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पाठ्यक्रम विकास केन्द्र
सानोठिमी, भक्तपुर
(मान्यता, समकक्षता तथा पाठ्यपुस्तक अङ्कन शाखा)

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विषय : पाठ्यसामग्री स्वीकृति सम्बन्धमा ।

श्री नोभा पब्लिकेसन प्रा.लि,
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 २०७६, आधारभूत शिक्षा (कक्षा ६-८) 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 ।

तारा पाण्डे तिवारी
पाठ्यक्रम अधिकृत

तपसिल

(क)पाठ्यसामग्रीको नाम

१	Science and Technology	आधारभूत तह/ कक्षा ७

(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 स्खयान 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, होच्याउने 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 ।

Modern Concept Science AND TECHNOLOGY 7

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PREFACE

Modern Concept Science and Technology for grade 7 is written to meet the objectives of the curriculum of class 9 science and technology developed by CDC (Curriculum Development Center), Sanothimi, Bhaktapur. This edition of our textbook meets the criteria of basic knowledge in science and technology for students who study in class 6. It will help students to achieve the goals of life by gaining of knowledge, skills and values in Science and technology.

Logical placing of key points and well organized matter are given high priority throughout the textbook. Appropriate pictures, matter in simplified language and organization of the content with new features are our high expectation values about popularity of this textbook among the readers.

Features of Modern Concept Science and Technology

A notable concern of many teachers is to follow a well-organized textbook with step by step learnings in a continuous flow. The organization of this textbook is logically designed to make the book's information more accessible.

1. Top of the first page of each unit consists of syllabus issued by CDC (Curriculum Development Center), Sanothimi, Bhaktapur for class 7.
2. Learning outcomes of each unit are given just below the syllabus issued by CDC to focus the teaching learning goals.
3. The most important idea of writing terms and terminologies on the first page of each unit is devoted to screen out the main content to be covered.
4. Highlighted definitions, catchy memory tips and bubble box on pages inside of a chapter for a quick look on important points to be remembered are provided in the first page of each unit.
5. Activities and solved numerical problems are given in each unit of the same page with corresponding to the topic to develop the scientific skill in the readers.
6. Sample questions of Knowledge, Understanding, Application, and Higher Ability with their answer are given at the end of each unit under the title answer writing skill to get idea to solve the questions given in the three steps exercise.
7. This text book focuses primarily on all three level questions to test students' skill under the title three steps exercise.

With these all features in a well-organized content, the central focus of this book is to encourage students and make the text user-friendly for all. The answer writing skill and three levels grid based exercise will help teachers to set test papers for assessments. Students' interest will be peaked when they will find the screen out terms and terminologies, the appropriate pictures and key points throughout the textbook. We hope that this book will help teaching in learner-centered way.

We wish to express our sincere gratitude to Mr. Meghraj Poudel, Managing Director of Nova Publication Pvt. Ltd. for publishing this book. for publishing this book. Similarly, thanks are due to Mr. Deepak Bahadur Bista, Ashim (Indra) Rijal, Deepak Banjade, Dilip Belbase, Srijan Pasachhe, Shree Ram Lamsal and Srijan Adhikari for their valuable help during the preparation and content editing of the book.

Finally, we owe full responsibility of misprints and other technical errors, if any, found in this textbook in spite of our best effort to make this book error-free. Constructive criticism and suggestions for improvement of this book will be highly appreciated.

Authors

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UNIT

1 SCIENTIFIC LEARNING

ESTIMATED TEACHING PERIODS	TH	PR
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Syllabus issued by CDC

- Introduction to experimental work of science and its processes
- Parts of the experimental work report: topic, objective, hypothesis, materials required, schematic diagram, procedure, result, and conclusion
- Report writing
- Model construction process

Learning Outcomes

After completion of this unit, students will be able to:

- prepare a report of experimental work of science.
- make a model and describe the process of scientific objects or processes.

Terms and terminologies

1. **Scientific learning:** Scientific learning is a process of learning using scientific methods like observing, measuring, describing, classifying, testing, analysing, and so on.
2. **Steps of scientific learning:** Steps of scientific learning include observation, description, prediction, test, analysis, conclusion, and communication.
3. **Practical work:** The teaching and learning activity that involves individuals or groups observing or using objects to build up understanding is called practical work.
4. **Scientific report:** A scientific report is a complete description of a

process or event under scientific study.

5. **Experiments:** All the activities that we perform to test a hypothesis or make discoveries are called experiments.
6. **Collection project work:** The project work that involves a collection of plants, animals, rocks, or other objects for scientific study is called collection project work.
7. **Field Excursions:** The project work that involves observation of phenomena or objects is called field excursions.
8. **Demonstration project work:** The project work in which students replicate a particular experiment is called demonstration project work.
9. **Experimental project work:** The project work in which hypotheses are tested by experimentation is called experimental project work.
10. **Research:** The investigation made to answer the research questions using scientific tools and techniques is called research.
11. **Research project work:** The project work in which research is carried out is called research project work.
12. **Model:** A model is a rough representation of an actual event or an object.
13. **Model preparation:** The practical work in which students make a model of particular objects or processes is called model preparation practical work.

Introduction

We have seen a tiny iron nail sink in water. But in the same water, a much heavier wooden board floats easily. This may raise several questions in our mind. Why does an iron nail sink when a wooden board floats in water? If iron nail sinks then why does an iron ship float? What difference can we can see in floatation in denser medium? Is there any relation between mass of objects and floatation? How is floatation related to density and volume? Such queries can be answered by scientific learning.

Scientific learning is a process of learning using scientific methods like observing, measuring, describing, classifying, testing, analysing and so

on. Scientific learning follows continuous steps. They are observation, description, prediction, test, analysis (interpretation), conclusion and communication. Scientific learning is a systematic process and, therefore, the steps should be used sequentially.

Memory Tips

Scientific study starts with observation.

1.1 Practical Works in Science

Science tries to answer questions using tests or predicts the answer based on existing tests or facts. Therefore, practical works are very important in teaching and learning science. By this, the learner acquire knowledge or understand concepts individually or in groups.

The science teaching and learning activity which involves individuals or groups in observing or manipulating objects to build up understanding is called practical work. It can be performed anywhere: inside or outside laboratories. Science practical works may include the activities such as observation, experiment, survey, project work and model preparation.

Scientific learning steps should be followed for practical work. Observe the event, object or phenomena of your interest and list out the questions. We can predict the answer to our questions based on our knowledge. We can test the events using appropriate tests or experiments. During an experiment on an object, we can observe its features, measure its dimensions, find its mass or volume, classify it, etc. based on the requirement. Experiments are not always laboratory based. We can conduct them in natural settings. We can analyze result or interpret it with the help of our own idea or compare it with previous ideas of same kind. Reach a conclusion and relay the information to others. We do not need to conduct this process always for learning science as these processes were followed by science scholars to generate new findings. However, we can conduct this process to re-test the findings by ourselves.

Some examples of practical work

i. Proving Newton's Third law of motion
ii. Measuring a diameter of iron ball using Vernier calliper.

iii. Proving a camphor as a sublimate
iv. Carry out distillation process to separate water and alcohol from their mixture
v. Proving that the green leaf produces food in them

Fact and Reason

Why is practical work important?

Practical work is important because it helps students to understand topics in depth and develops critical thinking ability.

Importance of practical work in science

i. Promotes learning through discovery
ii. Develops skills and abilities on which one can rely on
iii. Solves day to day problems
iv. Helps in the discovery or invention of objects, principles, laws etc.

fig: 1.1 Microscope is used to observe microbes

Precautions during practical work

While conducting practical work, it is mandatory to follow precautions. Precautions help us to avoid the hazards that result from our misconduct. Burns from acid and other strong chemicals, breakage of instruments, damaging specimen and samples, fire in laboratory, animal stings, irritation in eyes and skin, allergies and other types of accidents are the hazards that occur in the lab or out of the lab during practical work.

Memory Tips

During a field excursion to Phulchowki, Laliptur, Karan Shah (herpetologist) found a pit viper snake in 1998. It was a new species of pit viper discovered till that date. So, it was named after him, Karan's Pit Viper *(Trimeresurus karanshah)*.

Some of the common precautions for practical work are listed below:

i. Always wear apron, safety goggles, shoes etc. and cover the exposed skin wherever possible. Tie back long hair and cover it.

ii. Do not touch any chemicals or lab equipment unless instructed by teachers and never work in laboratories without the supervision of teachers.

iii. Eating, drinking, playing pranks, using mobile phones, or listening to music are strictly prohibited.

iv. Check the breakage or leakage of instruments before use.

v. If any accident takes place, do not panic. Inform teachers immediately for help.

Report Writing for Practical Works

Whenever practical works are done, we should communciate with others. We should tell them the conclusions of the practical works. Writing report is the best way to communciate with others. A Scientific report is a complete description of a process or event under scientific study. A scientific report can have different contents. However, some common contents of the laboratory report are title of the experiment, objectives, materials required, procedures, observation, analysis, results and discussion, conclusion, and precautions. The general contents for reporting science practical work are discussed below.

1. **Title:** It is the topic of our activity.
2. **Purpose (Objective):** We need to write for what purpose we conducted the activity. It can be one sentence or more depending on our activity.
3. **Materials Required:** In this section, all the materials used for the activity should be listed.
4. **Procedure (Method):** This section comprises the details of the activities we performed to complete the activity. Procedures must be clear so that others can duplicate the same to get the same results.
5. **Observation:** The data required to obtain the results are collected through observations.
6. **Result:** We need to calculate or analyze the data to get results and the results come along with discussions.

7. **Conclusion:** It summarizes the result of the experiment. It states whether our prediction was correct or not.
8. **Precautions:** This section lists the measures that should be followed for safe experiments.

Project Work

There are different types of project work in science. However, based on their mode of application in learning, they are categorized as experiments, field excursions, research, collection and demonstration project works. Generally, project work requires intensive time and effort as it discusses and concludes from wider perspectives. Some types of science project works are:

Collection Project Work

1.3. specimen of different animals

Such project work involves collection of plants, animals, rocks or other objects for scientific study. This project also helps other learners study their features. The project work in which materials are collected and used to explain the topic is called collection project work.

Field Excursions

Field excursion means travel to the site for study of interest. It generally involves observation of phenomena or objects. The main objective of a field excursion is learning by observation.

Fig. 1.4. field excursion

Experimental Project Work

The activities that we perform to test a hypothesis or make discoveries are called experiments. Experiments are the tests that help us to reach a conclusion and supports learning by doing. Preparation of oxygen gas is an example

Fig. 1.5 experiment in a lab

of laboratory experiment. Observing activities of an insect in nature is an example of outdoor experiments. The project work in which experiments are carried out is called experimental project work.

Memory Tips

Humans have installed an experiment lab in the space. It is called international space station.

Research Project Work

Sometimes we may need to know the answer of different questions. For an instance, we need to know why there is difference between the feeding habits of carnivores and herbivores. To answer this, we need to conduct various observations like external body features like teeth, limbs, body structures and internal body features like digestive organs etc. For this, we need a rigorous engagement. The investigation made to answer the research questions using scientific tools and techniques is research. Research is a good example of project work. The project work in which research is involved is called research project work.

Demonstration project work

We usually observe reports of the project work and replicate them in our school. This kind of project work is called demonstration project work. The project work in which students replicate the experiment is called demonstration project work. Project works are displayed in class or an exhibition. For example, we can replicate sedimentation and decantation.

Collection project work

During exhibitions, we collect various objects on a certain topic and display them to the audience. This kind of project work is called collection project work. The project work in which materials are collected and used to explain the topic is called collection project work.

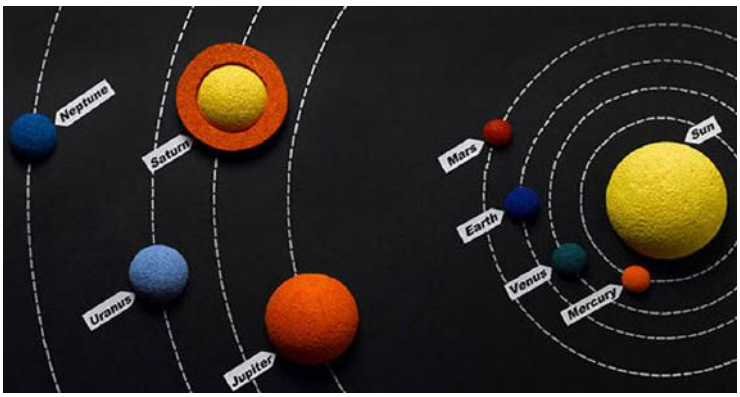
For example, we can collect scissors, screws, knives, etc. to explain simple machines.

Development of models

We may not have seen a real volcano as there are no active volcanoes in Nepal. But we have seen a model of a volcano. We cannot see DNA or an atom of an element physically because they are extremely microscopic particles. In such context, students can learn through the observation of their physical models. The project work in which research is involved is called research project work.

A model is a rough representation of an actual event or an object. Usually, three-dimensional physical models of objects or events are developed and demonstrated for learning science. Three dimensional models mean the models having length, breadth and height. Small kids can learn through collage models. Collaging is the process of gluing objects on a plane surface like paper, board etc. Collage is a two-dimensional model as they have length and breadth. Development of physical model is also an example of science practical work.

Is a globe a model of the earth? Let's try to remember other models that we have seen in science fairs.



model of solar system

Fact and Reason

Why is model preparation important learning process?

Model preparation is important learning process because it makes easier to explain scientific processes.

Example of report of experimental project work

Activity

Do all heavier objects float in water? Do all lighter objects sink in water?

Objective: to compare the density of aluminium foil and wooden plank

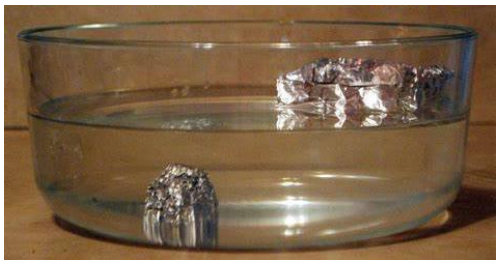
Materials required: a vessel with water, scissor, aluminium foil, small wooden plank

Procedure:

1. A flat small piece of aluminium foil was cut with scissors.
2. The foil was then squeezed and immersed in water in the vessel
3. A wooden plank was also immersed into the water.
4. Observation was made.

Observation: The aluminium foil sank while the wooden plank floated into the water.

wooden plank floating in water



properly crushed aluminium foil sinks in water but it can float if it has trapped air

Results: The density of aluminium foil is more than the density of water. Similarly, the density of a wooden plank is less than that of water.

Conclusion: Denser objects sink in water and less dense objects float in water. Therefore, aluminium foil is denser than the wooden plank.

Precautions:

1. The aluminium foil should be crushed properly. Otherwise crushed foil traps air inside it and floats in water.
2. Handle the scissors carefully.

Example of report of demonstration project work

Activity

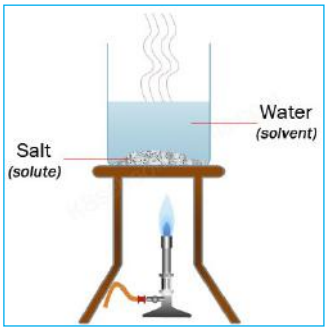
Conduct an experiment that separates salt from salt solution.

