of the examples of regular reflection. The surface from which regular reflection occurs, it shines. Due to regular reflection of light, image of object can be seen. We can see our image in to the mirror. Our face inside the mirror is the image. Similarly, smooth water surface, glass surface, smooth plane surface can make image.

2. Irregular reflection

Take a rough colourful glass piece and repeat the activity as in regular reflection. Are all reflected rays gone to particular direction ? Do repeat this activity for large wooden piece of paper. Is there bright spot seen ? Why reflected lights are spread out ? This type of reflected lights are not travelling in a particular direction. Due to which bright spot can not be seen. The reflected rays are scattered in various direction when light falls on rough surface.

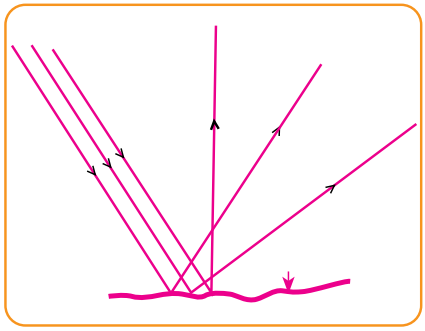


Fig. 7.4.8 irregular reflection

This type of reflection is called irregular reflection.

When a parallel beam of light fall on rough surface the rays are reflected in different directions from the surface is called irregular reflection.

On a rough surface is light undergoes irregular reflection and these object do not shine. Image can't be seen in rough surface body.

Think about

Steel utensils shines but wooden does not shine. Why ?

Some Terms Related to the Reflection of Light

Suppose a ray of light AO falls on a plane mirror PQ as shown in the figure. The incident ray is reflected along the same medium along OB. The perpendicular drawn at O on PQ is ON i.e. called normal.

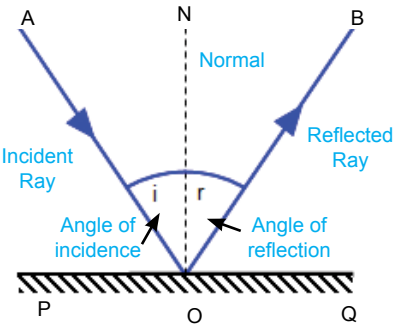


Fig. 7.4.9 reflection of light

i. Incident ray

The ray falling on the surface of an object from the source of light is called an incident ray. In the above figure, the ray AO falls on the surface of plane mirror PO. Therefore, here, AO is an incident ray.

ii. Point of incidence

The point on the surface at which an incident ray falls is known as the point of incidence. In the given figure, O, is the point of incidence.

iii. Normal

The perpendicular drawn at the point of incidence is known as normal. In the given figure, ON is a normal.

iv. Reflected ray

The incident ray which returns in the same medium after striking a certain surface is called a reflected ray. In the given figure, OB is a reflected ray.

v. Angle of incidence

The angle which is formed between the incident ray and the normal is called the angle of incidence. In the figure above ∠AON is the angle of incidence. It is usually represented by ∠i.

vi. Angle of reflection

The angle which is formed between the reflected ray and the normal is called the angle of reflection. In the given figure, ∠BON is the angle of reflection. It is represented by ∠r.

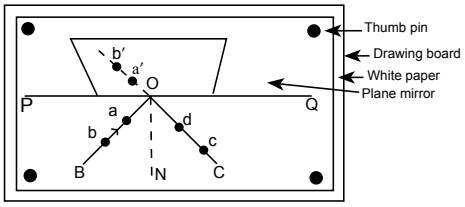
Laws of Reflection of Light

When rays of light reflects it obeys some rules. These laws are called laws of reflection of light.

Activity 7.4.2

Material Required

A drawing board, a plane mirror, a sheet of white paper, mirror holders, thumb pins, a geometrical box, pencil etc.



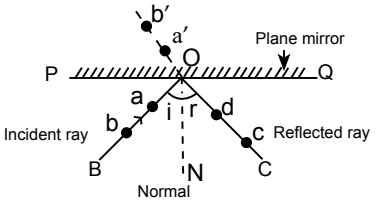
Procedures

i. Spread a sheet of white paper uniformly over a drawing board and fix it with thumb pins.

ii. Draw a straight line PQ in the middle of paper and draw a normal ON at the middle of the line. (Here, the normal is drawn by making an angle of 90° on one side of line). Draw slanted line OB as incident ray.

iii. Place a plane mirror in the upright position along the straight line PQ.

iv. Fix two pins 'a' and 'b' vertically in front of the mirror at a certain distance. The images a' b' of the pins are observed in the plane mirror.



Demonstration of reflection of light

v. Observe the image of the pins from other side and two pins 'c' and 'd' in such a way that it should overlap the image of the pins 'a' and 'b'.

vi. Mark the position of the pins, 'a' 'b' 'c' and 'd' with a pencil. Remove these pins and the plane mirror from a drawing board.

vii. Draw a line CO joining the points 'c' and 'd'

viii. Draw a normal ON at O.

ix. Now, measure ∠BON and ∠ CON.

Observation

You will find that ∠BON = ∠CON. Also, the incident ray (BO), the reflected ray (OC) and the normal (ON) at the point of incidence (O). All lie in the same plane.

Conclusion

From this activity, it can be concluded that

a. The angle of incidence (∠i) is equal to the angle of reflection (∠r).

b. The incident ray (BO), the reflected ray (OC) and normal (ON) at the point of incidence all lie in the same plane.

Therefore, the laws of reflection are verified.

Laws of reflection

i. The incident ray, reflected ray and normal all lie at point of incidence in the same plane.
ii. The angle of incidence is equal to angle of reflection.

Image

When we place a glass on the table in front of a plane mirror, we will see another glass inside the mirror. When we remove the glass from the table, no glass will be seen in the mirror. In this activity, the glass that appears in the mirror is the image of the glass on the table. Here, a plane mirror forms an image of the object which is similar to that of the ball.

Fig. 7.4.10

The counter part of an object which is formed by the reflection of light is called the image of an object. When the reflected rays from the object intersect or appear to intersect, then an image of an object is formed.

A real image is formed by the actual intersection of the reflected rays. Whereas a virtual image is formed when the reflected rays appear to meet or intersect at a certain point. A real image can be obtained on a screen whereas a virtual image cannot be obtained on a screen.

Plane Mirror

A plane mirror is generally a flat sheet of glass with a thin layer of shiny coal of metallic salt behind the glass.

Or, A plane mirror is a flat mirror which reflects light and forms a virtual image of an object .

The surface of the mirror is very smooth. It should be noted that the quality of the image formed by a plane mirror depends on the smoothness of its reflecting surface. We use a plane mirror or looking glass to see our face. The looking glass is smooth and flat is glass plate. One side of this glass is coated with silver due to which another side of the glass acts as a reflecting surface. While drawing, we generally represent the reflecting surface of the mirror by a straight line and the silver coated side of the mirror by shaded lines.

Fig. 7.4.11

Motionless water surfaces, polished surface of metals, glass, nickel etc. act as a plane mirror. Therefore, we can see our image on the surface of these substances. Usually, we fix a plane mirror on the frame of wooden board or hard paper board.

Image Formed by a Plane Mirror

A plane mirror forms a virtual image of an object. It is so because the image formed by a plane mirror cannot be obtained on a screen. The plane mirror forms an image of same size as that of object. Moreover, the distance between the object and mirror is equal to the distance between the mirror and image. Here, object distance is equal to the image distance.

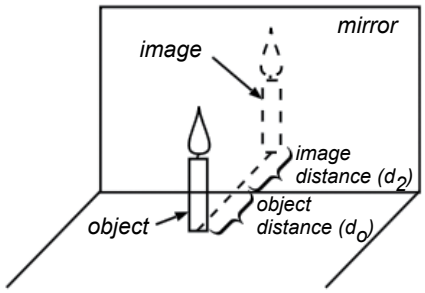


Fig. 7.4.12 image in plane mirror

Characteristics of the image formed by a plane mirror

The characteristics of an image formed by a plane mirror are as follows.

i. Image formed by plane mirror is virtual i.e. image cannot be obtained or focused on a screen.

ii. The distance of the image behind the mirror is as same as the distance of the object in front of the mirror.

iii. The size of the image formed is same as the size of the object i.e. the size of an image is equal to the size of an object.

iv. The image is laterally inverted i.e. left right reversal of the orientation of the image, not top down vertical reversal e.g. "PHYSICS' becomes 'SCISYHP' and 'E' become 'Ǝ'.

Application of a plane mirror

Some of the most important uses of plane mirror are given below.

i. Plane mirrors are used as looking mirror.

ii. Plane mirrors are used in optical instruments such as periscope (which is used in submarine), Kaleidoscope (used as toy) etc.

iii. Plane mirror is used in physics laboratory to prove a certain rules which are related to light.

iv. Plane mirrors are used in solar cookers.

Reflection from plane mirror

A plane mirror is a regular piece of glass which is polished or silvered on one side and it causes a regular reflection and forms a virtual image of an object. Let a ray of light AO fall on a plane mirror PQ as shown in the figure. Suppose a ray of light AO is returned into the same medium along OB after striking the plane mirror. Here, ON is perpendicular to the plane mirror PQ which is called normal.

Optical Instruments

Those instruments which are made by the use of mirrors, lens and prisms are called optical instruments. Microscope, telescope, camera, periscope, Kaleidoscope, overhead projector etc. are some of the optical instruments. In this lesson, we will study about periscope and kaleidoscope.

Lateral Inversion

Lateral inversion in a plane mirror means the apparent reversal of left and right in the mirror image compared with the object i.e. The side way reflecting of the image of an object is called lateral inversion. The object on right hand side of the person appears at the left side and object on left side appears on the right side. It is because of the lateral inversion. We do not feel it on our face because it has a symmetrical shape. Letters A, H, O, I, X, Y are symmetrical letters, so in a mirror they are not seen inverted. But letter F appears ꟻ due to lateral inversion.

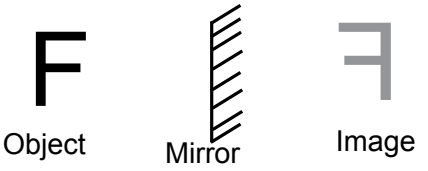
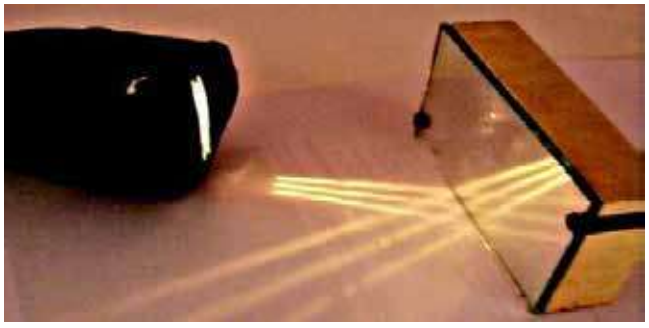


Fig. 7.4.13 lateral inversion in mirror

7.4.2 Reflection and Image on Plane mirror

Activity 7.4.3

1. Take a torch. Cover its glass with a chart paper which has three slits. Spread a sheet of chart paper on a smooth wooden board. Fix a plane mirror strip vertically on the chart paper. Now direct the beam of light on the mirror from the torch with slits. Place the torch in such a way that its light is seen along the chart paper on the board. Now adjust its position so that the light from the torch strikes the plane mirror at an angle. We will see that the mirror change the direction of light that falls on it. Now move the torch slightly to either side. We will see change in the direction of reflected light too. Look into the mirror along the direction of the reflected light. We see the slits in the mirror. This is the image of the slits. This activity shows how light gets reflected from a plane mirror.



2. Take a chess board. Draw a thick line in the middle of it. Fix a plane mirror vertically on this line. Place a pencil sharpner, at the boundary of the third square counting from the mirror. Note the position of the image. Now shift the object to the boundary of the fourth square. Again note the position of the image. We will find that the image is at the same distance behind the mirror as the object is in front of it.

7.4.3 Periscope

Periscope

Periscope is a simple device. It is constructed on the principle of reflection of light. It is used to see objects which are kept at high up distance. This is also used in sub-marine. This helps to see objects which are on the water surface by sitting under water from sub-marine.

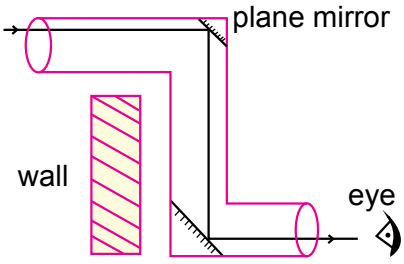


Fig. 7.4.14 periscope

Required materials

- Spherical or rectangular pipe or tube which is made up paper
- Two pieces of plane mirrors
- Glue
- Scissors
- Colours

Procedure

- Take a round rectangular shaped cardboard tube.
- Near the bottle of two opposite end of the tube, cut out circular hole of 5 centimeter diameter using a scissor.
- Fix the mirrors at an angle of 45^0 (parallel to each other) in each circular hole made opposite side of the cardboard tube using sticky tapes.
- Now colour the outside position of the cardboard tube to make your periscope more attractive.
- Now your periscope is ready.

  When an object is kept in front of the upper mirror, its image after reflection from the two mirrors is seen by the eye kept close to the lower mirror.

  Use your periscope to see the image of objects above you or around corners which you can not see directly.

Points to Remember

- Light can travel even through a vacuum i.e. light do not require any material medium for its propagation. Therefore, it is also called electromagnetic wave.
- When light falls on the surface of a body. Some of it returns back from it. The returned light when falls on our eye, the object can be seen.
- The reflection of light from smooth surface is called regular reflection.
- The counter part of an object which is formed by the reflection of light is called the image of an object.
- A plane mirror is a regular piece of glass which is polished or silvered on one side and it causes a regular reflection and forms a virtual image of an object.

Exercise

A. Choose the correct one and put the tick mark (√).

i. Light is a form of

a. Energy b. Power
c. Heat d. Temperature

ii. Normally a plane mirror forms

a. a real image only b. a virtual image only
c. Both real as well as virtual image d. Neither real nor virtual image

iii. We can see the objects only when

a. reflected light reaches our eyes
b. the objects absorb all the light
c. the objects allow all the light to pass through them
d. None of the above

iv. Light is

a. an electromagnetic radiation b. a transverse wave
c. mass less d. All of the above

v. A smooth shining surface, which rebounds the light back in same or in different direction, is called

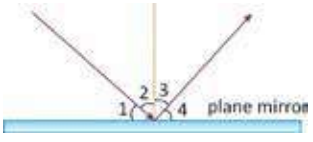
a. a mirror b. a lens
c. reflection of light d. point of incidence

vi. Beam of light striking the reflecting surface is called

a. reflecting ray b. incident ray
c. refracted ray d. normal ray

vii. If the angle of incidence of light falling on a plane mirror is 30^0, what will be the angle of reflection ?

a. 90^0 b. 60^0
c. 30^0 d. 0^0

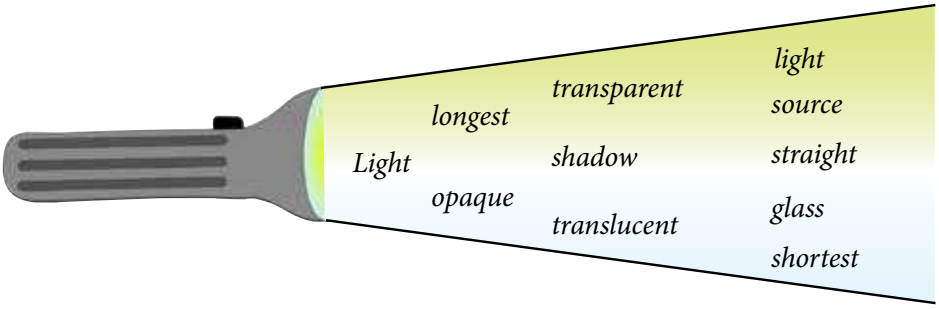


viii. **The diagram below shows a ray of light being reflected from a plane mirror. Which of the labelled angles are the angle of incidence and the angle of reflection ?**

a. Angle of incidence-1, Angle of reflection-2
b. Angle of incidence-2, Angle of reflection-3
c. Angle of incidence-1, Angle of reflection-4
d. Angle of incidence-3, Angle of reflection-1

B. Select the missing words from the torch below and fill in the gap.

Light travels in _____ lines from a _____ of light, wchich bounces off an object. We can see the object because the _____ enters our eyes. Wood and cardborad are _____ objects which light cannot travel through. _____ is a _____ material which allows light to pass through. Tissue paper is _____ which lets some light travel through. When an object blocks out the _____ a _____ is formed. Shadows are _____ at midday and _____ at the end of the day.



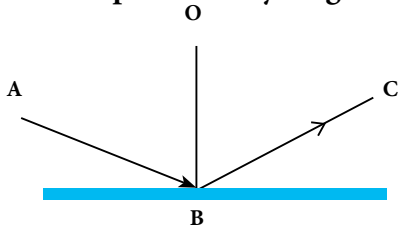
C. Answer the following questions :

i. What is light ?
ii. Define the reflection of light. Write down the laws of reflection of light.
iii. What is a plane mirror? Make a list of its applications.
iv. What is a periscope? Write about its use.

D. Diagrammatic questions

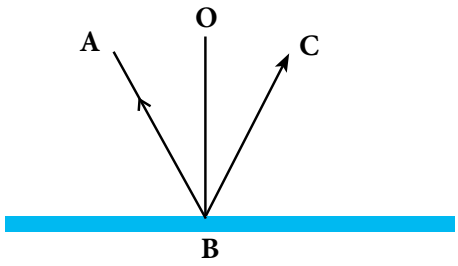
i. **Use what you know about the Law of Reflection, your protractor and ruler to complete the ray diagrams.**

a.



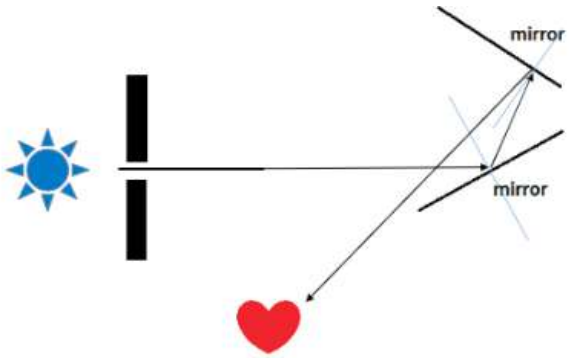
Angle of Incidence: _____ Angle of Reflection: _____
Angle of Incidence: _____ Angle of Reflection: _____

b.

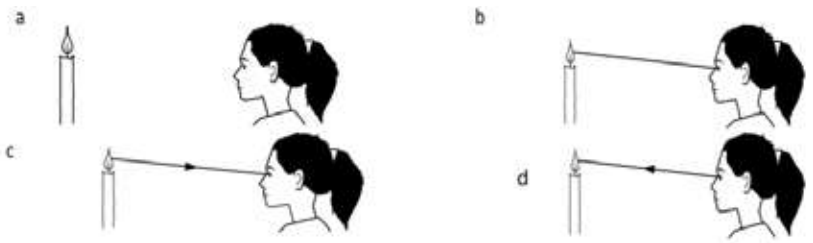


Angle of Incidence: _____ Angle of Reflection: _____

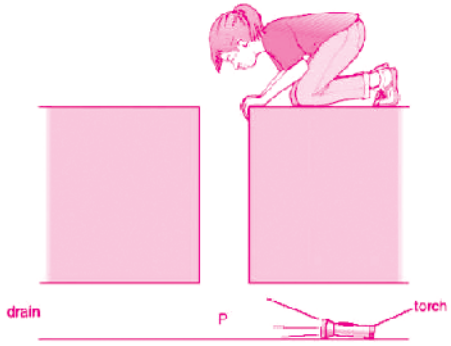
ii. The following diagram shows a light ray coming through an opening and being directed towards 2 mirrors and a heart. Use what you know about the Law of Reflection, your ruler and your protractor to draw the light ray as it bounces from mirror to mirror.



iii. Which diagram shows how Ramila can see a candle flame? Explain your answer



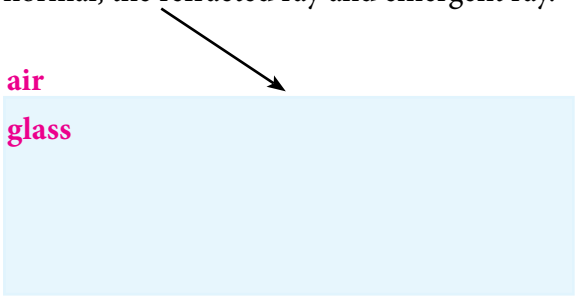
iii. Jenny dropped her torch down a drain. The torch was still switched on but Jenny could not see it. Explain your answer.



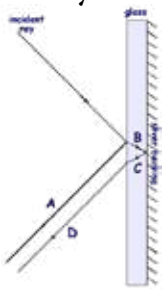
a. Jenny lowered a mirror into the drain placed it at position P. At which angle sould jenny put the mirror to see the torch?

b. What happens to the light from the torch when it hits the mirror?

c. Complete, by sketching, the ray diagram below, indicating the normal, the refracted ray and emergent ray.

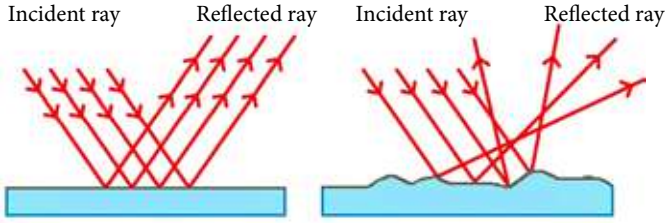


iv. The diagram shows a ray of light hitting the surface of a mirror made from thick glass. The incident ray is both reflected and refracted.



a. Give the letters of the two reflected rays.
b. give the letter of one refracted ray.

v. Identify the following types of reflection. Explain your answer.



vi. The diagram below shows Navin using his laptop. Light from the lamp is reflected by the laptop screen.

a. On the diagram above draw a ray of light to show how Navin sees the light from the lamp reflected by the laptop screen. Use a ruler. Draw arrows to show the direction of light.

b. With the laptop screen in the position shown in part 'a', Navin sees an image of the lamp on the screen. Navin tilts the screen forwards as shown below. When the screen is tilted forwards it is easier for Navin to see the words on the screen. What happens to the reflected ray of light when the screen is tilted? _____
_____ _____
_____
_____

Unit 8 Electricity and Magnetism

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- demonstrate the fact that rubbing two objects generates static electric force
- introduce static electricity and to explain the general effects
- explain the cause of lightning and the function of the lighting rod
- introduce current electricity
- introduce the combination of cells and to explain the usefulness of series and parallel combinations of cells

Fig. 8.1

The picture shows how electricity is generated. What are the other methods of generating electricity? What are the electrical appliances in your home? How do you feel about load shedding? What are the uses of electricity?

8.1 Introduction to Electricity

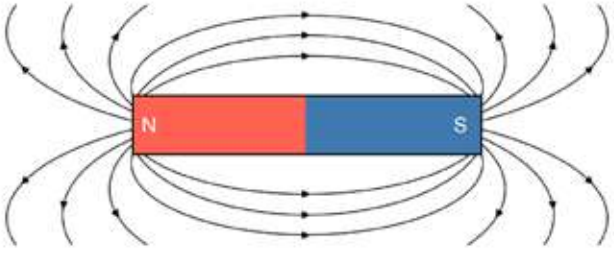
We use electricity in our daily life. We use electricity for different purpose. We use electricity to glow light, operate machines, cook food, watch television, charge our mobile phone, run electric vehicles etc. Electricity provides energy necessary to operate these devices. Electricity has made our life easier and comfortable.

Have you noticed the plastic chair attracting your hair? Sometime, we see electric spark when we put off nylon clothes. They also produce some cracking sound. Why does it is happen? They contain charge. This charge produced in cannot be transmitted through wires. So, it is called static electricity.

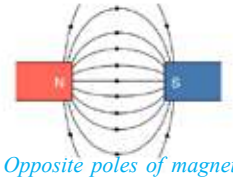
Where does electricity come from in your home? How does it reach up to your home? Where is it produced? How is it produced? You might have seen a wire connected to electric pole from your home. This electric wire helps in transmission of electricity. The electricity is produced in many ways. Magnets play very important role in production of electricity. The electricity used in our home is current electricity. It can be carried from one place to another with the help of wire.

The spinning of the electrons around the nucleus of an atom creates a tiny magnetic field. The electrons in most objects spin in random directions, and their magnetic forces cancel each other out. Magnets are different because the molecules in magnets are arranged so that their electrons spin in the same direction. This arrangement and movement creates a magnetic force that flows out from a north-seeking pole and from a south-seeking pole. This magnetic force creates a magnetic field around a magnet.

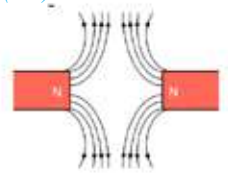
Have you ever held two magnets close to each other? They don't act like most objects. If you try to push the two north poles or two south poles together, they repel each other. But if you put a north pole and a south pole together, the magnets will stick together because the north and south poles attract each other. Just like protons and electrons—opposites attract in magnets.



Magnetic field around a bar magnet



Opposite poles of magnets (N-S) Attract each other.



Link poles of magnets (N-N or S-S) repel each other.

Fig. 8.2

The properties of magnets are used to make electricity. Moving magnetic fields pull and push electrons. Metals such as copper and aluminum have electrons that are loosely held. Moving a magnet around a coil of wire, or moving a coil of wire around a magnet, pushes the electrons in the wire and creates an electrical current. Electricity generators essentially convert kinetic energy (the energy of motion) into electrical energy.

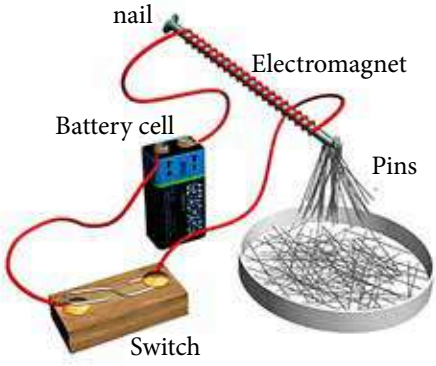


Fig. 8.3

Generators are based on the connection between magnetism, motion and electricity. Generators typically use an electromagnet, which is created by electricity and a rapidly spinning turbine to produce massive amounts of current.

Electricity generation from an electric turbine

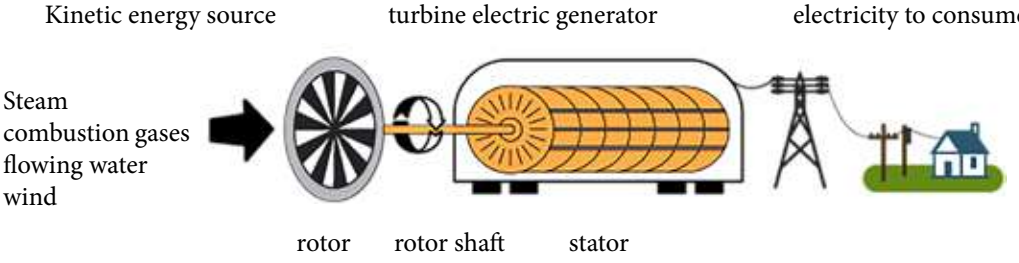


Fig. 8.4

The standard generator contains a group of insulated wire coils in the shape of a cylinder. Within the cylinder is a rotary electromagnet. When the magnet spins, it induces a tiny current in each part of the wire coil. Each part of the wire coil then turns into a small, individual electric conductor and the tiny currents of individual sections merge to create a single large current. Resulting electricity is then sent through power lines to consumers.

Electricity (or electric energy) is a form of energy which is associated with electric charge and sub atomic particles such as electrons and protons. The sub atomic particles electrons and protons carry negative and positive charge respectively. The flow of electrons is the cause of current electricity and change in number of electrons is responsible for the generation of static electricity.

Electricity is very important in our daily life. Electricity has made our life easier and more comfortable. Electricity has multi-purposes. We require electricity to run computer, television, heater, radio, fan, iron etc. Electric bulb is used as common source of light nowadays.

We may often hear a crackling sound, when we remove our nylon vest. The crackling sound is followed by sparks of light which may be seen in the dark room. Why does this happen ?

Types of Electricity

The following types of electricity are the major ones which we describe in the sub-sections below.

Static Electricity : Electricity produced due to change in number of electrons as in lightning, rubbing of comb on hair, etc.

Current Electricity : Electricity produced due to flow (or movement) of electrons through a conductor as in turning on a light, cooking on an electric stove, etc.

Activity 8.1

Make an electromagnet.

Materials Required: An iron nail, a battery, a switch, some insulated copper wire, and some iron paper pins or all pins.

Iron nail behaves like a magnet

Iron nail no longer behaves like a magnet

Procedure: Coil the insulated copper wire around the iron nail. Connect the ends of the cable to the battery through the switch. Close the switch so that electric current flows through the copper wire. Now bring the iron paper pins close to the iron nail.

Observation And Conclusion: The paper pins get attracted to the nail, showing that the nail has turned into an electromagnet. Now, if you switch off the current, the iron paper pins will drop off the iron nail.

8.1.1 Introductions to Static Electricity

As we know every substance is made up of atoms. An atom consists of three sub atomic particles namely electrons, protons and neutrons. Electrons are revolving around the nucleus. Nucleus consists of protons (p^+) and neutrons (n°). Electrons are negatively changed (e^-) chemical species and protons (p^+) are positively charged whereas neutrons are chargeless (n°) chemical species. Electrons can move from one atom to another. When electrons move from one atom to another atom, a charge gets developed in the substance. The charge is developed due to static electricity.

The electricity that is developed due to change in the number of electrons in a substance is known as static electricity. It cannot be transported from one place to another through a conducting wire . The lightning which generally occurred in rainy season, the electricity developed in a ruler when it is rubbed against hair are some of the examples of static electricity.

[Note: the substance which gains electron will be negatively charged as it has more number of electrons (e–) than that of the protons (p+) When a substance loses electrons (e–), it will be positively charged as it contains more number of protons (p+) than electrons.]

The electricity which is produced in an insulators by the transfer of electrons through frictions or rubbing is called static electricity.

Activity 8.2

To produce static electricity, we carry out these activities.

Materials required

A plastic ruler (or you may use comb), small pieces of paper.

Procedure

1. Take a plastic ruler. Rub it on your dry hair for a number of times.
2. Bring the ruler near the small pieces of paper.
3. Observe What happens ?

Observation

You will find that a small pieces of paper get attracted towards the plastic ruler.

Explanation

When the plastic ruler is rubbed on dry hair, electrons move from hair to the ruler. Therefore, there will be more number of electrons than the number of protons in the plastic ruler. Hence, the ruler is negatively charged.

If the negatively charged plastic ruler is brought near the small pieces of paper, the positively charged particles of the paper will be attracted towards the ruler. Thereafter, the small paper pieces will be attracted.

Conclusion

Here, the plastic ruler gets negatively charged due to the movement of electrons (e^-) from hair to ruler i.e. static electricity is produced in the plastic ruler. This can be concluded by the fact that small pieces of paper are attracted towards the ruler.

[Note1 : Usually static electricity is produced in insulators (e.g. glass, plastics, stones, wood, paper, etc.]

[Note 2 : Charges develop in different insulators or non-metals such as nylon, polyester, wool, plastic etc. due to friction. When we wear clothes made up of wool, nylon, polyester, etc. charges produced on those clothes due to friction with our body. When these clothes are put off, charges move and sound like tik tik can be heard.]

How is charge produced ?