Objective: to separate salt and water from its mixture

Materials required: tripod stand, wire gauge, evaporation dish with water, spirit lamp or gas burner, salt

Procedure:

1. One teaspoon of salt was added in an evaporating dish containing water and stirred well.
2. The apparatus was set as shown in the diagram.
3. The evaporation dish was heated until the water boiled and evaporated.
4. The burner was turned off before the water completely dried.
5. The apparatus was left for some minutes to cool down.



Observation: All of the water in the dish evaporated during the process while the salt remained behind.

Results: The boiling point of salt is higher than that of water. Water evaporates during boiling while salt remain behind as a residue.

Conclusion: By using evaporation, we can separate salt from its solution.

Precautions:

1. Should not touch evaporating dish with bare hands during evaporation process. It may cause burns.
2. Switch off the gas burner or blow off the spirit lamp after use to avoid fire.

Example of report of model preparation

Title: Preparing a model of a thermometer for measuring hotness and coldness

Objective: to prepare a model of a thermometer to measure the hotness and coldness inside and outside the room.

Materials required: transparent straw, red colouring agent (liquid or powder), alcohol, water, and plastic bottle, dough (either of clay or flour)

Procedure:

1. About $\frac{1}{8}$ cup of water and same amount of alcohol were mixed in a bottle.
2. Red colouring agent was added and stirred to make the solution red.
3. A transparent straw was inserted from the mouth of the bottle and dipped in the liquid without touching the bottom.
4. The mouth of the bottle was then closed with dough securing the straw at its place.
5. A model of a thermometer was then ready for use.
6. Warm rubbed hand was placed around the bottle and a rise of the solution level in the straw was observed.
7. The observation was made by leaving the model inside of the room and outside in the sun for 15 minutes in each.

Observation: When warm hands were placed around the bottle, the solution rose up through the straw. When placed in the sun, it rose higher while placed in a ventilated room the level of solution dropped lower.

Results: The instrument did not help us to record the actual temperature but helped us to compare the coldness and hotness. Therefore, the instrument is a model of a thermometer.

Conclusion: In this way, we can prepare a model of thermometer.

Precautions:

The dough should be wrapped around the lip of the bottle ensuring no air leakage.

Answer writing skill

1. Write the name of the practical work where students learn by making a model.

The name of practical work where students learn by making models is model preparation.

2. What do you mean by research?

The investigation made to answer the research questions using scientific tools and techniques is called research.

3. Why are experiments very important?

The experiments are very important because it helps to test a hypothesis, collect new information etc.

4. Science practical works are an important process of learning. Justify.

The science practical works are an important process of learning because a student:

i. learns by doing

ii. develops reliable skills

iii. understands laws and principles

5. Write any two differences between demonstration project work and research project work.

The differences between demonstration project work and research project work are:

SN	Demonstration project work	SN	Research project work
1	The project work in which students replicate a particular experiment is called demonstration project work.	1	The investigation made to answer the research questions using scientific tools and techniques is research.
2	It helps students to understand laws and principles.	2	It helps researchers to discover new knowledge.

6. If you are asked to explain certain devices or processes in a science fair at your school, how can you explain it to the audience?

If I am asked to explain certain devices or processes in a science fair at my school, I can explain it by following ways:

i. Demonstration project work: Here I can replicate the laws or processes and demonstrate.

ii. Experimental project work: Here I can experiment on the spot for the audience.

iii. Collection project work: Here I can collect samples on various topics and display them.

iv. Model preparation: Here I can prepare a model that can explain the given object or laws and demonstrate it to the audience.

EXERCISE

Step 1

1. Fill in the blanks with appropriate words from the text in the unit.

scientific	projects	precaution	research	hypothesis

a. Scientific learning is a process of learning using …… methods.

b. The activities we conduct during practical work in science are called …….

c. The measures that need to followed for conducting experiments safely is called ……..

d. An educated guess is called ……..

e. The investigation made to answer the research questions using scientific tools and techniques is a …….

2. Write True for the correct and False for the incorrect statements.

a. A hypothesis means a prediction about the object or an event which may or may or may not be true scientifically.

b. Tests or experiments are required for very few activities in science.

c. Practical work promote learning through engagement and discovery.

d. All experiments need well managed labs for conducting science experiments.

e. Collage is an example of a three-dimensional model.

3. Choose the best answer from the given alternatives

a. There is no difference between the boiling point of milk and water. What is this statement related to in scientific learning?
   i. Prediction ii. Result
   iii. Title iv. Objective

b. What are the steps for scientific learning?
   i. Observation ii. Testing
   iii. Analysis iv. All of them

c. Which is an example of science project work?
   i. Demonstration ii. Experiment
   iii. Research iv. All

d. What usually involves observation of an event or object?
   i. Lab experiment ii. Model development
   iii. Excursion iv. Research

e. What kind of activity is breaking a rock with a hammer and observing its pieces?
   i. Lab experiment ii. Outdoor experiment
   iii. Model construction iv. Herbarium

4. Match the following with appropriate pairs

a. Prediction	a. Length, breadth and height
b. Objective	b. Methods
c. Experiment	c. Goal of experiment
d. 3 D models	d. Tests in field or laboratory
e. Procedure	e. May or may not be correct

Step 2

5. Answer the following questions in one word (or two).

a. How many basic steps are there for scientific learning?
b. What is the work that involves hands-on activities called?
c. What is the most important activity to test the prediction?
d. What is the foremost content for scientific report writing?
e. What is the ultimate step of scientific learning?

6. Write any two differences between.

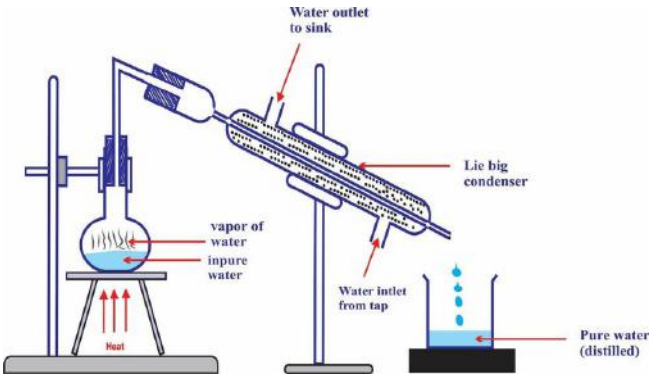
a. Prediction and conclusion
b. Collage and 3D model

c. Collection project work and demonstration project work
d. Experiment and model preparation

7. Give reason.

a. Collages are very applicable for kids learning.
b. Scientific methods are the only means of scientific learning.
c. Precautions are used in most of the laboratory experiments.

8. Observe the figure below and name the types of practical works.



a.

b.

Step 3

9. Answer the following questions.

a. What do you mean by scientific learning?
b. Write any two importance of scientific learning?
c. List the steps for scientific learning.
d. Define practical work and list four different types of practical work.
e. Point out the importance of practical work in science learning.
f. What do you mean by scientific reports? List the major contents necessary for reporting practical work from laboratories.

10. Conduct project work for demonstrating solar eclipses.

UNIT

2 INFORMATION AND COMMUNICATION TECHNOLOGY

ESTIMATED TEACHING PERIODS

TH	PR
15	15

Syllabus issued by CDC

- Introduction and examples of ICT tools.
- Introduction of internet, email, and browser and their uses
- Use of spreadsheet to make graph and chart
- Click a photo and edit them
- Diagnosis of computer virus and safety measures
- Introduction of software
- Internet and computer ethics

Learning Outcomes

After completion of this unit, students will be able to:

- introduce and give examples of information and communication technology tools.
- introduce internet, email, and browser and use them
- do simple calculations, make graphs and charts in a spreadsheet.
- prepare and present a presentation with photos and text.
- computer virus, its diagnosis, and safety measures.
- introduce the type of software.
- formulate and follow the internet and computer ethics

Terms and terminologies

1. ICT tool: All the instruments or devices that comfort information and communication are known as information and communication tools (ICT tools).
2. Internet: The internet is a globally connected network system that facilitates worldwide communication and access

		to a vast collection of information.
3.	Information:	Information means the facts, knowledge or data about something or someone.
4.	Communication:	Communication is the process of exchanging the information with others through any medium like oral, written, signal and wave.
5.	One-way communication:	Transferring of information from the sender to the receiver only is called one-way communication.
6.	Two-way communication:	The exchange of information between two or more people at a time is called two-way communication.
7.	Web browser:	A web browser is an application program for accessing the internet through the World Wide Web.
8.	Website:	A website is a set of pages of information published on the internet by any person or organization for internet users.
9.	Search engine:	A search engine is a software program that searches particular websites based on the keywords.
10.	E-book:	The electronic version of a printed book that can be read by using a computer or smart device is called an e-book.
11.	E-mail:	An e-mail is a message sent from one device (computer or smartphone) to another over the internet by using the mailing address of the sender and recipient.
12.	Spreadsheet:	A spreadsheet is a computer program that uses rows and columns for recording, editing, analyzing, and interpreting numerical and alphabetical data or information.
13.	Photo:	A photo is an image or picture of a visible object captured using a camera.
14.	Cropping:	Cropping a photo means removing an unnecessary part of the photo.
15.	Powerpoint presentation:	PowerPoint presentation is an excellent tool to present our ideas to others more simply and powerfully by using text, photos, audios and videos.
16.	Computer Virus:	A computer virus is a type of computer program that replicates itself by modifying other computer programs and inserting its own code when executed.
17.	Software:	Software is a set of programs, procedures, and routines associated with the operation of a computer system.
18.	System software:	System software is the program that operates the computers by giving instructions to the hardware.
19.	Application software:	The software that helps us to perform the desired task to get the desired outcome is called application software.
20.	Driver software:	Software that drives or operates the devices plugged into a computer is called driver software.

Introduction

We are in the digital era of information and communication. We use smartphones, tablets, computers, scientific calculating devices, internet, social networking applications, utility tools etc. for performing almost all of our daily activities. This all is possible because of information communication and technology. Our easy access to these technology has made our life easier and better.

Local technologies


stone axe


water mill


dhiki

Modern technologies


train


satellite


computer

Fig. 2.1 Local technologies and modern technologies

Activity 1

Look at the circumstances below. Interact with your teacher about the situation before 15 years and now. Example: learning from textbook was common 15 years ago but now we can read e-books. Give any other three examples.

Information means the facts, knowledge or data about something or someone. Communication is the process of exchanging the information with others through any medium like oral, written, signal and wave. Technology is the method, system or devices created through the application of scientific knowledge. Information and communication technology is, therefore, the tools and techniques that enable the users to access, retrieve, store, transmit and manipulate the information in a digital form. ICT includes internet, wireless networks, cell phones, computers, software, video-conferencing, social networking, and other media applications that aid information and communication.

2.1 Information and Communication Tools (ICT Tools)

All the instruments or devices that ease information and communication are known as information and communication tools (ICT tools). An ICT tool should have the features like accessibility, retrieval ability, storage, transmittable and manipulability.

ICT tools are important because they help in accessing information throughout the world. It helps to take online classes and use other educational materials. It also helps to access social media, websites, news etc.

ICT tool may sometimes decrease academic performance of students because they spend lots of times in social media and entertainment only.

radio

television

projector

smart phones

fig: Some ICT tools

Means of communication

There are two types of means of communication. They are: one-way communication and two-way communication. Exchange of information between two or more people at a time is called two-way communication. Telephone conversation is an example of two-way communication. Similarly, transferring of information from the sender to the receiver only is called one-way communication. Broadcast of radio is an example of one-way communication.

Memory Tips

Radio waves bounce back from fourth layer of atmosphere and helps in communication.

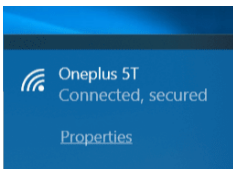
Activity 2

Ask your parents what tools they used for studying when they were students. Make a list, write its use and classify them as one-way or two-way means of communication. Make a list of tools used for studying nowadays. Write their use and classify them as well.

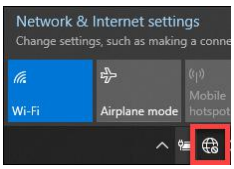
2.2 Internet

We have watched videos on youtube and taken online classess through mobiles or computers. We are able to do that because we have access to the internet. The internet is a globally connected network system that facilitates worldwide communication and access to a vast collection of information. World Wide Web, abbreviated as WWW, is the biggest service of internet that connects us to the global network. We can connect the internet in our devices through connecting wires like communication cables or through wireless networks called Wi-Fi (wireless fidelity).

ICT device, application (software) and internet network are necessary to use internet. ICT devices are computers, laptops, smartphones, smart watch, tablets, smart TV etc. The device should also have applications (program) to access the internet. And, finally we need an active internet cable or router. Internet cable is joined to our devices while router radiates waves for Wi-Fi connection. By looking the icons of network connection at the right end of the task bar, we can find the internet connection status of the computer.



wifi connected



wifi not connected

Fact and Reason

Why is internet important?

Internet is important because it helps to access information through out world and also helps in communication.

Activity

Let's make a list of internet service providers available in our city. For example: World link.

Web Browser

A web browser is an application program for accessing the internet through the World Wide Web. Internet Explorer and Microsoft Edge are the default browsers in computers with windows operating system. Google Chrome is default browser in android phones. Safari, Opera and Firefox are other examples of browsers.


Google Chrome


Internet Explorer


Safari


Opera


Firefox


Microsoft edge

Website

Website is a set of pages of information published on the internet by any person or organization for internet users. It contains texts, pictures, videos, sounds etc. We need to type web address in address bar. A web address means the location of a webpage in the internet network. As it identifies the location of web resources in the universe of network, it is also called Universal Resource Locator (URL).

Activity

Surf the website of moecdc.gov.np. Click on publication and select audio visual resources. Then click on browse next and click on laboratory-based science subject 6,7 and 8 (in Nepali) to select audio video materials.

Search Engine

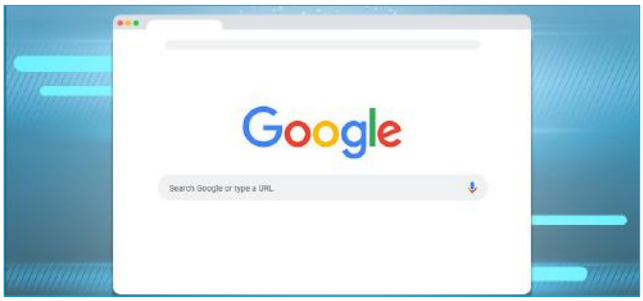


Fig : Google search

If we don't know the web address of the site we can just type key words or phrase in the search engine and look at the result to find any site. A search engine is a software program that searches particular websites based on the key words. Examples of other search engines are Bing, Yahoo, Ask.com, DuckDuckGo, Baidu etc.

Memory Tips

Google is the most reliable and widest surfed publicly available search engine.

How to select a search engine and make it default?

We can make Google Search as our default search engine by following steps.

i. Open chrome.
ii. Click at the top right three vertical dots icon.
iii. Press setting > Press downward arrow> select google

E-book

The electronic version of a printed book that can be read by using computer or smart devices is called an e-book. Usually, electronic books are available in portable document formats (pdf.). To open and read documents in pdf. format, we need pdf. reading applications in our devices, like Adobe Reader and Nitro pdf. E-book is important because it reduce use of paper.

Activity

Search "moecdc.gov.np." Click on it and you will be directed to the website of Curriculum Development Center. Download class 7 science eBook.