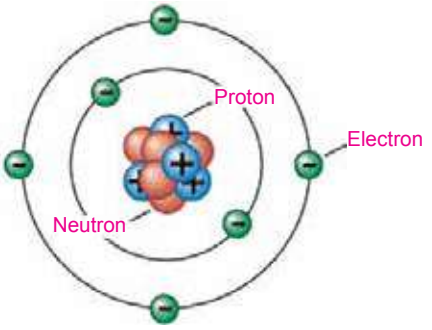


Fig. 8.5 sub particles of

All substances are made up of molecules and all molecules are made up of atoms. In atoms, it consists of two parts, central part, nucleus and outer part, electrons. Nucleus has protons and neutrons. Proton has positive charge and electron has negative charge and neutron is chargeless. In normal state, number of proton is equal to number of electron in an atom. So, atom is chargeless. If atom has more electrons than protons, it acquires negative charge and if it has less electrons than protons, it acquires positive charge. When one substance rubs to another, then electrons transfers from one substance to another. The substance which gain electrons acquires negative charge and which looses electrons acquires positive charge.

When a comb is rubbed with hair, electron transfer from hair atoms to comb atoms. In this way, comb acquires negative charge and hair becomes positive charge.

How negatively charged comb attracts pieces of paper ?

At first, piece of paper has no charge. When negatively charged comb is brought near to it, it acquires new charges. Due to effect of negative charge of combs, a part of paper near to comb acquires positive charge and other end of it acquires negative charge.

Same charges repel and opposite charges attract. So, piece of paper is attracted.

Plastic, wool, nylon, polyster, etc. are insulators. When they are rubbed with metals or non-metals they acquire charge. So, while wearing the cloths of nylon, polyster, wool, etc. charges are developed due to friction between our body. While removing these clothes from body, charges are transferred and a cracking sound is heard. Along with this we can see sparks of light in the dark room.

Effects of Static Electricity

There are many effects of static electricity. Some common effects are lightning and thunderstorm. Lightning is a large spark of electricity in the atmosphere between the clouds, the air or the ground. It is known that lightning occurs in thunderstorms when there is a separation of electrical charge within the storm clouds which can lead cloud to lightning. The majority of lightning which occurs in a storm. A charge separation can also form between thunderstorm clouds and the ground by leading to classic cloud to ground lightning. Thunder is acoustic shock wave that results from the heat which a lightning strike produces. NASA (National Aeronautics and Space Administration) research suggests that lightning flashes 40 times per second around the globe.

Thunderstorm (or lightning storm) is a storm with lightning and thunder (a sound produced by lightning). It is produced by a cumulonimbus cloud, generally producing winds, heavy rain and sometimes hail.

Thunderstorms can occur throughout the year. However, they are most likely to occur in spring and summer months and during afternoon and evening hours.

It is estimated that there are around 1800 thunderstorms that occur our planet every year. Despite their small size, all thunderstorms are very dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes.

There are many effects of static electricity. Lightning is one example of the effect of static electricity. Have you ever heard sound of thunder with lightning? How does it happen ?

Lightning is an example of electricity. Benjamin Franklin in 1752, A.D. discovered that lightning is due to the effect of static charge. He flew kite in a thunder storm and showed clouds have static charge.

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i. Fold over about 1 cm on the end of a roll of transparent tape to make a handle. Tear off a strip of tape about 10 cm long.

ii. Stick the strip to a clean, dry, smooth surface, such as a countertop. Make another identical strip and stick it directly on top of the first.

iii. Pull both pieces off the counter together and pull them apart. Then bring the nonsticky sides of both tapes together. What happens?

iv. Now stick the two strips of tape side by side on the smooth surface. Pull them off and bring the nonsticky sides near each other again.

Analysis

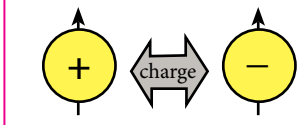
i. What happened when you first brought the pieces close together?

Were they charged alike or opposite? What might have caused this?

ii. What did you observe when you brought the pieces together the second time? How were they charged? What did you do differently that might have changed the behavior?

What is static electricity?

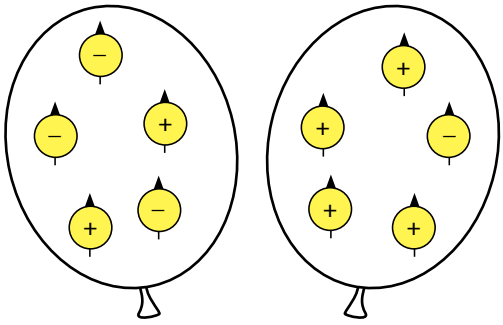
_____ are tiny building blocks that make up matter.



positive charge negative charge

Atoms are made up of even smaller particles. Some of these particles have a _____ charge (+), same of these particles have a _____ charge (-), and some of theser particles have _____.

Most matter has the same number of positive and negative particles. When charges are the same, _____ _____ . This is called being neutral.



Charged particles can _____ when this happens, the charges are not he same and the object becomes charged.

When an object that has more of a positive or negative charge, it is called _____

Static Charge

Electric charge can either flow or be gathered in one place.

Charge that is flowing is called current and when it does not flow, is called static electricity,

What type of materials can charge flow through?

Conductors, such as copper wire.

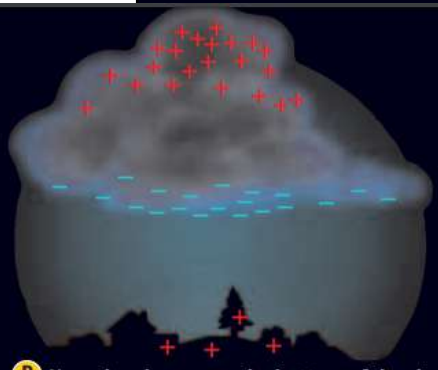
However, when a charged material is not connected to conductor the electricity cannot flow away and so the charge stays in place when a charged object comes close to a conductor the electricity jumps across as a spark.

8.2 Introduction to lightning

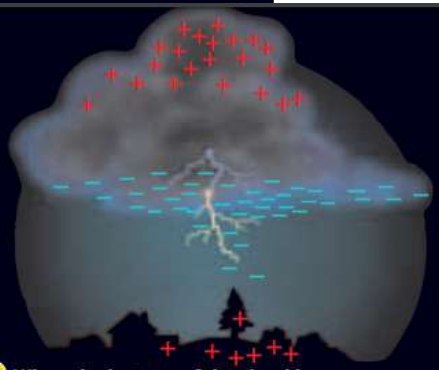
VISUALIZING LIGHTNING

Storm clouds can form when humid, sun-warmed air rises to meet a colder air layer. As these air masses churn together, the stage is set for the explosive electrical display we call lightning. Lightning strikes when negative charges at the bottom of a storm cloud are attracted to positive charges on the ground.

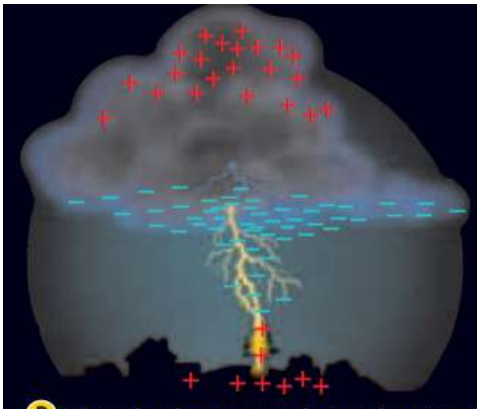
A Convection currents in the storm cloud cause charge separation. The top of the cloud becomes positively charged, the bottom negatively charged.



B Negative charges on the bottom of the cloud induce a positive charge on the ground below the cloud by repelling negative charges in the ground.



C When the bottom of the cloud has accumulated enough negative charges, the attraction of the positive charges below causes electrons in the bottom of the cloud to move toward the ground.



D When the electrons get close to the ground, they attract positive charges that surge upward, completing the connection between cloud and ground. This is the spark you see as a lightning flash.

INTRA-CLOUD LIGHTNING never strikes Earth and can occur ten times more often in a storm than cloud-to-ground lightning.

How is electricity produced in the sky ?

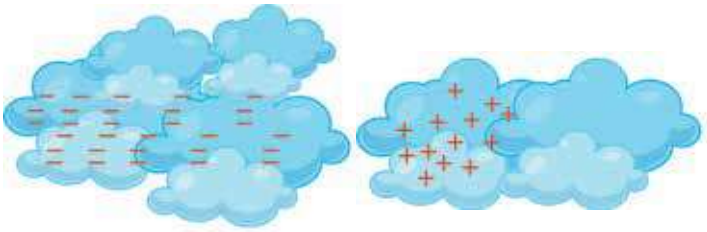


Fig. 8.6 electric charges produced in cloud

Clouds are made up of particles of water vapours and air particles. When air moves rapidly in the sky there is friction between the air and the different layers of clouds. Because of this friction, some clouds get positively charged whereas others get negatively charged. However, when two clouds having large amount of positive and negative charge approach each other, there occurs a flow of very large amount of charge in a very short time between these layers. It results to produce an intensive spark of electricity between the clouds in a very short time. The electric spark seen is called lightning in the sky.

The lightning process lasts for a very short time but it releases tremendous amount of heat and light. Due to this heat, air gets rapidly heated and expanded suddenly. This sudden expansion of air produces a loud sound called thunder.

When a large amount of electrons flow from negatively charged clouds to positively charged clouds in a very short time, it produces heat, light with sound called lightning and thundering.

How does lightning strike on the earth ?

Fig. 8.7 precaution during lightning

When positively charged clouds pass near to the earth, they induce negative charge on the tall trees, buildings, etc. Similarly, when negatively charged clouds pass near to the earth, they induce positive charge on the tree and buildings. We know opposite charge attracts each other. Sometime, these charges on building and the tree builds up to such a high value that there occurs a huge flow of charge from clouds to buildings and trees. Thus, a huge spark between the clouds and the buildings and the trees is produced. When this happens, we say lightning has struck the building and tree.

Lightning can kill human beings and animals. It can put buildings on fire. During the lightning, we should not stand under the tree.

Lightning rods

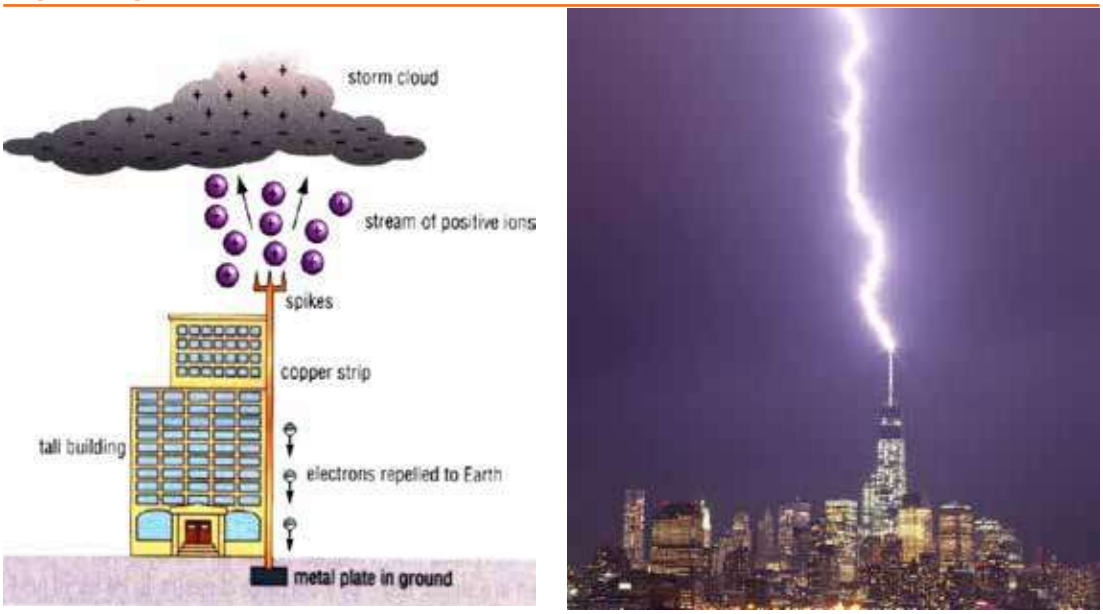


Fig. 8.8

Lightning rods are placed on the roof of the house to protect it from lightning. This rod is connected to the copper wire, and the copper wire is carried underground, which is called "electric earthing." The rods and wires carry the electricity flowing from the lightning underground, causing no damage to the house. Lighting rods are used in buildings constructed using modern technology, such as earthquake-resistant schools, apartments, commercial buildings, cinema halls, etc.

The lightning rod's long, narrow shape causes charges induced into it to bunch together and produce a strong electric field. This electric field causes nearby air molecules to be ionized, enabling charges to travel from the storm cloud to the lightning rod. This reduces the likelihood of a lightning strike elsewhere. Look for lightning rods on buildings in your area.

8.3 Introduction to Current Electricity

The electricity which is produced due to flow of electrons (or flow of electric charges) through a conductor is called current electricity. It is one of the most important forms of energy and is very useful because electrical energy (or current) can be converted to almost all forms of energy known by using energy converters. Metals such as copper, aluminium, iron, etc. are good conductors of electricity.

Some major sources of electricity are :

- Cells such as simple cell, dry cell, photo cell etc.
- Generator and dynamo.

Electricity is a kind of energy. Electric energy can be easily converted into light energy, heat energy, chemical energy and mechanical energy. Electricity has become very essential. We can't think modern life without electricity. We are using electricity for lighting, heating, cooking, driving vehicles, making electro-magnets, running television and computers, etc. To use electricity, the electricity should pass through a particular path called electric circuit.

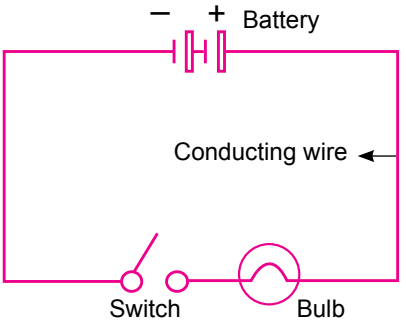
Electric circuit

Activity 8.3

Take a electric bulb and connect it to the two terminals of a cell using connecting wires and switch. Put on the switch. What do you observe? Do you think bulb glows? Now put off the switch. The bulb does not glow.

When the bulb glows we say that current is flowing through the circuit. When the bulb does not glow, we say that electric current is not flowing in the circuit.

In figure dry cell is the source of electricity. The bulb is electric load. The device which produces electricity is called the source of electricity. Similarly, the device which is operated by using electricity is called load.



electric circuit

The closed path consists of a battery, connecting wire, a switch and a load in which the current flows is called an electric circuit.

There are two types of electric circuit.

Closed circuit

In the above activity - 2, when the switch is put on the load works and the bulb glows. The electric circuit in which the load is working is called closed circuit.

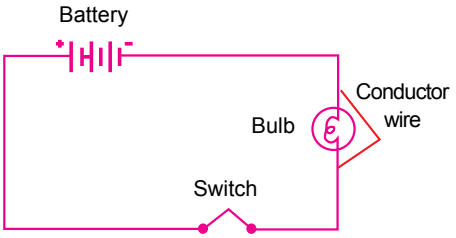


Fig. 8.9 closed electric circuit

Open circuit

Similarly, when the switch is put off in the above activity - 2, the load does not work and bulb does not glow. The electric circuit in which the load is not working is called open circuit.

Symbols in Electric-circuit

While drawing a electric circuit, it is difficult to draw the picture of the various components connected. This problem is overcome by replacing different components

of electric circuit by their symbols. Some symbols are as below:

S.N.	Electrical Components	Symbol of the Components
1.	A single cell	
2.	Two cells	
3.	Bulb	or
4.	Connecting wire	
5.	Open switch	
6.	Closed switch	
7.	Ammeter	A
8.	Resistor	
9.	Voltmeter	V
10.	Non-connected wire	
11.	Wire	

Table 8.1

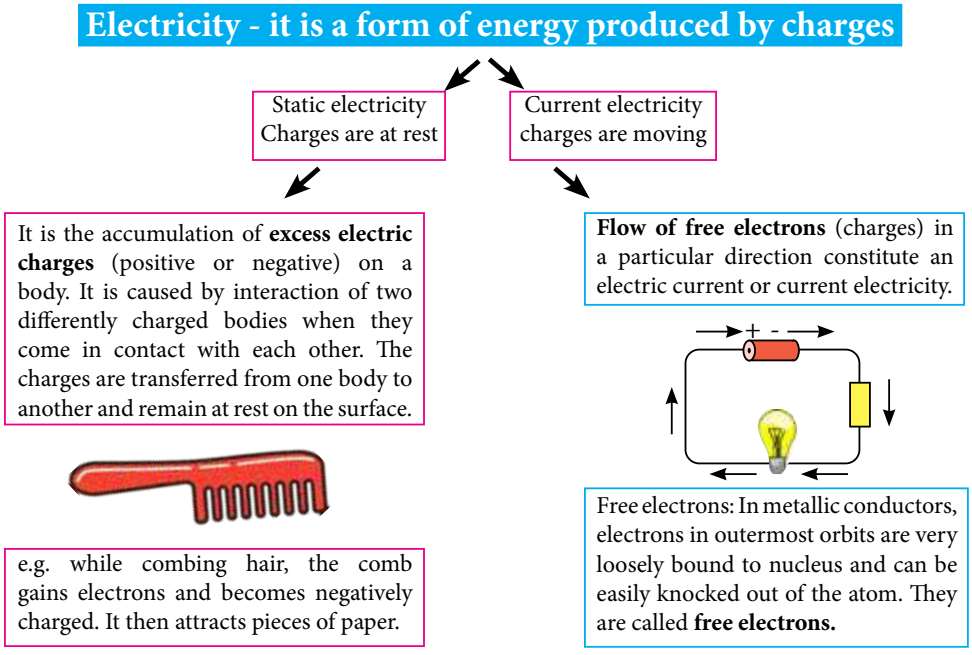


Fig. 8.10

8.4 Combination of cells

We use more than one cell in torch light, radio, transistors etc. The group of cells connected together is known as combination of cells. There are two types of combination of cells viz :

i. Series combination ii. Parallel combination

i. Series combination

The combination of cell in which the negative end of first is connected to positive terminal of second cell, negative of second cell to positive end of third and so on is called series combination.

In this type of connection, after each addition of a cell results to increase the electric pressure. For example: electric pressure of one cell is 1.5 volt. The combination of two cells gives 3 volts. The combination of three cells gives 4.5 volts and combination of 4 cells gives 6 volts.

As the number of cells increases in series combination, the more brightness of the bulbs goes on increasing.

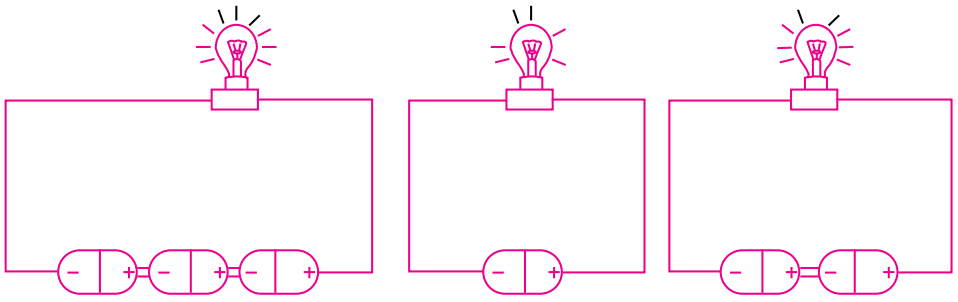


Fig. 8.11 series combination of cells

Activity 8.4

Make different combination of cells as shown in figure (a), (b) and (c), also connect a bulb in each case as shown using connecting wires. Now, the bulbs glow in each combination. Observe the brightness in each case and fill the following table.

S.N.	Number of cell	Brightness	Conclusion
a.			
b.			
c.			

ii. Parallel combination

The combination of cells in which all positive ends of cells are connected to one point and all negative ends to the other point is called parallel combinations.

In this combination, the addition of cell does not increase the electric pressure. So, brightness of bulb remains the same. But bulb glows for longer time.

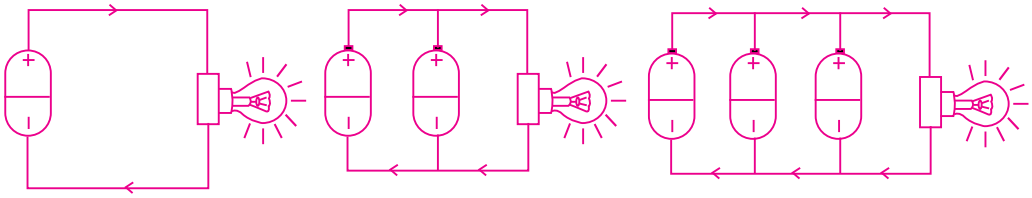
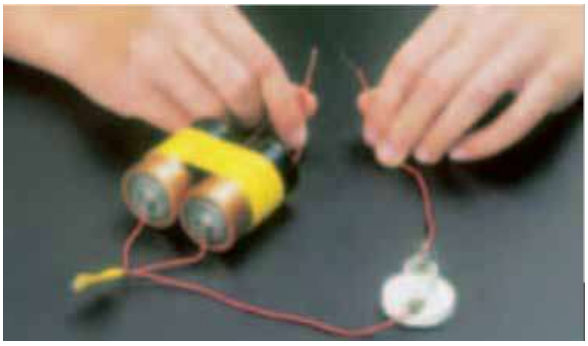


Fig 8.12 parallel combination of cells

Activity 8.5

How does the way that batteries are connected affect the voltage they provide?

Materials



1.5-V lightbulbs (2) 1.5-V batteries (3)
minibulb sockets (2)
10-cm long pieces of insulated wire (8) tape

i. Make a brightness tester by connecting one battery to a lightbulb. Disconnect one wire after you've made the lightbulb light.
ii. Tape two batteries together in series so that the positive terminal of one battery touches the negative terminal of the other battery.
iii. Connect the batteries to a lightbulb. Close the circuit in the brightness tester and compare the brightness of the lightbulbs. Record your observations. Tape two batteries together in parallel side-by-side with positive terminals on one end and negative terminals on the other end.
iv. Tape a wire to each battery terminal. Twist together the ends of the wires connected to both negative terminals. Do the same for the wires connected to the positive terminals.
v. Repeat step iii.

Points to Remember

- Generators are based on the connection between magnetism, motion and electricity.
- Electricity (or electric energy) is a form of energy which is associated with electric charge and sub atomic particles such as electrons and protons.
- An atom consists of three sub atomic particles namely electrons, protons and neutrons. Electrons are revolving around the nucleus. Nucleus consists of protons (p+) and neutrons (n°).
- The electricity which is produced in an insulators by the transfer of electrons through frictions or rubbing is called static electricity.
- All substances are made up of molecules and all molecules are made up of atoms.
- When a comb is rubbed with hair, electron transfer from hair atoms to comb atoms.
- Lightning is a large spark of electricity in the atmosphere between the clouds, the air or the ground.
- Thunderstorm (or lightning storm) is a storm with lightning and thunder (a sound produced by lightning).
- Clouds are made up of particles of water vapours and air particles. When air moves rapidly in the sky there is friction between the air and the different layers of clouds. Because of this friction, some clouds get positively charged whereas others get negatively charged.
- Lightning can kill human beings and animals. It can put buildings on fire. During the lightning, we should not stand under the tree.
- Electric energy can be easily converted into light energy, heat energy, chemical energy and mechanical energy.

Project Works

i. Take three cells, a conductor wire, a bulb, and a switch. Connect a cell to the circuit first. Now observe the brightness of the bulb. Then connect two cells in the circuit in series and finally connect all three cells in series to observe the brightness of the bulb. Discuss in groups and prepare a report with conclusions.

ii. Take three cells, a conductor wire, a bulb, and a switch. Connect a cell to the circuit first. Now observe the brightness of the bulb. Then connect two cells in the circuit in parallel and finally connect all three cells in parallel to observe the brightness of the bulb. Discuss in groups and prepare a report with conclusions.

Exercise

A. Choose the correct one and put the tick mark (√).

i. What type of electricity is produced when two insulators are rubbed each-other ?

a. Current electricity b. Static electricity
c. Potential difference d. Current

ii. Which one is the effect of static electricity ?

a. Glowing bulb b. Sparkling
c. Lightning d. Ringing bell

iii. Which of the following sources of electricity changes light energy into electricity ?

a. Dry cell b. Simple cell
c. Photo-cell d. Generator

iv. Which of the following is not a conductor of electricity ?

a. Copper b. Aluminium
c. Dry air d. Gold

v. Which of the following is not essential in an electric circuit ?

a. A cell b. A bulb
c. A switch d. An ameter

vi. Which of the following is load ?

a. Magnet b. Cell
c. Bulb d. Insulator

vii. What differences is observed in brightness of bulb when cells are added in series connection ?

a. Increases b. Decreases
c. Remain constant d. Nothing

B. Fill in the blanks.

i. Electricity is a kind of _____.
ii. The electricity produced by friction is called _____ energy.
iii. Bulb does not glow in a _____circuit.
iv. Unlike charges _____ each other.
v. If we have to light a lamp for a long time, we should use _____ combination of cells.
vi. The series combination of cell increases _____.

C. Differentiate between the following.

i. Open circuit and closed circuit
ii. Series connection and parallel connection
iii. Electric source and electric load

D. Draw an electric circuit with bulb, cell, wire and a switch.

E. Choose the correct word and fill in the blanks.

wires	hurt	force	hair	sockets	work
careful	batteries	flow	lightning	phones	

Electricity is an invisible _____. You cannot see electricity,

but you can see what it does! it makes _____ streak across the sky. It can make your _____ stand on end. Electricity can _____ Through wires and make things work. We can plug into things into _____ in the wall electricity

flows through lightbulbs, computers, and refrigerators to make them _____ . Some things have _____ in them to create electricitv

Flashlights and cell _____use batteries.

Be _____ with electricity! It can _____ or even kill you. Never touch electric _____ or sockets.

F. Answer these questions in short.

i. Name any three types of energy on which electricity can be converted.

ii. What is electrification ?

iii. What is thunder ?

iv. What is static electricity ?

v. What is lightning ?

vi. Write the utility of series connection of cells.

vii. How is charge produced?

viii. How does negatively charged plastic attract paper pieces?

ix. Write the effects of static electricity.

x. How is lightning caused?

xi. How can buildings be kept safe from lightning?

xii. Write the symbols of the following electrical components:

cells, bulb, open switch, resister, voltmeter

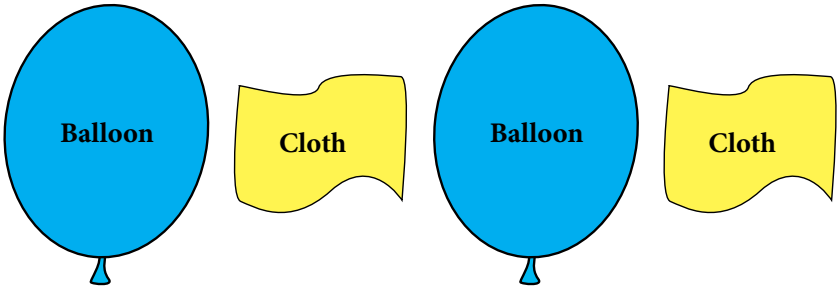
xiii. If in a circuit you have arranged cells in series. Will the bulb continue to shine even if the connection of one of the cells is reversed?

xiv. How are cells arranged in a torch—in parallel or in series?

G. Diagrammatic questions

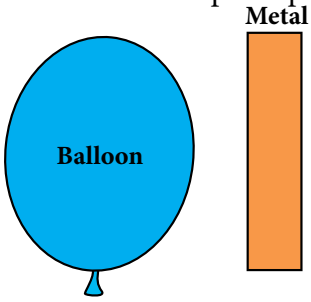
i. Draw appropriate charges on each material and show the tranfer of charges after rubbing .

a.

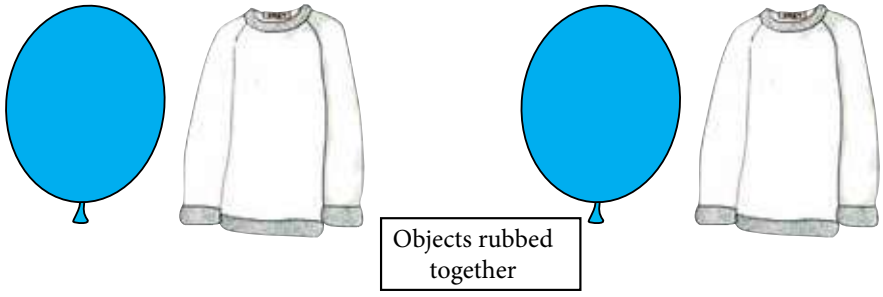


Balloon and cloth before rubbing *Balloon and cloth after rubbing*

b. What happens if the balloon in stage 2 of question 'a' is in contact with a metal strip ? Explain.



ii. Draw appropriate charges on each material before and after static charge has been created



What has happened to the ballon?

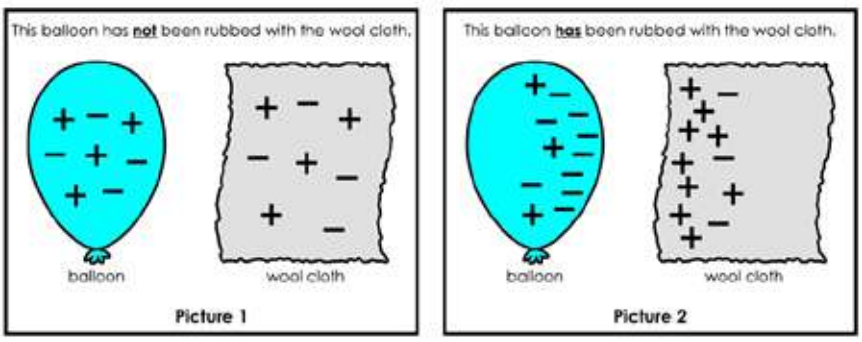
iii. Use the following diagram to answer the questions below:

a. Explain why the girl's hair sticks out when she touches the charges Van de Graff generator. _____

b. Why is the girl probably standing on a plastic box rather than right on the floor?_____

c. What might happen if the girl got her left hand close to a water tap or other grounded object? _____
Explain why this would happen ? _____
_____

iv. Look at the pictures and answers the questions



a. Look at picture 1. What kind o charge does the balloon have?
Positive charge Nagatic charge Natural charge

b. Look at picture 1. What kind of charge does the cloth have?
Positive charge Nagatic charge Natural charge

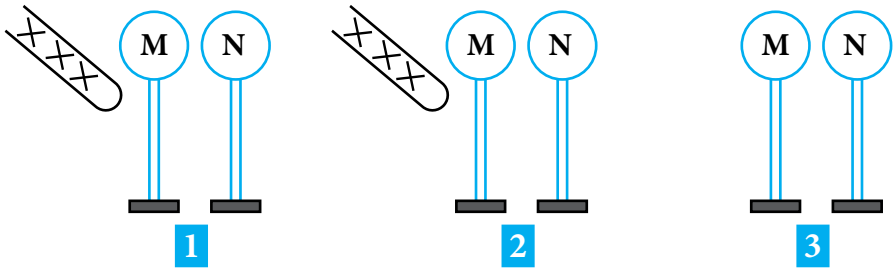
c. Look at picture 2. How did the balloon charge its charge?

d. When positive charge pull nagative charges we call it ...

v. **Two conducting spheres M and N, on insulating supports, are in contact with each other. At first they are not charged.**

The following therr operation are performed:

a. A positively charged rod touches sphere M.
b. Sphere N is moved away from sphere M.
c. The charged rod is moved away.