2.3 Email

An e-mail is a message sent from one device (computer or smartphone) to another over the internet by using the mailing address of sender and recipient. Its full form is electronic mail. Emails also requires web-based applications. Gmail, Yahoo Mail, Hotmail, etc. are examples of applications that provide email service free of cost.

Opening an email account

Gmail is the most used email service in the world. It is developed by Google, a leading company in ICT sector. To create a Gmail account, we should follow the following steps.

Step 1 : Visit Google account creation page, accounts.google.com
Step 2 : Click on Create account.
Step 3 : Sign-up form will appear. Enter first and last name.

Step 4 : Choose a Username for account or create our own. Enter a password. Type the password again to confirm and tap next.

Step 5 : On next page enter mobile phone number to verify account.

Step 6 : We will receive a text message from Google with a verification code. Enter the verification code and tap on Verify.

Step 7 : On next page enter date of birth, choose gender and tap next.

Step 8 : Read, Google's Terms of Service and Privacy Policy will appear on the screen and click on I agree.

Logging, Sending, Receiving and Signing Out of an Email (Gmail)

We should follow the steps below for logging in our email ID, sending and receiving emails and signing out of the email program.

- Open chrome browser. Enter Google account email or phone number and click next.
- To compose a new mail, click compose tab with + sign at the left corner of the screen. New message box appears. Write the email address of the receiver, for example, jamescrook@gmail.com. Click to CC or BCC of send carbon or blind carbon copy of the email to others email address. In subject line, write subject. Then type the email message in box below subject. Click on (attaché files) at side to attach documents of send tab. Select location from where files are to be attached, select files and click OK. Click on send.
- To view incoming emails, click on Inbox menu. The sender email ID and subject are seen on screen. Click on it. Click on download if needed.
- To sign out of email, navigate to the circle (in top-right corner of page). Here tap on it, from below option, select Sign-out.

Advantages of email

- It is a free means of communication.
- Email is extremely quick.

- It is very simple to use
- Email is accessible anywhere and anytime upon connecting to the internet.
- Email is paperless and, therefore, saves resources.

Disadvantages of email

- Email cannot be used without internet connection.
- It has a limited capacity for free service.
- One cannot attach large size documents in an email.
- Email messages can contain applications that steal our privacy or damage our devices.

Activity

Create an email address of you own. Share it among the friends and send greetings to each other.

2.4 Spreadsheet

Spreadsheet is a computer program that uses rows and columns for recording, editing, analyzing and interpreting numerical and alphabetical data or information. Let's learn calculating and visualizing some simple information. For this purpose, we will use a Microsoft Office program called Microsoft Excel.

Calculations in Excel

Activity

F8 | fx | =E8/C8

	A	B	C	D	E	F
1						
2	S.N	Posts	No. of people	Wages per day (Rs)	1 day wage (Rs)	
3	1	Team leader	1	3000	3000	
4	2	Research Officer	3	2000	6000	
5	3	Senior researcher	5	1750	8750	
6	4	Junior researcher	7	1500	10500	1750
7	5	Helpers	2	900	1800	
8			18		30050	1669.44
9						

1. Look at spreadsheet above. It contains different posts of a research project with their numbers and daily wages. A, B, C, D, E… at top of the sheet represent columns and 1,2,3,4… on left side represent rows. To perform calculations, we should know name of each cell. The highlighted cell with value of 3000 is D3 (D column and 3 row). Similarly, D6 represents wage of junior assistants. Which cells represent numbers of research officer and helpers? Open the excel application by typing excel in search box and pressing Enter. Copy the information.

2. Addition: To find out number of people working for the research?

   - We need to add C3, C4, C5, C6 and C7 to find total number of people. Click on cell C8 or any cell where we want to write sum of people.
   - Type = and click on C3 and click + then C4 and click +, C5 and Click +, C6 and click + and C7 and press Enter. = command is used for using formulas. Now we've got the sum of staff members on that project.

3. Multiplication: To find out wage expense of research officer in a day.

   Add a column and name it '1 day wage'. To find wage of research officers we need to multiply no. of research officers with their daily wage. For this, type = and click on C4 and type or click the multiplication sign and click D4 ie. =C4*D4 and press Enter. If we place cursor and align it with bottom right corner of formula-applied cell and drag it up or down, all cells uses same formula for multiplication all at once.

4. Division: Can we find average salary the project provides to its employees in a day? For this we need to divide total wage of a day by the number of staff members. For this, place cursor in the cell where mean should be calculated. Click = and click on E8 and press / (divide) sign and click on C8 and press Enter, i.e., =E8/C8 Enter. Look, average salary of the project staff in a day is Rs 1669.44, as seen in the cell F8.

Activity

Enter the marks you obtained during your recent test and calculate percentage.

Showing data on chart

Excel can express our data in the forms of charts. For this, we should be skilled at arranging data as per the requirement of the chart. Always remember, all data does not fit in all charts. Let's display our simpler data into charts.

Look at spreadsheet. It shows expenses of a family in a month. Follow the steps given below to get beautiful charts of them.

1. Select the data first. To select the click at top end of one cell and drag to cover all of cells with data.

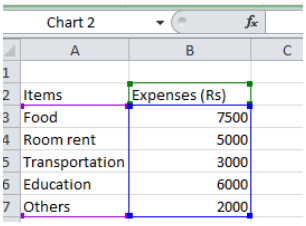
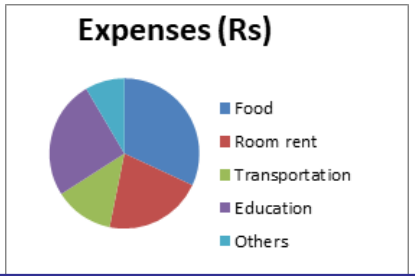


Chart 2

	A	B	C
1			
2	Items	Expenses (Rs)	
3	Food	7500	
4	Room rent	5000	
5	Transportation	3000	
6	Education	6000	
7	Others	2000	

2. Click on insert tab and select an applicable chart from the chart menu. Here a pie chart is selected for first data. A pie chart then appears on the same sheet.



Activity

Express the number of girls and boys in your class using a pie chart.

2.5 Photo

A photo is an image or picture of visible object captured using camera. Our ICT devices like smartphones, laptops, desktops etc. are equipped with a camera that allows us to take photographs. Photo is used in reports, presentations, greetings, email, social media etc. It is the simplest and fastest way of communicating information.

Photo

Transferring Photos from Camera or Smartphones to computer

There are different methods of transferring photos to PC.

- With a USB cable, connect phone or camera to computer.
- Tap Allow to access the data, or under use USB for, select File Transfer in the phone. It is not needed in camera.
- Click on This PC (or My computer) icon in the desktop. Connected device are seen under Devices and Drives menu
- Double click the mobile or camera device icon.
- Select the DCIM folder and open it.
- Open the Camera folder. Icons of photos will be seen. Photos may be present in different other folders like download, screenshots and Facebook. Select and open as per the need.
- Select the photo. Press Ctrl and click photo to select one or more while press Ctrl+A to select all photo.
- Press Ctrl+C to copy them or right click mouse and select copy
- Go to location where photo should be pasted and press Ctrl+V or right click mouse and select paste option.

Editing Photos

Sometimes we may need a certain portion of a photo only. Sometimes, the light and colour of photo need to be changed and dark marks should be adjusted. Sometime, we need to email pictures but we cannot due to its large size. For this, we need to edit photos.

Cropping a photo

Cropping a photo means removing unnecessary part of the photo.

- To crop photo, double click photo. The photo opens in an application named 'Photos'.
- Click on edit and create menu and select edit.
- Drag the corners of the photo to fit the desired part inside the frame.
- Then click on save a copy.

Adjusting a photo (Light, Colour, Clarity and Others)

Usually, light, colour, clarity, vignette (boarder disappearing in background) etc. are done to adjust and enhance the photo. Photos application in our computer helps us to make adjustments in the photo. Follow the steps below to change light, colour, clarity and vignette of the photo.

- Double click a photo to open it.
- Click on edit and create.
- Select edit option by clicking it.
- Click on adjustments at the top of the screen
- At the right side, we can see light option, drag central vertical white line and adjust light of the photo. To further adjust contrast, exposure, highlights and shadow, click on > at light menu and adjust as per need.
- Similarly, we can adjust colour of photo. The colour option is below light option. Click on > at colour menu to change tint and warmth of photo.
- After working on adjustments, click on save a copy for saving the photo in the desired location.

Adjusting the size of the photo

We need to adjust the size of our photos. The size of the photo can be adjusted using Paint program by following the given steps.

- Open photo in Paint program.
- At the right end of screen click on + or – to fit photo in the screen.
- Click on Resize option and select the pixel.
- You can either write value of horizontal or vertical pixel.
- Click on Ok. The size is decreased now.
- In this way, by changing pixel you can either decrease or increase the size of the photo.

Activity

Let's take a photo of any object from our smartphone or a camera and transfer it to our computer. Let's edit photo by cropping, adjusting light, clarity, contrast and decreasing its size. Then let's compare original photo and edited photo.

2.6 PowerPoint Presentation

PowerPoint presentation is an excellent tool to present our ideas to others more simply and powerfully by using text, photos, audios and videos. We use Microsoft PowerPoint to prepare presentations. We can present texts, pictures, audio-videos, animations etc. using Microsoft PowerPoint program. Using photos in PowerPoint presentation makes the presentation attractive and easily understandable.

Editing Photos in PowerPoint

Microsoft PowerPoint has a powerful option to edit the photos as per our need. For this, we just need a picture or photo to edit.

1. Opening a photo in PowerPoint

- Open PowerPoint program.
- Then click on Insert menu and click on Picture.
- Click on the desktop and click on file and click on insert. Then the photo appears on the slide.

2. Cropping a photo

- Double click the picture on the slide. This activates Format menu with pictures tools.
- Click on Crop icon near the top end of the screen. Click and drag the bold corner or central boarder line to crop photo.

3. Corrections and colours

- In correction menu we can sharpen and soften the image and change the brightness and contrast of the image.

  Similarly, in Colour menu we can adjust colour saturation, colour tone and recolour the image.

- Double click the photo of the slide.
- This activates Picture tools. Now, click on the Correction icon, select any appropriate image from the sharpen and soften menu and click one of them.
- Again, click the correction option, select one of the options from the brightness and contrast menu. It helps the image to look bright and dim and increase or decrease the contrast of the photo.
- We can select one or more images at once to use these corrections.

2.7 Computer virus

A computer virus is a type of computer program that replicates itself by modifying other computer programs and inserting its own code when executed. A computer virus is simply a program or code that alters the way computer operates. It is developed by hackers. Trojan, Nimda, SQL etc. are examples of computer viruses. Slow computer performance, erratic computer behavior, data loss, and frequent computer crashes are the symptoms of the condition when a computer is infected with the virus.

Ways of spreading of computer virus

i. Internet

The Internet is the main source of virus. Viruses enter into our computer when we use insecure websites, online programs, online advertisement and scams, email spams, program downloads etc.

Fact and Reason

Why should we not open spam mails?

We should not open spam mails because viruses may infect our computer.

ii. Installation of Cracked Software

Duplicate and cracked software can contain viruses. Installation of such software infects our computer.

iii. Transferring of Files

Transferring of files from one computer to another computer offline also transfers viruses in the healthy computer. Transferring of files through USB devices, portable hard disk, CD etc. also transfers the virus infecting our computer.

Preventing Computer viruses

Mentioned below are some safety measures that should be followed to prevent computer viruses from infecting the computer system.

- Never download programs from untrusted sites.
- Scan email attachments before opening and don't reply the spams.
- Always assure that system firewall is on.
- Use authentic antivirus program in the computer.
- Regularly update operating system.
- Monitor all devices proactively.
- Uninstall suspicious application from system.

Treatment of Computer viruses

fig: some popular antivirus software

Activity

Conduct a survey in your home and in your neighbourhood to include 6 people of different ages and professions. Which antivirus do they have in their mobiles and computers? Write their name, age, profession, ICT tools they use and antivirus they use in that device.

Following conditions must be assured to treat the computer virus.

- Authentic antivirus programs should be installed and updated.
- Update the operating system regularly.

- Quick scan and full scan of the operating system should be conducted in regular basis.
- Suspicious programs should be quarantined or deleted by using the antivirus program.
- The antivirus program and system firewall should always be on.
- Carefully observe notification from antivirus and operating system.

2.8 Software

Software is a set of programs, procedures and routines associated with operation of a computer system. Software contains sequence of instructions written to solve a particular problem. Example of software includes operating system, Microsoft Office packages, antivirus programs and drivers.

Software is divided into four major types. They are system software, application software, programming software and driver software.

System Software

System software is the program that operates the computers by giving instructions to the hardware. This provides the platform for other software to operate. Example of system software is Windows Operating System, Android System and iOS.

Application Software

The software that helps us to perform a desired task to get a desired outcome is called application software. It is the end-user program. Example: game software, Office packages, Web-browsers etc.

Driver Software

Software that drives or operates the devices plugged into a computer is called driver software. Driver software creates an environment for the device to perform their functions. Examples of driver software are printer driver, Scanner driver and Graphic card driver.

Activity

List out the examples of software you know or have been used in your phone or computer. One is done for you.

System Software (any two)	Application Software (any six)	Program Software (any two)	Driver Software (any two)
Apple's iOs	Microsoft excel	C+	Scanner Driver

2.9 Code of Conduct for using computer and internet

Code of conduct applies to anyone who uses a computer. This means the user should follow the ethics while using the internet and computer. Some of the code of conducts we should consider while using the computer and internet are listed below.

- We should not attempt to access the email accounts of others without permission.
- We should not engage in unauthorized hacking activities.
- We should not make any attempt to steal any digital information of any users.
- We should not use offensive, rude and harassing materials.
- We should use authentic program in our computer and internet.

2.10 Rules for using computer and internet

We should adhere to certain rules for using computer and internet safely. Unable to follow the rules, we can fall victims of financial threats, harassments, data loss, system crash, hardware failures, legal issues etc. Some general rules for using the computer and the internet are mentioned below.

- Maintain privacy of personal information and data.
- Never download any applications from the unsafe sites.

- Be very careful while posting anything on the internet as it may remain in the copies of other people for ever even if we delete it.
- Be careful while trusting people from online source.
- Don't open spam from email inbox as they may be a tool of fraud.

Answer writing skill

1. What is a search engine?

A search engine is a software program that searches particular websites on the World Wide Web, based on the keywords or characters specified by the users.

2. Write names of any four-computer virus.

Some computer viruses are:

Trojan, Nimda, SQL Slammer, Stuxnet, CryptoLocker, Conficker, Tinba etc

3. What is an electronic version of paper books called?

The electronic version of paper books is called an e-book.

4. Differentiate between system software and application software.

The differences between system software and application software are:

SN	System software	SN	Application software
1	System software is the program that operates computer system by giving instructions to the hardware.	1	The software that helps us to perform the desired task to get the desired outcome is called application software.
2	This provides the platform for other software to operate.	2	It is the end-user program that allows us to do work.

5. Why should we install antivirus on our computer?

We should install antivirus in our computer to prevent the entry of virus, diagnose virus and get rid of the virus from our computer.

6. Email is advantageous application software. Justify.

Email is an advantageous application software because:

i. It is a free means of communication.

ii. Email is simple and extremely quick.

iii. Email is paperless and, therefore, saves resources.