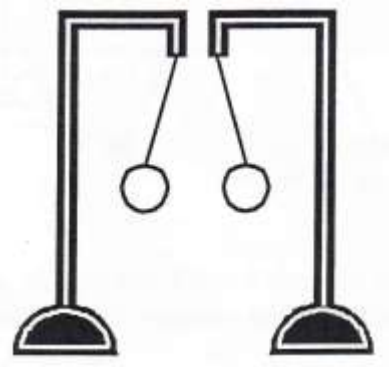


What are the charges on the spheres M and N after the operations?

a. Negative for sphere M, positive for sphere N
b. Negative for sphere M, no charge for sphere N
c. Negative for sphere M and N
c. Positive for sphere M and N

vi **The diagram represents the interaction of charged spheres that you chave observed.**

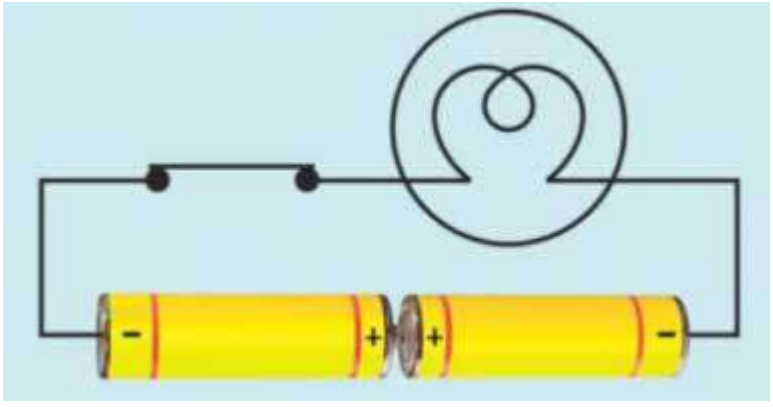
Which of the following statements describes the situation in the diagram?



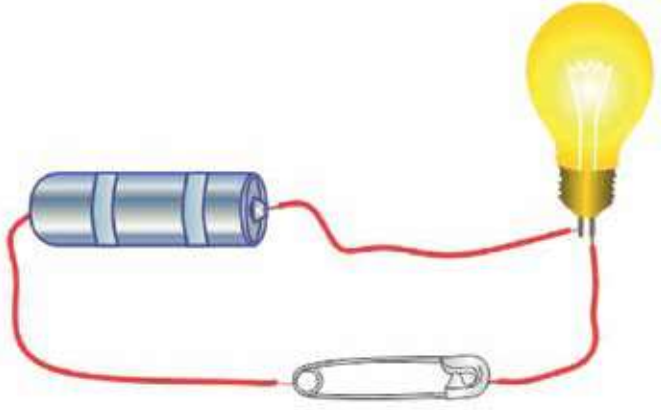
a. The right-hand sphere is charged positively and the left-hand sphere negatively.
b. The two spheres are both electrically neutra.
c. The right-hand sphere is charged negatively and the left-hand sphere positively.
d. The two spheres both carry the same electrical charge.

vii. **Figure shows four cells fixed on a board . Draw lines to indicate how you will connect their terminals with wires to make a battery of four cells.**

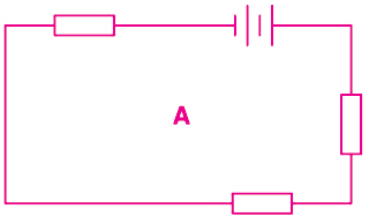
viii. **The bulb in the circuit shown in Figure does not glow . Can you identify the problem ? Make necessary changes in the circuit to make the bulb glow.**

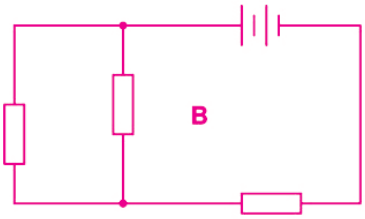


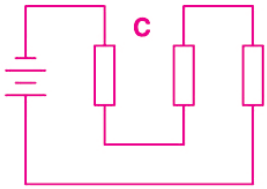
ix. **Draw the circuit diagram to represent the circuit shown in Figure given below.**

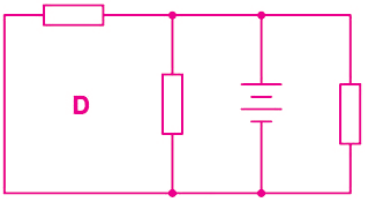


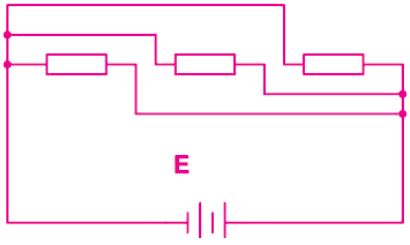
x. **Identify which of these circuits are parallel circuits and which are series curcuits**

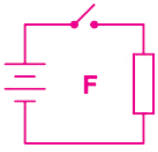




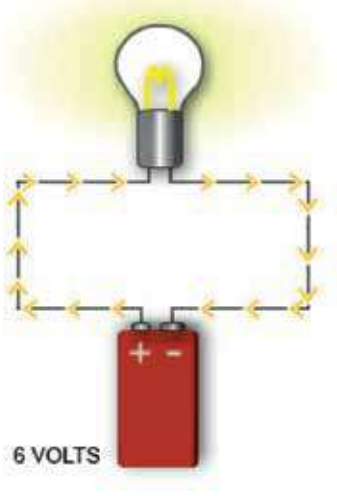


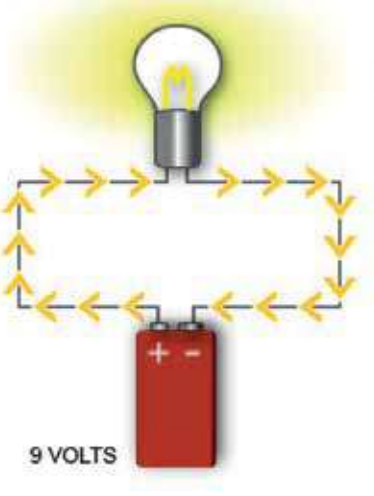






xi **Why is 1 buld brighter than the other?**





xii. Two cells can be joined in two ways in series and in parallel. What do you mean by these two ways? In which way the cells are joined in a torch?

xiii. Take four lengths of electric wire with differently coloured plastic coverings. Remove a little of the plastic covering from each length of wire at the ends. This would expose the metal wires at the ends of each length. Fix the exposed parts of two wires to the cell and the other two of the bulb as shown in Fig. (A) and Fig. (B).

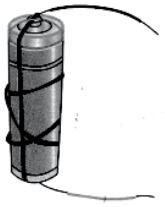


Fig. (A). Electric cell with two wires attached to it

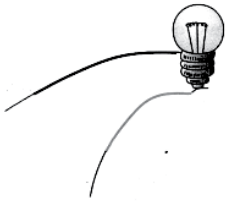


Fig. (B). Bulb connected to two wires

You can stick the wires to the bulb with the tape used by electricians. Use rubber bands or tape to fix the wires to the cell. Now, connect the wires fixed to the bulb with those attached to the cell in six different ways as have been shown in Fig. C [(a) to (f)]. For each arrangement, find out whether the bulb glows or not. Write "Yes' or 'No' for each arrangement in your notebook. Now, carefully look at the arrangements in which the bulb glows. Compare these with those in which the bulb does not glow.

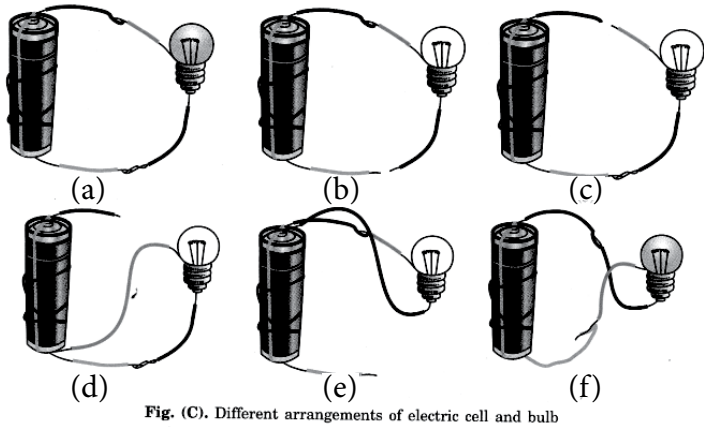
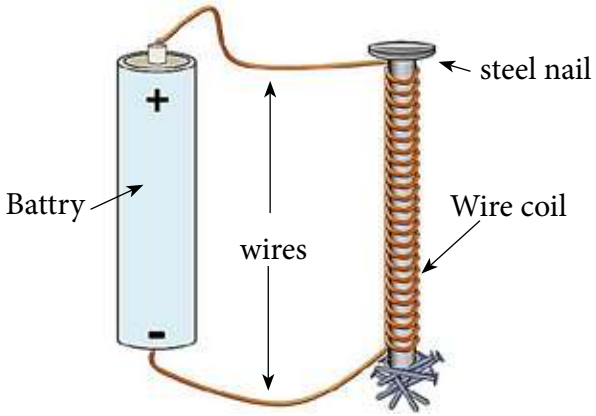


Fig. (C). Different arrangements of electric cell and bulb

Can you find the reason for the difference?

Figure	Bulb lights up/Bulb does not light up	Reasons
(a)	Bulb lights up	Wires from the cell are connected with two terminals of the bulb
(b)	Bulb does not light up	One of the wires is connected with terminal, while other wire is left free
(c)	Bulb does not light up	Two different wires are not connected properly
(d)	Bulb does not light up	One wire is not connected with one terminal, bulb connected to one terminal of the cell
(e)	Bulb does not light up	Wire is not connected with one terminal, bulb connected to one terminal of the cell
(f)	Bulb lights up	Both the wires from the cell are connected with two terminals of the bulb (by changing the position of wire)

xiv. A simple electromagnet used to pick up paperclips is shown below.



- Steel is a magnetic material. Name two other magnetic materials.
- The results for the current in the circuit and the number of paperclips attracted to the nail are shown below.

Current (A)	0.2	0.4	0.6	0.8	1.0
Number of paperclips	3	6	7	12	15

Write a sentence to explain how current affected the number of paperclips attracted to the magnet.

Unit 9 Matter

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- define density and solve mathematical problems related to it.
- find the relative density of an object by comparing it with the density of water.
- introduce elements and atoms.
- mention the charge and load of subatomic particles.
- describe the atomic number, symbol, and number of subatomic particles of elements up to atomic number 20 .
- introduce compounds and molecules
- introduce, characterize, and demonstrate matter's physical and chemical changes.

The picture below shows various objects.

Fig. 9.1

i. Do all these things occupy space?
ii. Is it the mass of all these things?

iii. Air, water, soil, rocks, light, shadow, wood, and various other things are all around us. Do all these things have a mass?
iv. Is there a mass of shadow, heat, light, etc.?
v. What is an object that occupies space and is called a mass?
vi. In the picture above, try to classify objects into solids, liquids, and gases.

There are different types of objects around us. For example air, water, wood, metals, plastic, paper, rubber, petrol, milk, diesel, etc. Some objects around us occupy space and some do not. The air, water, wood, metals occupy space. They have mass. Light, sound, heat, etc. do not occupy space. They do not have mass. They are not matter.

The objects that occupy space and has mass is called matter. They are made up of atoms. The air occupies space and has mass. Similarly, book occupy space and has mass. So, air and book are matter.

The matter are found in different states. The matters exists in 3 states. They exist in solid, liquid or gaseous states. The matters of different states have different arrangement of molecules in them. Some matter contains molecules that are closely packed whereas some molecules in some matter are loosely packed. The molecules in solid are lightly packed whereas the molecules in gases are loosely packed. The solids occupy less space and gases occupy more space for same amount of matter.

9.1 Density of matter

A material's density is defined as its mass per unit volume. Put another way, density is the ratio between mass and volume or mass per unit volume. It is a measure of how much "stuff" an object has in a unit volume (cubic meter or cubic centimeter).

Activity 9.1

Take a container the size shown in the picture. Find the volume of that container by measuring its inner length, width, and height. One after the other, sand, dusty soil, rice husks, wood dust, etc., fill out the container. Pour each into a separate plastic container. The mass of each measurement is done with the help of a beam balance. Now, find the mass per unit volume (mass/volume). Fill in the table below. Discuss the results in class.

Name of Matter	Mass of Matter	mass(m)/volume(v)
sand		
dusty soil		
rice husks		
wood dust		

Density of Cork <wood<Metal

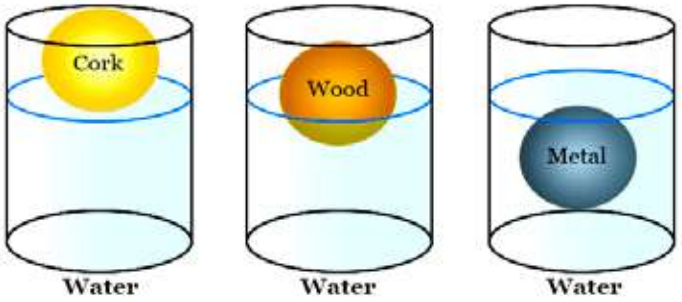


Fig. 9.2

The concept of density

- Density means the number o particles contained in an object
- Density measures how close particles are to each other
- Density = mass/volume [how much mass an object has in a certain volume]
- The density of an object explains why it will float or skin in water

Microscopic ← ? → Microscopic

Mathematical Problems of Density1

Find the density of the following:

Substance	Volume in cm^3	Mass in g	Density in g/cm^3
Gasoline	5	3.5	
Milk	10	10.3	
Gold	8	154.4	
Aluminum	12	32.4	
Water (at 4^0C)	14	14	
Water (at 20^0C)	16	15.968	
Ice (at 0^0C)	20	18.4	

Table 9.1

Think!

When milk is mixed with gasoline, which substance will float? _____

Why do ice cubes always float at the top of a glass of water? _____

Relative Density

The density of water is 1000 kg/m^3. The density of iron is 7800 kg/m^3 which is more heavier. By how many times iron is heavier than water. Dividing density of iron by density of iron we get,

$$\frac{\text{density of iron}}{\text{density of water}} = \frac{7800\ \text{kg/m}^3}{1000\ \text{kg/m}^3}$$

$$= 7.8$$

It means that iron is 7.8 times heavier than water.

The relative density of a substance is calculated by comparing the density of the substance with the density of water at 4^{0}C.

i.e. Relative density of the substance = $\frac{\text{density of the substance}}{\text{density of water at } 4^0\text{C}}$

The relative density is the ratio of density of the substance to the density of water at 4^{0}C. Hence, it has no unit.

You might have seen a scene of flood. Make a list of materials that you have seen floating in water. Find the density of such matter from some book or internet. Here a list of some of the matters are given along with their density.

Matters	**density gm/cm^3**
Wood	0.60
Plastic	0.92
Ice	0.90
Insulation foam	0.03
Iron	7.80
Aluminum	2.50
Glass	2.70
Sand stone	2.41
Water	1.00

From the list of the given substances sort out the substances that floats in water. Compare the density of such substances with the density of water. What do you find?

The substances having density less than the density of water floats on water. It means the relative density of the substance less than 1 can float on water.

Numerical

A block of a substance of dimension 4cm×1cm×0.5cm has a mass of 50kg. Calculate its absolute density and relative density. State whether the substance will float or sink in water. (density of water at 4^{0}C = 1gm/cm^3)

Sol^{n}

Volume of the substance (V) = 4cm×1cm×0.5cm

$= 2cm^3$

Mass of the substance (M) = 50g

i.e. Density of the substance (d) = ?

According to formula,

$$\text{density of substance (d)} = \frac{\text{Mass (m)}}{\text{Volume (v)}}$$

or, $$d = \frac{50g}{2cm^3}$$

$\therefore \quad d = 25gm/cm^3$

density of substance (d) = $25gm/cm^3$

Now,

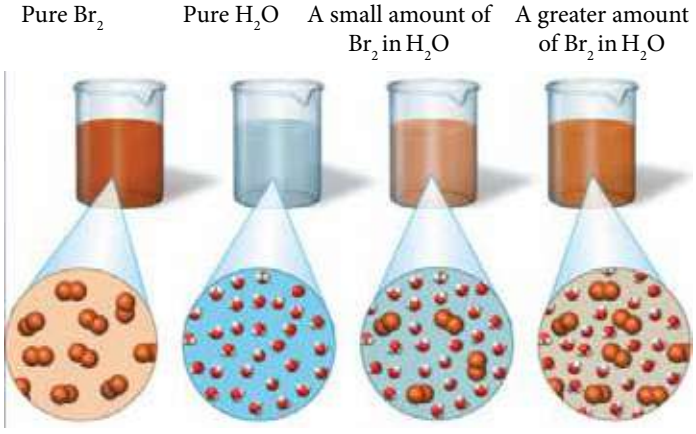
$$\text{Relative density} = \frac{\text{density of the substance}}{\text{density of water at } 4^0C}$$

$$= \frac{25gm/cm^3}{1\ gm/cm^3}$$

$\therefore$ Relative density = 25

Hence, the substance will sink in water.

A pure substance cannot be distinguished from a mixture of uniform appearance by observation alone at the macroscopic level



There are different types of substances around us. Some substances have fixed composition. They are always made up of some types of matter in fixed properties. Such substances have constant density. The density of elements like gold, silver, copper, iron, water, etc. is constant in their pure form.

If some impurities are added to them, their density changes. The density of substances which does not have fixed composition like soil, glass, plastic varies according to matter which makes such substances. The density of substances help in knowing the purity of the substance. Lactometer measures the density of milk. It gives idea about the purity of milk.

Floating and sinking

Activity 9.2

i. Materials Needed: A bin or sink filled with water, various household objects including ones that float (feather, Lego, bath toy, crayon, ping pong ball, plastic utensil, pencil, etc.) and ones that don't float (toy cars, coins, metal spoon, eraser, dry pasta, pipe cleaner, etc.), towel.

Procedure :

Step 1: Set up the activity by gathering various household objects. Spread the objects onto a towel. Fill a bin or sink with water.

Step 2: Drop objects into the water. Explore what sinks and floats.

Extensions: Try liquids (for example, corn syrup or oil).

ii. **Materials:** wooden, stone, plastic, iron, and wooden pieces, erasers, spoons, and so on.

Procedure: Fill a large container halfway with water. Turn these objects into water. Keep looking.

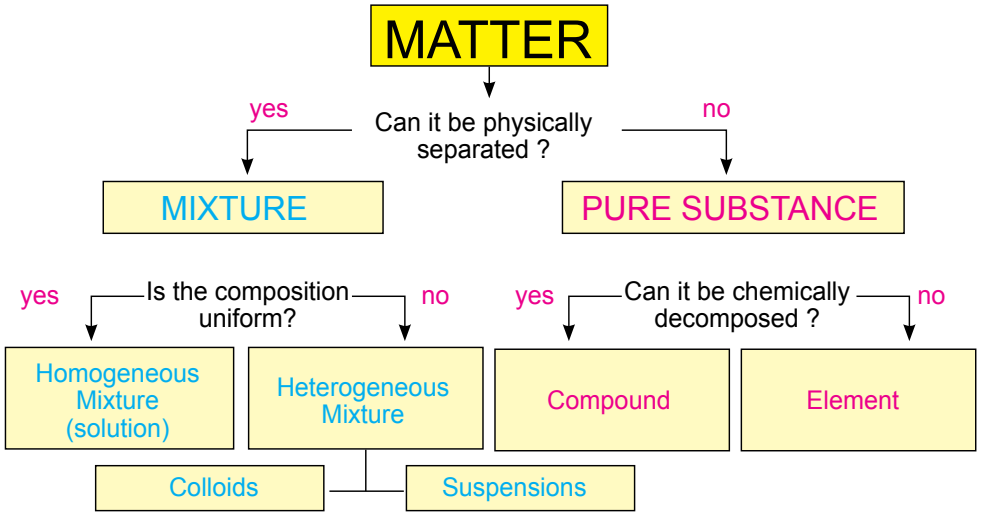
Observation: Observe which objects sink in water and which ones float.

What might be the reason for this? Discuss in class and fill in the following results:

S.No.	Object	Density	Floating or sinking	Cause
1.	Iron	8 gm/cm^3		
2.	Ice	0.98 gm/cm^3		
3.	Water(4^{0}C)	1 gm/cm^3		
4.	Kerosene oil	0.8 gm/cm^3		
5.	Aluminium	2.7 gm/cm^3		

9.2 Element and Compound

A substance which is made up of only one kind of atoms or molecules is called pure substance. Elements and compounds are pure substances. For example, iron, copper, distilled water, carbon dioxide etc. are pure substances . Pure substances have uniform composition and properties. Impure substances are made up of two or more kinds of molecules. Impure substances are also known as mixture. Impure substances do not have fixed composition and properties. Muddy water, sandy water, salt solution, sugar solution, air, etc. are some examples of impure substances or mixture.



Element

A pure substance that cannot be further divided into two or more simpler substances, by any physical or chemical process is known as an element. Many elements are found in nature. Elements can not be prepared. We can not get other elements from hydrogen. We can get only gold elements by breaking gold. Elements are the basic units of matter. There are 118 elements that have been discovered till date. Out of them, 92 elements have been found in nature and rest elements have been synthesized artificially. Each element has its own name like hydrogen, oxygen, carbon, nitrogen, iron, gold, sliver, etc. In nature, elements are found either in free or in combined states. Elements like oxygen, nitrogen etc. are found in free states while some other elements like iron, aluminum, etc. occur in combined state. Elements are classified as metals, metalloids and non-metals.

Atom

The atom is the smallest particle of a substance that can take part in chemical reaction. The atoms consists of nucleus and shell (orbit). The atom is made up of sub-atomic particles: electron, proton and neutron. The proton and neutron is situated at the center of atom. The center of atom is called nucleus. The electron revolves around nucleus it fixed path. The fixed path which electron revolves around the nucleus is called orbit or shell.

Electron

The electron is negatively charged particle. It revolves around the nucleus. Its mass is 1/1837 amu. It is denoted by e^{-}.

Proton

The proton is a positively changed particle. It is situated in nucleus. Its mass is equal to the mass of hydrogen atom i.e. its mass is 1 amu. It is denoted by P^{+}.

Neutron

It is a chargeless particle. It is situated ion nucleus. Its mass is equal to the mass of hydrogen atom. It is denoted by n^{0}.

Sub atomic particle	Symbol	Mass	Charge	Location
electron	e^{-}	1/1837 amu	-ve	orbit
proton	P^{+}	1 amu	+ve	Nucleus
Neutron	n^{0}	1 amu	0	Nucleus

Table 9.2

Symbol

The abbreviation of the full name of the element is known as symbol. Symbol is the short name of the elements. The symbols of element are expressed by using English letters. They are made up of either one or two letters. If the symbols of an element has two letters, the first letter must be written in capital letter and the second letter must be in small letter.

S. N.	Name of Elements	Symbol
1.	Hydrogen	H
2.	Helium	He
3.	Lithium	Li
4.	Beryllium	Be
5.	Boron	B
6.	Carbon	C
7.	Nitrogen	N
8.	Oxygen	O
9.	Fluorine	F
10.	Neon	Ne

S. N.	Name of Elements	Symbol
11.	Sodium (Natrium)	Na
12.	Magnesium	Mg
13.	Aluminium	Al
14.	Silicon	Si
15.	Phosphorus	P
16.	Sulphur	S
17.	Chlorine	Cl
18.	Argon	Ar
19.	Potassium(Kalium)	K
20.	Calcium	Ca

Table 9.3

Atom

The smallest particle of a pure substance which can take part in a chemical reaction is known as atom. All atoms of an element are exactly similar in every respect. Different elements have different kinds of atoms. Each atom can be further divided into smaller sub-atomic particles that include electrons, protons and neutrons. The number of protons present in the nucleus of an atom oy an element is called its atomic numbers.

Atomic Number = Number of Protons = Number of electrons.

Generally, an atom is electrically neutral because the number of positively and negatively charged particles are equal in an atom. A charged atom is called an ion. There are two types of ions; i.e. cation and anion. Cation is positively charged and anion is negatively charged .

cations	anions
H^+, Na^+ etc.	OH^- , Cl^- etc.

Composition of the atoms of the first twenty elements

Name of element	symbol	Atomic number	No. of p^+	No. of n^0	No. of e^-	distribution of electrons				Valencey
						K	L	M	N	
Hydrogen	H	1	1	-	1	1				1
Helium	He	2	2	2	2	2				0
Lithium	Li	3	3	4	3	2	1			1
Beryllium	Be	4	4	5	4	2	2			2
Boron	B	5	5	6	5	2	3			3
Carbon	C	6	6	6	6	2	4			4
Nitrogen	N	7	7	7	7	2	5			3
Oxygen	O	8	8	8	8	2	6			2
Fluorine	F	9	9	10	9	2	7			1
Neon	Ne	10	10	10	10	2	8			0
Sodium	Na	11	11	12	11	2	8	1		1
Magnesium	Mg	12	12	12	12	2	8	2		2

Aluinium	Al	13	13	14	13	2	8	3		3
Silicon	Si	14	14	14	14	2	8	4		4
Phosphorus	P	15	15	16	15	2	8	5		3, 5
Sulphur	S	16	16	16	16	2	8	6		2
Chlorine	Cl	17	17	18	17	2	8	7		1
Argon	Ar	18	18	22	18	2	8	8		0
Potassium	K	19	19	20	19	2	8	8	1	1
Calcium	Ca	20	20	20	20	2	8	8	2	2

Table 9.4

Atomic Structure of Elements

Atomic structure gives a clear concept about the atom of an element. The atomic structure of some common elements are described below.

1. Hydrogen

Atomic number (Z) = 1 [1 electron (e^-), 1 proton (p^+), no neutron (n°)]

Atomic mass (A) = 1 [No. of proton (P^+) + No. of neutron (n°)]

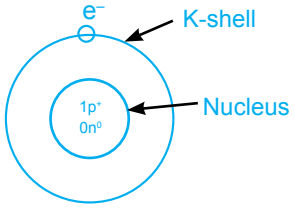


Fig. 9.3 Atomic model of hydrogen

Electronic configuration of hydrogen

Shell	K	L	M	N
No. of electrons (e^-)	1	-	-	-

2. Sodium

Atomic number (Z) =11 [11 electrons, 11 proton and 12 neutrons]

Atomic mass (A) = 23 [No. of neutrons (n^0) + No. of protons (p^+)]

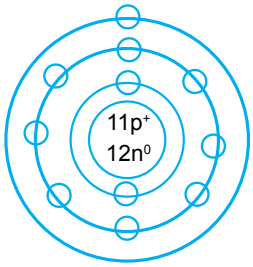


Fig. 9.4 Atomic model of sodium

Electronic configuration

Shell	K	L	M
No. of electrons (e^-)	2	8	1

[Note : The maximum number of electrons in each shell is determined by $2n^2$ rule where, n = number of orbits or shells.]

Project Work

Draw the model of atom on a chart paper using coloured wool, gum and small circular pieces of paper. Using a compass, draw a small circle using the same center, draw more concentric circle, of different diameter. Paste the different coloured wool over this circles using glue. Paste the small circular paper over the wool to denote electrons. Label the parts of atom and name the atom.

Compound

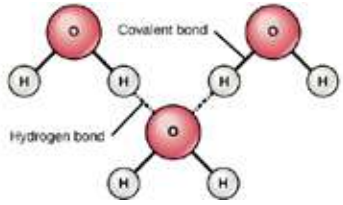


Fig. 9.5

A form of pure matter which is composed of two or more than two elements combined chemically in a fixed proportion by weight is called compound. Hydrogen and oxygen when chemically combined in a fixed ratio, it forms water. Water is a liquid compound having two elements. Common salt (NaCl) is formed by the combination of sodium and chlorine. Physical properties of hydrogen and oxygen are not found in water because chemical reaction takes place between these elements. The properties of a compound are always different from its original substances from which it is formed. A compound is usually homogeneous and shows definite chemical and physical properties. Some compounds and their elements are as follows.

S.N.	Compounds	Reacting Elements	Molecular formula
1.	Water	Hydrogen, Oxygen	H_2O
2.	Methane	Carbon, Hydrogen	CH_4
3.	Carbon dioxide	Carbon, Oxygen	CO_2
4.	Common salt (Sodium chloride)	Sodium, Chlorine	NaCl
5.	Ammonia gas	Nitrogen, Hydrogen	NH_3

Molecule

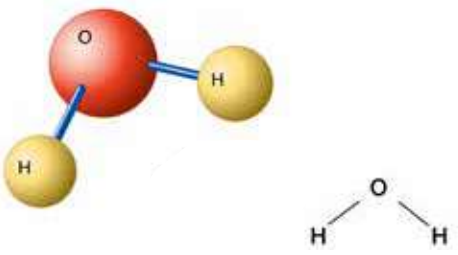


Fig. 9.6 Water Molecule

Group of two or more atoms of a substance which can exist independently and retain the physical and chemical properties of a substance is molecule. It may be made up of one or different elements. e.g. H_2, O_2, M_2O, Nacl. The molecules of a compound are similar to each other. Salt is formed by a large number of sodium chloride molecules. A single molecule of sodium chloride has all the chemical properties at a large block of salt.

A molecule can break or combine to form the molecule of another substance when a molecule breaks or combine, with other elements. It loses its initial properties and gains new properties.

A water molecule is made by reaction between hydrogen molecule and oxygen molecule. When water molecule is formed, the hydrogen and oxygen molecules lose their property and show the properties of water.

Project Work

Take a chart paper. Make a list of elements according to increasing order of their atomic number. Write their symbol, atomic number, number of electron, proton and neutron present in them. Show it to your science teacher. Paste the chart in your classroom or science laboratory.

9.3 Change in Matter

The substances change due to heat, light, pressure, action of chemicals etc. Some changes are temporary and some changes are permanent. Some changes alter only the state and structure of matter where as some changes the properties of matter. The changes occuring in substances can be divided as physical change and chemical change.

Activity 9.3

Take a piece of wood and iron. Place the wood and iron in fire. What happens to the iron and the wood? Observe. What happens when fire is put off?

The iron becomes red hot. It expands to some extent. When fire is put off, it cools down and returns to its initial condition. On the other hand, the wood starts burning in fire and changes into ashes. We cannot make wood out of ashes again. The wood has permanently changed into ashes where as the change in iron was temporary.

Physical Change

Perform the following activities:

a. Grind the block of black salt into fine powder.
b. Heat on iron rod.
c. Boil the water.
d. Melt the pieces of glass.
e. Heat a polythene bag.
f. Dissolve sugar in water.

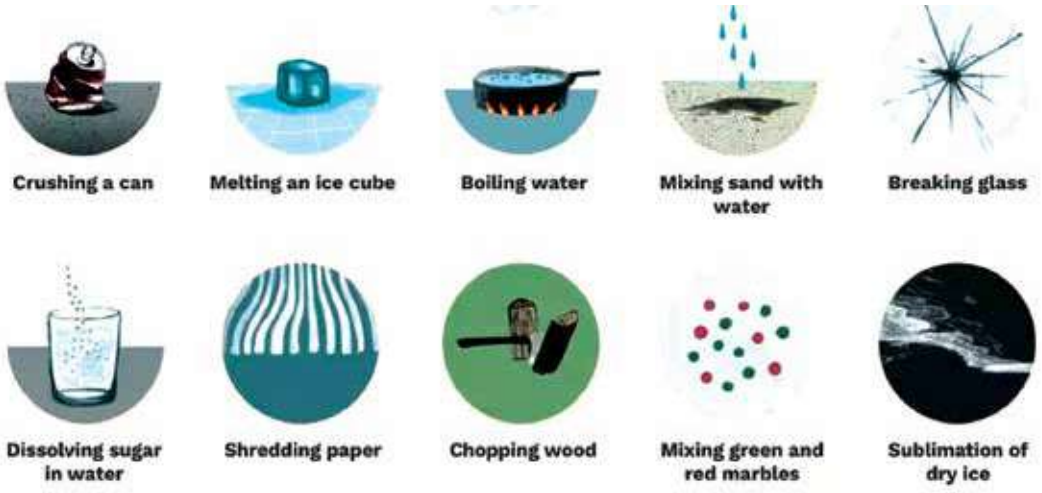


Fig. 9.7

What changes do you see? The colour of fine powder of black salt is different from the block of black salt block and its colour has changed. But the taste does not change. Similarly, on heating iron rod , its colour and size changes but iron does not change its properties. The boiling water changes into vapour. Its state changes but its chemical composition remains same. We can cool water vapour and obtain water again.

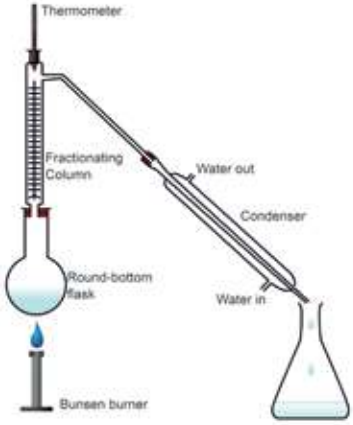
The change in which the physical properties of the substance like shape, size, temperature, density, volume, colour etc. changes but the chemical properties remains unchanged is called physical change. Generally, physical change is temporary and reversible.

Activity 9.4

Study of the physical change in water.

a. Apparatus Required

i. Distilling flask
ii. Condenser
iii. Conical flask
v. Stand
vi. Burner



b. Procedure

Take a distilling flask and fill it with water. Arrange the apparatus as shown in the figure. Place the flask over tripod stand and connect it with condenser. Place a conical flask at the other and of the condenser. Heat the flask with the help of burner.

c. Observation

On heating, the water changes into stem. The stem passes through the condenser. The stem changes into water inside the condenser. The water form is collected in a conical flask.

d. Conclusion

Water changed into steam and cooled back to form water. The state of water changed on heating. However, there was no chemical change as water was obtained again. It concludes that physical change can change the state of substance but not in chemical properties.

Activity 9.5

Make a saturated salt solution. Obtain pure salt crystals by the process of crystallization. Show that obtaining salt crystals by the process of crystallization is a physical change. Present the activity in the format shown in previous practical activity.

Chemical Change

Have you seen rust? How is it formed? What happens when you burn a candle? What happens when an egg is boiled? What happens to biodegradable waste?

Rusting is a chemical change. The iron combines with water vapour in air to form rust. The rust is brittle. It has no strength like iron. Rust cannot be changed back into iron. When egg is boiled, the white part and yolk of egg solidifies. Biodegradable wastes convert into manure and gases. They cannot be changed into waste again.

Fig. 9.8

Chemical changes happen around us in many natural processes. It occurs during digestion of food, decomposition of wastes, drying of leaves, rusting of iron, lightning rotting of fruits, photosynthesis etc.

The chemical change is a change of substance into another substance having different chemical properties. The chemical change changes the internal structure and composition of the substance. The chemical change is irreversible and permanent change.

Rusting of Iron

Iron is a reactive metal. It can react with water vapour and oxygen present in air. Rust radish brown oxide of iron. It reduces the life of iron. The objects made up of iron becomes weak due to collusion.

Fig. 9.9

The iron can be protected from rusting by preventing the contact of iron with oxygen. This is done by applying all on the surface of iron. Galvanization also prevents iron from rusting. Applying enamel and painting the surface of iron prevents it from rusting.

Practical Work

Ask your teacher to demonstrate that passing CO_2 gas in lime water is a chemical change. Present the practical activity with necessary details about apparatus required, procedure, observation and conclusion.

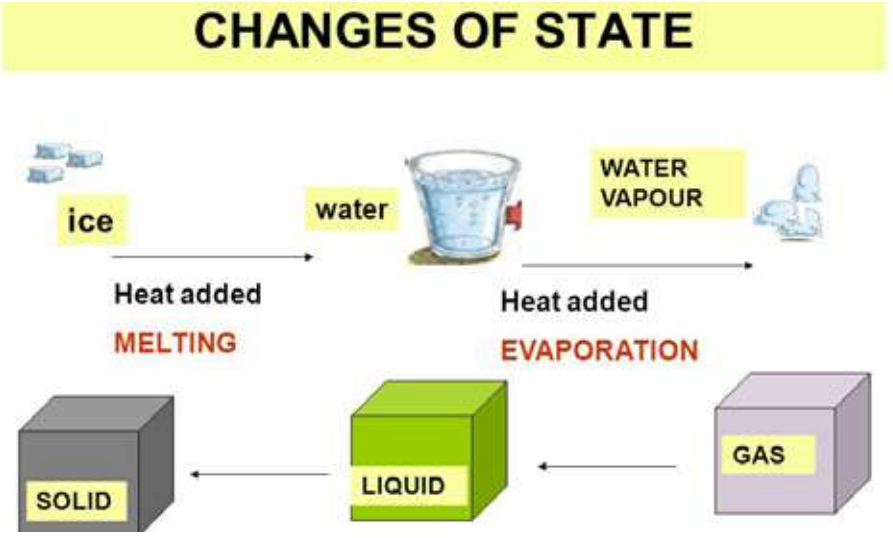


Fig. 9.10

In a physical change, the particles of matter themselves are unchanged

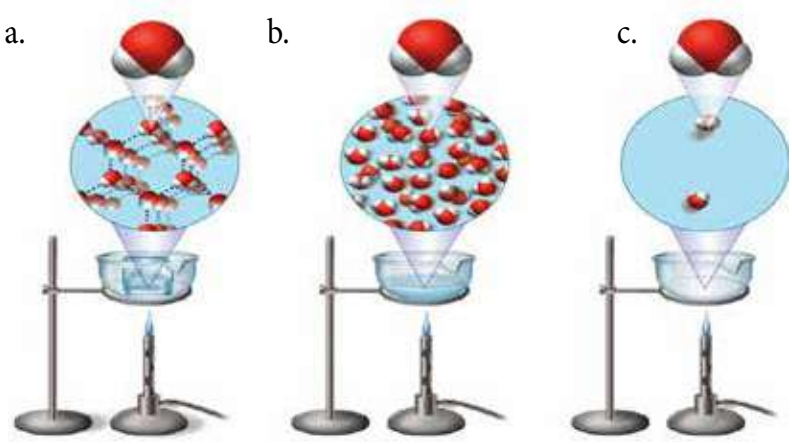


Fig. 9.11

Points to Remember

- Some objects around us occupy space and some do not. The air, water, wood, metals occupy space. They have mass. Light, sound, heat, etc. do not occupy space. They do not have mass. They are not matter.
- The relative density is the ratio of density of the substance to the density of water at 4^0C. Hence, it has no unit.
- A substance which is made up of only one kind of atoms or molecules is called pure substance.
- A pure substance that cannot be further divided into two or more simpler substances, by any physical or chemical process is known as an element.
- The atom is the smallest particle of a substance that can take part in chemical reaction.
- A form of pure matter which is composed of two or more than two elements combined chemically in a fixed proportion by weight is called compound.
- Compound is made up of large number of small particles. These small particles have same properties as that of a compound.
- The change in which the physical properties of the substance like shape, size, temperature, density, volume, colour etc. changes but the chemical properties remains unchanged is called physical change.
- Chemical changes happen around us in many natural processes. It occurs during digestion of food, decomposition of wastes, drying of leaves, rusting of iron, lightning, rotting of fruits, photosynthesis etc.
- Iron is a reactive metal. It can react with water vapour and oxygen present in air. Rust radish brown oxide of iron. It reduces the life of iron.

Project Works

i. Use physical balance to find the body of the science and technology book. Now use the scale to measure its length, width, and height. Find the volume and density of the book by using formulas.

ii. Collect various materials around you. Find the density of those objects using formulas. Does the density of an object compare with the density of water so that the object sinks or floats in water? Write down the results and show them to the teacher.

iii. Prepare a chart with the names and symbols of the elements from atomic numbers 1 to 20, the number of electrons, protons, and neutrons, and present it in the classroom.

A. Choose the correct one and put the tick mark (√).

i. What are the states of matter ?

a. solid, liquid, and juice b. solid and liquid
c. solid and gas d. solid, liquid, and gas

ii. Which form of matter has a definite shape and takes up space (has definite volume) ?

a. liquid b. solid
c. gas d. clay

iii. Boiling

a. liquid to gas b. gas to solid
c. gas to liquid d. solid to liquid

iv. Define a liquid.

a. Indefinite shape, indefinite volume
b. Definite shape, definite volume
c. Found in stars
d. Definite volume, indefinite shape

v. Neutrons have _____ .

a. no electric charge b. positive charges
c. negative charges d. particles

vi. Electrons have_____ .

a. no charges b. positive charges

c. negative charges d. fast charges

vii. Carbon has a mass number of 12. Thus, it has _____ protons and_____ neutrons.

a. 6, 6 b. 12, 12

c. 6, 12 d. 12, 6

viii. Matter is made up of _____ .

a. atoms b. cells

c. phospholipids d. sulfides

ix. How many protons are in Beryllium ?

a. 4 b. 9

c. 5 d. 2

x. What is the mass contained in unit volume?

a. Pressure b. density

c. weight d. relative density

xi. Which is not a sub-atomic particle?

a. shell b. electron

c. proton d. neutron

xii. Which contains some types of atoms?

a. element b. compound

c. substance d. shell

xiii. Which an example of chemical change?

a. bending an iron rod b. melting of polythene

c. photosynthesis in leaves d. dissolving salt in water

xiv. Which one of the following positively charged particle?

a. electron b. neutron

c. proton d. Anion

B. Match

Name of Atom	Symbol	Atomic Number
Potassium	**S**	**4**
Beryllium	**B**	**13**
Boron	**Si**	**19**
Sulphur	**Be**	**16**

Silicon	**K**	**5**
	P	**14**
	C	**18**

C. Answer the following questions :

i. Which of the following has/have mass ?

Air, Water, Sound, Light,Wood, X-Ray

ii. Which of the following has/have matter(s)?

Copper, Sound, Plastic,Air, Water, Light, Ultraviolet rays,Heat from the fire.

iii. Complete the subatomic particlles table below and answer the questions that follow:

Particle	Relative mass	Relative charge	Location	Symbol
Proton	1		Nucleus	
Neutron		Nill/0		
Electron		-1		e

a. Explain why particles have no overall charge

_____

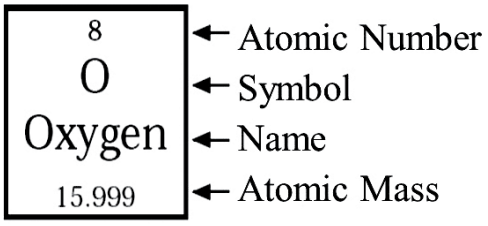
b. How can particles from positive ions?

_____

c. Hwy would atoms of the same element have different masses?

_____

iii. Complete the sentences in right hand side .



atomic number equals the number of _____ or _____

Atomic mass equals the number of _____ + _____

iv. Which of these are compounds? (Y/N)

1	O_3	7	H_2SO_4	13	CO_3
2	H_2O	8	N_2	14	NHO_3
3	NH_3	9	Fe_2O_2	15	C
4	H_3	10	Ne	16	SO_3
5	$C_6H_{12}O_6$	11	CH_4	17	NaCl
6	SO_4	12	S_2	18	$SuSO_4$

v. The information below is from part of the Periodic Table of Element. Use this information to answer the question that follow.

IA							VIII
1 H 1	IIA	IIIB	IVB	VB	VIB	VIIB	2 He 4
3 Li 7	4 Be 9	5 B 11	6 C 12	7 N 14	8 O 16	9 F 19	10 Ne 20
11 Na 23	12 Mg 24	13 Al 27	14 Si 28	15 P 31	16 S 32	17 Cl 35	18 Ar 40

a. How many protons, neutrons and electrons are in each of the following atoms?

Lithium (Li)	Magnesium (Mg)	Carbon (C)	Oxygen (O)	Chlorine (Cl)
P = _____	P = _____	P = _____	P = _____	P = _____
n = _____	n = _____	n = _____	n = _____	n = _____
e = _____	e = _____	e = _____	e = _____	e = _____

vi. Identify the following as physical (*P*) or chemical (*C*) changes.

a. NaCl (table Salt) dissolves in water. _____

b. Ag (Silver) tarnishes. _____

c. An apple is cut. _____

d. Heat changes H_2O to steam. _____

e. Baking soda reacts to vinegar. _____

f. Fe (Iron) rusts. _____

g. Alcohol evaporates. _____

h. Ice melts. _____

i. Milk sours. _____

j. Sugar dissolves in water. _____

k. Wood burn. _____

l. Pancakes cook. _____

m. Grass grows. _____

n. A tire is inflated. _____

o. Food is digested. _____

p. Paper towel absorbs water. _____

vii. Can you recognize the chemical and physical changes that happen all around us? If you change the way something looks, but haven't made a new substance, a Physical change (P) has occured. If the substance has been changes into another substance, a chemical change (C) has occured.

1.		An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
2.		Two chemical are mixed together and a gas is produce.
3.		A bycycle changes color as it rusts.
4.		A solid is crushed to apowder.
5.		Two substances are mixed and light is produced.
6.		A piece of ice melts and reacts with sodium.
7.		Mixing salt and pepper.
8.		Chocolate syrp is dissolved in milk.
9.		A marshmallow is toasted over a campfire.
10.		A marshmallow is cut in half.

viii. **Classify each of the following observations as a physical or a chemical change:**

(a) Freezing water in a refrigerator makes cubes of ice.

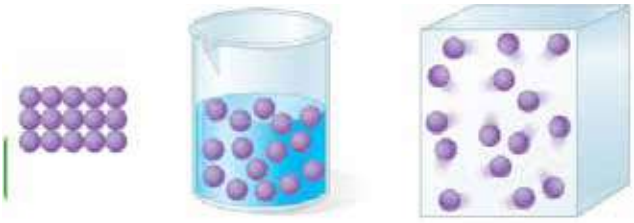
(b) Adding silver nitrate to tap water gives a cloudy solution.

(c) Burning sulfur gives a light blue flame.

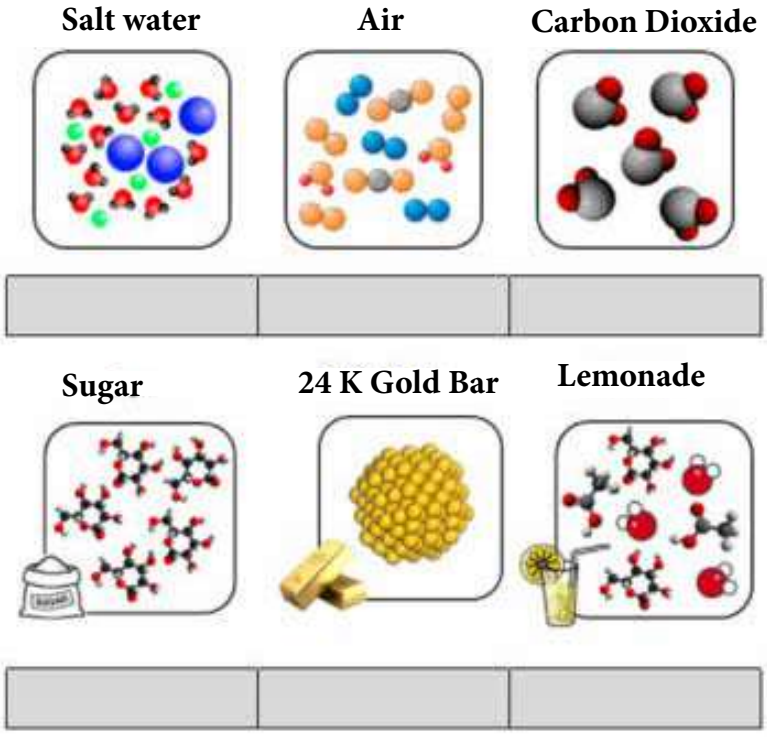
(d) Grinding aspirin tablets produces a powder.

D. Diagrammatic questions

i. Identify the physical state (solid, liquid, gas) that corresponds to each of the following pictorial representations:



ii. Classifying matter as pure substance or mixture



iii. Calculate

a. You have a mineral with a volume of 15 cm3 and mass of 45g. What is its density?

D= $\frac{45g}{15cm^3}$ Its density is _____ g/cm^3

b. You have a different mineral with a volume of 15cm3 and mass of 75g. What is its density?

D= $\frac{___g}{___cm^3}$ Its density is _____ g/cm^3

c. In the above two examples:

Which mineral is more dense?

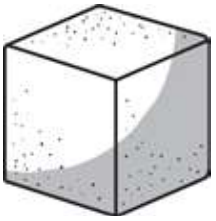
The _____ mineral is more dense than the _____ one.

d. What is the density of a cube of sugar weighing 12.8gms. measuring 2 cm on a side?

Mass = ____ g

volume = _____ ×_____= _____ cm^3

D= $\frac{___g}{___cm^3}$ Its density is _____ g/cm^3



e. A brick of Himalayan salt measure 20cm×10cm×4 cm and weight 1kg and 600g. What is its density?

Mass = ____ g

volume = _____ ×_____= _____ cm^3

D= $\frac{___g}{___cm^3}$ Its density is _____ g/cm^3

g. A brick of lead measures the same and weights 9 kg and 120g. What is its density?

Mass = ____ g

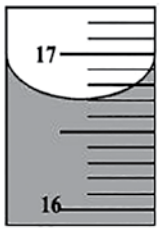
volume = _____ ×_____= _____ cm^3

D= $\frac{___g}{___cm^3}$ Its density is _____ g/cm^3

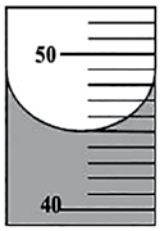
i. **Two liquids, A and B, have densities 0.75 g/cc and 1.14 g/cc respectively. When both liquids are poured into a container, one liquid floats on top of the other. Which liquid is on top?**

Solution: Liquid _____ floots on top of liquid _____

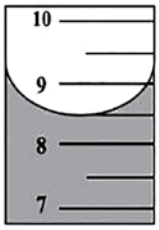
iv. **Read the volumes on the graduated cylinders below :**



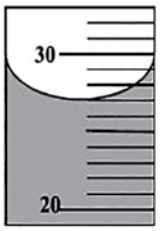
A volume of _____ mL



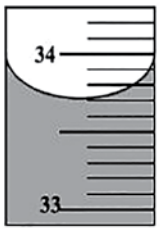
A volume of _____ mL



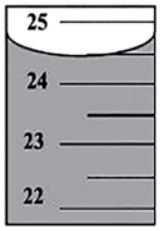
A volume of _____ mL



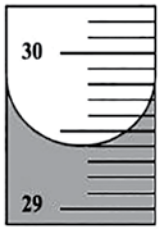
A volume of _____ mL



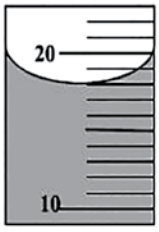
A volume of _____ mL



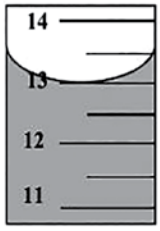
A volume of _____ mL



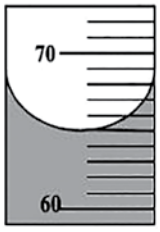
A volume of _____ mL



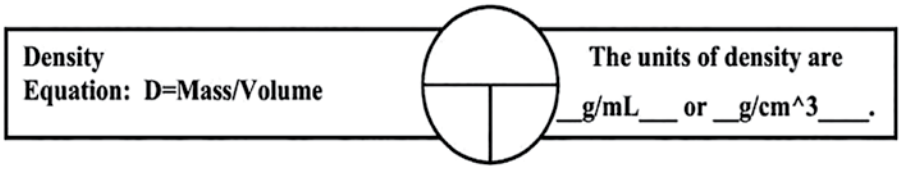
A volume of _____ mL



A volume of _____ mL



A volume of _____ mL

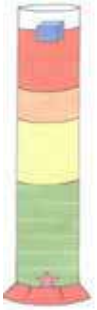


a. What is the density of a liquid at 25^0C that has a mass of 4.5 grams and a volume of 12.0 milliliters ?

b. A student is doing a lab over the rock cycle and he has been given a rock sample to analyze. He is told that the density of the rock is 4.5g/cm^3 and determines that the volume of the rock is 8cm^3. Based on this information, calculate the mass of the rock sample.

c. What is the density of marble that has a mass of 4.3g and a volume of 2.7 cm^3?

v. The following list contains information for four liquids and two solid objects. Complete the table below .

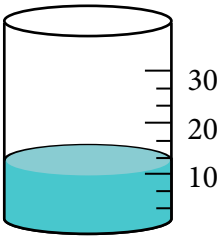


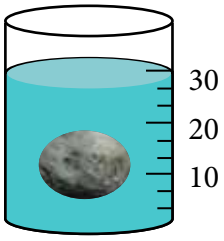
- a yellow liquid with a mass of 2.8g. and a volume of 2 ml.
- a green liquid with a mass of 6g and a volume of 3ml
- a red liquid with a mass of 1.8 g and a volume of 2ml
- a orange liquid with a mass of 1.3g and a volume of 1ml
- a blue cube liquid with a mass of .8g and a volume of 2 cm^3
- a pink star with a mass of 2.4g and a volume of .8 cm^3

Object	Mass (g)	Volume (ml or cm^3	Density (g/ml or $g/cm^{3)}$
yellow liquid	2.8	2	.....
green liquid	6	3	.....
red liquid	1.8	2	.....
orange liquid	1.3	1	.....
blue cube	0.8	2	.....
pink star	2.4	0.8	.....

a. Which liquid is the most dense ?
b. Which liquid is the least dense ?
c. Which object will settle to the bottom ?

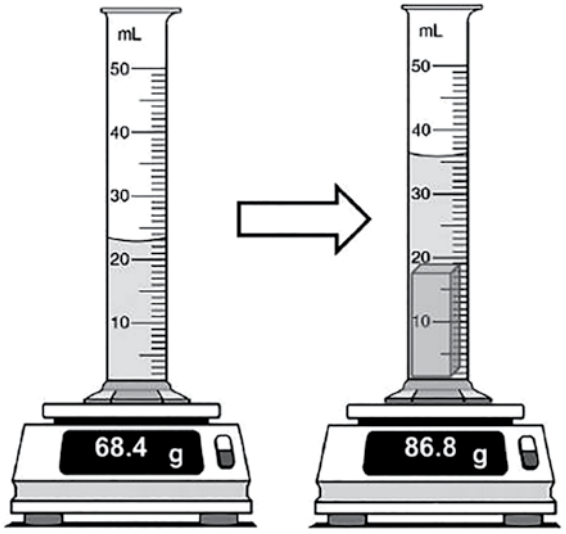
vi.





a. What is the mass of the following object? And the volume? Calculate the density?
b. After calculating the density of the stone, will it sink or float in the water?
c. One rock has got a mass of 30 g and occupies a space of 50 ml. Can you calculate its density? will this rock sink of float in the water?

vii. A Student uses a rubber stopper to close off the end of a test tube. What is the densityof this rubber stopper if it has a mass of 3.4g and a volume of 6.1cm3.

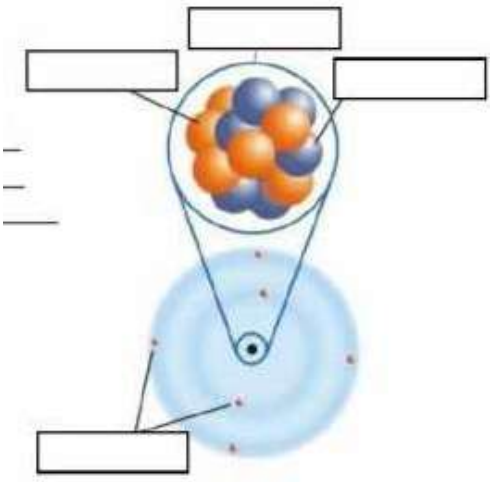


Density Experiment with a Magnetic Steel Alloy	
Mass of weighing bottle (g):	22.35
Mass of Weighing bottle + alloy (g):	161.02
Mass of ally (g)	_____
Volume of water in graduated cylinder (mL):	40.3
Volume of water in graduated cylinder after alloy submerged (mL):	60.4
Volume of alloy (mL):	_____
Density of allyo (g/mL):	_____

a. Use the information in the data table above to fill in the missing blanks.

b. The figure shows the lab setup used to determine the density of a solid object before and after the object was submerged. According to the figure, what is the density of the object.
Density = _____

viii. Label the diagram



a. Which one of them has positive charge?

b. Which one of them has negative charge?

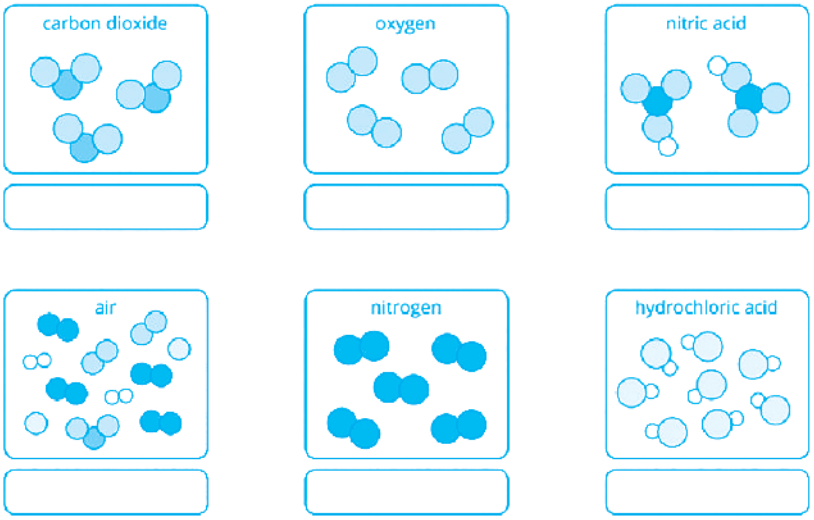
c. Which one of them does not have any charge?

d. Which of them are found in nucleus?

e. Which particle moves around the orbit oa an atom?

f. What determines the properties of the matter?

ix. State whether each substance given below is an element, a compound or a mixture.



Unit 10 Materials used in Daily Life

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- mention the physical properties of acids, bases, and salts.
- introduce the indicator and use it to separate the acid, base, and salts.
- make an indicator using local materials
- mention the physical properties and utilities of aluminum, zinc, silver, iron, copper, and gold.
- mention the physical properties and uses of sulfur and iodine.

The picture below shows various objects.

Fig. 10.1

The picture below shows some of the materials used in daily life. How can these materials be classified? Make a list of the materials you use in your daily life and separate them into acid and base.

We use different types of substances in our daily life. We use water for many purpose. We use soap and detergent for cleaning. We use salt for cooking. We use vinegar in pickle. We use baking soda to make bread and cakes. These substances have different properties. Some of them are soft and some are hard. Some of them conduct heat and electricity while some does not. They exist in different form. They have different tastes. Some of them are sour. Some bitter. Some salty and some are tasteless. The substances can be divided into different classes on the basis of their nature.

10.1 Acid, Base and Salt

The substances used in our daily life have some common characteristics. For example curd, lemon, pickle, raw fruits like oranges, guava, gooseberry all taste sour. Why do they taste sour? They all contain acid. Acid have sour taste.

Fig. 10.2

Acid

Acids are sour tasting substances. They can be obtained from animal and plant products. Some acid can be prepared in lab using minerals. The table below shows the sources of organic acid.

Source	Acid Present
Apple	Malic acid
Lemon	Citric acid
grape	Tartaric acid
Tomato	Oxalic acid
Vinegar	Acetic acid
Curd	Lactic acid
Orange	Ascorbic acid
Tea	Tannic acid
Stomach juice	Hydrochloric acid
Ant, Bee	Formic v acid

Table 10.1

The acid obtained from minerals are inorganic acid. They are used in industries. For example: hydrochloric acid, sulphuric acid, nitric acid, etc.

Properties of Acid

i. They are sour in taste.
ii. They dissolve in water to produce hydrogen ion.
iii. They react with metals.
iv. They turn blue litmus paper into red and methyl orange into red.

Uses of Acid

i. Acetic acid is used in pickles.
ii. Carbonic acid is used to make soda water.
iii. Sulphuric acid is used to make detergent.
iv. Hydrochloric acid is used for bleaching purpose in textile industries.
v. Nitric acid is used to manufacture plastic, explosives and fertilizers.

Base

Bases are slippery and bitter tasting substances. Bases are found in materials like soap, dish washing, ashes, bitter gourd, drain cleaner, toothpaste, etc. The examples of bases are calcium hydroxide, calcium oxide, sodium hydride, sodium oxide, etc.

Properties of Bases

i. They are bitter in taste.
ii. They are slippery in touch.
iii. Strong bases are corrosive.
iv. They change red litmus paper into blue, phenolphthalein into pink and methyl orange into yellow.

Uses

i. They are used to make soap and paper.
ii. They are used in alkaline battery.
iii. Magnesium hydroxide (milk of magnesia) is used to remove acidity in stomach.
iv. Caustic soda is used in to unblock drainage.

Salt

Salt is substance formed by reaction between acid and base. Some salt are salty whereas others are bitters or tasteless. They are mostly soluble in water.

For example: common salt, black salt, copper sulphate, ammonium chloride etc.

Properties of Salt

i. Salts may be salty, bitter or tasteless.
ii. Most of the salts are soluble in water. Some of them are insoluble in water.
iii. Some of them are colourful whereas some of them are colourless.
iv. Salt solution conduct electricity.

Uses

i. Common salt is used in cooking. It is also used to preserve food.
ii. Copper sulphate is used as insecticides
iii. Calcium sulphate is used for plastering bandages.
iv. Urea, ammonium chloride, potassium chloride etc are used as fertilizers.

Indicator

An indicator is a chemical substance which is used to identify whether a given substance is acidic or basic in nature. Litmus paper, methyl orange and phenolphthalein are the examples of indicators. Indicators are made from petals of flowers, lichens etc. Litmus

Fig. 10.3

paper is a commonly used indicator. Indicators indicate whether the substance is acidic, basic or neutral by changing their colours.