EXERCISE

Step 1

1. Fill in the blanks with appropriate words given below.

web browsers	gmail	cropping	application	internet

a. The applications needed for surfing the internet are …….

b. The most widely used free email service is ……

c. The method of editing photo by cutting unwanted area or part is called ……..

d. The main source of computer virus is ……..

e. Microsoft PowerPoint is an …….. software.

2. Write True for the correct and False for the incorrect statements.

a. Newspaper is an example of a digital ICT device.

b. Google is the most popular search engine.

c. The web address of each website is same to another.

d. Inbox contains the emails delivered to us.

e. Microsoft Excel is a powerful presentation tool.

3. Choose the best answer from the given alternatives.

a. Which one is an ICT tool for two-way communication?

i. Smartphones ii. Radio

iii. Email iv. All of them

b. Which one is an example of a web-browser?

i. Google chrome ii. Spreadsheet,

iii. PowerPoint iv. E-book

c. What are Yahoomail, Gmail and Hotmail?

i. Email ii. Website

iii. Search engine iv. Browser

d. What is the use of Spreadsheet?

i. Data analysis ii. Presentation

iii. Word-processing iv. All of them

e. What type of software is windows operating system?

i System software ii. Application software

iii. Driver software iv. Programming software

4. Match the following with appropriate pairs.

a. One way communication	a. World Wide Web
b. Email	b. Browser
c. Search engine	c. Television
d. WWW	d. Google.com
e. Google chrome	e. Electronic mail

Step 2

5. Answer the following questions in one word (or two).

a. What is the most used tool for two-way communication?

b. Which is the most popular search engine?

c. What is the name of an electronic version of a book?

d. Write the full form of Wi-Fi.

e. Which icon is used for adding all the numeric data of a column or row?

6. Write any two differences between.

a. Means of two-way communication and means of one-way communication

b. Browser and search engine

c. Spreadsheet and PowerPoint

7. Give reason

a. A smartphone is a two-way communication device.

b. We sometimes need to decrease the size of a photo.

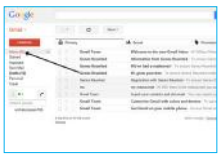
c. Browser is called an application software.

d. Windows is known as system software.

8. Study the figure below and name their computer programs.

a. 

b. 

c. 

d. 

Step 3

9. Answer the following questions.

a. What do you mean by ICT?

b. State the meaning of ICT tools. Write any two importance of ICT tools.

c. Define the term internet. What are the requirements for surfing the internet?

d. What do you mean by web-browsers? Name any two.

e. What is an email? Write down the step for sending an email.

f. List two advantages and two disadvantages of email.

g. What do you mean by a computer virus? Write two measures to prevent computer viruses from entering the computer system.

h. Define the term search engine. Why do we need it?

i. State the meaning of software with it types and give two examples of each of the types.

10. Take the data of yearly total number of students of your school of at least 12 years, record it in excel and make a line graph (chart) and write a brief report interpreting the data.

UNIT

3 LIVING BEINGS AND THEIR STRUCTURE

ESTIMATED TEACHING PERIODS	TH	PR
	9	3

Syllabus issued by CDC

- Structure and function of parts of the plants: root, stem, leaf, flower and fruit
- Identification, structure and function of modified parts of the plants
- Classification of invertebrates
- Characteristics and examples of nine phyla of invertebrates.
- Introduction to cell
- Plant cells and animal cells
- Structure of plant cell and animal cell

Learning Outcomes

After completion of this unit, students will be able to:

- describe the functions of different parts of the flowering parts.
- identify the modifications of plants parts (root, stem and leaf) and discuss their structure and function
- write the characteristics of each group by classifying the animals that lack backbone.
- identify the cell organelles of plant cells and animal cells

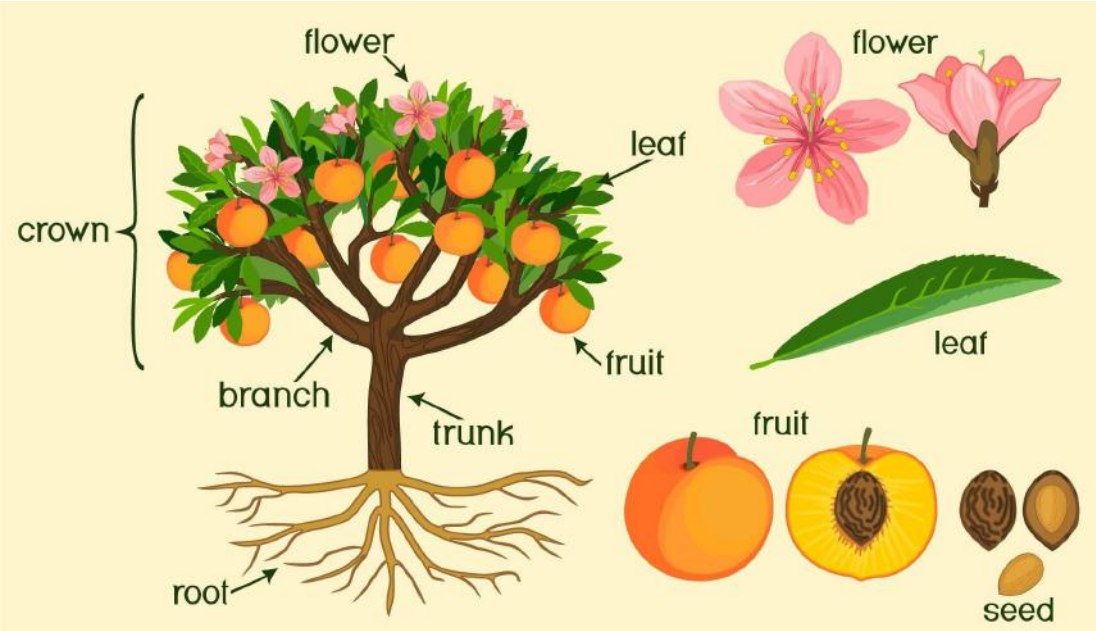
Unit 3.1 Parts of the plant

Terms and terminologies

1.	Root system:	The part of the plant which grows inside the soil is called the root system.
2.	Shoot system:	The part of the plant that grows above the soil is called the shoot system.
3.	Non-flowering plants:	The plants that do not bear flowers are called non-flowering plants.
4.	Flowering plants:	The plants that bear the flowers are called flowering plants.
5.	Root:	The plant part which helps to collect water and minerals is called the root.
6.	Stem:	The stem is the main support of the plant.
7.	Leaf:	The leaf is a flat green structure that grows from the stem or branches of the plant.
8.	Venation:	The arrangement of veins and veinlets in a leaf is called venation.
9.	Flowers:	Flowers are colourful reproductive parts of the flowering plant.
10.	Complete flower:	The flower that has all four parts, i.e., calyx, corolla, androecium and gynoecium is called a complete flower.
11.	Incomplete flower:	The flower which does not contain at least one of the four whorls is called an incomplete flower.
12.	Calyx:	The group of sepals that forms the outermost whorl of a flower is called a calyx.
13.	Corolla:	The coloured part formed by a group of petals is called the corolla.
14.	Androecium:	The group of stamens (male reproductive parts) of a flower is called androecium.
15.	Anther:	An anther is a top bi-lobed part of the stamen.
16.	Gynoecium:	The group of carpels of a flower is called gynoecium.
17.	Unisexual flower:	A flower that contains only one reproductive part (either male or female part) is called a unisexual flower.
18.	Bisexual flower:	A flower that contains both male and female reproductive parts is called a bisexual flower.
19.	Pollination:	Pollination is a process of transfer of pollen grains (male gametes) from the anther to the stigma of a flower.
20.	Fertilization:	Fertilization is a process of union of a male gamete and a female gamete to form a zygote.
21.	Embryo:	An embryo is a multicellular structure formed by the growth of a zygote.
22.	Fruit:	The fruit is a matured ovary.
23.	Seed:	A seed is a ripened ovule of a flowering plant.

Introduction

There are millions of species of plants. Each species is different from the other. They differ in shape, size and structure. Usually, a plant body contains root, stem, leaf and flower. Each part has a different function in the plant.

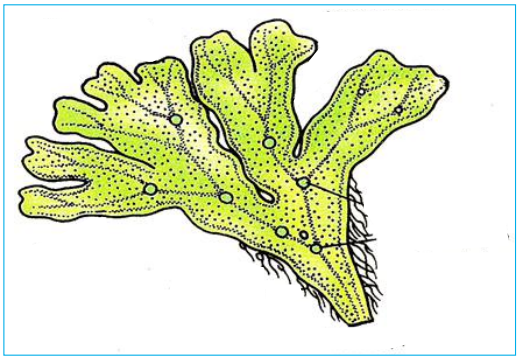


parts of the plant

Memory Tips

The flower is a modified shoot.

3.1.1 Structure of a non-flowering plant



Chlamydomonas is a unicellular plant. It is made of a single cell. It contains chlorophyll. Spirogyra is more developed than the Chlamydomonas. It is a long green thread-like plant. Marchantia is a plant that grows in moist soil. It has rhizoids under the leaf. The ferns

are the most developed among non-flowering plants. They do not bear flowers. The plants that do not bear flowers are called non-flowering plants. Ferns have rhizoids, rhizomes and leaves. The rhizoids absorb water for them.

3.1.2 Structure of the flowering plants

Herbs are very small flowering plants. They bear flowers, fruits and seeds. The plants that bear the flower are called flowering plants. Shrubs are bushy plants. They have a taproot, woody stem and leaves.

Trees are big plants. They have well-developed taproots, strong stems and leaves.

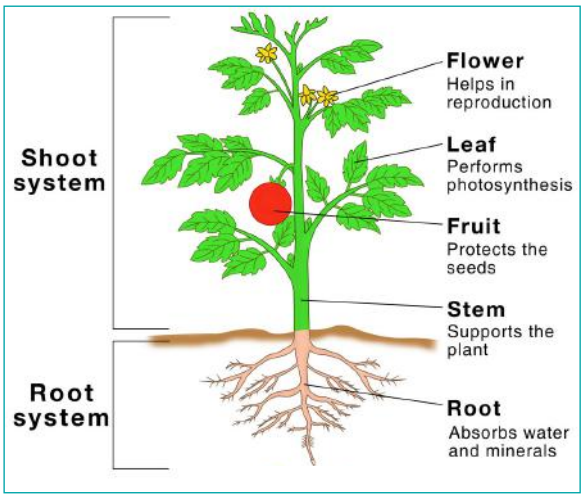


fig: flowering plant

Some of the plants have weak stems. They either crawl on the ground like the pumpkin plant or climb the supports like the cucumber plant. Flowering plants bear flowers. Flowers help in reproduction.

money plant

Fact with Reason

Why does the plant of cucumber climb the support?

The cucumber plant climbs the support to collect more amount of sunlight.

Memory Tips

1. *The Agave, also known as the century plant, spends many years without growing any flowers. After its single bloom, it dies.*
2. *Moonflowers bloom only at night and close their petals during the day as soon as sunlight falls upon them.*

Activity

Observe the structure of any flowering plant available in your surroundings. Study its parts and draw them on your note copy.

Pine tree have needle-like leaf

Plants are found in different habitats. Some of the plants are aquatic. Some of them are terrestrial. Some plants grow in the desert. Some of them grow on fertile land. Based on where they grow, their body parts are modified. For example, the leaves of the pine tree are needle-like. A pine tree grows in the mountain. The mountain is dry land. Therefore, the leaves of pine trees are modified into needle-like forms so that they will not lose water.

3.1.3 Root and its function

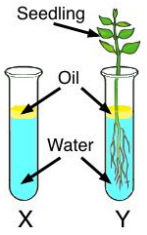
The plant part which helps to collect water and minerals is called the root system. It contains roots, root hairs and root caps. The root grows toward the soil. It searches water under the ground. It can sense the fertilizer, chemicals and water. It grows toward gravity.

Activity

Objective: To show that root absorbs water

Requirement: Two test tubes, healthy plant with root, water, marker, oil

The figure of a plant inside the water in a test tube



Procedure:

1. Take two test tubes with an equal volume of water.
2. Add a few drops of oil enough to cover the surface of the water to block evaporation.

3. Uproot a small plant and clean its root with clean water.
4. Mark the level of water in both the test tubes using a marker.
5. Dip the root of the plant in one of the test tubes.
6. Leave both of the test tubes in sunlight for about 5 hours and observe.

Observation: The water level in the test tube with the plant goes down in comparison to the water level without the plant.

Conclusion: The roots of the plant conduct water to their different parts. Due to this, the water level in the test tube falls. This shows that the root absorbs water for the plant.

Roots are absent in unicellular plants. Thallophytes do not have roots. Rhizoids are similar to roots. They are present in bryophytes and pteridophytes. Flowering plants have developed roots.

The roots of aquatic plants are spongy because they have air sacs. They are covered with wax. The roots of terrestrial plants are highly developed. The roots are modified for various purposes.

The functions of the root are:

i. The roots of the desert plant are very long. They collect water from a distance.

ii. Radish, carrot and beetroot have fleshy roots. They store food and water.

iii. The banyan tree has aerial roots. These roots grow from branches and grow toward the soil. They absorb water from moist air. They act as a support for branches.

iv. Some plants propagate through roots.

v. The root helps plants to stay firmly on the soil. It prevents landslides.

some plants reproduce through roots

turnip's root store food

aerial root of banyan tree

Memory Tips

Roots absorb oxygen beside water and minerals from the soil.

Fact with Reason

Banyan tree has a prop root.

The long prop roots of a banyan tree penetrate the soil to provide additional support to it. So, a banyan tree has prop roots to provide mechanical support.

3.1.4 Stem and its function

The stem, leaves and flowers grow toward light. These parts are responsible for the preparation of food. They produce spores or seeds. The part of the plant that grows above the soil is called the shoot system. It grows away from the soil.

The stem is the main support of the plant. It is not present in unicellular plants. Thallophytes and bryophytes do not have a stem in them. Pteridophytes have rhizomes. A rhizome is an underground stem. It is fleshy. It stores food and water.

Herbs have a weak herbaceous stem. Shrubs have a woody stem. Trees have a very big and woody stem. The stem of the aquatic plant is spongy. It is covered with waterproof wax. The stem of terrestrial plants is highly developed than that of aquatic plants.

Fact with Reason

Why does a plant need its stem?

A plant needs its stem because it holds the branches, leaves, flowers, buds and fruits and also supplies raw materials, food and water.

Differences between the root system and shoot system.

SN	Root system	SN	Shoot system
1	The root system is the part of the plant that grows under the ground surface.	1	A shoot system is the part of the plant that grows above the ground.
2	The root system fixes plants in soil and absorbs water and minerals.	2	Shoot system helps in transportation of water, prepare food etc.

The stem is modified for various purposes. The stem of the cucumber is weak. It is modified to climb the trees to collect sunlight. The stems of banana, cactus and eucalyptus plants store tons of water and food in them.

Functions of the stem

i. The stem holds branches, leaves, fruits, flowers and buds.
ii. It transports food, water and minerals from one part to another.
iii. The stem keeps plants upright in the soil.
iv. Stem of sugarcane stores food.
v. Spongy stem helps the aquatic plant to float. It also provides flexibility.
vi. Deciduous plants lose leaves in the winter. Their stem grows green and performs photosynthesis.


stem of cucumber can climb on the support


stem of sugarcane stores food


stem of cactus stores food and water

Fact with Reason

Why is a potato tuber used for cultivation?

A potato tuber is a stem. It is used for cultivation because it can grow new plants.

Memory Tips

Perennation is a process in plants, that helps them to survive during unfavourable conditions.