Indicator	Acid	Base	Salt
Red Litmus	Red	Blue	Neutral
Blue Litmus	Red	Blue	Neutral
Methyl orange	Red	Yellow	Neutral
Phenolphthalein	Colorless	Pink	Neutral

Table 10.2

The pH scale with examples

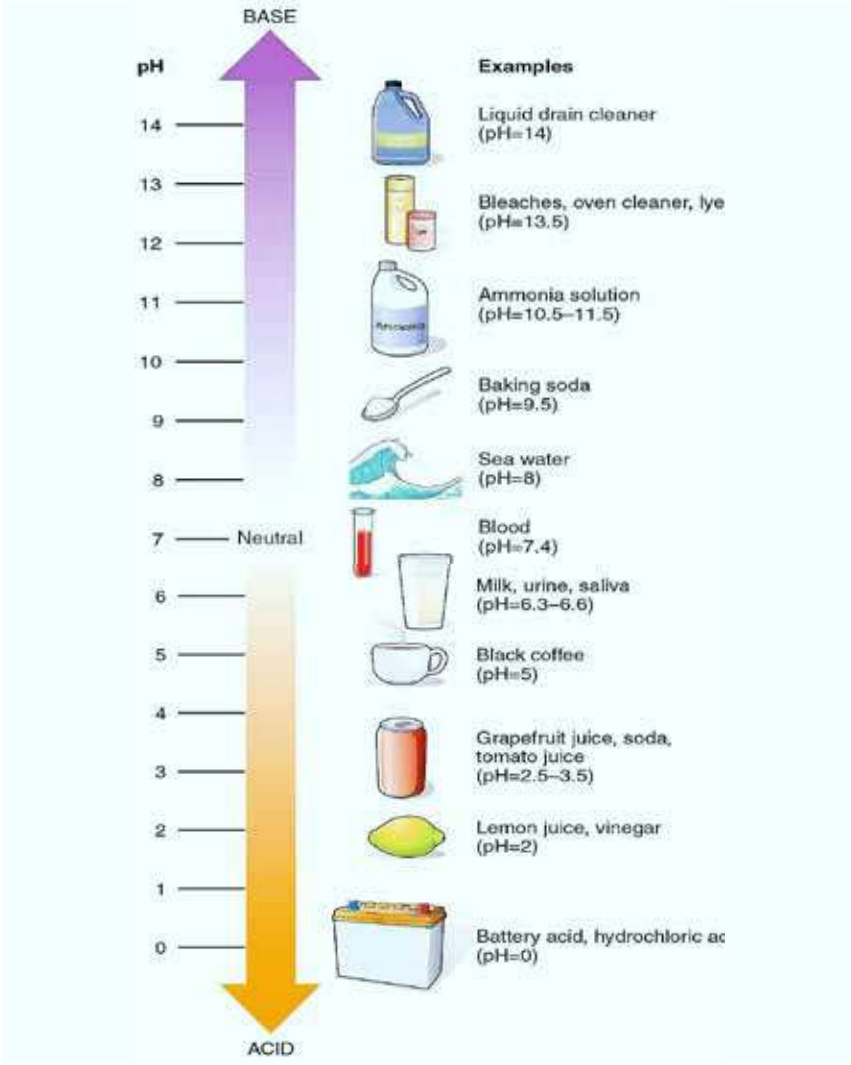


Fig. 10.4

Activity 10.1

Take a pinch of turmeric. Apply it in a piece of white cloth. Now rub a wet soap tar on it. Do you see the change in colour.

Activity 10.2

To demonstrate the action of different indicators.

Materials Required

Three hard glass test tubes, dilute sulphuric acid, sodium hydroxide, sodium chloride, indicators (eg.: litmus paper, methyl orange, phenolphthalein) etc.

Procedures

i. Take 2ml of dilute H_2SO_4, NaOH, and NaCl solution in separate three test tubes.
ii. Put one drop of methyl orange solution to each of the three test tubes.
iii. Observe the solution in each test tube.
iv. Now, repeat the same activity by using phenolphthalein, blue litmus and red litmus as an indicator one after another instead of methyl orange.

Observation

We will observe that light yellow methyl orange turns to red in dilute sulphuric acid and in NaOH solution, its colour changes to yellow. However, its colour remains the same in NaCl solution.

Indicators	Acidic Solution	Basic Solution	Salt Solution
Blue litmus paper	Turns to red colour.	No change in colour.	No change in colour.
Red litmus paper	No change in colour.	Turns to blue colour.	No change in colour.
Methyl orange	Turns to red colour.	Turns to yellow colour.	No change in colour.
Phenolphthalein	Colourless.	Turns to pink colour	No change in colour.
Purple cabbage juice	Turns to red colour.	Turns to green colour.	Turns to purple colour.

Conclusion

Chemical substances can be classified into acid, base and salt depending upon the change in colour when indicators are dipped into respective solutions.

Activity 10.3

A pH scale is used to measure how acidic or basic something is. An indicator is a special type of substance that is used to tell us if the item is more acidic or more basic. Litmus and turmeric are examples of natural indicators. Red cabbage is also a great natural indicator and will be used in this experiment.

Materials :

Red cabbage Eye dropper Test tubes (or clear glasses) Common household products

Procedure

i. Slice some red cabbage, put it in a pot with water and let simmer for about 30 minutes or so.

ii. Strain the cabbage, reserving the liquid to divide in to test tubes or glasses.

iii. Gather some household products you would like to test (bleach, cola, orange juice, pickle juice, salt, shampoo, tomato sauce, milk of magnesia, window cleaner)

iv. Create a visual baseline: fill three test tubes or glasses ¼ full with cabbage indicator. In the first one, mix in one dropper full of vinegar(a known acid)and watch the color turn red. Leave the second one as a straight cabbage indicator. In the third one add a dropper full of laundry detergent(a known base) and the color will turn green.

v. Add a dropper full of substances you have chosen to remaining glasses of cabbage indicator and see what happens.

Questions

a. What do you notice about the acids and bases?

b. Do they have anything in common?

c. What occurred during the experiment and why did it happen?

d. Can you turn an acid or a base into a neutral? How?

e. What effects would acids and bases have on teeth?

Sources of Acid

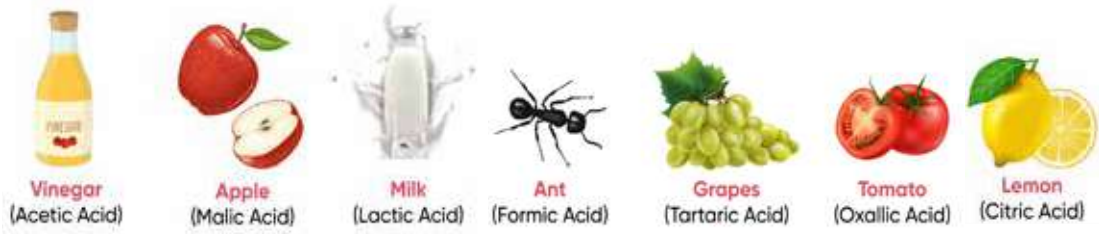


Fig. 10.5

Sources of Base

Fig. 10.6

Universal indicator and Ordinary indicator

Indicators can identify the basic or acidic nature of chemical substance. They are unable to measure their strength. A universal indicator is used to determine the strength of acid and base.

Universal indicator is a mixture of different ordinary indicators which is used to measure the strength of acidity or basicity. The colour of universal indicator is compared with pH table or pH chart and strength is determined.

Distinction between Ordinary Indicators and Universal Indicators

SN	Ordinary indicators	Universal Indicators
i.	Ordinary indicators help to identify only whether the given chemical substance is acid, base or salt.	Universal indicators are used to identify the given chemicals whether they are acid,base or salt and their strengths as well.
ii.	They are derived from parts of plants such as petals of flowers and lichens.	They are derived by mixing different types of ordinary indicators.

Activity 1

To prepare our own indicators

Materials Required

Rose petals (coloured whorls), some sand, mortar and pestle, acid, test tube, alcohol, filter paper etc.

Procedures

i. Take coloured rose petals with little amount of sand in a mortar and crush them with the help of pestle.
ii. Mix alcohol to dissolve plant pigment.
iii. Then, filter the mixture and soak the pigment in the strip of filter paper.
iv. Test acid and base by using the paper strips as litmus paper. Now your own indicator is ready.

Observation

Observe the test in different chemicals write what you have observed and draw conclusion.

Points to Remember

- Acids are sour tasting substances. They can be obtained from animal and plant products.
- Bases are slippery and bitter tasting substances. Bases are found in materials like soap, dish washing, ashes, bitter gourd, drain cleaner, toothpaste, etc.
- Salt is substance formed by reaction between acid and base. Some salt are salty whereas others are bitters or tasteless. They are mostly soluble in water.
- An indicator is a chemical substance which is used to identify whether a given substance is acidic or basic in nature. Litmus paper, methyl orange and phenolphthalein are the examples of indicators.

Exercise

1. Tick the correct options

a. Which acid is found in curd?

i. tartaric ii. lactic

iii. citric iv. formic

b. What is the colour of phenolphthalein in base?

i. pink ii. red

iii. colourless iv. yellow

c. Which of the following contains base?

i. lemon juice ii. vinegar

iii. soap iv. grapes

d. Which of the following is salt?

i. litmus ii. sodium chloride

iii. phenalphthalein iv. sodium hydroxide

e. Which of the following is property of acid?

i. sour taste ii. bitter taste

iii. slippery iv. neutral substance

B. Fill in the blanks :

Bases, Acids, Bitter, Bases, Spinach, Indicators, Formic acid, Neutral,Acetic acid, Curd, Neutral,

i. _____ fe Sour in taste.

ii. Bases are_____ in taste.

iii. _____are soapy to touch.

iv. _____are used to determine if a solution is acid or base.

v. Ant bite contains_____

vi. Vinegar contains_____

vii. Lactic acid is present in_____

viii. Solution which does not change colour in presence of any indicator is considered to be_____

ix. Oxalic acid is present in_____

x. Phenolphthalein turns pink in_____

C. Write "T" for true "F" for false statements.

i. Acids are bitter in taste.

ii. Bases are sour in taste.

iii. Acid turns blue litmus red.

iv. Tooth decay is caused by the presence of a base.

v. Indicator is a substance which shows different colour with acids & bases.

vi. The reaction between hydrochloric acid & sodium hydroxide will form salt & water.

D. Match the following words.

(a) Vinegar	i. Sodium hydroxide
(b) Fruits (orange)	ii. Ammonium hydroxide
(c) Curd	iii. Citric acid
(d) Lime water	iv. Calcium hydroxide
(e) Window cleaner	v. Lactic acid
(f) Soap	vi. Acetic acid

E. Give the reason for the following statements.

i. Great care should be taken while handling laboratory acids and bases.

ii. Solid powder of baking soda does not turn dry litmus paper to blue in color.

iii. It burns when touched by the stinging nettle.

iv. Adding litmus paper to the salt solution does not change the color.

v. Lemons and oranges taste sour.

vi. Curd and sour substance should not be stored in metal containers.

vii. An antacid tablet is taken when you suffer from acidity.

viii. lemon is sour in taste

ix. The colour of litmus paper does not change in salt solution

x. Tumeric change into red when mixed with soap

F. Answer the following questions:

a. What is acid?

b. What is base?

c. What is salt?

d. What is indicator?

e. Write any three uses of acid.

f. Write the properties of base.

g. Make a list of acid used in daily life. Mention their sources.

i. Why does milk get sour on keeping it for some time ? What substances are added by the milkman to keep it fresh ?

G. Identify the following properties as: acid, base or both.

_____ 1. It turns litmus paper to blue.

_____ 2. It tastes sour.

_____ 3. Can be dissolved in water.

_____ 4. It feels slippery

_____ 5. It is usually found in citric juices and other food.

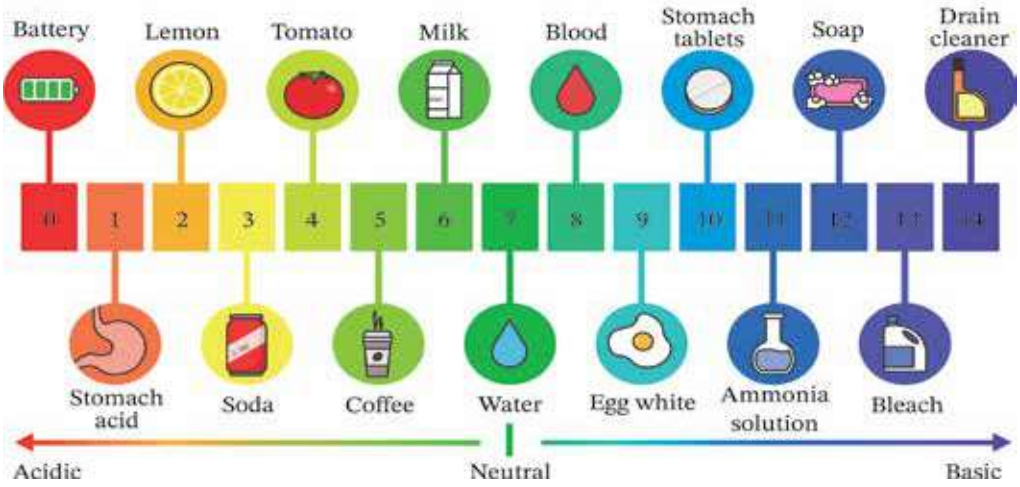
_____ 6. It tastes bitter.

_____ 7. Conduct electricity.

_____ 8. It turns litmus paper to red.

H. Diagrammatic questions

i. Look at the pH Scale below. Then answer the following question.



_____ a. What number is neutral?

_____ b. In the pH scale, where does coffee falls to?

ii. Use the pH Scale on the left to answer the questions below. Check the box in front of the correct answer.

a. Which is more acidic, tomato or a banana?

b. Which is more acidic, lemon or milk?

c. Which is more acidic, apple or vinegar?

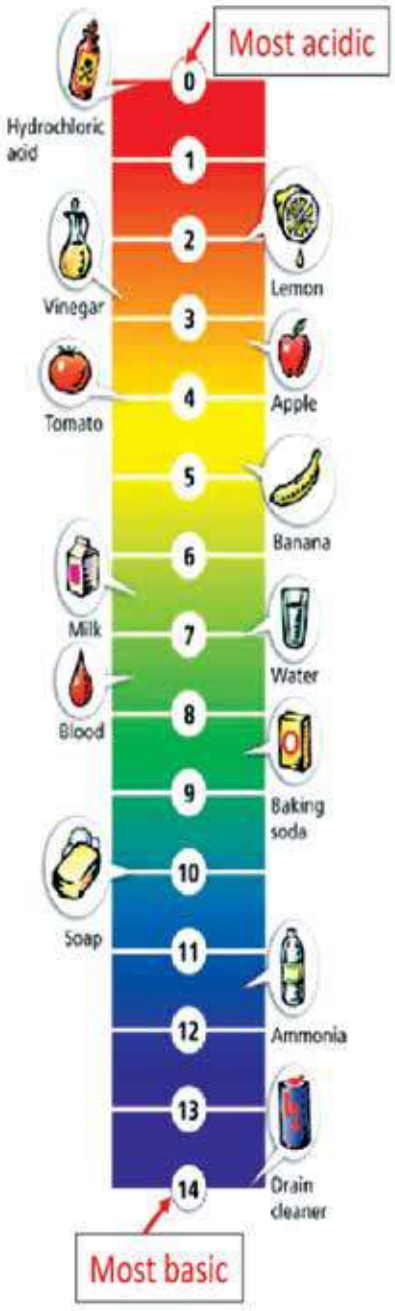
d. Which is more basic, water or baking soda?

e. Which is more basic, soap or baking soda?

f. Which is more basic, soap or water?

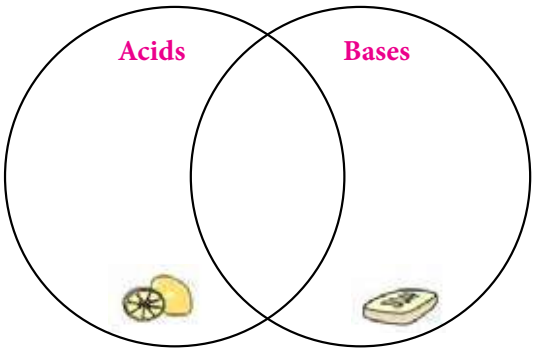
g. Which is more basic, baking soda or ammonia?

i. Which is more basic, drain cleaner or ammonia?



iii. **Color the boxes below that describe the properties of Acids- Red.**
Color the boxes that describe the properties of Base -blue .
Out the boxes and sort them on the venn diagram given below .

Sour taste	Not reactive with metals	Shampoo
H_3O+ ions	Conducts electricity	Drain cleaner
Fruits & Juices	Cleaning products	Vinegar
Feels Slippery	pH less than 7	Soap
Corrosive	pH greater than 7	Baking Soda
OH- ions	Blue litmus paper turns red	Soda
Bitter	Red litmus paper turns blue	Lemon
Reactive with metals (to produce Hydrogen gas)	Reacts with carbonates (to produce OO2 gas)	Ammonia (window) cleaner



iv. **Based on your observation, identify the following substances :Acid-base-Neutral**

Indicator				
Litmus paper				
phenolphthalein				
pH scale				

v. **Roshan used various indicators(phenolphthalein,litmus paper, methyl orange and universal indicator) to determine whether the following unknown substances are acid or base . Fill in the boxes to state whether the unknown substances is Acid or Alkali when tested with various indicators.**

a.

b.

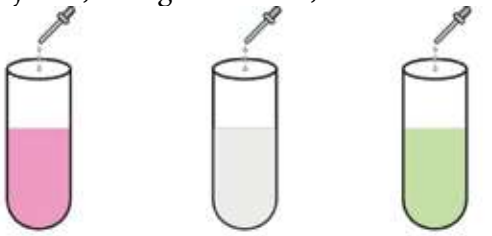
c.

d.

i. ____ ii. ____

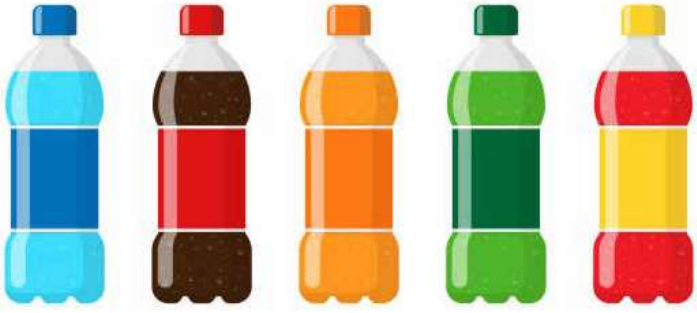
vi. The following figure shows the colour changes in test tubes I,II, and III when china rose indicator is added to them .The respective solutions in test tubes I, II and III are: (Give your reason, too.)

a. I:Sugar solution;II: Lime water;III:Lime juice
b. I:Sugar solution;II: Lime water;III:Lime water
c. I:Lime water;II: Sugar solution;III:Lime juice
d. I:Lime juice ;II: Sugar solution;III:Lime water



I (Magenta) II (No clour change) III (Green)

vii. Sushant has few bottles of soft drink in his restaurant. Unfortunately, these are not labelled .One customer wants acidic drink, another wants basic and third one wants neutral drink. How will Sushant decide which drink is to be served to whom ?



10.2 Metals and Non-metals

Discuss by looking at the picture below. Separate the metals and non-metals in it. Make a list of metals and non-metals used in your home.

Fig. 10.2.1

There are many substances around us. These substances may be pure or impure. Man has been looking for their own use. These substances show their own properties and are divided into metals and non-metals. The elements whose atom looses electrons to form positively charged ions are called metals.

The elements whose atom accepts electrons to form negatively charged ions are called non- metals.

Metal

The substances which are usually hard, lustrous, malleable, ductile and good conductors of heat and electricity are known as metals. Iron, copper, silver, gold, etc. are some of the common metals. The natural substances in which the metals or their compounds occur in the earth are called minerals. The minerals from which the metals can be conveniently and economically extracted are known as ores. All the ores are minerals but all minerals are not ores. The process of obtaining a pure metal from one of its ores is known as metallurgy.

Properties

- A metal is a good conductor of heat and electricity.
- It is opaque but a good reflector of light when polished.
- It can be beaten into sheets and can be drawn into wires.
- It produces a sonorous sound when struck.
- Metals have high density and are usually very heavy. Iridium and osmium have the highest densities whereas lithium has the lowest density.
- Metals have high melting and boiling points. Tungsten has the highest melting point. Sodium, potassium, barium, lead, tin, etc. have low melting points.

Activity 10.2.1

To show the properties of metals we can study the following activities.

Materials required : a circuit board, some copper wire, some aluminium wire, iron wire, a hammer etc.

Procedure

i. Make circuit board.
ii. Use A and B nails for the gap in the circuit.
iii. Connect these two points using naked copper, aluminium and iron one by one.
iv. Now, repeat the activity (i) using rubber band, thread, dry straw, wood, etc.
v. Then beat the wires end using a hammer.
vi. Heat an end of the wire catching the other end by hand.
vii. Beat and heat the rubber band, thread, dry straw and wood, as well.

Observation

By the connection of copper, aluminium and wire, the bulb glows. The wires can be beaten flat and when one end of metal wire is heated, other end also get heated. But, these properties are absent in rubber band, thread, dry straw and wood.

Conclusion

Therefore, metals like copper, iron, aluminium are ductile, malleable and good conductor of heat and electricity.

Aluminium (Al)

Aluminium was first isolated by Wholer in the year 1827 AD. It is the third most abundant element in the earth's crust. It is a bluish white metal with a bright lustre.

Physical properties of Aluminium

i. It is a light metal with silver colour.
ii. Its specific gravity is 2.7.
iii. It is good conductor of heat and electricity.
iv. It is malleable and ductile.
v. It melts at 660°C and boils at 1800°C.

Fig. 10.2.2

Uses of Aluminium

i. It is used to make utensils, pipes, window frames and electric wires.
ii. It is used to make coins.
iii. Since it is lighter metal, it is used to make body parts of vehicles, aeroplanes and ships.
iv. It is used to make alloy.
v. It is used for making aluminium paints for protection of iron and zinc.
vi Aluminium foil is used to wrap food, chocolates, cigarettes, medicines etc.

Copper (Cu)

Copper has been known since pre-historic times. It's latin name is cuprum, which has been derived from the island of cyprus.

Physical properties of copper

i. It is reddish brown metal.
ii. It is highly malleable and ductile.
iii. It is very good conductor of heat and electricity.
iv. Its specific gravity is 8.95.
v. It melts at 1080°C and boils at 2350°C.

Fig. 10.2.3

Uses of copper

i. It is used to make electric wire.
ii. It is used to make coins, medal and jewellery.
iii. It is used to make utensils.
iv. It is used to making alloys like bronze and brass.
v. It is used in electroplating.
vi It is used to make pesticides and insecticides.

Iron (Fe)

Iron is lustrous, ductile, malleable, and silver-grey in colour. It is the tenth most abundant element in the universe. It is found in large quantities in molten form at the Earth's core. The element iron (Fe), for example, can be made into a nail. Even if you cut an iron nail in half, it still contains the element iron. If you continue to cut the nail until it is so small that you can barely see it, you are still going to be holding the element of iron.

Physical Properties of Iron

i. It rusts in damp air, but not in the dry air.
ii. It dissolves readily in dilute acids.
iv. At room temperature, this metal is in the form of ferrite or α-form.
v. At 910°C, it changes to γ-iron, which is much softer in nature.
vi. It melts at 1536°C and boils at 2861°C.
vii. Iron/It is magnetic in nature.

Fig. 10.2.4

Uses of iron

i. It is used to manufacture steel and also used in civil engineering like reinforced concrete, girders etc.
ii. Iron is used to make alloy steels like carbon steels with additives such as nickel, chromium, vanadium, tungsten, and manganese.
iii. These are used to make bridges, electricity pylons, bicycle chains, cutting tools and rifle barrels.
iv. Cast iron contains 3–5% carbon. It is used for pipes, valves, and pumps.
v. Magnets can be made of this metal and its alloys and compounds.

Silver (Ag)

Silver is known as a coinage metal. It has been known to mankind since ancient time. The symbol Ag for silver is derived from the Latin word Argentum. It is a soft lustrous white metal.

Physical properties of silver

i. Silver is a white coloured lustrous metal.
ii. It is very good conductor of heat and electricity.
iii. It is malleable and ductile.
iv. It melts at 960°C and boils at 1955°C.
v. Its specific gravity is 10.52.

Fig. 10.2.5

Uses of silver

i. It is used to make coins, medals, jewellery, utensils etc.
ii. It is used in medicines and silver plating.
iii. It is used for filling teeth.
iv. Silver salts are used in photography and silvering mirrors.

Gold (Au)

Gold is known as coinage metal and mankind has known it since ancient time. The symbol Au for gold is derived from the Latin word Aurum.

Physical properties of gold

i. Gold is yellow coloured lustrous metal.
ii. It is a very good conductor of heat and electricity.
iii. It is an inert metal.
iv. Its specific gravity is 19.3.
v. It melts at 1063°C and boils at 2610°C.
vi It is extremely malleable and ductile.

Fig. 10.2.6

Uses of gold

i. It is used to make coins, medals and jewellery.
ii. It is used in gold plating (electro plating).

iii. It is used to make gold-leaf electroscope.
iv. It is used to make alloys.
v. Compounds of gold are used in photography and medicines.
vi It is used to make crown and bridge as false teeth.

Zinc (Zn)

It is a light bluish metal. It found in free state and combined state in nature. It is extracted from ore zinc blende.

Physical Properties

i. It is a good conductor of heat and electricity
ii. It is affected by water.
iii. It gets rusted.
iv. It melts at low temperature

Fig. 10.2.7

Uses

i. It is used in manufacturing hydrogen.
ii. It is used to make alloy like brass and bronze.
iii. It is used to make cover of dry cell.
iv. It is used for roofing.

Non-metal

The substance which are brittle, non - lustrous, non- malleable, non-ductile and poor conductor of heat and electricity are known as non - metals. Nitrogen, sulphur, phosphorus, carbon, oxygen, etc. are some non-metals. Non-metals make-up most of the earth i.e. crust, atmosphere and ocean. Non-metallic minerals are rock, salt, quartz, limestone, mica and chalk.

Properties of Non-metal

- Most of the non-metals exist as solids or gases at room temperature.
- Bromine is the only non - metal that exists as liquid at room temperature.
- Non-metals have no luster, and do not reflect light (except graphite).
- Non - metals are brittle, and do not show the properties of malleability and ductility.
- They are generally soft but diamond is the hardest one.
- They are poor conductors of heat and electricity. However, graphite is a good conductor of both heat and electricity.
- They usually have low densities.
- They are sonorous and do not produce a ringing sound when struck.

Uses of Non-metal

Non-metals are also very useful to us. They are used for different purposes some of the major uses of non metals are mentioned below.

i. Non metal such as nitrogen is very important for the growth of plants.

ii. Compounds of non-metals are very important for making different types of medicines.

iii. Non-metals such as carbon is used to make alloys (e.g. steel and stainless steel).

iv. They are used in the manufacture companies of pesticides.

v. Non-metal such as chlorine is used in the purification of water.

vi. Oxygen is one of most important non-metals which is very important during respiration.

vii. Diamond (the purest form of non metal, carbon) is very precious gems used in making jewellery.

viii. Sulphur is used to make firecrackers, matches, and other explosives.

ix. Helium (He) is used to fill hot air balloons.

x. Non metals such as carbon (C), hydrogen (H), oxygen (O) etc. are very important components of organic compounds.

Some useful Non-metal

Sulphur

Sulphur is an odourless, tasteless, light, yellow and solid. It is a reactive element and under suitable circumstances combines with all other elements except gases, gold and platinum. It is insoluble in water. It burns with a blue flame oxidizing to sulphur dioxide. Sulphur occurs naturally near volcanoes. The main commercial use of sulphur as a reactant in the production of sulphuric acid (H_2SO_4). Sulphur is also used in making explosives such as gunpowder.

Uses of Sulphur

i. The main use of sulphur is in the preparation of SO_2 which is used in the manufacturing of sulphuric acid (H_2SO_4)

ii. Sulphur is used to manufacture medicines such as sulpha drugs and ointments for skin diseases.

iii. Sulphur is used in the manufacture of sodium thiosulphate, gun powder, matches, firecrackers and explosives.

iv. Sulphur is used in beauty parlours to give specific shapes to the hairs.

Fig. 10.2.8

v. Sulphur is used on vulcanization of rubber. Natural rubber is soft and sticky. Heating it with sulphur makes it hard, non sticky and more elastic. This process of heating natural rubber with sulphur is known as vulcanization.

vi. Sulphur is used as a fungicide and insecticide in agriculture.

vii. Sulphur is an important part of many enzymes.

Iodine

Iodine and its compound are primarily used in nutrition. It is the heaviest essential element utilized widely by life in biological functions. Iodine is required by higher animals, which is used to synthesize thyroid hormones which contain this element. Iodine under standard condition is a bluish black, solid. Its solubility in water can be increased by adding potassium iodide. Iodine melts at very low temperature of -113.7°C. In medicines, e.g. for the preparations of tincture of iodine (solution Iodine in alcohol water contain potassium iodine and iodex) Iodine (dissolved in petroleum jelly). Iodine is used for preventing goiter. Iodine is used in common salt, such salt is called iodized salt. It is also used in the manufacture of organic compound like dyes, drugs, photography, etc. If there is lack of iodine in our diet, thyroid gland increases in size causing disease which is known as goiter.

Uses of Iodine

i. A solution of iodine and potassium iodine (KI) in alcohol, generally known as tincture of iodine is used as an antiseptic used to kill germs on cuts and wounds.

ii. Iodine is needed in small quantity for the proper physical and mental growth of children.

iii. Iodine takes part in the release of thyroxine hormone by thyroid gland. Thyroxine controls metabolism and growth of our body.

iv. Iodine combined with cleaning agents is used in common sanitizer.

v. Iodized salt helps to prevent goitre.

vi. It is used to make photographic film.

vii. It is used to sterilize the drinking water.

Comparison between Metals, Non-metals and Metalloids

S.N.	Metals	Non metals	metalloids
1.	Metals are generally good conductor of heat and electricity.	They are generally bad conductor of heat and electricity.	They are semi - conductors.

2.	They are lustrous, ductile and malleable.	They are dull, brittle and non-ductile	They are generally brittle.
3.	They have high melting and boiling points.	They have low melting and boiling points.	They have moderate melting and boiling points.
4.	The are usually found in a solid state. (except : mercury).	They are found in all three states.	They are found in solid state.
5.	They generally have high density.	They have density in between metals and non-metals.	They often have low density.
e.g.	Gold, silver, copper etc. are the examples	Hydrogen, carbon, nitrogen, etc. are the examples	Boron, silicon, etc. are the examples

Activity 10.2.2

Study the various materials in your home or school and complete the given table. Divide those materials into two groups based on the properties of the items mentioned in the table.

Object	Hardness	Good reflector of light (shine)	Heat transmission	Drawn into wire	Produces a sonorous sound
Iron	Hard	shine not-shine	Transmission	Drawn into wire	Sonorous Sound
Wood	Soft	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

Activity 10.2.3

Collect samples of iron, copper and aluminium and note down the colour of each sample. Clean the surface of all the samples of the metals with sand paper and compare the appearance before and after cleaning the surfaces.

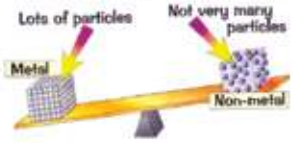
Activity 10.2.4

Properties of Metals and Non-metals

Characteristic	Definition	Metals	Non-metals
Appearance			
Density			
Strength			
Malleable			
Brittle			
Conductor			
Sonorous			
Ductile			

Dull Weak Shiny Strong High Yes Low No

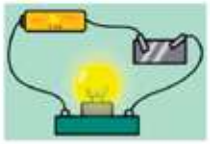
Dense – a material that contains a lot of particles in a small space.



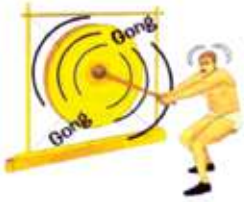
Brittle – a material that is delicate and easily broken.

Malleable – a material that can be bent or shaped.

Conductor – a substance that allows heat or energy to flow through it.



Sonorous – a substance that makes a sound when hit.



Ductile – materials that can be easily bent without breaking and drawn into wires.

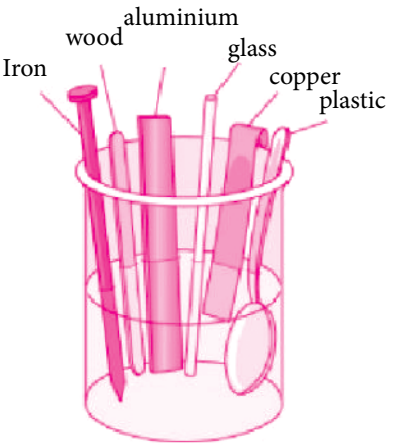
Activity 10.2.5

Investigate the properties of metals compared to substances that are not metals. Properties tested are conduction of heat, conduction of electricity and density(heaviness)

Materials :

Beaker, hot water tap, stop clock, rods of iron, copper, plastic, wood, glass and aliminium

A. Fill a beaker with hot water.
B. Put all the objects into the hot water and start the stop clock.
C. Feel the ends of each of the objects.
D. When you can start to feel the heat coming through, write down the time. Use the table below.
E. If you still can't feel the heat after 5 minutes stop the clock and write 'more than 5 minutes' in the table.
F. Put the materials in order, from the best conductor to the worst.



Recording your results

Meterial	Time to feel the heat (min:sec)	Order (1=first, 6= last)
Iron		
plastic		
glass		
wood		
copper		
aluminium		

Considering your results/conclusions

1. Three of the materials are metals and three are not. From the results of my experiments:
   a. _____ b._____ c._____
   d. _____ e. _____ f. _____
2. Are the metals good or bad conductors of heat?
3. Are the metals good or bad conductors of electricity?
4. Are the metals usually heavy or light?

Points to Remember

- The elements whose atom looses electrons to form positively charged ions are called metals.
- Non metal such as nitrogen is very important for the growth of plants.
- Sulphur is an odourless, tasteless, light, yellow and solid. It is a reactive element and under suitable circumstances combines with all other elements except gases, gold and platinum. It is insoluble in water.
- Iodine and its compound are primarily used in nutrition. It is the heaviest essential element utilized widely by life in biological functions.

Project Works

Grind sand mixed with red flowers. Remove the filtrate by sifting it. Make a piece of A4-sized paper in the filtrate, leave it for two or three hours, dry it, and prepare it with red litmus paper. Make blue litmus paper with blue flowers in the same way. Use these litmus papers to differentiate between lemon juice, bitter gourd juice, water, neem leaf juice, etc.

Exercise

A. Tick the correct options

i. By which property, metals transfer heat from one end to other end?

a. Radiation b. Induction
c. Conduction c. Convection

ii. Which of the following has the highest conductivity of heat?

a. Copper b. Sodium.
c. Zinc d. Magnesium

iii Which material given below is not fit for the handle of cooking vessel?

a. Wooden b. Steel
c. Plastic d. Rubber

iv. To prevent rust, iron is mixed with

a. Zine b. Sulphur
c. Magnesium d. Copper

v. The substance that mixes with iodine to form tincture iodine.

a. Acid b. Alkali
c. Alcohol d. Water

vi. The metal in ferric oxide is

a. Copper b. Zine
c. Aluminium d. Iron

vii. The nature of metallic oxide

a. Acidic b. Neutral

c. Basic d. Dual

viii. The nature of carbon dioxide is (Carbon is a non metal)

a. Acidic b. Basic

c. Neutral d. Dual nature

ix. The best example for metal which does not rust is

a. Iron b. silver

c. Gold d. Copper

x. Which of the following is correct in the case of solution formed when sodium react with water?

a.Solution turns blue litmus to red

b. Solution turns red litmus to blue

c. Solution turns blue litmus to pink

d. Solution can't change the colour of any litmus paper

xi. Which of the following does not react with water

a. Iron b. zine

c. sulphur d. sodium

xii. Generally, which metalic wire is used in our household circuit

a. Silver b. Copper

c. Iron d. Gold

xiii. Which material does not conduct electricity?

a. Iron b. Silver

c. Sulphur d. Copper

xiv. Which handle is not suitable for electric iron ?

a. Plastic b. Wooden

c. Rubber d. Iron

B. Answer the following questions

i. What are metals ?

ii. What are non.metals

iii. Which properties of gold allows it to make ornaments?

iv. Name a few metals which are found in free state?

v. Metals are generally very hard. Name the metal which is soft like wax?

vi. Name a non-metal which is a good conductor of electricity.

vii. Name two metals which show malleability and ductility.

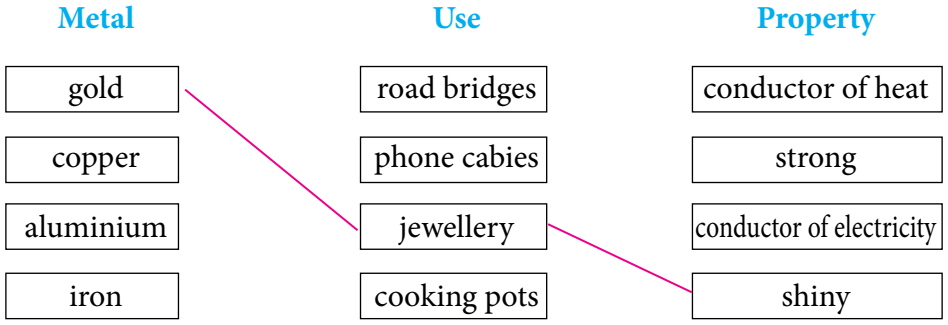
viii. We now know some of the physical properties in various metals. on the basis of the kowledge complete the following table. Write YES or NO accoridng to their property.

Matcrial sample	Lustrous	Sonorous	Heat Conductivity	Electricity Conductivity	malleable	ductilc
Iron						
Zinc						
Copper						
Sulphur						
Aluminium						
Carbon						
Magnesium						
Iodine						

ix. Here are some descriptions of different elements at room temperature. Tick the box to show whether you think the descriptions fits that of a metal or a non-metal.

	Metal	Non-metal
a. Silvery solid that is a good conductor of heat		
b. Colouriess gas.		
c. Hard, strong but flexible solid.		
d. Dark coloured liquid that does not conduct electricity.		
e. Crumbly yellow solid.		
f. Solid that is flexible and conducts electricity.		
g. Solid that conducts electricity.		
h. Green gas.		
i. Black dull solid.		
j. Shiny solid that does not conduct electricity or heat well.		
k. Shiny liquid that conducts electricity		

x. Draw a line to link up the 'use' with the 'metal' and the 'property' that is important. One link has been done for you.



xi. Here are some common substances, including some that you might fine at a recycling centre. Fit each substance into the correct box in the table.

copper, aluminium, bronze, silicon oxide, brass, zinc, bottle,

	Made of metal elements	Made of non-metal elements
Made of one element only		
Made of more than one element		

xii. Mark the following properties as metal or non-metal.

Property	Metal	Non-metal
a. I shine when I'm polished		
b. I can be broken down to a powdery substance on tapping down		
c. I am sonorous and produce ringing sound on hitting		
d. I am not lustrous		
e. I am a bad conductor of electricity and heat		

C. Diagrammatic Questions

i. Write down the properties of following objects and mention whether they are metal or non-metal.

Object	Properties:	It is a metal or non metal?
Penny:		
Eraser:		
Wires:		
Water bottle:		
Screws:		

ii. The word that describes the property of the material being used, and which is important for the use shown.

Aluminium is used for cooking pots as it is a good:

_____ of _____

Iron is used for bridges as it is:

_____

Silver is used for mirror as it is:

_____

Silver is bent to make jewellery as it is:

_____

Unit 11 Earth and Space

STUDENT'S LEARNING OUTCOMES

After studying this unit, the students will be able to :

- describe the various types of rock
- describe the importance of rocks and to identify the rocks found in Nepal,
- conduct a general comparative study of planets based on details such as size, distance, day, and year
- provide general information about the moon's shape, size, distance, and orbit.
- demonstrate an understanding of the art and date of the moon.
- introduce the eclipse and to demonstrate the process of the eclipse.

The figure below shows celestial bodies. How are these made? How far are they spread in the sky? What are these bodies made of ?

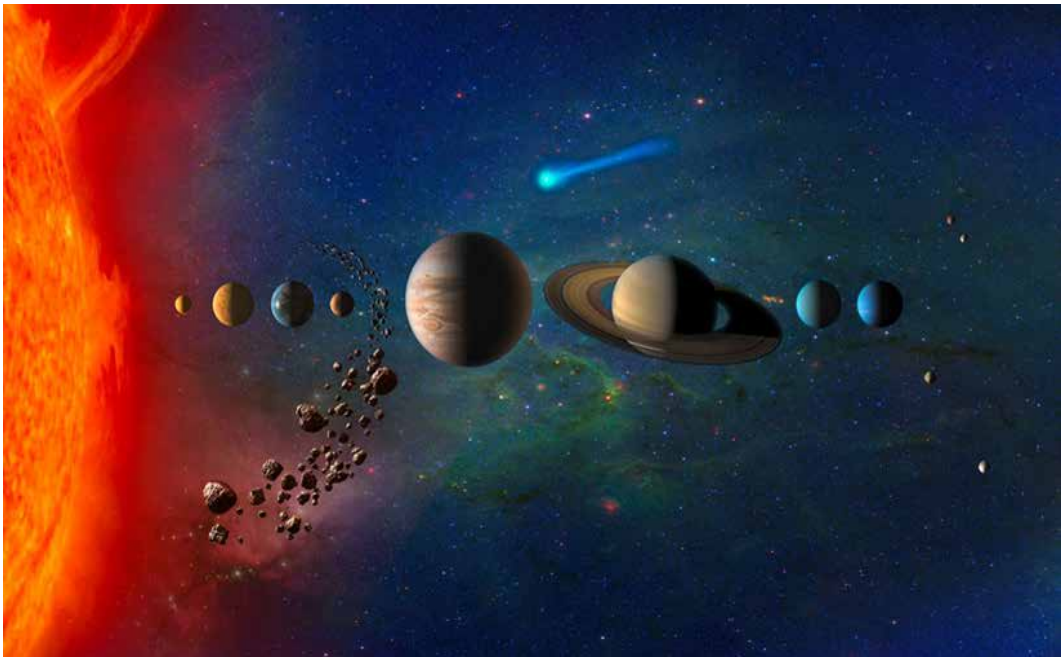


Fig. 11.1

There are various celestial bodies in the universe. Celestial objects like the sun, moon, earth, etc. These bodies are divided into stars, planets, satellites, etc. The solar system

includes the Earth and other planets and satellites. The earth in the solar system is our common habitat. Most of its exterior and interior parts are made of clay and rock. In the same way, most of the celestial bodies' parts are found to be composed of rocks.

11.1 Rock

The picture below shows some rocks. How are these made? Do they all have the same nature? Collect the rock fragments around you and discuss their hardness and heaviness with your friends.What do they smell like when rubbing against each other?

Fig. 11.2

You see, solid matters are around you. These hard substances are rocks. The inside and outside of the earth are rock. Rocks are made up of different minerals. There are different colors, textures, and weights. Rock is formed by breaking the soil into pieces. As a result, small rocks are discovered in the soil.

Some rocks, like igneous rocks, are formed by the cooling and solidification of lava coming out of the Earth's interior. Solidification of rocks below the earth's surface is known as "intrusive rocks". The magma that reaches the earth's surface and gets solidified is known as "extrusive rocks."

Particles that form a sedimentary rock by accumulating are called sediments. Before being deposited, sediment was formed by weathering and erosion in a source area and then transported to the place of deposition by water, wind, ice, mass movement, or glaciers, which are called agents of denudation.

Sedimentary rock formation

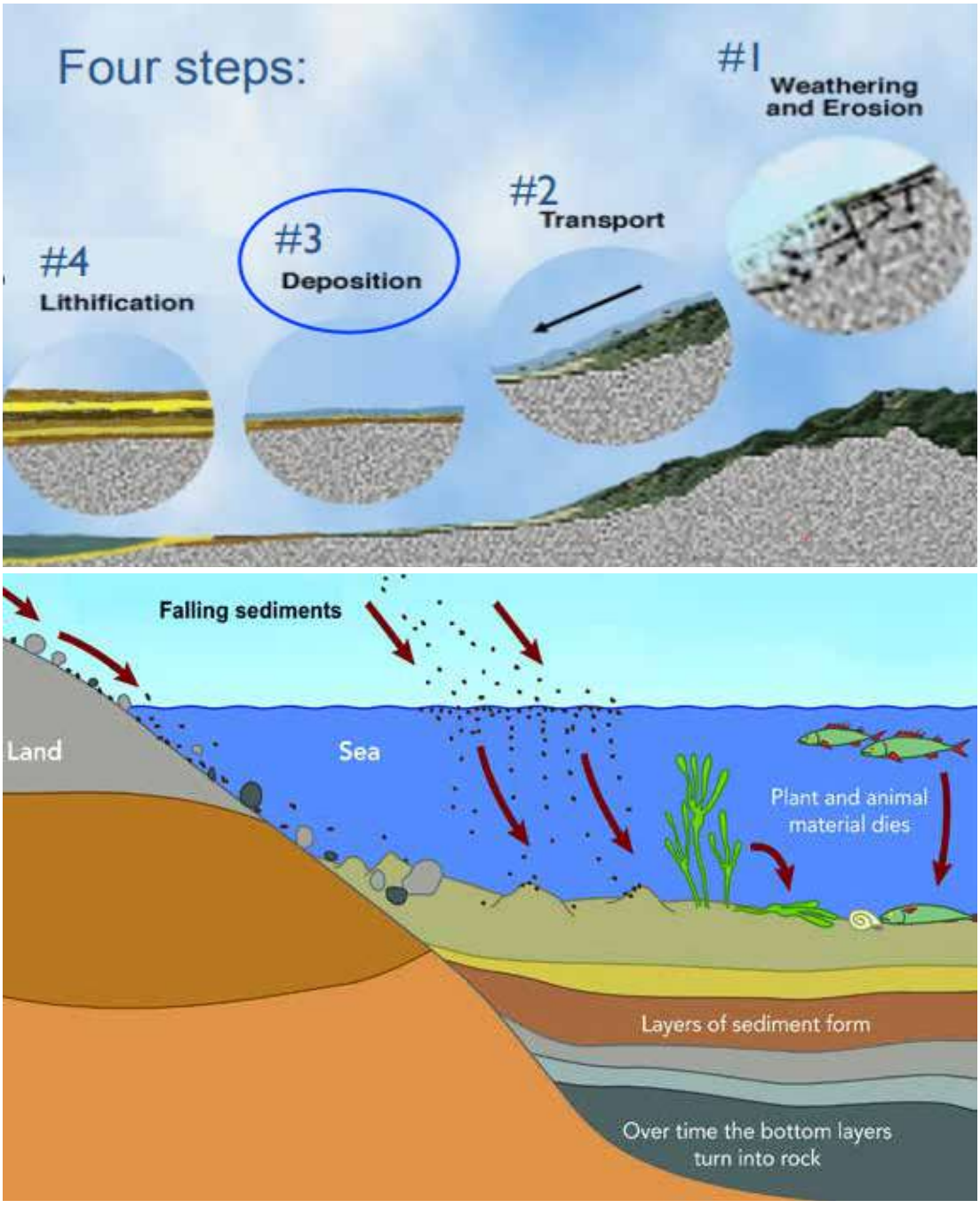


Fig. 11.3

When igneous or sedimentary rocks are subjected to great heat or pressure, the original character and appearance of the rock change into a new form. Thus, these rocks are formed by the alteration of other rocks.

Rocks undergo a cycle of transformation. Change into sedimentary rock or into metamorphic rock. Sedimentary rock can change into metamorphic rock or into igneous rock. Metamorphic rock can change into igneous or sedimentary rock.

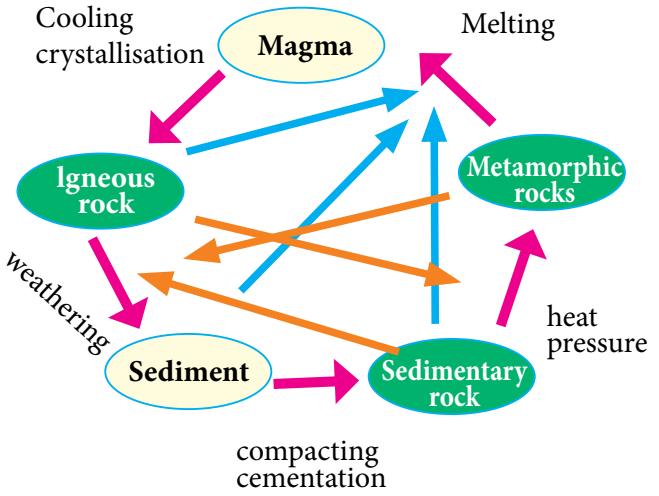


Fig. 11.4

Hence, this cycle of change from one type of rock to another is called 'rock cycle'. Rocks are continually being formed, destroyed and reformed due to changing weather conditions and forces of nature (eg. Wind, river, glaciers, earth movements, etc.)

Rocks form the solid mass of the earth's crust. The rock forming materials are known as "Minerals".

The earth is divided into four layers. They are crust, mantle, outer core and inner core. The outermost layer of the earth is crust. All the activities by the living organisms are done on this crust. We build house, canals, road and do agriculture on the crust. We can get soft soil and some small rocks on the crust region. Weathering of rocks form soil.

Minerals

A naturally occurring chemical substance usually found in crystalline form and are not produced by living organism is called mineral. A mineral has specific chemical composition whereas rocks contain different types of minerals. The minerals are found being mixed in soil. Soil is weathered form of rock. Soil is mixed with different minerals and rocks.

Generally, minerals are pure substances which are naturally found in the earth's crust. They are found in solid and crystalline form. Quartz, graphite, sapphire, diamond, gypsum, talc, calcite, topaz, emerald, halite, kerolite etc.

About 3000 minerals are found on the earth but only 100 minerals among them are commonly used.

Note :

- A pearl is commonly used chemical substance. Pearl is not considered as a mineral as it is produced out of living organism called oyster.
- Coal, petroleum and natural gases are considered as fuel minerals by economist, but scientists do not consider them minerals because they are obtained from living organisms.
- Feldspar is the name given to a group of minerals distinguished by the presence of alumina and silica (SiO_2) in their structure. It is the single most abundant mineral group on the earth. They account for an estimated 60% of exposed rocks as well as soils, clay, and other components.

Rock

Rock form the earth's surface as well as the inner part of the earth. The hard materials found in the earth's crust are called rocks. They consist of different minerals with different colours. We can find rocks at the bottom of the ocean and below the snow as well. Structure of mountains are also made up of rocks. Bank of the river and surrounding are also made up of rocks.

Structure of Rock

Rocks are found in different texture forms and colours. They are also found in different sizes. Their size varies between sand particle to boulders of several meters. Some forms of rocks are crystalline or non-crystalline.

Difference between Minerals and Rocks

Minerals	Rocks
i. Minerals are homogeneous (or pure) substance with very specific chemical composition.	i. Rocks are aggregates with variable chemical composition and are generally mixture of different minerals.
ii. Minerals are inorganic.	ii. Rocks contain organic matter, even fossil.
iii. Minerals usually have a specific shape.	iii. Rocks do not have definite shape.
iv. Some minerals help in blood coagulation, in bone formation and muscle contraction, and some have nutritive value for the human body.	iv. Rocks do not have any nutritional value
v. The science that studies minerals is called mineralogy.	v. Petrology is the science which studies rocks
e.g. garnite topaz, etc are some examples.	e.g. basalt, marble, shale etc. are some examples.

Table 11.1

Types of Rock

Rocks are formed by different methods. But, the main raw materials for the formation of rock is magma. Thus, it can be said that rock is originated from magma. Magma is the molten material found inside the earth's crust. On the basis of origin process, the rocks are classified into following three categories: (i) Igneous rock (ii) Sedimentary rock (iii) Metamorphic rock.

i. Igneous rock

It is the primary rock that is made of the magma. Magma may be cooled in or out of the surface of the earth. When the magma comes out on the earth surface during a volcanic eruption, it cools and forms igneous rock. Pumice, obsidian, basalt, etc. are some examples of this type of rock. Some of them are spongy with less density (pumice). They are also called volcanic rocks.

Sometimes, magma cools inside the earth before it reaches on the earth surface. Such igneous rocks are specially known as plutonic rocks. These rocks have rough surface as size of crystals is big in them. They are very hard and non-porous. Igneous rocks are crystalline and inorganic i.e. no-remanent of living organisms is found in them. They do not contain fossil. Some igneous rocks are as follows:

a. Granite

It is plutonic rock that is black or brown in colour. It is very hard and strong rock. Granite is widely used in construction of building, paving floor and making statues.

Fig. 11.5

b. Pumice

Pumice is a volcanic type of igneous rock. It has very less density. As it has trapped gases and ashes inside. It makes the rock spongy and light. It is so light or it can float on water. It is used as scrubber to polish furniture and floor.

Fig. 11.6

c. Obsidian

Obsidian is a volcanic rock. It has glassy surface and weak formation. It is also called volcanic glass. It is black in colour.

d. Basalt

Basalt is also volcanic rock. It is very strong. It is dark in colour. It is believed that basalt forms the foundation in the crust.

Fig. 11.7

ii. Sedimentary rock

Weathering of rock is a continuous process on the earth surface. The continuous breaking of rock changes into smaller particles. These particles and some minerals are the main raw material for the formation of sedimentary rock. Wind, river, rain etc. carry the particles and other materials and deposit them at the bottom of oceans. Such deposited layer is called sediment. Sediments may be formed in many layers and the upper layers press the lower one. It squeezes the water from the sediments and the sedimentary rocks are formed. Sedimentary rocks are layered and they may have fossils in them. Some sedimentary rocks are described below.

a. Conglomerate

Conglomerate can be compared with concrete as rough gravel pieces and sand combined to form this rock. Due to this reason, it is also called concrete rock. This rock contains quartz or silica like minerals. Quartz containing conglomerate is softer than the silica containing conglomerate.

Fig. 11.8

b. Sandstone

Sandstone is formed by the binding of sand particles together. The softness or hardness of this type of rock depends upon the cementing materials. Silica binds the sand particles in sandstone. Tightly cemented sandstone is harder than loosely cemented sandstone.

Fig. 11.9

c. Shale

Shale is a soft, black rock. The particles smaller than the sand grain is called silt. Smaller particles than silt which form a type of soil is called clay. The rock formed by the combination of silt and clay is called shale.

Fig. 11.10

d. Limestone

Marine animals have shell to protect their body. After the death of these organisms, the shells deposit at the bottom of ocean. Limestone is formed by the shells of organisms due to the pressure of sediments over them. The main component in this type of rock is calcium carbonate. Limestone may be white, brown, red or even black.

Fig. 11.11

iii. Metamorphic rock

Those rocks which are formed by the change in preexisting rocks (sedimentary or igneous rock) under the influence of high temperature, pressure and chemically active solutions. Force within the earth creates large amount of heat and pressure. These factors change igneous and sedimentary rock into metamorphic rock. This type of metamorphic rocks are found in the inner side of the earth.

Fig. 11.12

Formation of metamorphic rocks

The rocks formed can be changed in the due course of time. The rocks which change due to high temperature and pressure give different forms and texture. Thus, a new type of rock is formed, hence called metamorphic rock. Metamorphic rocks are mainly formed in two ways:

a. By excessive heat and temperature acting on the sedimentary or igneous rocks.

Rock	Metamorphic rock
i. Silica	Quartzite
ii. Limestone, dolomite	Marble
iii. Coal	Graphite, slate
iv. Metamorphosed graphite	Diamond
v. Granite, deorite	Niece, schist

b. The metamorphosed rock formed by the above method can undergo another metamorphosis and form rock. The rocks like slate and schist can undergo metamorphosis and form marbles, graphite and diamond.

Uses of rock

Rocks are used for different purpose. Some major uses of rocks are given below:

- Hard rocks are used in construction work. Rocks are used in building construction, road construction, dam construction, etc.
- Marbles of different colours and types are used for decoration and flooring in house.
- Slate is used in sloping roofs. It is also used by the children for writing purpose.
- Rocks like granite is used in the construction of temples.
- Some rocks are very expensive and used in jewellery as they have valuable minerals like diamond, sapphire, emerald, etc.
- Coal is a type of sedimentary rock that is used as fuel.
- Limestone is used as raw material for cement and lime industries.

Some important rocks of Nepal

- Conglomerate : These are the rocks formed by joining small pebbles gravel and sand. Such stones are found at the river side.
- Sandstone : Sandstone are formed from the compaction of small granules of sand. They are found at the river sides.
- Silica : As the rivers flow down the hills, the force of water erodes the rock and silica is formed. The silica contains oxygen and silicon.
- Limestone : Limestone is made of calcium carbonate, It possesses small granules. It is found in different colours like brown, white, etc. It is used in cement factory. Since lime is a part of cement. Limestone's ore is found in Godavari, Bhaise, Chovar, Udaipur, Jogimara, etc.
- Marble : Marble is made after the metamorphosis of limestone. The marble is found as sedimentary rocks, one layer above the other. Marble is used in flooring, staircase, bathrooms, etc. Marble is found in Godavari Lalitpur.
- Slate : Slate is also a kind of metamorphic rock. It is found in layers. Slate is used in roofing. Slate boards are also used in writing purpose. One of the popular slate mines is located in Bandipur, Tanahun, etc.

Project Work

Collect some rocks around you. Use of ICT equipment available at home or school to classify them all as volcanic rock, sedimentary rock, or metamorphic rocks. Fill in the table with one of its main features:

Collected Rock No.	Volcanic rocks	Features	Sedimentary rocks	Features	Metamorphic rocks	Features
1.						
2.						
3.						
4.						
5.						

Points to Remember

- Rocks are made up of different minerals. There are different colors, textures, and weights. Rock is formed by breaking the soil into pieces. As a result, small rocks are discovered in the soil.
- Particles that form a sedimentary rock by accumulating are called sediments.
- A naturally occurring chemical substance usually found in crystalline form and are not produced by living organism is called mineral.
- Rock form the earth's surface as well as the inner part of the earth. The hard materials found in the earth's crust are called rocks.
- On the basis of origin process, the rocks are classified into following three categories: (i) Igneous rock (ii) Sedimentary rock (iii) Metamorphic rock.
- Magma may be cooled in or out of the surface of the earth. When the magma comes out on the earth surface during a volcanic eruption. It cools and forms igneous rock.
- Weathering of rock is a continuous process on the earth surface. The continuous breaking of rock changes into smaller particles.a These particles and some minerals are the main raw material for the formation of sedimentary rock.
- Those rocks which are formed by the change in preexisting rocks (sedimentary or igneous rock) under the influence of high temperature, pressure and chemically active solutions.

Exercise

A. Tick the correct options

i. Which of the following rock does not consist of fossils?

a. Granite b. Sandstone

c. Limestone d. Slate

ii. Which one is metamorphic rock ?

a. Silica b. Diamond

c. Dolomite d. Pumice

iii. Which rock is used in making cements ?

a. Marble b. Sandstone

c. Limestone d. Pumice

B. Fill in the blanks

i. _____ rock is used while manufacturing cements.

ii. Igneous, metamorphic and _____ are the three types of rock.

iii. Layers of different substance are responsible for the formation of ___

iv. Pumices is an example of _____ rock.

v. Any rocks at high pressure and high temperature may change into ____

C. Answer these questions.

i. Define the following terms.

a. Rock b. Igneous rock

c. Metamorphic rock d. Sedimentary rock

ii. Differentiate between these pairs.

a. Igneous and sedimentary rock

b. Sedimentary and metamorphic rocks

iii. Classify the following rocks:

a. Marble b. Pumice c. Slate

d. Limestone e. Conglomerate f. Diamond

iv. Why is diamond called metamorphic rock?

v. What types of rock are called sedimentary rock ?

vi. Which rock consists of fossils?

vii. How are metamorphic rock are formed ? Give examples.

viii. Write four uses of rocks.

ix. Write short notes on :

a. Conglomerate b. Pumice c. Granite

d. shale e. Basalt f. sandstone

x. Write the physical properties of rocks.
xi. Write the location of the following rocks in Nepal.
conglomerate, sandstone, silica, limestone, marble, slate.

D. State True or False –

i. All rocks are formed in the Earth's atmosphere, which includes the Earth's crust and the top part of its mantle.

ii. Sediments are deposited when weathered rock is moved from one place to another by the wind, running water, the sea or glaciers. That process is called metamorphism.

iii. Rocks that form from the cooling of magma below the Earth's crust or lava are called igneous rocks.

iv. The heat and pressure can change the composition and appearance of the minerals in rocks.

v. Deposits of dead plants and animals are also called sediments.

E. Fill in the blank to complete each statement using the word bank below.

Sandstone marble arrangement slate pressure

i. The metamorphic rock _____ usually form when limestone is subjected to heat and pressure deep beneath the surface.

ii. because the foliated metamorphic rock _____ splits easily into flat pieces, it is used for roofing material.

iii. Any rock formed when another rock is changed by heat or _____ is a metamorphic rock.

iv. Geologists classify metamorphic rocks according to the _____ of the grains making up the rocks.

v. Quartzite forms when the quartz particles in _____ recrystallize.

F. Find out the chart below to identify the metamophic rock that forms when heat and pressure transform each type of sedimentary rock.

Sedimentary Rock	Metamorphic Rock
Sandstone	
Shale	
Limstone	

G. Read the following definitions. Match the type of rock where they belong.

Rock that forms from material that has settled into layers	Rock that was once melted and then cooled and hardened.	Rock that has been changed by temperature and pressure

Igneous Rock	Metamorphic Rock	Dedimentary Rock

H. Diagrammatic questions

Ubicate the tpyes of rocks in the correct box.

Granite

limestone

obsidian

sandstone

quartzite

pumice

conglomerate

Slate

marble

shale

gneiss

Igneous	Sedimentary	Metamorphic

ii. Join the rocks with the type of rock

MARBLE AND CLAY	IGNEOUS ROCKS
COAL	METAMORPHIC ROCKS
GRANITE AND BASALT	SEDIMENTARY ROCKS

iii. Fill in the boxes the types of following rocks

1.

Sandstone

_____

2.

obsidian

_____

3.

marble

_____

4.

gypsum

_____

5.

granite

_____

6.

slate

_____

iv. **Match the picture to the rocks type.**

Sandstone

Dimond

Marble

slate

Quartz

Granite

v. **Instruction: Choose the word from the box that best named the image. Then match the correct definition of each type of rock.**

Sedimentary rock	Igneous rock	Metamorphic rock

_____ _____ _____

Rock formed by layer of sediments.

When heat and pressure change a rock

Rock formed when magma cools and hardens.

vi. **Troy and cooper discuss which of the rocks in their rock collection are the hardest. They decide to carry out the scratch test.**

This table show their results:

Rock	Was scratched by ...			
	Fingernail	nail	matchstick	plastic knife
Coal	No	Yes	No	Yes
Limestone	No	Yes	No	No
Granite	No	No	No	No
Chalk	Yes	Yes	Yes	Yes

a. **Which rock could Troy's fingernail scratch?**

_____

b. **Which rock was the hardest? How do you know?**

_____

_____

c. **Use the table above to answer the following question.**

Write the name of each rock in the boxes below. Place them in order from softest to hardest.