Fact with Reason

The stems of the cactus, opuntia, aloe, etc. are thick and fleshy. Why?

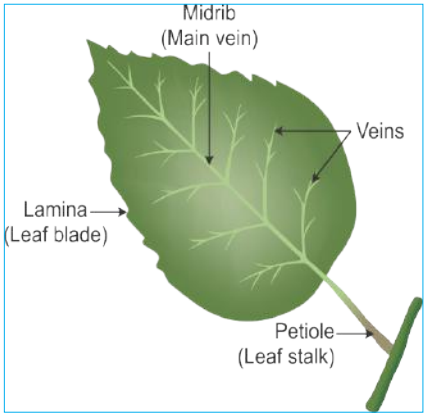
The stems of the cactus, opuntia, aloe, etc. are thick and fleshy to store food and water.

Activity

Observe the stem of various plants.

3.1.5 Leaf and its function

The leaf is a flat green structure that grows from the stem or branches of the plant. Leaves contain a green pigment called chlorophyll. Dicots generally have short and broad leaves. Lamina is the flat green portion of the leaf. The leaf also contains a midrib that runs from the petiole to the leaf apex. Veins are present on either side of the midrib. They transport water, minerals and food in and out of the leaf. The arrangement of veins in a leaf is called venation.



leaf

Leaves are modified for various purpose. For example, cactus leaves are modified into thorns to prevent loss of water. Water lily has broad leaves that help the plant to float. Aloe Vera has a fleshy leaf. It stores food and water. The leaves of insectivorous plants (pitcher plants) modified to trap insects.

Functions of leaf

i. Leaves perform photosynthesis to prepare food and stores it.
ii. The stomata present in the leaves take in carbon dioxide during photosynthesis and oxygen during respiration.
iii. Stomata of leaves lose excess water in the form of water vapour by the process called transpiration.
iv. It releases oxygen into the air.
v. Leaves modified into thorns protect plants from herbivores.
vi. Some plants propagate through leaves.

leaf of pitcher plant catch insects

leaf of fern produces spores

leaf of Aloe Vera stores food and water

Fact with Reason

Some plants bear thorns, or small leaves, why?

Thorns or small leaves reduce the loss of water from plants by transpiration. So, some plants bear thorns or small leaves.

Memory Tips

Venus flytrap is an insectivorous plant. Its leaves trap insects.

Activity

Divide yours class into four groups. Get a complete mustard plant for each group. Observe its vegetative parts and discuss with your friends and teacher.

3.1.6 Flower and its function

Flowers are not present in non-flowering plants. Flowers are colourful reproductive parts of the flowering plant. Flowers have a sweet smell. Paddy has a very small flower. Some plants have large flowers. Flowers are available in different colours. The flower contains the reproductive part of the plant. The four main parts of the flower are calyx, corolla, androecium and gynoecium. Flower are modified for various purposes.

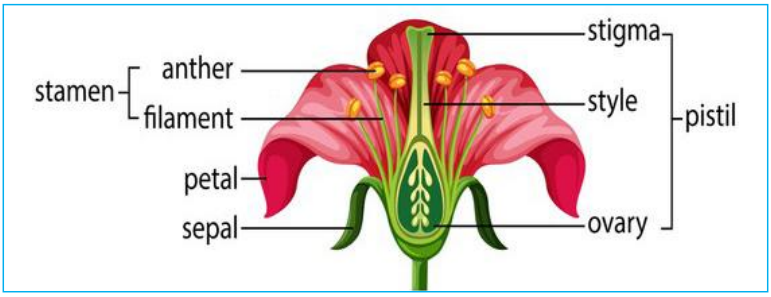
Functions of flower

i. The flowers produce sweet smell to attract insects for pollination.

ii. It helps in the formation of the seed.

iii. Some flowers produce foul smell to chase away insects.

iv. Some flowers are modified to store food.



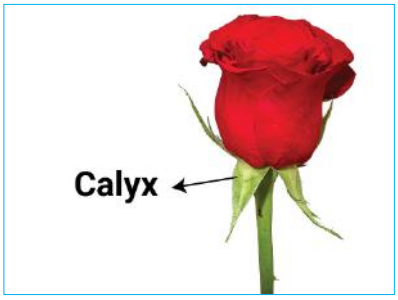
Structure of flower

Complete and Incomplete flowers

The flower that has all four parts, i.e., calyx, corolla, androecium and gynoecium is called a complete flower. Example: Mustard flower

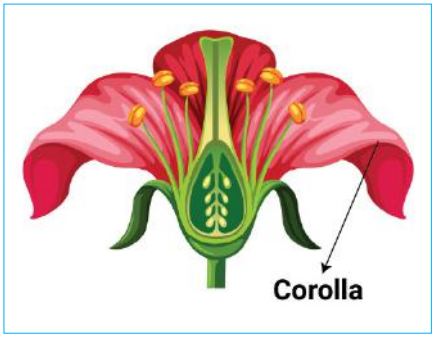
The flower which does not contain at least one of the four whorls is called an incomplete flower. Example: flowers of pumpkin

Calyx



The group of sepals that forms the outermost whorl of a flower is called a calyx. It is usually green in colour. The calyx encloses and protects the flower during the budding stage and performs photosynthesis.

Corolla



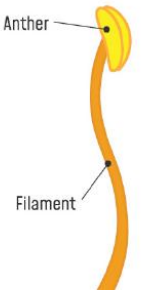
The coloured part formed by a group of petals is called the corolla. It is usually colourful. The corolla protects the reproductive organs during their development and attracts insects for pollination.

Fact with Reason

Why is the corolla scented?

The corolla is scented to attract insects. Insects help in pollination.

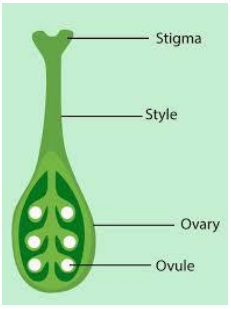
Androecium



stamen

The group of stamens or male reproductive parts of a flower is called androecium. A stamen has two parts: anther and filament. An anther is a top bi-lobed part of the stamen. It contains numerous small sacs called pollen sacs. The pollen sacs have tiny male reproductive units called pollen grains.

Gynoecium



carpel

The group of carpels of a flower is called gynoecium. A pistil is divided into three different parts: stigma, style and ovary. Stigma is the uppermost part of the pistil which receives pollen grains. Style is a stalk that joins ovary and stigma. The ovary is the swollen part at the base of the pistil. It contains an ovule. The ovule holds the female reproductive cell called egg or ovum. Ovule after fertilization develops into seeds and ovary develops into fruit.

Unisexual and Bisexual

A flower that contains only one reproductive part (either male or a female part) is called a unisexual flower. Examples are pumpkin, cucumber etc. A flower that contains both male and female parts is called a bisexual flower. Examples are mustard, and sunflower.

Memory Tips

Rafflesia arnoldii is the largest flower found on the island of Indonesia. It is parasitic and has no distinct stems, leaves and branches. The flower is about 100 centimetres in diameter, and weigh up to 10 kilograms.

Fact with Reason

Why is a pumpkin flower called a unisexual flower?

The pumpkin flower is called a unisexual flower because it lacks either androecium or gynoecium.

Activity

Observe the pumpkin flower. Which part is it missing?

Pollination

When a flower becomes mature, androecium releases pollen grains from its anther and pollen grains reach the stigma. The process of transfer of pollen grains (male gametes) from anther to stigma of a flower is called pollination. Insects are the most common agents that help in pollination.

Memory Tips

About one-third of the human diet is derived from insect-pollinated plants, and honey bees are responsible for 80 % of this pollination.

Fact with Reason

Some insects like the honey bee are the helpers of farmers, why?

Some insects like the honey bee are the helpers of farmers because they help in the pollination of crops.

Fertilization

Fertilization is a process of union of a male gamete and a female gamete to form a zygote. The zygote develops into an embryo. An embryo is a multicellular structure formed by the cell division of a zygote. The fertilized ovule forms the seed. The embryo is the baby plant inside the seed.

Memory Tips

A zygote is the first cell of the baby plant, which is formed from the fusion of male and female gametes.

3.1.7 Fruit and its functions

The non-flowering plants do not grow fruits. Gymnosperms also do not bear fruits. Fruits are present in angiosperm only. The fruit is a matured ovary. Wild animals feed upon fruits. Most of the fruits are edible. Some fruits are poisonous. Fruit is a good source of energy, minerals and

vitamins for us. Different plants have different shapes, sizes, colours and tastes of the fruit. Fruits are fleshy. The fleshy part of the fruit is called the pericarp. It has three layers. Epicarp, mesocarp and endocarp are three layers of the fruit.

Functions of fruits

It stores food, protects seeds and helps in dispersal of seed.

3.1.8 Seed and its functions

A seed is a ripened ovule of a flowering plant. Seeds of different plants have different shapes, sizes, colours and numbers. Seeds of angiosperm are enclosed in the fruit. Seeds of gymnosperm are on the cone.

Mango has one large seed

apple has few seeds

water melon has lots of tiny seeds

Memory Tips

There is one cotyledon in a monocot, two cotyledons in dicot and one or more cotyledons in gymnosperms.

Function of seed

It stores food for embryo, protects embryo and helps in germination.

Answer writing skill

1. **What is the root?**
   The plant part which helps to collect water and minerals is called the root.
2. **What does the spongy stem of aquatic plants do?**
   The spongy stem of aquatic plants helps in floatation and provides flexibility.
3. **What is a sessile leaf?**
   The leaf that is directly attached to the node without a petiole is called a sessile leaf.
4. **Seeds stores food. Give reason.**
   Seeds stores food so that seedling can get nutrition after germination.

5. Differentiate between leaf and root.

The differences between leaf and root are:

SN	Leaf	SN	Root
1	The leaf is a flat green structure that grows from the stem.	1	The plant part which helps to collect water and minerals is called the root.
2	It prepares food.	2	It absorbs minerals.

6. Write the functions of fruits.

The functions of fruits are:

i. To store food.

ii. To protect seed.

iii. To help in dispersal of seed.

EXERCISE

Step 1

1. Fill in the blanks.

water	internode	pollination	stem	zygote

a. Corolla attracts insects for…….

b. The fusion of male and female gametes forms …….

c. The rhizome is the underground ……...

d. The primary function of the roots is to collect ……. and minerals.

e. The distance between two nodes is called an …….

2. Tick the correct and cross the false statement.

a. Calyx is a group of petals.

b. Pumpkin plants bear unisexual flowers.

c. The mustard plant has an incomplete flower.

d. The stem holds all the structures of the root system.

e. The leaf that has a petiole is called a petiolate leaf.

3. Choose the correct answer from the given alternatives.

a. What part of the plant grows above the soil?

i. Taproot ii. Stem

iii. Root hair iv. None

b. Where do branches grow from?

i. Roots ii. Apical bud

iii. Nodes iv. Leaf

c. What part helps in the growth of the height of the plant?

i. Apical bud ii. Node

iii. Root iv. Leaf

d. What is the arrangement of veins on the leaf called?

i. Root system ii. Shoot system

iii. Venation iv. None

e. Which whorl of the flower can perform photosynthesis?

i. Calyx ii. Corolla

iii. Androecium iv. Gynoecium

4. Match the following

Seed	leaf
Stigma	matured ovule
Anther	receives pollen grain
Kitchen of the plant	petal
Single unit of corolla	produces pollen grain

Step 2

5. Answer the following questions in one word.

a. What part of the plant grows under the soil?

b. Which plant's leaves are modified to trap insects?

c. What is the term for a single unit of calyx?

d. Which natural process produces a zygote?

e. What is a matured ovary called?

6. Differentiate between the following.

a. Leaf and root

b. Stamen and pistil

c. Calyx and corolla

d. Unisexual flower and bisexual flower

e. Pollination and fertilization

7. Give reason

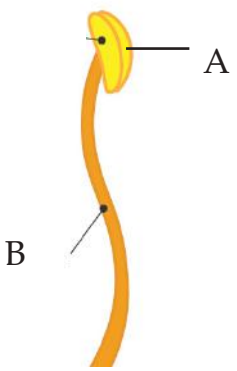
a. Pine trees have needle-like leaves.

b. Eucalyptus plant have a huge fleshy stem.

c. Desert plants have long roots.

d. Aquatic plant have spongy roots and stems.

8. Study the given diagram and answer the following questions.



i. What is shown in the diagram? Write names of A and B.

ii. Why is it called the male reproductive part?

iii. Which part produces pollen grains?

Step 3

9. Answer the following questions.

a. What are the functions of the root?

b. What kinds of modifications are observed in leaves?

c. Describe the major structure and functions of leaves.

d. List a few functions of the stem.

e. Name the whorls of a flower and list their functions.

f. What is a zygote? How is it formed?

g. What is a fruit? What are its functions?

10. Draw a well-labelled diagram of a complete flower.

Unit 3.2 Invertebrates

Terms and terminologies

1.	Vertebrates:	The animals which have a backbone (vertebral column) in them are called vertebrates.
2.	Invertebrates:	Invertebrates are animals that do not have a backbone in their body.
3.	Protozoa:	The phylum of unicellular, eukaryotic and aquatic animals is called Protozoa.
4.	Porifera:	The phylum of organisms that have pores in their body is called Porifera.
5.	Coelenterates:	Invertebrates that have hollow cavity or gut in their body are called coelenterates.
6.	Platyhelminthes:	The phylum of invertebrates having a flat body is called Platyhelminthes.
7.	Nematodes:	Nematodes are organisms that have a thread like round body.
8.	Annelida:	Annelida is a group of invertebrates that have rings (segments) on their body.
9.	Arthropoda:	The phylum of invertebrates having jointed legs is called Arthropoda.
10.	Mollusca:	The phylum of invertebrate organisms having a soft body is called Mollusca.
11.	Echinodermata:	The phylum of invertebrates having spines in their body is called Echinodermata.

We see different types of animals around us. They differ in shape and size. Different types of animals have different features. Based on the presence or absence of backbone, the whole animal kingdom is divided into two sub-kingdoms. They are invertebrates and vertebrates.

The animals which have a backbone (vertebral column) in them are called vertebrates. Fish, frogs, snakes, birds, dogs etc. are examples of vertebrates.

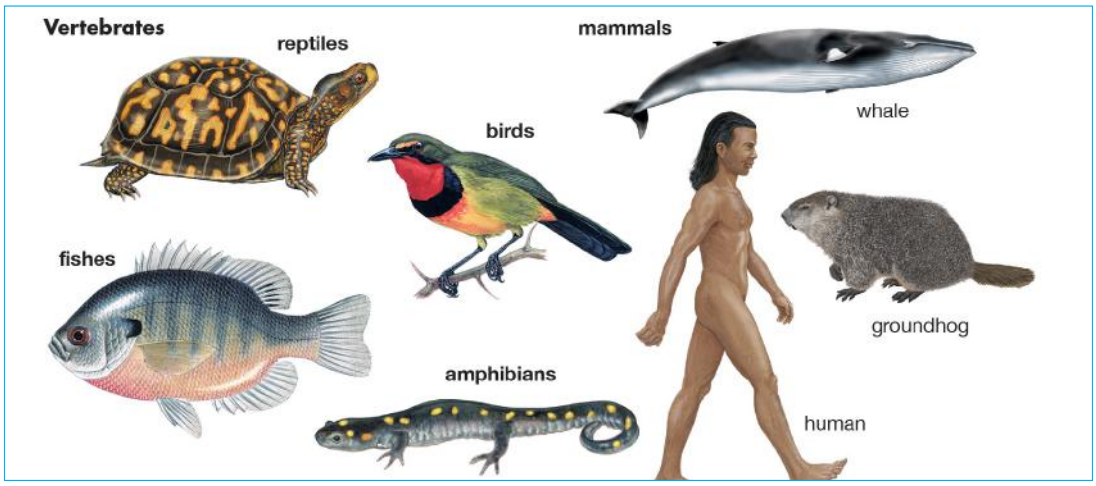


fig: examples of some classes of vertebrates

Invertebrates are animals that do not have a backbone in their body. Animals like a butterfly, spider, cockroach, dragonfly, mosquito, earthworm, roundworm etc. are some of the examples of invertebrates.

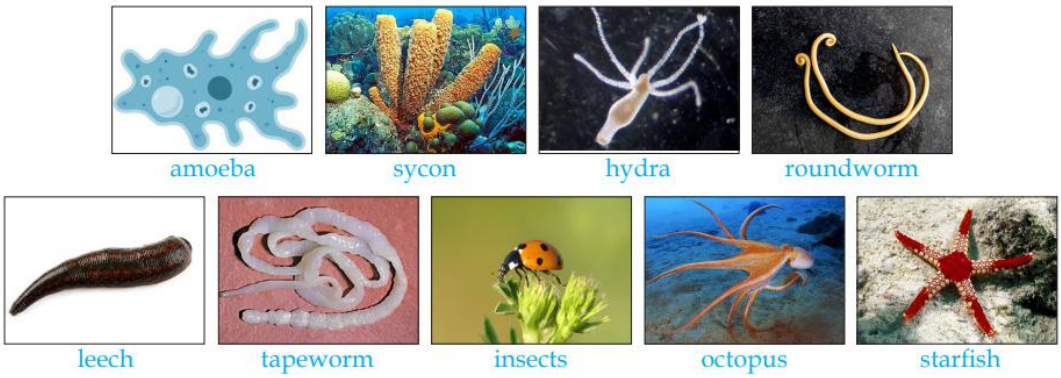


fig: nine types of invertebrates

Memory Tips

The backbone contains the spinal cord inside it.

Characteristics of invertebrates

i. They do not have a backbone or vertebral column in their body.

ii. They are multicellular organisms except for protozoans.

iii. They do not have a hard bony skeleton inside their body.

iv. Some invertebrates have a hard exoskeleton on their body surface which is made up of a substance called chitin.

v. Most of the invertebrates can move from one place to another.

Fact with Reason

Why do mosquitoes belong to subkingdom invertebrates?

The mosquitoes belong to a subkingdom invertebrate because they do not have a backbone.

Differences between vertebrates and invertebrates:

SN	Vertebrate	SN	Invertebrate
1	The animals which have a backbone (vertebral column) in them are called vertebrates.	**1**	Invertebrates are animals that do not have a backbone in their body.
2	Vertebrates are more developed than invertebrates.	**2**	Invertebrates are less developed than vertebrates.

3.2.2 Classification of invertebrates

The invertebrates are classified into nine phyla.

They are:

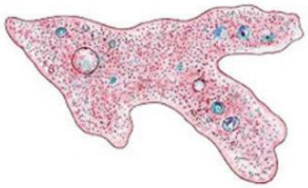
1. Phylum Protozoa
2. Phylum Porifera
3. Phylum Coelenterata
4. Phylum Platyhelminthes
5. Phylum Nemathelminthes
6. Phylum Annelida
7. Phylum Arthropoda
8. Phylum Mollusca
9. Phylum Echinodermata

1. Phylum protozoa

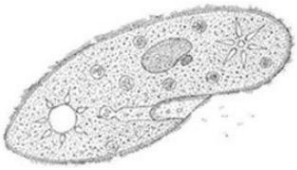
The word protozoa is derived from Greek words: protos and zoon. Protos means first and zoon means animals. This phylum consists of primitive unicellular organisms. The phylum of unicellular aquatic animals is called Protozoa. Protozoans are found in both fresh water and marine water. Some protozoans are found in moist soil and

even as a parasite in different organisms. Amoeba, paramecium, plasmodium, euglena, etc. are protozoans.

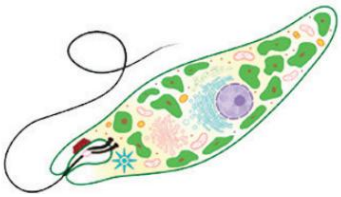
The characteristics of phylum Protozoa are:



Amoeba



Paramecium



Euglena

i. Most protozoans are aquatic.
ii. They are unicellular microscopic organisms.
iii. They move with the help of flagella, pseudopodia and cilia.
iv. They breathe through the general body surface.
v. They reproduce asexually by fission and sexually by conjugation.

Fact with Reason

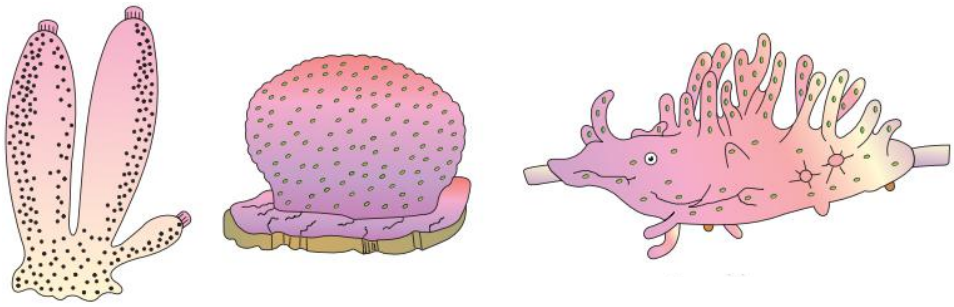
Paramecium is called a protozoan, why?
Paramecium is called a protozoan because it is a primitive unicellular and aquatic organism.

Activity

Observe protozoans under the microscope.

2. Phylum Porifera

The word porifera is derived from two Latin words: porous and fera. Porous means pore and fera means bearing. Porifera have numerous pores on their bodies. The numerous small pores present on their bodies are called Ostia. The large opening present at the tip is called osculum. The phylum of organisms that have pores in their body is called Porifera. Examples of poriferans are sponges like Euspongia, Spongilla, Sycon etc.



Sycon *Euspongia* *Spongilla*

The characteristics of phylum Porifera are:

i. They have numerous pores on their body.

ii. Poriferans are mainly found in the marine (saltwater) habitat.

iii. They are sessile. They are attached to the substratum like rocks.

iv. Their body is asymmetrical.

v. They can reproduce by both asexual and sexual methods.

3. Phylum Coelenterata

The word coelenterate is derived from Greek words, kilos, which means hollow, and enteron, which means gut. Invertebrates that have hollow cavities or gut in their body are called coelenterates. Examples of coelenterates are jellyfish, hydra, sea anemone, etc.

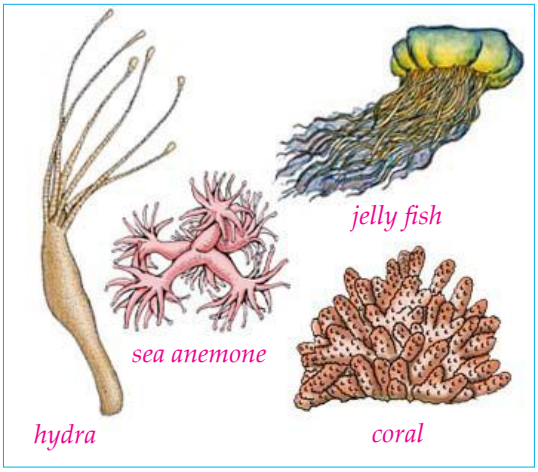
The characteristics of phylum Coelenterata are:

Their body contains a hollow gut called coelenteron.

i. They have a mouth but no anus.

ii. They are found in marine habitats.

iii. They are radially symmetrical animals. Their body can be divided into two halves by cutting them in many ways.



iv. Their mouth is surrounded by tentacles. The functions of tentacles are protection and capturing food.

v. They show both asexual and sexual reproduction.

Fact with Reason

Hydra belongs to the phylum Coelenterata. Why?

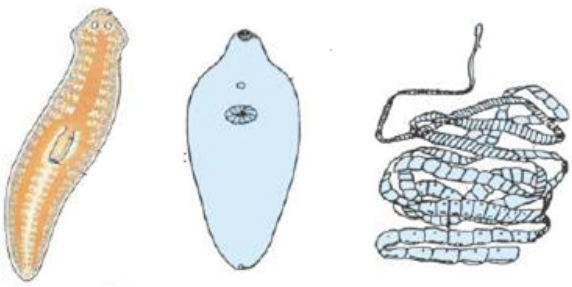
Hydra belongs to phylum Coelenterata because it has a hollow cavity in its body

Memory Tips

Hydra lives in freshwater.

4. Phylum Platyhelminthes

The word platyhelminthes is derived from two Greek words: platy, which means flat and helminth, which means worm. The phylum of invertebrates having a flat body is called Platyhelminthes.



planaria *liver fluke* *tapeworm*

Some of the examples of platyhelminths are planaria, tapeworm, liver fluke etc.

The characteristics of phylum Platyhelminthes are:

i. They have dorsoventrally flattened bodies.

ii. They are mostly parasites. They have hooks or suckers or both to absorb the nutrients.

iii. Flatworms have a thick cuticle that protects their body from the harmful enzymes of a host.

iv. They have both segmented and unsegmented bodies.

v. They can reproduce by both asexual and sexual methods.

5. Phylum Nematoda/ Nemathelminthes/ Aschelminthes

The word nematoda comes from the Latin word: nemat, which means thread and ode, which means like. Therefore, nematodes are organisms that have a thread like round body. Examples of nematodes are hookworm, pinworm, trichinella, ascaris, etc.

whipworm *roundworm* *hookworm*

The characteristics of phylum Nemathelminthes are:

i. They have a round, smooth and cylindrical body that is tapering at both ends.

ii. Their body is covered by a protective cuticle.

iii. They have a complete digestive system i.e.; they have both mouth and anus.

iv. They are bilaterally symmetrical. Their body can be divided into two halves by cutting them in only one way.

vi. They are hermaphrodite organisms i.e., both male and female sex organs are present in the same body.

6. Phylum Annelida

Annelida is derived from a Latin word annulus, which means little ring. The animals which belong to this phylum are called annelids. Therefore, annelids are animals that have rings (segments) on their body. They are also called segmented worms. Examples of annelids are earthworm, sandworm, leech etc.

leech

earthworm

sandworm

The characteristics of phylum Annelida are:

i. They have cylindrical, elongated and segmented body.
ii. They have complete digestive system.
iii. They have bilaterally symmetrical body.
iv. They breathe through their body surfaces.
v. They are unisexual or hermaphrodite. They reproduce sexually.

Fact with Reason

Earthworms belong to phylum Annelida while tapeworms belong to phylum Platyhelminthes. Give reason.

The earthworm belongs to phylum Annelida because its body is long and cylindrical with little rings. But the tapeworm belongs to the phylum Platyhelminthes because it has a long, segmented and flat body.

Differences between tapeworm and earthworm

SN	Tapeworm	SN	Earthworm
1	The tapeworm has a long, segmented and flat body.	1	The earthworm has a long cylindrical body with little rings.
2	It is a parasitic animal.	2	It is a free-living animal.

7. Phylum Arthropoda

In Greek, arthros means joint and podos means foot. Animals that have jointed legs belong to this phylum. Arthropods have the highest number of species among all invertebrates. The phylum of invertebrates having jointed legs is called Arthropoda. They are found in all types of habitats in nature. Some of the examples of arthropods are spider, ant, butterfly, prawn, housefly, crab, scorpion etc.

centipede

spider

crab

The characteristics of phylum Arthropoda are:

i. They have a segmented body with jointed legs.

ii. They are found in all types of habitats.

iii. They have an exoskeleton made up of chitin.

iv. Their body is bilaterally symmetrical and divided into head, thorax and abdomen.

v. They have well developed digestive, circulatory and nervous systems.

vi. They reproduce sexually.

Fact with Reason

Phylum Arthropoda is the largest phylum. Why?

Phylum Arthropoda is the largest phylum because arthropods are adapted to any kind of environment. They are found on land, in water, air, cold place, hot place and everywhere.

Memory Tips

Insects belong to the phylum Arthropoda. Insects are six-legged animals. There are over one million species of insects.

Activity

Go to a garden and observe the types of insects or other arthropods that you see. Draw the diagrams of those animals and label them.

8. Phylum Mollusca

The word mollusca is derived from a Latin word mollis, which means soft. Animals belonging to this phylum have a soft body and they are called molluscs. The phylum of invertebrate organisms having a soft body is called Mollusca. Some examples of molluscs are slug, pila, squid, snail, oyster, octopus etc.

slug

snail

octopus

The characteristics of phylum Mollusca are:

i. They have a soft body covered by a hard shell.

ii. They are found in marine water, freshwater as well as terrestrial habitats.

iii. They often move with the help of strong muscular feet present on their ventral surface.

iv. Their body is divided into head, visceral mass and foot.

v. They reproduce sexually.

Memory Tips

1. *Phylum Mollusca is the largest marine phylum. About 23% of all marine organisms are molluscs.*
2. *The only hard body part of an octopus is a hooked beak at the end of its tentacles.*

9. Phylum Echinodermata

The word echinodermata is derived from a Greek word echinos, meaning spiny and derma, meaning skin. Therefore, this phylum consists of animals that have rough spiny skin. The phylum of invertebrates having spines in their body is called Echinodermata. Echinoderms are only found in salty or marine water. Hence, they are not found naturally in Nepal. Some examples of echinoderms are sea stars (starfish), sea urchins and sea cucumbers.

sea urchin

starfish

sea cucumber

The characteristics of phylum Echinodermata are:

i. They have a rough and spiny exoskeleton.
ii. All echinoderms are marine organisms living mainly on the ocean floor.
iii. They have tube feet for movement.
iv. They have a complete digestive system.
v. They have a radially symmetrical body.

Activity

Collect some samples of invertebrates. Draw their labelled diagrams and list out their characteristic features.

Answer writing skill

1. Define invertebrates with three examples.

Invertebrates are animals that do not have a backbone in their body. The three examples of invertebrates are earthworm, roundworm and tapeworm.

2. Differentiate between a leech and a roundworm.

The differences between a leech and roundworm are given in the table below:

SN	Leech	SN	Roundworm
1.	A leech has a ring-like segment in its body.	1	A roundworm has a smooth body without rings.
2	It is a parasite that lives outside of the human body.	2	It is a parasite that lives inside the human body.

3. What is the term used for the animals having calcareous spines on their skin?

The term used for the animals having calcareous spines on their skin is Echinodermata.

4. Write the phylum of the following organisms:

[amoeba, paramecium, oyster, brittle star, silverfish, jellyfish]

Amoeba	–	Protozoa	Paramecium	–	Protozoa
Oyster	–	Mollusca	Brittle star	–	Echinodermata
Silverfish	–	Arthropoda	Jellyfish	–	Coelenterata

5. What do you mean by a hermaphrodite animal? Give two examples.

The animal which has both male and female reproductive systems in a single body is called a hermaphrodite animal.

Examples are earthworms and tapeworms.