Softest Rock ⟶ **Hardest Rock**

vii. **Write the name of the rock you think is being used in the picture and explain why you think that rock was chosen. What are the properties of the rock that make it good for doing that particular job?**

Chopping Board

Rock: _____

Reason: _____

_____

Fireplace

Rock: _____

Reason: _____

_____

Roof	Pavement
Rock: _____ Reason: _____ _____	Rock: _____ Reason: _____ _____

Monument	Wall
Rock: _____ Reason: _____ _____	Rock: _____ Reason: _____ _____

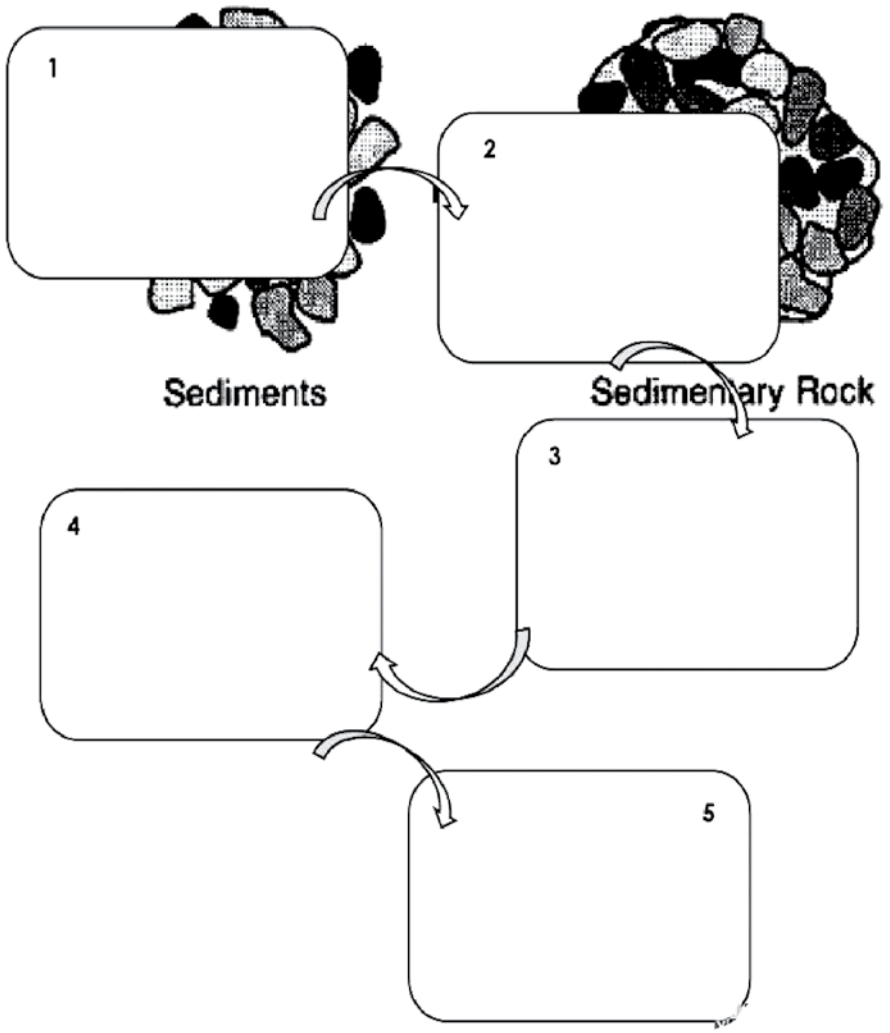
Art and drawing	Engagement ring
Rock: _____ Reason: _____ _____	Rock: _____ Reason: _____ _____

viii. Match the rock with its products.

Rocks	Products

ix. **Drag and drop the options in the box to order the process of the sedimentary rock's formation.**

Breaking down sediments	Dropping off sediments	Solidifying layers of sediments
Squeezing the sediments forming layers	Carry away of sediments by water, wind or ice	



x. Match the rocks and minerals to their uses:

granite cement diamonds talcum powder quartz

jewellery talc watches limestone counter tops

Complete the sentences using the words in form activity above:

a. _____ Is a hard rock formed of calcium carbonate and fossils. It is used to make _____ for roads and buildings.

b. _____ is a soft mineral. It is a solid lubricant and is used to make _____

c. _____ are hard, transparent carbon minerals. Because they are resistant to scratching, they can be used in drills, they are also used in expensive _____

d. _____ is a hard mineral. It is used in _____ to keep accurate time.

e. _____ is a hard, igneous rock, in kitchens it is used on _____

11.2 Introduction to Planets

We can see many heavenly bodies in the sky. The branch of science that deals about the heavenly bodies is known as astronomy. The universe consists of galaxies, constellations, stars, planets, satellites, comets, etc. One of the components of the universe is solar system. The sun of our solar system is the closest star to the earth. The group of different heavenly bodies that revolves around the sun is called as solar system. Planets, satellites, comets, asteroids, etc. are its members. The planets revolve around the sun and the satellites revolve around the planets in their own orbits. There are eight planets and more than 160 satellites in the solar system.

Units Used in Astronomy

The universe is huge and it is very inconvenient to express distance between heavenly bodies in meter or km. Therefore, astronomers use convenient units such as Astronomical unit, Light year, and Parsec.

i. Astronomical unit(AU) : An astronomical unit is defined as the distance between the sun and the earth and its value is about 1.5×10^{11} m or 1.5×10^{8} km (15 crores km).

ii. Light year : It is defined as the distance travelled by light in one year. Its value is about 9.46×10^{12} km (300000 km x 60 x 60 x 24 x 365)

iii. Parsec : 1 parsec = 3.26 light year = 3.08×10^{13}km.

The sun

The sun is the centre of the solar system. It is the closest star to the earth. It is about 1. 5 x 10^{8} km. away from the earth. It is a medium sized star and its diameter is about 1,392,400 km., its weight is 330 times more than the weight of the earth. All the members of the solar system are remaining around the sun due to the gravitational force of the sun. It is a luminous body and produces heat and light energy. Light takes about 8 minutes 20 seconds i.e. 8. 3 light minute to come on the earth from the sun. Its surface temperature is about 6,000°c and centre temperature is about 15,000,000°c.

11.2.1 Planets

Fig. 11.2.1

Fig. 11.2.2

i. Compare which planets are closest and farthest from the sun.
ii. Compare the sizes of the largest and smallest planets.
iii. What difference do you find in the composition of the planets?
iv .What is the difference in the color of the planets?

The sun is one of the stars. It is the closest star to the Earth we live on. When we look at it, it looks brighter and bigger than other stars. Heavenly (Celestial) bodies combine to form the solar system.

As we live with our family, our planet Earth also has a family. As we have our parents and siblings in our family. The Earth has Sun and other planets in his family. The family of the Earth is known as the solar system.

A solar system is a collection of the Sun, eight planets and their moons, comets, asteroids, meteoroids, and dwarf planets revolving around the Sun. The eight planets revolving around the Sun in a sequence are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. There is an asteroid belt between Mars and Jupiter. These planets revolve around the Sun in an elliptical orbit. There are other astronomical objects too in our solar systems such as meteoroids, comets, and a dwarf planet. Pluto is a dwarf planet. Earlier it was considered as a planet but then it was discarded because it doesn't satisfy the criteria of planets.

Mercury

It is the nearest planet to the sun. Its diameter is about 4,851.2 km. It takes about 59 days to complete one rotation and about 88 days to complete one revolution. It is very cold at night and very hot at day time. It does not have any satellite.

Venus

The venus is the brightest planet. It is smaller than the earth. Its diameter is about 12,035.2 km. It has no moon. It takes about 243 days to complete a rotation and about 225 days to complete one revolution. It is also called the morning star and the evening star because it can be seen before sunrise in the east and after sunset in the west. It is the brightest one after the sun and the moon.

Earth

It is in third position in distance from the sun. It is the single planet having a suitable temperature and environment for living things. It is about 12,672 km. in diameter. It completes one rotation in about 24 hours and one revolution in about 365 days. It is also called green planet. It has only one natural satellite i.e. moon.

Mars

The mars is also known as red planet because it is seen red due to the presence of iron oxide on it. Its diameter is about 6742.4 km. It completes one rotation in about 24 hours and 37 minutes and one revolution in about 687 days. Its both poles are covered with ice, called ice caps.

Jupiter

It is the largest planets. Its diameter is about 11,39,040 km. It has 63 satellites. It takes about 10 hours to complete one rotation and about 12 years to complete one revolution. Its outer layer is covered by clouds and centre portion consists of one big red spot. Its atmosphere consists of hydrogen, helium, methane, ammonia and water vapour.

Saturn

It is the biggest planet after Jupiter. It has three flat rings around it. These rings consist of the ice pieces. Its diameter is about 1,15,811.2 km. It has 60 moons. It completes one rotation in 10 hours and 39 minutes and one revolution in 29. 5 years. Its biggest satellite is "Titan", which is bigger than mercury planet.

Uranus

Uranus planet is made up of gas and liquid matters. Its diameter is about 50,441.6 km. It takes about 17 hours and 14 minutes to complete one rotation and about 84 years to complete one revolution. It has 27 satellites.

Neptune

This is the farthest planet from the sun. It has 13 satellites. Its diameter is about 48,972. 8 km. It needs about 16 hours for one rotation and 164 years for one revolution.

The international convention of Astronomers held in 2006 in Czech republic removed pluto from the group of planets. The convention gave new definition to be a planet. The characteristics to be a planet are :

- It should revolve in a elliptical path around the sun.
- The heavenly body planet should be round in shape with its own gravity.
- The orbit of the heavenly body planet should not intersect with the orbit of other planets or it should have a fixed neighbourhood with other planet.

Since the pluto does not follow the last characteristic feature, it is removed from the list of the planet. Ceres, Pluto and Eris are now considered as dwarf planets.

Name of planets	Distance from the sun(km)	Diameter (km)	Period of rotation	Period of revolution	No. of moons (satellites)
Mercury	5.76×10^7	4851.2	58.65 days	87.97 days	0
Venus	10.7×10^7	12035.2	243.02 days	224.7 days	0
Earth	14.88×10^7	12672	23 hrs. 56 min.	365.25 days	1
Mars	22.56×10^7	6742.4	24 hrs. 37 min 22 seconds	686.98 days	2
Jupiter	76.8×10^7	1139040	9 hrs 55 min 30 sec	12 years	63
Saturn	144×10^7	115811.2	10 hrs 30 min	29.5 years	60
Uranus	288×10^7	50441.6	17 hr 14 min. 24 sec	84 years	27
Neptune	448×10^7	48972.8	16 hrs 6 min 36 sec	164 years	13

Table 11.2.1

Activity 11.2.1

i. Prepare a chart of the solar system.
ii. During a vacation visit a planetarium and describe your experience in the class.
iii. Organise a quiz contest on the earth and the solar system.

Project work

Take nine round loaves of clay or flour of different sizes. The sun is created by the largest, and the other eight lumps are determined by size, distance, and location. Build a simple model of the solar system into a group.

Fig. 11.2.3

Points to Remember

- The group of different heavenly bodies that revolves around the sun is called as solar system.
- The universe is huge and it is very inconvenient to express distance between heavenly bodies in meter or km. Therefore, astronomers use convenient units such as Astronomical unit, Light year, and Parsec.
- The sun is one of the stars. It is the closest star to the Earth we live on. When we look at it, it looks brighter and bigger than other stars.
- The venus is the brightest planet. It is smaller than the earth. Its diameter is about 12,035.2 km. It has no moon.
- The mars is also known as red planet because it is seen red due to the presence of iron oxide on it.

The characteristics to be a planet are :

- It should revolve in a elliptical path around the sun.
- The heavenly body planet should be round in shape with its own gravity.
- The orbit of the heavenly body planet should not intersect with the orbit of other planets or it should have a fixed neighbourhood with other planet.

Exercise

A. Tick the correct options

i. Which planet in the solar system has a natural satellite having its own atmosphere?

a. Mercury b. Saturn
c. Earth d. Uranus

ii. The planet known as the "Earth's Twin" is

a. Jupiter b. Saturn
c. Venus d. Earth

iii. Which is the third nearest planet to the sun ?

a. Venus b. Earth
c. Mercury d. Saturn

iv. All the planets move around the sun in a

a. Circular path b. Rectangular path
c. Elongated path d. Square path

v. Pluto was discontinued to be regarded as planet in 2006 due to its

a. dwarf size b. unusual orbit
c. rotation d. both a and b

vi. According to size Earth's position in the Solar System is

a. 3rd b. 5th
c. 7th d. 8th

vii. Stars are made up of.

a. Rocks b. Glass
c. Water d. Gases

viii. Family of Sun is called

a. Milky Way b. Solar System
c. Andromeda d. Constellation

ix. How many times you can see full moon in about a month ?Going by the content of book we are using 'month' but to be precise it should be '28 days' .

a. Once b. Twice
c. Thrice d. Four times

x. Which is the brightest planet in the universe ?

a. Mercury b. Venus
c. Earth d. Saturn

xi. How far is the Sun from Earth?

a. 150 Million Km approx b. 150 lakh Km approx

c. 1500 Million Km approx d. 15 light years

xii. Why is the earth called as Blue- Planet?

a. Colour of air is blue

b. Colour of land is blue

c. Buildings are of blue colour

d. Two- third surface is covered by water

xiii. Moon moves round the

a. Earth b. Sun

c. Mars d. It stays at one place

B. Fill in the blanks

eight, star, planet, solar system, light, satellite

i. The group of celestial bodies revolving around the Sun is called .....

ii. The Sun is medium size .....

iii. The Earth is a .....

iv. The solar system contains ..... planets .

v. The moon is a .....

vi. Planets do not have their own.....

C. True or False.

- Nearly the 50% of the Earth's surface is covered with water.
- The Earth is also called the blue panet.
- The Earth is the only planet on which known life exist.
- Mars is also called the red planet.
- Jupiter is the smallest planet in our Solar System.
- Saturn is the first planet in our Solar System.
- Saturn has rings around it that are made of ice and dust.

D. Differentiate with examples

i. Stars and Planets

ii. Mars and Jupiter

E. Answer the following questions :

i. What are planets ?

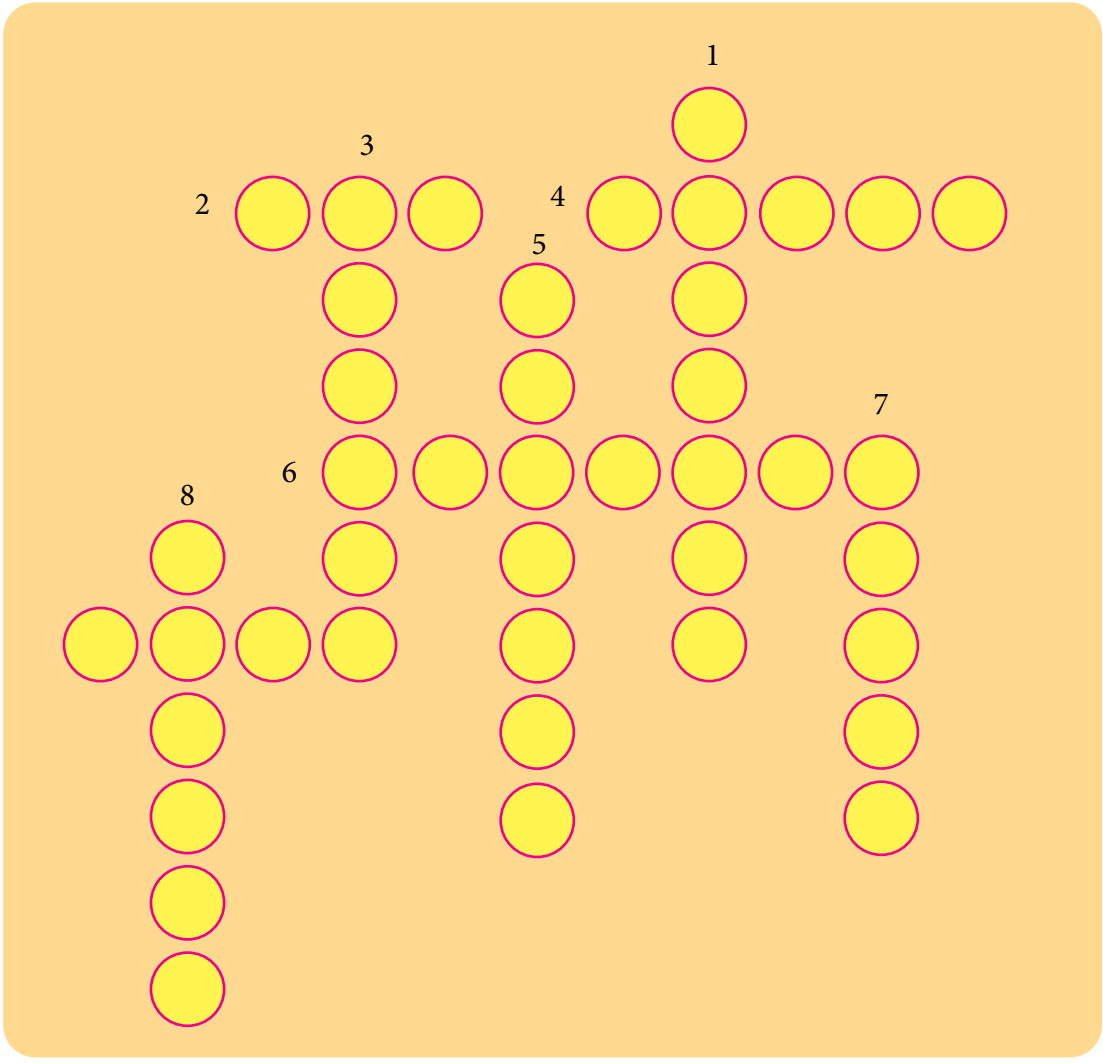
ii. Why is mars called red planet ?

iii. Explain in short about eight planets.

iv. Name the planets according to their distance .

v. Draw the picture of solar system .

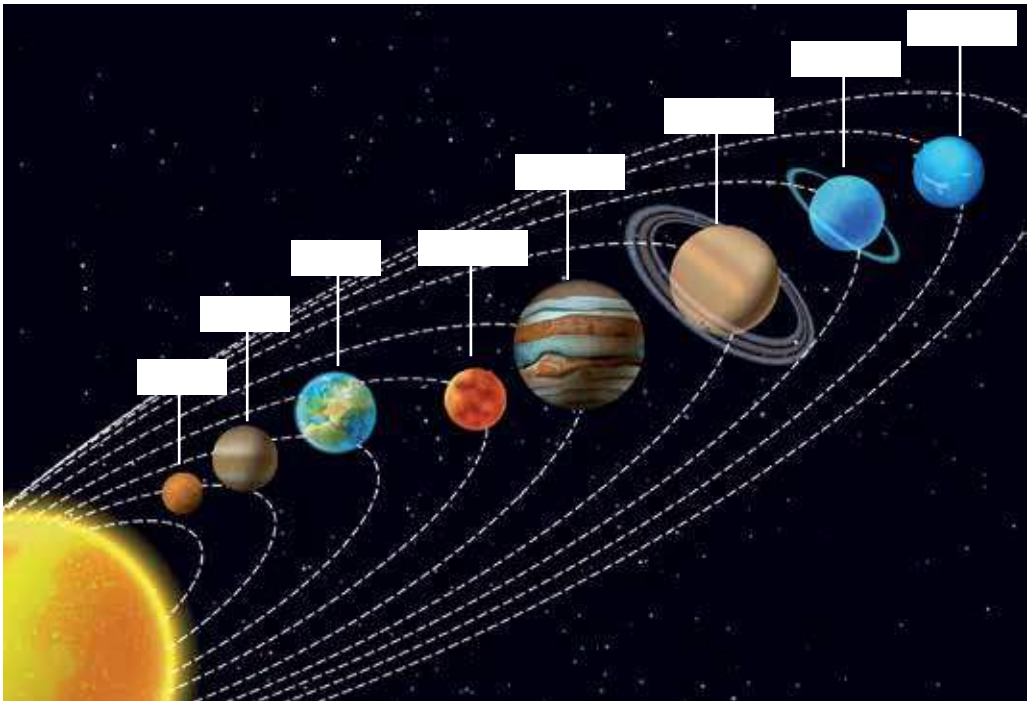
F. Complete the crossword



1. This is the nearest planet to the sun.
2. This is a star, not a planet.
3. This is the second farthest planet from the Sun.
4. This planet is placed between Mercury and the Earth.
5. This is the largest planet in our Solar System.
6. This is the farthest planet from the Sun.
7. This is the third planet from the Sun.
8. This planet has rings.
9. This is the fourth planet from the Sun.

G. Diagrammatic questions :

i. Identify the planets and write their names



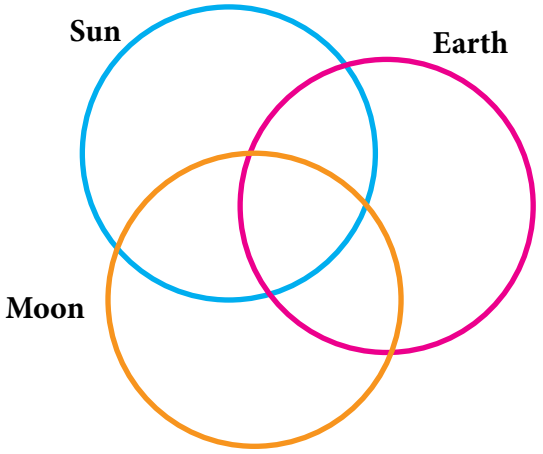
ii. Drag the words below and put them in their correct place to Compare and Contrast the Earth, Sun And Moon.

Planet | Satellite/ asteroid | Support life | Is a star | Rotates on its axis | can't support life

Rotates on its axis | 28 days for rotation | 24 hrs for rotation | Orbits nothing | bigessest object in the solar system

Doesn't support life | In the solar system | Filled with craters | Covered with trees, soil, water and landforms

Experiences seasons | Experiences phases



iii. Match each planet to its description :

Mercury •

- The largest planet in our solar system

Venus •

- The smallest planet in our solar system

Earth •

- Where we live

Mars •

- the hottest planet

Jupiter •

- Has seven rings and at least 60 moons

Saturn •

- The windiest planet with winds up to 1200 mph

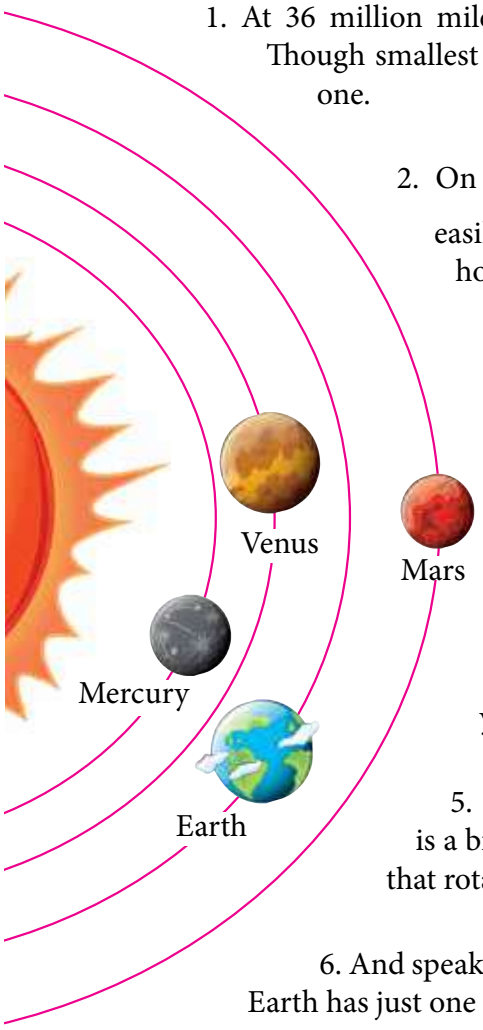
Uranus •

- Known as the red planet

Neptune •

- An "ice giant" that spins on its side

iv. Read the poem below. Then complete the chart



1. At 36 million miles away, Mercury's nearest to the sun. Though smallest of the inner planets, it's not the hottest one.

2. On the second planet, Venus, you could easily melt lead. At 870^{0}F, we might call it a hothead.

3. If you like things a ittle cooler, Mars tops out at 70^{0}F;

Earth hits twice that number. Now what exacly will that be?

4. Earth has a range of temperatures but is known for air and water.

A mars year lasts 687 days, but an Earth year is much shorter.

5. It size is what you need to know, Earth is a bit wider than the 7521-mile-wind planet that rotates beside her.

6. And speaking of poor Venus, she hasn't any moons Earth has just one satelite, and Mars leads the wy with two.

Inner planet	Distance From Sun (millions of miles)	Length of year (In Earth days)	Highest Surface Temperature (^{0}F)	Diameter (Miles)	Number of moons
Mercury		88	800	3,032	0
Venus	67	225			
Earth	93	365		7,926	
Mars	142			4,222	

11.3 Moon

The moon is a natural satelite of the earth. It revolves around the earth. The diameter of moon is 5,475 km which is nearly about one-quarter of the diameter of the earth. The mass of the moon is 7.35×10^{22} kilograms. The moon does not have atmosphere. The surface of the moon is covered with dead. Volcanoes, impact craters and lava flows.

Fig. 11.3.1

The moon reflects the light of the sun. It does not have its own light. When moon revolves around the earth, the bright part of the moon is visible in different amount. When whole bright part is facing toward the earth, it is seen as full moon. When the bright part of the moon is facing away from earth, it is called new moon. The portion at the bright part visible from earth changes due to revolution of moon around the earth and revolution of earth around the sun. So, the shape of bright part of moon changes. The change in shapes of the bright part of moon seen from the earth is called phases of the moon.

Phases of the moon

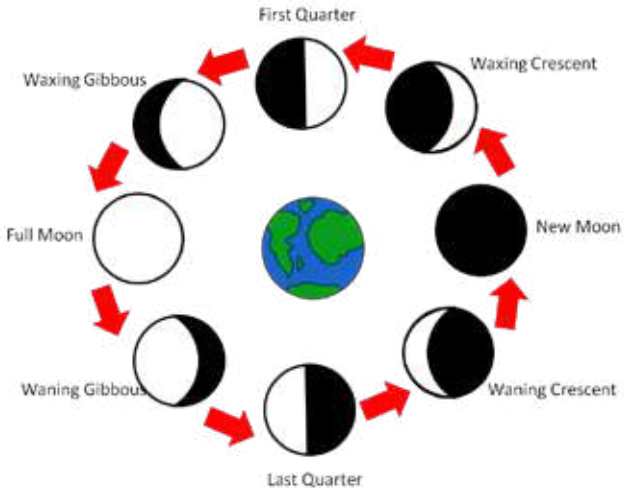


Fig. 11.3.2

Due to spherical shape of the moon, one half of it is brighter and other half becomes darker. We observe the moon from the earth's surface, its lighted part can be seen. The different sizes of the lighted part of the moon are called the phases of the moon.

New moon

When the moon lies in between the sun and the earth, no lighted part of the moon is seen. It is called new moon.

Full moon

When the earth lies between the sun and the moon, full brightness of the moon can be seen. This condition is known as full moon.

The day after new moon, a small portion of the moon will be visible called crescent moon. It rises 50 minutes later than the previous day. The visible portion of the moon is increased day by day. This phase of the moon is called first quarter and the position of the moon is called quadrature. In this position, the moon rises at noon and sets at around midnight. This type of moon is seen after Bright half and Dark half.

After the first quarter the moon enters into the second quarter and its size will increase. The phase of the moon is known gibbous phase. The shape of the moon in this phase is the reverse of the crescent. When the moon revolves the earth by 180° full moon is seen from the earth. This phase of the moon is called full moon. The moon rises at sunset and sets at sunrise. When the moon revolves round the earth by 270° ,one half of it will be seen from the earth surface. The phase of the earth is called last quarter and the position of the moon is called quadrature.

Finally the moon is not visible which is called new moon.

Sidereal month and synodic month

The moon completes a rotation around the earth at about 27.3 days (27 days 7 hours 43 minutes and 11.5 seconds more accurately). This is the time taken by the moon to complete one rotation is called sidereal month.

The period from new moon to new moon or full moon to full moon is called the synodic month. It is about 29.5 days (more accurately 29 days 12 hours 44 minutes and 3 seconds). It is the period of time taken by the moon in going once around the earth with reference to the sun. It takes 2 days 5 hours more.

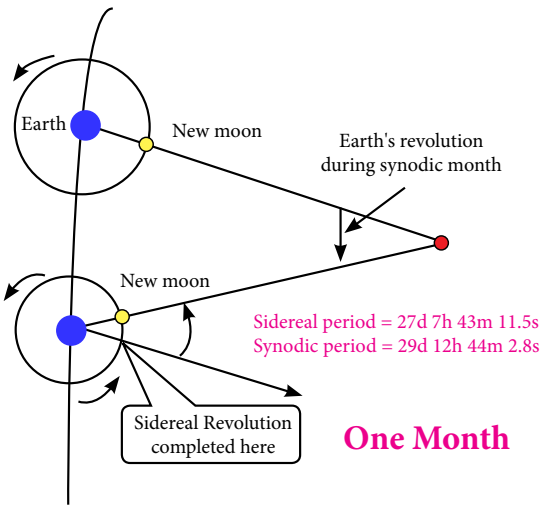


Fig. 11.3.3

Bright half and Dark half

In this period between new moon to full moon, the bright part of the moon goes on increasing. This duration is called the bright half (Sukla Pachhya) of the moon. The moon is said to be waxing in this duration. This periods lasts about 15 days.

Similarly, in the period between full moon to new moon, the bright half of the moon goes on decreasing. This duration between full moon and the new moon is called the dark half (Krishna Paksha) of the moon.

This moon is said to be waning in this duration This duration also lasts for about 15 days.

We follow solar calendar for our daily activities. The religious activities are performed on the basis of lunar calendar. A lunar calendar is based on the monthly cycles of moon's phases. In hindu lunar calendar, a lunar month starts from the day of new moon. It is called "Aushi". A lunar month and solar month may not start on same day. However, the lunar month is named after the solar month on which the lunar month starts. For example "Aushi" falls on Mangsir 18, 2078, then the lunar month starts from this day. Lunar "mangsir" month starts from this day.

Generally, only one "Aushi" falls within a solar month. Sometimes, two "Aushi" falls on a single month. For example, if "Aushi" falls on Kartik 1 and next Aushi falls in Kartik 30, then the name of two lunar month has to be named as Kartik. In this condition the lunar month is repeated. Due to this, the repeated lunar month is called "Adhik Maas" or "Mala Mass" or "Purushottam Maas". The "Ashik Maas" usually repeats in period of 3 years.

Kshay-Mass

When moon is far away from the earth, it may take longer time for completion of lunar month. At the same period, the earth may be nearer to the sun due to which solar month may be shorter. In such condition, not a single "Aushi" may fall in a solar month. In this condition, a solar month does not contain lunar month. This discontinuity of lunar month is solar calendar is called "Kshay Maas". Two "Mala Maas" may occur in a year that contains "Kshay-Maas".

11.4 Eclipse

Umbra and penumbra

Observe your shadow in ground in sunny day. How is it formed? Think about it.

When an opaque object is placed, it bends the light sources and screen, the dark portion formed in the screen is called shadow. There are two types of shadow umbra and penumbra. To form the shadow, sources of light, opaque objects and screen are required.

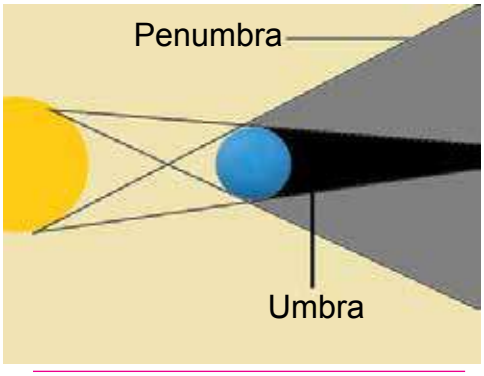


Fig. 11.3.4

The completely dark portion of the shadow is called umbra and partial dark portion of the shadow is called penumbra.

Activity 11.4.1

Place cardboard at one corner of a table and torch light at another corner of the table. Place a ball between them. Try to form the shadow on the cardboard with the help of torch light. Two parts of shadow are formed. In the middle called umbra and around it there will be a partly dark shadow called penumbra.

Eclipses

We know that the earth and moon are opaque, non- luminous bodies while the sun is luminous body. The earth revolves round the sun and moon revolves round the earth in their fixed elliptical orbits.