6. What are the special features of starfish?

The characteristics of phylum Echinodermata are:

i) They have a rough and spiny exoskeleton.

ii) All echinoderms are marine organisms living mainly on the ocean floor.

iii) They have tube feet for movement.

EXERCISE

Step 1

1. Fill in the blanks with appropriate words.

coelom	backbone	invertebrates	unicellular	radially

a) Animals that lack vertebral column are called ……

b) Vertebrates have …… in them.

c) Protozoans are …… organisms.

d) Coelenterates have hollow …… in their body.

e) Starfish has …… symmetrical body.

2. Write True for the correct and False for the incorrect statements.

a. Hydra is an example of a cnidarian.

b. A snail has a hard covering in its body.

c. The earthworm has a round and unsegmented body.

d. Octopus lies in the phylum Echinodermata.

e. Arthropoda is a phylum with few species of invertebrates.

3. Choose the correct answer from the given alternatives.

a. Which phylum does a plasmodium belong to?

i. Porifera ii. Protozoa

iii. Arthropoda iv. Platyhelminthes

b. What animals are called flatworms?

i. Porifera ii. Protozoa

iii. Platyhelminthes iv. Echinodermata

c. Which phylum has a complete digestive system?

i. Protozoa ii. Porifera

iii. Annelida iv. Echinodermata

d. Which one is not a parasite?

i. Tapeworm ii. Leech

iii. Roundworm iv. Earthworm

e. Which one lives in the ocean only?

i. Protozoa ii. Porifera

iii. Echinodermata iv. Mollusca

4. Match the following.

Invertebrate	starfish
Protozoa	lacks backbone
Substratum	unicellular
Liver fluke	sponges
Radially symmetrical	flat body

Step 2

5. Answer the following questions in one word.

a. What is the sub-kingdom that contains organisms with backbones?

b. What is the phylum of animals with lots of small pores on their body?

c. What is the phylum of invertebrates with jointed legs?

d. What is the phylum of animals with a soft body inside a hard shell?

e. Name the phylum of animals that have a spiny exoskeleton.

6. Write any two differences between:

a. Vertebrates and invertebrates

b. Poriferans and protozoans

c. Hydra and starfish

d. Earthworm and tapeworm

e. Coelenterates and molluscs

7. Give reasons.

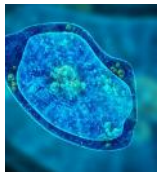
a. Paramecium is a protozoan.

b. Sponges are called porifera.

c. Hydra belongs to the phylum Coelenterata.

8. Write down the name of the following organisms and mention any one characteristic of each.

a.



b.

c.

d.

e.

Step 3

9. Answer the following questions.

a. What are vertebrates? Write its two special features.

b. Define invertebrates. Write its two special features.

c. What do you mean by a hermaphrodite animal?

d. Write any four important features of the following phyla:

i. Protozoa
ii. Coelenterata
iii. Nemathelminthes
iv. Arthropoda
v. Echinodermata
vi. Porifera
vii. Platyhelminthes
viii. Annelida
ix. Mollusca

e. Name the phylum of animals having the following features and also give two examples of each:

i. Pores are found all over the body surface.

ii. Have a hollow cavity in the body and the mouth is surrounded by tentacles.

iii. Dorsoventrally flattened worms.

iv. The body is divided into head, thorax and abdomen.

v. Radially symmetrical body with a spiny exoskeleton.

10. Draw a diagram of the following animals and mention their phylum:

a) Amoeba
b) Snail
c) Hydra
d) Starfish

Unit 3.3 The cell

Terms and terminologies

1.	Cells:	Cells are tiny building blocks of living organisms.
2.	Prokaryotic cell:	The cell that lacks an organized nucleus and other membrane-bound cell organelles is called a prokaryotic cell.
3.	Eukaryotic cell:	The cell that has a well-organized nucleus and membrane-bounded cell organelles is called a eukaryotic cell.
4.	Unicellular organisms:	Organisms that are made of a single cell are called unicellular organisms.
5.	Multicellular organisms:	Organisms that are made up of more than one cell are called multicellular organisms.
6.	Cell wall:	The cell wall is the outermost tough covering of a plant cell.
7.	Cell membrane:	Cell membrane or plasma membrane is the semi-permeable membrane that surrounds the cell.
8.	Cytoplasm:	The cytoplasm is the fluid-like substance that is present between the nucleus and the plasma membrane.
9.	Mitochondria:	Mitochondria are the rod or oval-shaped cell organelles that produce and store energy in the cell.
10.	Respiration:	Respiration is the process by which energy is produced by utilizing food and oxygen in the cell.
11.	Nucleus:	The nucleus is a double-layered round cell organelle that controls all activities of the cell.
12.	Nucleolus:	A dark spot inside the nucleus is called the nucleolus.
13.	Vacuoles:	Vacuoles are the membrane-bound sap filled structure present in the cytoplasm.
14.	Tonoplast:	The outer covering of the vacuole is called tonoplast.
15.	Plastids:	Plastids are the disc-shaped, double-layered cell organelles found only in plant cells.
16.	Endoplasmic reticulum:	The endoplasmic reticulum is the branching tubules and flattened sacs that extend throughout the cytoplasm.
17.	Golgi bodies:	Golgi bodies are a network of flattened layers of membrane-bound sacs.
18.	Ribosomes:	Ribosomes are small granular structures that float freely in the cytoplasm or are bound to the endoplasmic reticulum.
19.	Lysosomes:	Lysosomes are membrane-bound sacs that contain digestive enzymes.
20.	Centrosome:	The centrosome is pair of tubular organelles that are found near the nucleus.

The body of living organisms is made up of tiny building blocks called cells. Cells are the basic unit of life. They are responsible for performing living activities in organisms such as growth, reproduction, excretion, etc. The body of a living organism as a whole is the sum of the activities of all the cells. Hence, the cell is called a structural and functional unit of life. The word 'cell' was first coined by an English scientist named Robert Hooke in 1665 A.D.

microscope

Fact with Reason

Why is a cell called the structural and functional unit of life?

A cell is called the structural and functional unit of life because the structure of an organism depends upon the number of cells. Also, everything performed by an organism is the outcome of the work done by the cells.

Memory Tips

Robert Brown discovered the nucleus of the cell.

Activity

Observe plant tissues through the microscope.

Memory Tips

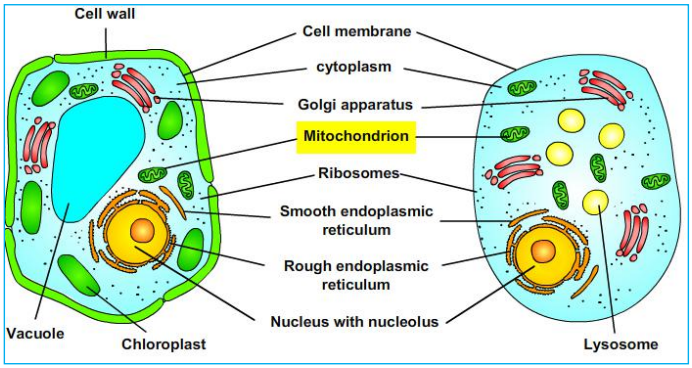
1. *Mycoplasma is the smallest cell.*
2. *Egg of the ostrich is the largest cell.*
3. *Nerve cell in the neck of the giraffe is the longest cell.*

Activity

Make a model of animal cells from reusable waste.

3.3.1 Structure of a typical cell

The cell that lacks an organized nucleus is called a prokaryotic cell. Example: bacteria. The cell that has a well-organized nucleus is called eukaryotic cell. Organisms that are made of a single cell are called unicellular organisms. Examples: amoeba. Organisms that are made up of more than one cell are called multi-cellular organisms. Example: Cow, dog. Cells differ in shape, size and functions. Every cells contains cell organelles. Some of the important cell organelles are discussed below.



Plant cell and animal cell

a. Cell wall

The cell wall is the outermost tough covering of a plant cell. It is absent in an animal cell. The cell wall is mainly composed of non-living materials called cellulose. The cell wall maintains the rigidity of the cell. It is a permeable membrane.

Functions

i. The cell wall protects the cell from external injuries.

ii. It maintains the shape and size of the cell.

b. Cell membrane

Cell membrane or plasma membrane is the semi-permeable membrane that surrounds the cell. It is made up of phospholipids and proteins. It is a thin and elastic membrane with numerous pores on it.

Functions

i. It acts as a protective covering of a cell.

ii. It helps in the selective transport of chemical substances in and out of the cell.

Differences between the cell wall and cell membrane

SN	Cell wall	SN	Cell membrane
1	The cell wall is made of cellulose.	1	The cell membrane is made up of lipid and protein.
2	The cell wall is dead and it is permeable.	2	The cell membrane is living and it is semi-permeable.

c. Cytoplasm

The cytoplasm is the fluid-like substance that is present between the nucleus and the plasma membrane. Cell organelles float freely in the cytoplasmic fluid. It is made up of lipids, proteins, minerals and water.

Functions

i. Cytoplasm maintains the turgidity of the cell.
ii. It distributes nutrients and enzymes within the cell organelles.

d. Mitochondria

Mitochondria are the rod or oval-shaped cell organelles that produce and store energy in the cell. Respiration occurs in mitochondria. This produces energy in the cell in the form of a chemical called adenosine triphosphate (ATP). So, mitochondria are also called the powerhouse of a cell.

mitochondria

Functions

i. Mitochondria produce energy needed for various cellular activities.
ii. They are also involved in the synthesis of smaller units of proteins called amino acids.

Fact with Reason

Why are mitochondria called the powerhouse of the cell?
Mitochondria are called the powerhouse of the cell because they perform cellular respiration to release energy and store it.

e. Nucleus

The nucleus is a double-layered round cell organelle that controls all activities of the cell. It contains nuclear membrane, chromatin fibres, nucleolus and nucleoplasm. The nuclear membrane is the outermost covering of the nucleus. A dark spot inside the nucleus is called the nucleolus.

Functions

i. The nucleus controls the metabolic activities in the cell. So, it is also called the control centre.

ii. The DNA present in the nucleus helps to transfer the hereditary information from the parents to the offspring.

Memory Tips

The nucleus dissolves into the cytoplasm during cell division.

f. Vacuoles

Vacuoles are the membrane-bound sap filled structure present in the cytoplasm. The fluid inside the vacuole is called cell sap. The outer covering of the vacuole is called tonoplast. A plant cell has a large central vacuole while an animal cell has many smaller vacuoles.

Function

i. The vacuole stores water, sugar, salts and other waste materials of the cell.

ii. The space inside the vacuole helps to maintain the turgidity of the cell.

g. Plastids

Plastids are the disc-shaped double-layered cell organelles found only in plant cells. There are three kinds of plastids. They are chloroplast, chromoplast and leucoplast.

Chloroplast

Chromoplast

Leucoplast

Functions

i. Chloroplasts help to trap sunlight for photosynthesis.

ii. Chromoplasts help to ripen fruits and provides colour to the flowers.

iii. Leucoplasts are involved in the synthesis of starch, oils and proteins.

Memory Tips

Animal cells do not have plastids.

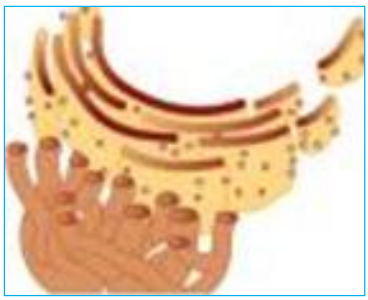
Fact with Reason

The chloroplast is called the kitchen of the cell. Give reason.

The chloroplast is called the kitchen of the cell because it prepares the food needed for the plant

h. Endoplasmic reticulum

The endoplasmic reticulum is the branching tubules and flattened sacs that extend throughout the cytoplasm. It provides mechanical support to the cell.



Endoplasmic reticulum

Function

i. Rough endoplasmic reticulum transports proteins to various parts of the cell.

ii. Smooth endoplasmic reticulum helps in lipid formation.

i. Golgi body

Golgi bodies are a network of flattened layers of membrane-bound sacs. They are located near the nucleus.

Function

i. They store, package, and distribute the proteins and lipids made in the endoplasmic reticulum.

ii. They also manufacture substances like cellulose and pectin.

j. Ribosome

Ribosomes are small granular structures that float freely in the cytoplasm or are bound to the endoplasmic reticulum. Ribosome synthesis proteins.

k. Lysosome

Lysosomes are membrane-bound sacs that contain digestive enzymes. If the lysosome breaks open, the enzymes can destroy the cell by digesting the cellular organelles. So, it is also called a suicidal bag.

Function

i. Lysosomes help in intracellular digestion.

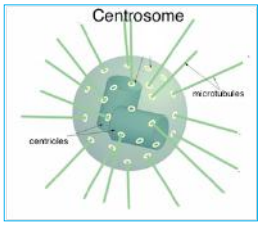
ii. They engulf viruses or bacteria and protect the cell organelles from foreign bodies.

Memory Tips

Lysosomes are called suicidal bags because if the lysosome breaks open, the enzymes can destroy the cell by digesting the cellular organelles with their digestive enzymes.

l. Centrosome

The centrosome is pair of tubular organelles that are found near the nucleus. They help in cell division.



centrosome

Activity

To observe onion cells under a compound microscope.

Take an onion and cut a small section of it. Peel a thin transparent layer. Transfer the slice of a thin layer into the glass slide. Add a drop of saffron for colour. Observe the slice under a compound microscope.

Differences between plant cells and animal cells.

S.N.	Plant cell	S.N.	Animal cell
1	The plant cell is usually larger than an animal cell.	1	An animal cell is comparatively smaller in size.
2	It has a cell wall.	2	It does not have a cell wall.
3	Plastids are present in the plant cell.	3	Plastids are absent in an animal cell.
4	It contains a large central vacuole.	4	It contains many small vacuoles.
5	The nucleus lies on one side in the peripheral cytoplasm.	5	The nucleus lies at the centre.
6	Centrioles are usually absent.	6	Centrioles are present.
7	Reserve food is in the form of starch.	7	Reserve food is in the form of glycogen.
8	Lysosomes are rare.	8	Lysosomes are always present.

Answer writing skill

1. What is a cell?

The cell is the structural and functional unit of life.

2. Write any two functions of the cell wall?

The functions of the cell wall are:

i. The cell wall protects the cell from external injuries.

ii. It maintains the shape and size of the cell.

3. Bacteria is considered prokaryote. Why?

Bacteria is considered prokaryote because it does not contain membrane bound well developed nucleus.

4. What cell organelle helps in internal respiration?

Mitochondria help in internal respiration.

5. Write the function of the endoplasmic reticulum.

The functions of the endoplasmic reticulum are:

i. The endoplasmic reticulum transports molecules to a specific destination.

ii. Smooth endoplasmic reticulum helps in lipid formation.

6. Differentiate between prokaryotic cells and eukaryotic cells.

The difference between prokaryotic cell and eukaryotic cell:

SN	Prokaryotic cell	SN	Eukaryotic cell
1	The cell that lacks an organized nucleus and other membrane-bound cell organelles is called a Prokaryotic cell.	1	The cell that has a well-organized nucleus and membrane-bounded cell organelles are called a eukaryotic cell.
2	It does not have a modern nucleus.	2	It has a modern nucleus.