Shadow is formed while opaque objects lie between the source of light and screen. Similarly eclipse is formed.

During their motion, when the sun, earth and moon come to lie in a straight line, the middle object casts a shadow and causes an eclipse. Hence, the eclipse is the phenomenon of casting shadow on the earth or the moon. When the shadow is formed on the earth solar eclipse and shadow is formed on the moon. Lunar eclipse can be observed from the earth.

Causes of eclipse

1. The light travels in straight path.
2. The earth revolves around sun and the moon revolves around the earth.
3. The sun, the moon and the earth come to lie on a straight line.

There are two types of eclipse

a. Lunar eclipse
b. Solar eclipse

Lunar eclipse

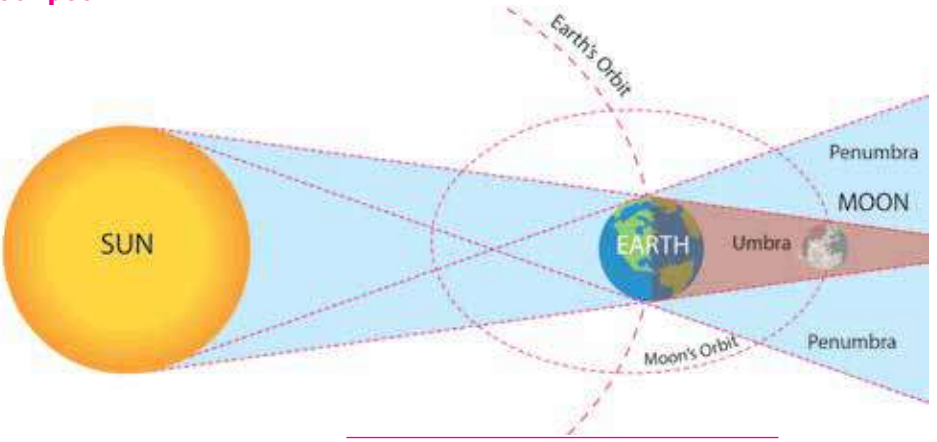


Fig. 11.3.4

When the sun, the earth and the moon come to lie in a straight line with the earth in the middle, the shadow of the earth falls on the moon causing the lunar eclipse. Thus, the phenomenon in which the shadow of the earth falls on the moon is called lunar eclipse. Lunar eclipse occurs only on full moon day. Therefore, the orbits of the earth and that of the moon intersect at two points. These points are called Rahu and Ketu. On the full moon night, the moon lies at this points and the sun, the earth and moon come to lie in the straight line since the earth lies between the sun and the moon. The earth casts its shadow on the moon and lunar eclipse occurs. But every full moon day, the moon does not lie at this points and the Sun, the Earth and the Moon do not come to lie in a straight lines. Hence, there is no lunar eclipse on every full moon day.

Types of lunar eclipse

a. Total lunar eclipse
b. Partial lunar eclipse

Total Lunar eclipse

If the moon is in the umbra shadow of the earth , the lunar eclipse occurs. It is called total lunar eclipse. In this type of eclipse, the moon does not receive any light from the sun.

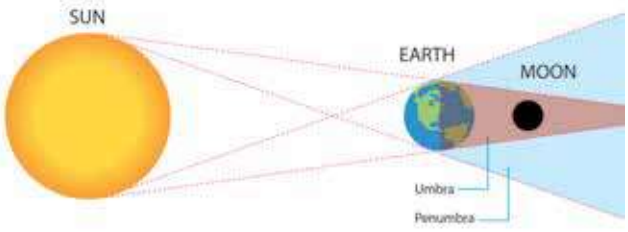


Fig. 11.3.5

Partial lunar eclipse

If the moon is in the penumbra shadow of the earth, the lunar eclipse is called partial lunar eclipse. In this case, the moon receives some light from the sun and makes it self partially visible from the earth.

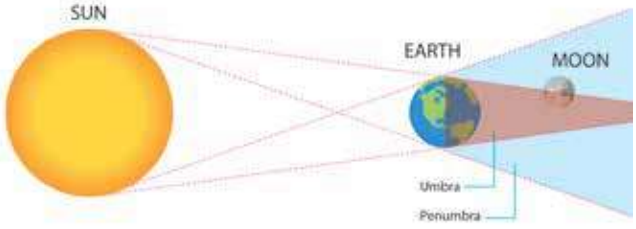


Fig. 11.3.6

Till last records, the lunar eclipse occurred up to 1 hours 40 minutes. Lunar eclipse starts from eastern part of the moon and ends at its western parts. This is because moon spins about its axis from the west to the east.

Causes of lunar eclipse

a. Light travels in a straight line.

b. The shadow of earth falls on the surface of moon.

c. The sun, earth and moon come to lie in a straight line.

d. The earth revolves round the sun and the moon also revolves round the earth in their own orbits.

Solar eclipse

When the sun, the earth and the moon are in a straight line, in the middle the moon casts its shadow on the earth. This is called solar eclipse. A solar eclipse occurs only on a new moon day since dark side of the moon faces the earth. But there is no solar eclipse on every new moon day. The orbital plane of the earth is at an angle with the orbital plane of the moon on every new moon day. The sun, the earth and the moon do not come to lie in a straight line.

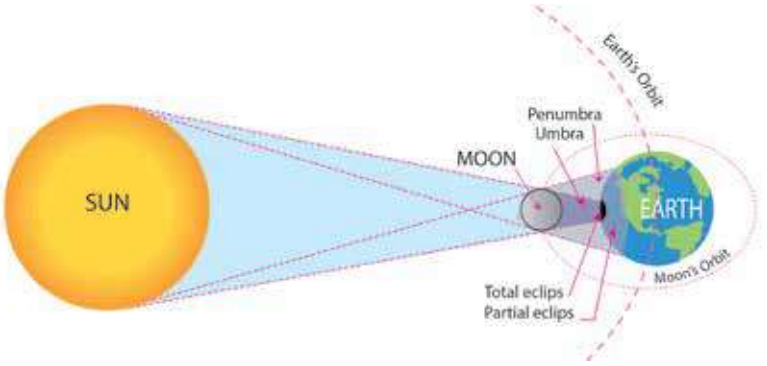


Fig. 11.3.7

There are three types of solar eclipse

a. Total Solar eclipse b. Partial Solar eclipse c. Annular Solar eclipse

Total solar eclipse

During the solar eclipse the portion of the earth falling completely in the umbra region has total solar eclipse. In this case, the sun appeared as a black circler disk with a ring of light. It is of a short duration about 8 minutes. This occurs at particular place after 360 years.

Partial solar eclipse

During the solar eclipse the portion of the earth falling in penumbra region has partial solar eclipse.

Annular eclipse

During the solar eclipse, sometimes the distance between the earth and the moon is increased. In this case the central part of the sun is blocked and the sun appears as a ring structure. This kind of eclipse is called an annular solar eclipse. This occurs in a particular place after 1000 years.

Causes of solar eclipse

a. Light travels in a straight line.
b. Shadow of moon falls on the surface of earth.
c. Sun, moon and the earth lie on the same straight line.
d. The earth revolves round the sun and the moon revolves round the earth in its own orbits.

Points to Remember

- The moon is a natural satelite of the earth. It revolves around the earth. The diameter of moon is 5,475 km which is nearly about one-quarter of the diameter of the earth.
- When the moon lies in between the sun and the earth, no lighted part of the moon is seen. It is called new moon.
- When the earth lies between the sun and the moon, full brightness of the moon can be seen. This condition is known as full moon.
- The moon completes a rotation around the earth at about 27.3 days (27 days 7 hours 43 minutes and 11.5 seconds more accurately). This is the time taken by the moon to complete one rotation is called sidereal month.
- The period from new moon to new moon or full moon to full moon is called the synodic month. It is about 29.5 days (more accurately 29 days 12 hours 44 minutes and 3 seconds).
- Generally, only one "Aushi" falls within a solar month. Sometimes, two "Aushi" falls on a single month.
- When moon is far away from the earth, it may take longer time for completion of lunar month.
- When an opaque object is placed, it bends the light sources and screen, the dark portion formed in the screen is called shadow.
- The completely dark portion of the shadow is called umbra and partial dark portion of the shadow is called penumbra.
- During their motion, when the sun, earth and moon come to lie in a straight line, the middle object casts a shadow and causes an eclipse.

Causes of eclipse

- The light travels in straight path.
- The earth revolves around sun and the moon revolves around the earth.
- The sun, the moon and the earth come to lie on a straight line.
- If the moon is in the umbra shadow of the earth , the lunar eclipse occurs. It is called total lunar eclipse. In this type of eclipse, the moon does not receive any light from the sun.
- When the sun, the earth and the moon are in a straight line, in the middle the moon casts its shadow on the earth. This is called solar eclipse.
- During the solar eclipse the portion of the earth falling completely in the umbra region has total solar eclipse. In this case, the sun appeared as a black circler disk with a ring of light.

Project Works

Make models of solar and lunar eclipses using table tennis balls, volleyballs, and flashlights.

Exercise

A. Tick the correct options

i. What is the correct alignment during a lunar eclipse?

a. Sun, Moon, Earth b. Moon, Sun, Earth

c. Earth, Moon d. Earth, Sun, Moon

ii. Angela watched the Moon from her bedroom window for one week. She noticed that, at first, it was round and fully lit. At the end of the week, the Moon was lit on the left side and looked like it had been cut in half. How do scientists describe this stage of the moon phase cycle?

a. waning b. wasting

c. waxing d. warming

iii. When the Moon is 99% illuminated, it is what type of moon is it?

a. New Moon b. Full Moon

c. Crescent Moon d. Waning Gibbous Moon

iv. People who stand in the Moon's umbra, the darkest part of its shadow, experience .

a. a partial lunar eclipse b. a partial solar eclipse

c. a total solar eclipsed. a total lunar eclipse

v. A half moon is also referred to as a .

a. new moon b. full moon

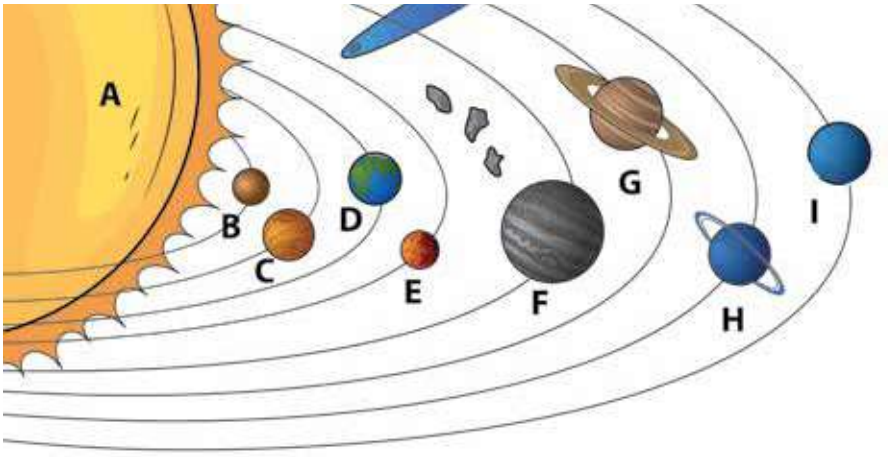
c. first quarter d. waxing crescent

vi. Which is the Earth's natural satellite?

a. the Moon b. the International Space Station

c. any meteoroid d. the Sun

v. Object "F" on the solar system diagram represents which planet?

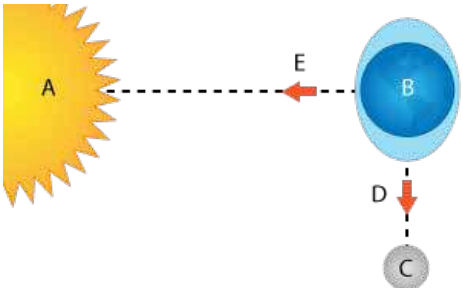


a. Saturn
b. Jupiter
c. Neptune
d. Mercury

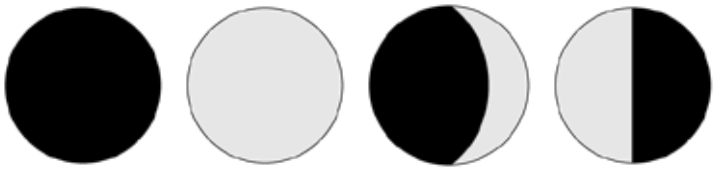
vi. The rings of the planet pictured below are mainly made of what?

a. water ice.
b. helium gas.
c. liquid hydrogen.
d. frozen carbon dioxide.

vii. The diagram shows the relative positions of the Sun (A), Moon (C), and Earth (B). Which Moon image best represents the phase of the Moon when viewed from Earth based on the diagram?



a. b. c. d.



viii. Identify the moon phase in the picture.

a. third quarter
b. first quarter
c. full moon
d. new moon

viii. **The Moon is a of Earth.**

a. luna
b. satellite
c. crater
d. night light

B. Match the word with the correct definition.

i. Moon phases	a. entire lighted side of the moon can be seen
ii. New moon	b. light on right side in increasing or returning
iii. Crescent moon	c. half-moon where the light is on the right side
iv. Full moon	d. half-moon where the light in on the left side
v. Gibbons moon	e. the change in the amount of reflected light seen
vi. Waxing	f. the first phase of the lunar cycle; no visible shape
vii. Waning	g. more than half of the lighted side of the moon is lit
viii. Third quarter	h. less than lighted side of the moon can be seen
ix. First quarter	i. light on the left side is decreasing or leaving

C. Fill in the blank.

Complete the following sentences.

i. The moon complete one revolution around the earth every _____ days.

ii. A lunar month is the period of time from one _____ to the next.

iii. Because of the earth's rotation around the sun, the period from one full moon to the next is _____

iv. The moon is _____ km away from Earth.

v. The moon is made of _____ rock with a core of _____ and _____

vi. The moon has a rocky crust made up _____ and _____

vii. The gravity on the moon is _____ of earth's gravity.

viii. The first man set foot on the moon was _____

D. Give the reason :

i.L unar eclipses occur only on the full moon.

ii. Lunar eclipses occur with greater duration than solar eclipses.

iii. On each new moon and full moon day, an eclipse doesn't occur.

E. Differentiate

i. Lunar eclipse and Solar eclipse

ii. Penumbra and Umbra

iii. Total lunar eclipse and Partial lunar eclipse

iv. Partial Solar eclipse and Annular Solar eclipse

v. Sideral month and Synodic month

F. Answer the following questions :

i. Define the phases of the moon.

ii. What is the New Moon?

iii. What is the full moon?

iv. What is the bright half and dark half?

v. Define the terms "sideral month" and "synodic month."

vi. What is an eclipse?

vii. What do you mean by a lunar eclipse and a solar eclipse?

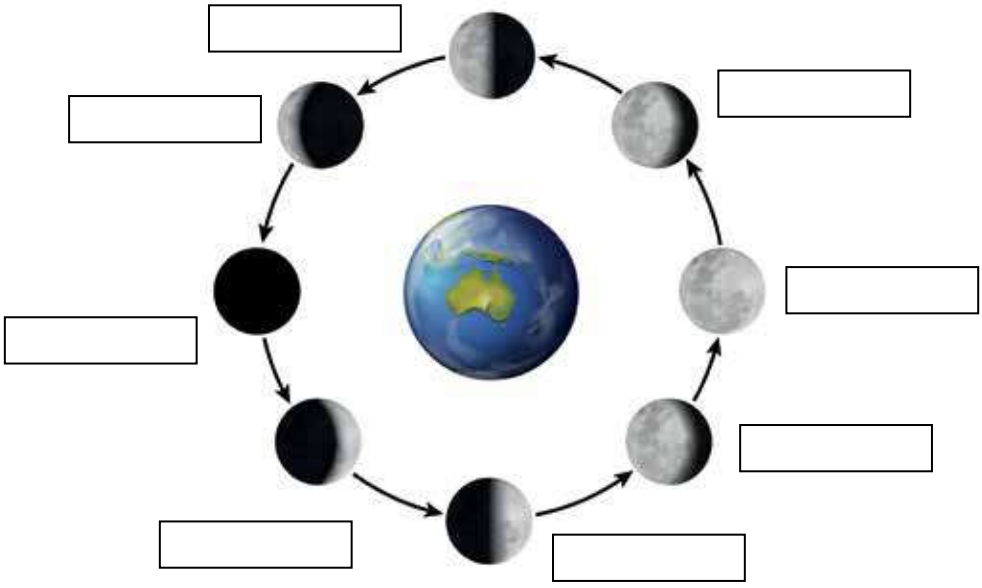
viii. Write down the causes of the lunar eclipse.

ix. Write down the causes of the solar eclipse.

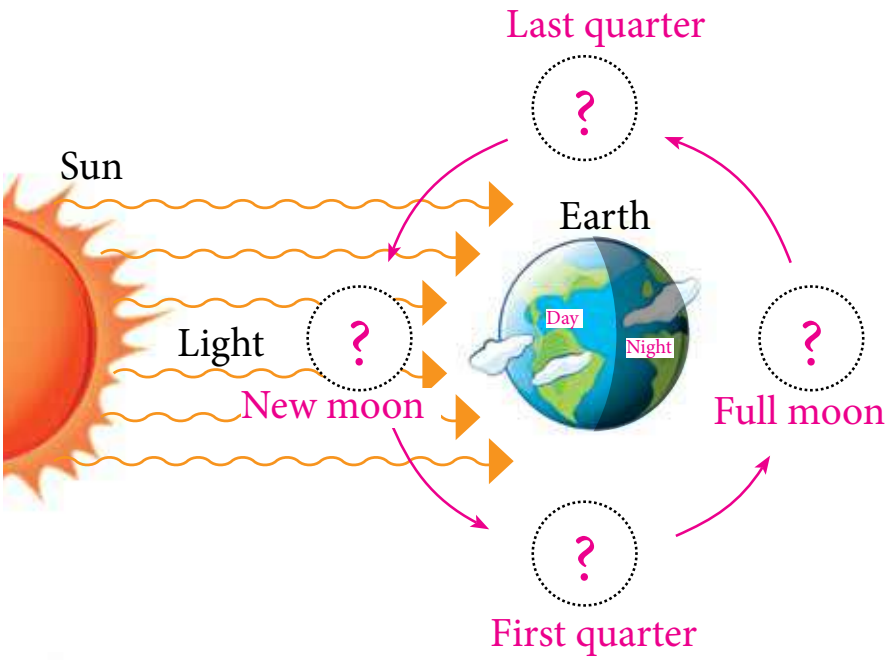
G. Diagrammatic questions

i. Use the wordbank to fill in the blanks.

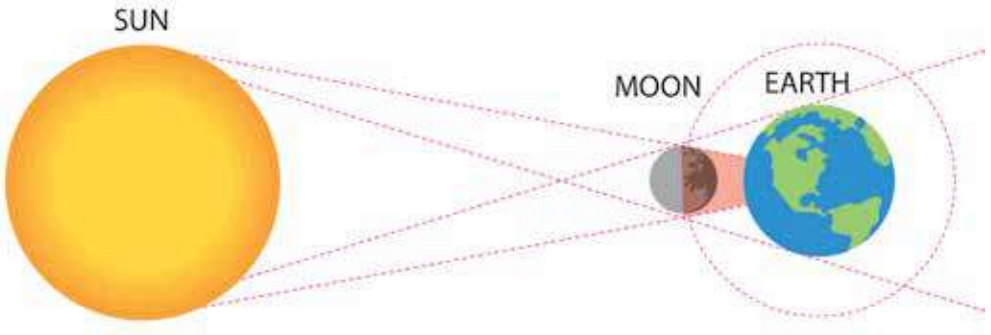
Waxing gibbous	First Quarter	Waxin Crescent	Full Moon
Waning Crescent	New Moon	Waning Gibbous	Third Quarter

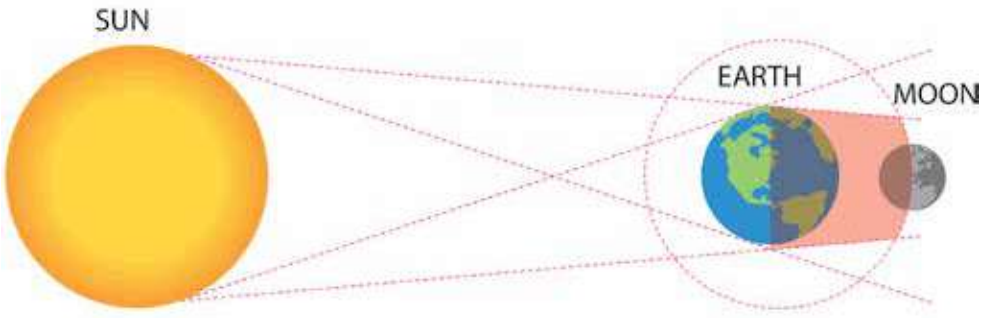


ii. Drag each phase of the Moon into its correct position

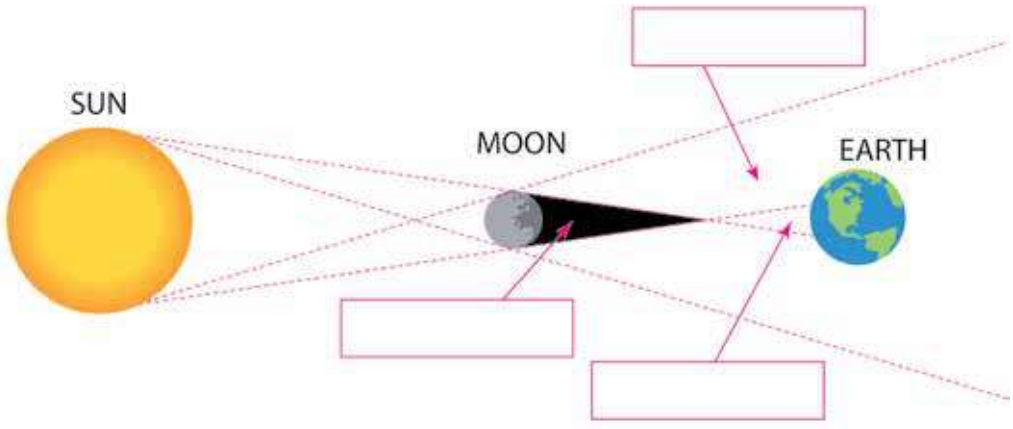


iii. Choose the correct answer.



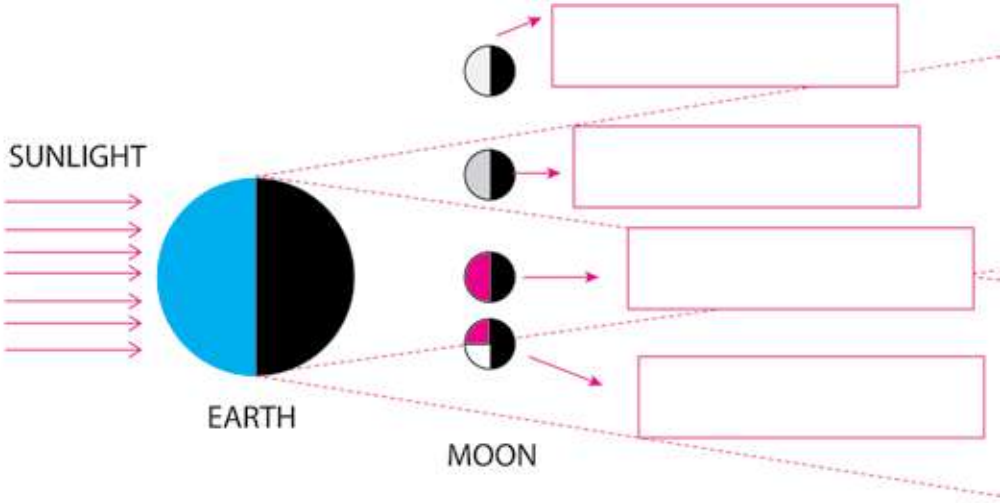


iv. **Drag & drop, make the correct anser.**
Shadow in eclipse.



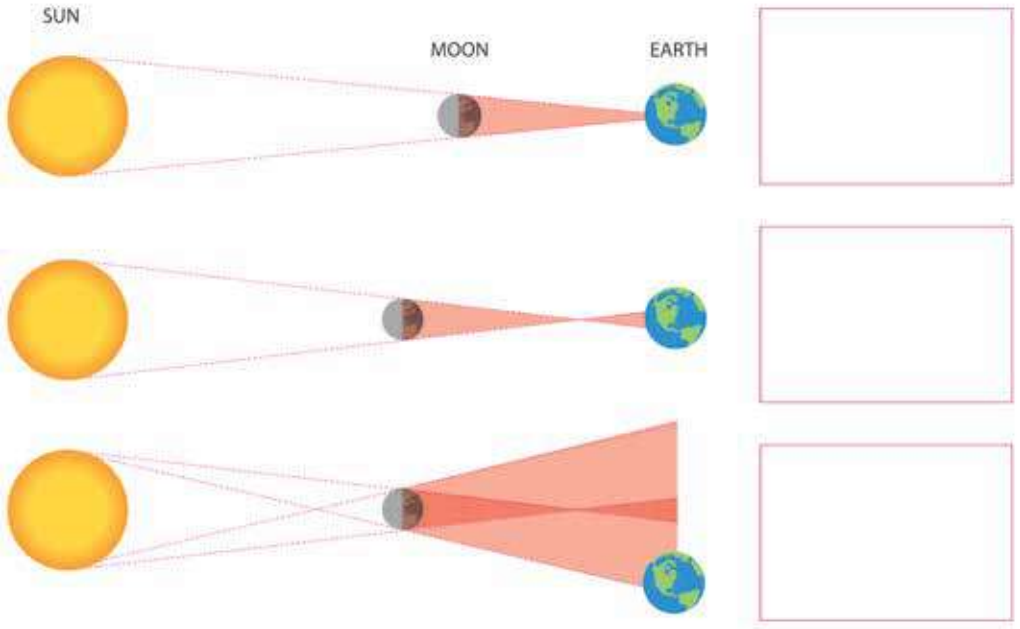
umbra | penumbra | antumbra

V. Write down the types of Lunar Eclipse in Boxes.

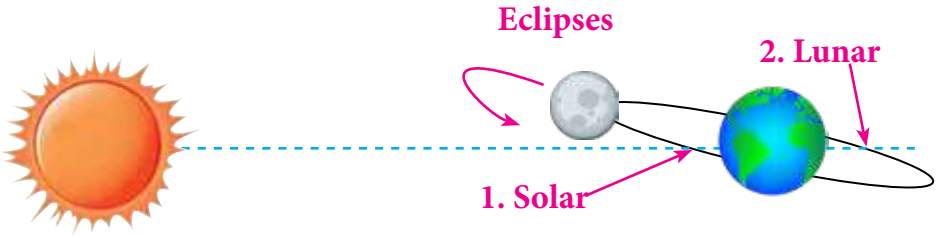


Uneclipsed | penumbra | partial | Total lunar

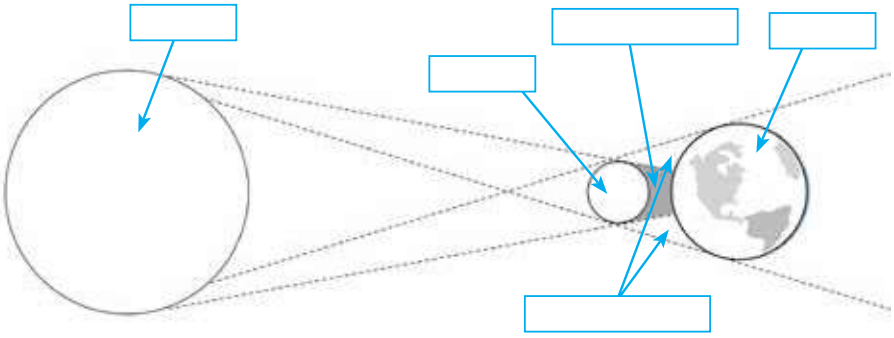
vi. Write down the types of Solar Eclipse in Boxes.



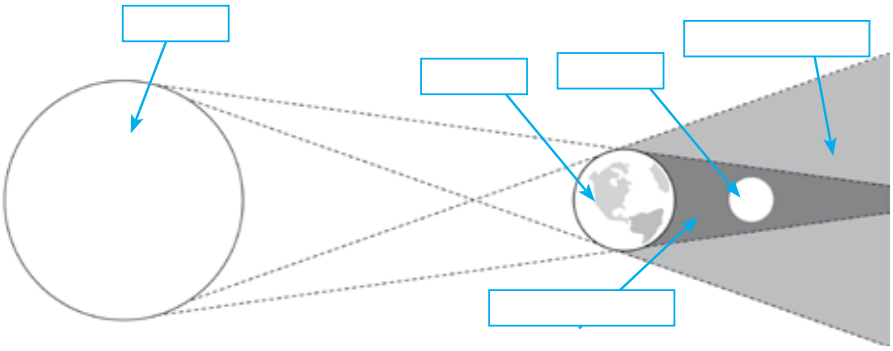
vii. **The moon's orbit is tilted 5 degrees from the Earth's orbit. There are two points in this orbit that can cause an eclipse to occur.**



i.



ii.



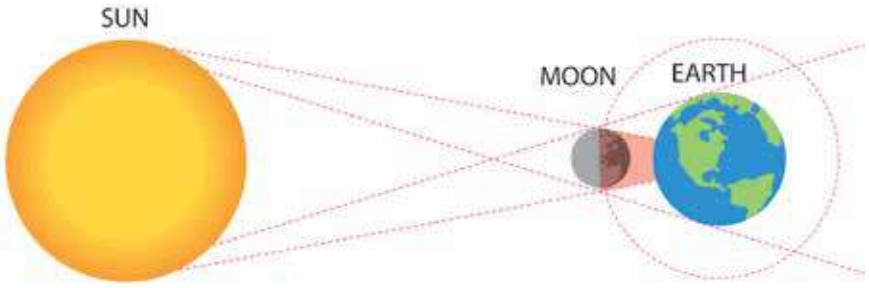
Fill in the blanks using this word bank & then colour in the diagram.

Earth- (Blue) the planet on which we live.
Moon- (white) the natural satelite of the Earth.
Penumbra- (Gray) the area is which the shadow of an object (the moon on the Earth) is partial and the area in which a partial solar eclipse in experienced.
Sun- (Yellow) the star in our Solar System.
Umbra- (Black) he area in which the sadow of an object (the moon on the Earth) is total and the area in which a total solar eclipse in experienced.

viii. Fill in the box .

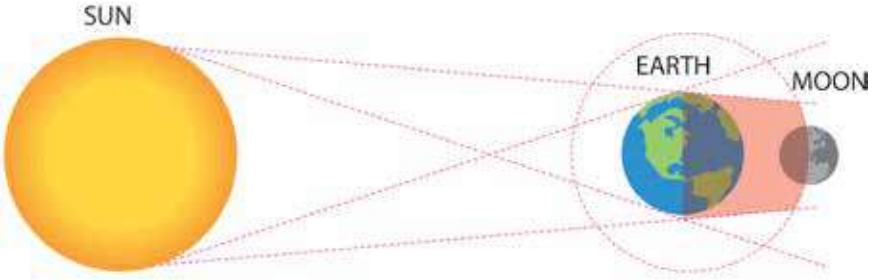
a. Solar eclipse: _____ block the light from the _____ and small part of _____ is in moon's shadow.

- Total solar eclipse can only occur during _____ moon



b. Lunar eclipse: Earth's shadow completely or partially covers the _____

- Total lunar eclipse can only occur during _____ moon



- The moon is visible during a total lunar eclipse and it looks _____