EXERCISE

Step 1

1. Fill in the blanks.

nucleus	chromoplast	prokaryotic	mitochondria	protein

a. Bacteria have ……cells.

b. Energy is produced by …… in the cell.

c. The control centre of the cell is…….

d. Flowers are colourful because of the presence of…….

e. Ribosome synthesise ……

2. Tick the correct and cross the false statement.

a. A single cell contains all the vital structures and substances for its independent function.

b. The main material of the cell wall is wax.
c. Lysosomes are called suicidal bags of the cell.
d. Vacuoles synthesize proteins.
e. Golgi bodies manufacture cellulose and pectin.

3. Choose the correct answer from the given alternatives.

a. Which one is a prokaryotic organism?
   i. Paramecium ii. Hydra
   iii. Bacteria iv. Amoeba

b. What is the largest cell?
   i. Ostrich egg ii. Amoeba
   iii. Red blood cell iv. None

c. Which is the energy produced in mitochondria?
   i. ATP ii. DNA
   iii. RNA iv. None

d. Which organelle is capable of digesting even the cell organelles?
   i. Ribosome ii. Lysosome
   iii. Nucleus iv. Mitochondria

e. Which one of the given cell organelles is non-living?
   i. Mitochondria ii. Cell wall
   iii. Nucleus iv. Plastids

4. Match the following

Cell wall	Control centre of the cell
Cell membrane	Centrosome
Cell sap	Cellulose
Nucleus	Plasmalemma
Cell division	Vacuole

Step 2

5. Answer the following questions in one word.

a. Which material makes the cell wall?

b. Which plastid is colourless?
c. Which plastid helps in photosynthesis?
d. What is the outermost layer of the plant cell called?
e. Name the site for the production of energy in the cell.

6. Differentiate between the following.

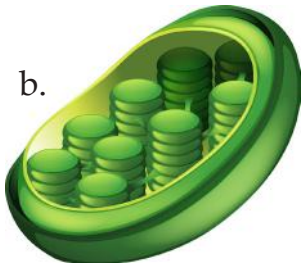
a. Cell wall and cell membrane
b. Unicellular organisms and multicellular organisms
c. Eukaryotic cell and prokaryotic cell

7. Give reason

a. The chloroplast is the kitchen of a plant cell.
b. The euglena is a unicellular organism.
c. The lysosome is called a suicidal bag.
d. Mitochondria are the powerhouse of the cell.

8. Identify the cell organelles and write their major functions.

a. 

b. 

c. 

Step 3

9. Answer the following questions.

a. What is a cell? Who discovered it?
b. How is a cell in our body different from the cell of bacteria?
c. List any three functions of the cell membrane.
d. Write a short note on mitochondria.
e. What is the importance of the nucleus?
f. What is the endoplasmic reticulum? Write its functions.

10. Draw a well-labelled diagram of the animal cell.

UNIT

4

BIODIVERSITY AND ENVIRONMENT

ESTIMATED TEACHING PERIODS

TH	PR
8	2

Syllabus issued by CDC

- Environment and its balance
- Introduction and importance of natural resources
- Classification of natural resource as renewable natural resources and non-renewable natural resources
- Importance of water resources, wetlands and watersheds
- Causes and effects of depletion of natural resources
- Introduction of solid waste
- Management of solid waste

Learning Outcomes

After completion of this unit, students will be able to:

- introduce, classify and describe importance of natural resources.
- introduce water resources, wetlands and watersheds and explain their importance.
- explain the causes and effects of depletion of natural resources.
- manage solid waste using 3R methods.

Terms and terminologies

1. Biodiversity: The existing number of living organisms in a particular area is called biodiversity.
2. Environment: The group of living things and non-living things around us is called the environment.

3. Natural resources:	Resources that are directly provided by the nature itself are called natural resources.
4. Non-renewable resources:	The resources that cannot be renewed or reproduced after they are finished are called non-renewable resources.
5. Renewable resources:	The resources that are unlimited or can be renewed or reproduced even after they are finished are called renewable resources.
6. Water resources:	The sources of water like rivers, ponds, lakes and sea, which are useful to the living organisms in various ways, are called water resources.
7. Surface water:	The water which is available on the surface of the earth like springs, streams, rivers, ponds, lakes etc. is called surface water.
8. Ground water:	The water which is available under the surface of the earth is called groundwater.
9. Watershed:	A watershed is an area that drains the water from the rain and melted snow into water bodies like rivers and lakes.
10. Wetland:	Wetlands are the areas filled with water temporarily or throughout the year.
11. Environment sanitation:	Environment sanitation means maintaining clean and healthy surroundings that are needed for a healthy life.
12. Reduce waste:	Reduce means to decrease the amount of waste.
13. Reuse waste:	Reuse means the use of the same material repeatedly.
14. Recycling:	Recycling means changing or modification of waste materials into new ones.

4.1 Biodiversity

The existing number of living organisms in a particular area is called biodiversity. Plants and animals are important components of the environment. All plants are not the same; they vary from each other. Bacteria, fungi, algae, mosses, pteridophytes, angiosperms, monocots, dicots etc. are different groups of plants. Animals can be divided into several different groups like invertebrates, vertebrates, fishes, amphibians, reptiles, mammals etc. Each individual of these groups also differs from the other. This variability among living beings and within living beings is called biodiversity or biological diversity.

Biodiversity

Fact with Reason

Human activities are a threat to biodiversity. Give reason.

Human activities are a threat to biodiversity because our activities such as urbanization, deforestation, poaching, etc. have forced different species of biodiversity to be endangered, rare and even extinct.

Memory Note

There are three types of biodiversity, ecosystem diversity, genetic diversity and species diversity.

4.2 Environment

The group of living things and non-living things around us is called the environment. We get oxygen, food and shelter from the environment. We receive water from different sources like wells, tube wells, taps and rivers. We tame animals and grow crops on the land. We are capable of producing energy from different sources like water, fossil fuels, sun, wind etc. We use medicinal herbs from forests to manufacture medicines. But, while doing development activities, we are degrading the environment and over exploiting natural resources. As a result there is an environmental imbalance. Natural disasters and epidemics are occuring frequently and resources are scarce. At this rate earth won't be suitable for living things to live anymore. Therefore, conserving the environment and its resources is very important.

environmental degradation

Activity

Make a list of activities that happen in your community that are harming the environment.

Some of the ways to conserve the environment are:

i. Prevent deforestation and encourage afforestation.

ii. Control air, water and land pollution.

iii. The concept of reduce; reuse and recycle should be adopted.

iv. Vehicles and industries that produce more smoke should be banned.

v. We should not use chemical fertilizers and insecticides.

4.3 Natural resources

Resources that are directly provided by the nature itself are called natural resources. Natural resources like air, water, sunlight and land are the most essential resources for the survival. Other natural resources like forests, wildlife, minerals, etc. are used to meet the survival needs and to satisfy the demand of life.

Activity

People in rich countries consume 10 times more natural resources than people in poor countries.

Types of natural resources

There are two types of natural resources. They are renewable resources and non-renewable resources.

Fact with Reason

Sunlight is a renewable natural resource, why?

Sunlight is a renewable natural resource because it is perpetual. It can be obtained on the earth forever.

a. Renewable natural resources

Those resources that are unlimited or can be renewed or reproduced even after they are finished are called renewable resources. Plants, animals, air, water, sunlight and fertile land are examples of renewable resources. Some of them are perpetual but some get scarce if overused.

plant

animals

water

fig: renewable natural resources

Fact with Reason

Why is grass an example of a renewable resource?

The grass is an example of a renewable resource because it can regrow again even after cutting or grazing.

Memory Tips

Renewable natural resources also produce clean energy.

b. Non-renewable natural resources

Those resources that cannot be renewed or reproduced after they are finished are called non-renewable resources. Metallic and non-metallic minerals, diesel, petrol, natural gas and coal are examples of non-renewable resources. Once these natural resources are depleted, they cannot be regenerated within the human time scale as they take more than thousands or millions of years to get deposited back in nature.

coal

LPG

petroleum

Fact with Reason

Minerals and fuels should be used wisely, why?

Minerals and fuels should be used wisely because these are non-renewable resources.

Differences between renewable resources and non-renewable resources.

SN	Renewable source	SN	Non-renewable source
1	Those resources that can be renewed or reproduced even after they are finished are called renewable resources.	1	Those resources that cannot be renewed or reproduced after they are finished are called non-renewable resources.
2	Renewable resources can be regenerated. Examples: forest, water etc.	2	Non-renewable resources cannot be regenerated. Examples: coal, petrol etc.

Importance of natural resources

Natural resources are the backbone of mankind and development. The importance of natural resources is mentioned below:

i) Food:

Environment provides food for all life forms. Photosynthesis is source of food in the environment.

ii) Fresh air:

Photosynthesis in plants not only provides food, but also oxygen. Oxygen is needed for all living beings for respiration.

iii) Water:

All living beings including humans obtain water from nature.

iv) Habitat:

Some organisms live on forest, meadow, hills, burrow, water and land.

v) Fuels and minerals:

Different sources of fuel like wood, uranium, coal, petrol, natural gas etc. come from nature. Minerals like gold, limestone, iron, copper etc. that are needed for infrastructure development also come from nature.

vi) Income:

Protected natural resources like national parks and wildlife reserves, beautiful places like rivers, mountains, valleys and gorges attract domestic and foreign tourists. This also helps in the economic growth of the country through the collection of revenue.

tourists visit national parks for site seeing and viewing animals

Depletion of natural resources

We are continuously exploiting natural resources to meet our needs and demands. Our activities are increasing environmental pollution. We throw garbage, vegetable wastes, wastewater, etc. on land and in water. Our industries, factories and vehicles add smoke and harmful chemicals to the air every day. We, humans, are overusing fertilizers, insecticides and chemicals. Our cities have been excessively urbanized and industrialized. The rate of deforestation is also higher. Due to these various activities, natural resources are depleting day by day. Thus, we can say that human beings are responsible for the depletion of natural resources.

forest fire

deforestation

pollution

fig: causes of depletion of natural resources

Causes of the depletion of natural resources

i. Rapid population growth and uncontrolled migration.
ii. Unmanaged urbanization and industrialization.
iii. Deforestation and forest fire
iv. Environmental pollution
v. Use of fossil fuel

Conservation of natural resources

The best way of conserving natural resources is by limiting their overuse and sustainably using them. Allocating protected areas, harvesting forests scientifically, afforestation and reforestation, controlling pollution etc. can conserve natural resources in the long term.

4.4 Water resources

The sources of water like rivers, ponds, lakes and sea, which are useful to the living organisms in various ways, are called water resources. About 97% of all water on the earth's surface is ocean water. The freshwater of rivers, ponds, lakes etc. is only about 3%. The freshwater of the earth is stored in glaciers, mountain caps, rivers and groundwater.

Sources of water

Surface water, groundwater and rainwater are three different sources of water. Water that is available on the surface of the earth like springs, streams, rivers, ponds and lakes etc. is called surface water. Water that comes from rain is called rainwater. Water under the surface of the earth is called groundwater. Nepal is rich in water resources as it has a large number of rivers and lakes that are formed by icy mountains.

lake *river* *well* *tube well*

fig: sources of water

Memory Tips

Rainwater, groundwater and surface water are the main sources of water.

Fact with Reason

Nepal is rich in water resources, why?

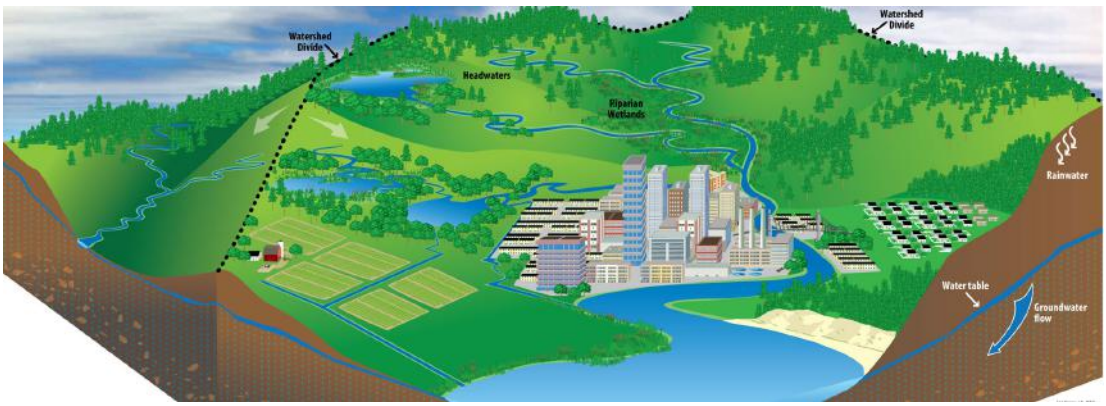
Nepal is rich in water resources because of the snow stored in the Himalayan range and the vast amount of forest, which gives rise to many rivers, lakes etc.

Activity

List the water resources available in your locality. Categorize them as surface water, groundwater and rainwater sources and list the purposes of using such water.

4.5 Watershed

A watershed is an area that drains the water from the rain and melted snow into water bodies like rivers and lakes. The size of a watershed may vary from place to place. Example: Shivapuri watershed, Indra Sarovar and Bagmati watershed.



Watershed

Fact with Reason

Watersheds are very important for preventing the depletion of groundwater.

Watersheds absorb water during the rainy season. Destruction of watersheds will cause more amount of runoff and a decrease in groundwater level. Thus, watersheds are very important for preventing the depletion of groundwater.

Memory Tips

The amazon river watershed is the largest in the world.

4.6 Wetland

Wetlands are the areas filled with water temporarily or throughout the year. Aquatic plants, shrubs or trees grow in it. In simple words, wetlands are marshy or swampy areas of land with moist soil or soil covered with water. Example: Fewa lake, Koshi Tappu etc.

Wetland

Importance of wetland and watershed

Wetlands are not only important for animals and plants, but they are very important for humans as well. Below are some of the major importance of wetlands.

i. Wetlands and watershed are homes of many plants and animals.

ii. The plants in the wetlands give us food and medicines.

iii. Animals found in the wetlands like fishes provide food for us.

iv. Wetlands are the sources of water for domestic purposes, industrial processes, hydroelectricity, irrigation etc.

v. They attract tourists and generate national income.

vi. Wetlands control floods by storing excess flood water.

vii. Wetlands maintain the natural environment and beauty of the place.

Activity

Visit a nearby wetland with guardian and list the names of four major animals, birds and plants each found in that wetland.

Memory Tips

Wetlands cover nearly 5% area of our country.

Conservation of water resources, watershed and wetlands

Different types of human activities like deforestation, pavement tiling, water pollution, urbanization etc. have affected watersheds badly.

Some of the ways to conserve watersheds are:

i. Government should declare watershed areas as protected areas.
ii. Deforestation should be stopped and encourage afforestation.
iii. Plotting cultivable land for settlement areas should be stopped.
iv. Water pollution should be controlled.
v. Drainage should be built in urban areas.

4.7 Management of solid waste

Environment sanitation means maintaining clean and healthy surroundings that are needed for a healthy life. Wastes like plastics, papers, scrap metals, clothes, food wastes, wastewater from the kitchen and bathroom etc. degrade environment. We need to maintain environmental sanitation by managing the waste. Some of the ways to manage waste are composting, burning, landfilling etc. Waste management locally at the source level is very cheap and easy to practice if we follow the '3R Principle'. 3R means reduce, reuse and recycle.

Reduce

Reduce means to decrease the amount of waste. We should use resources only in the required amount. The resources should not be overexploited.

reduce

Reuse

Reuse means the use of the same material times and again. Materials should be reused again as far as possible. This limits the amount of waste in the community. For example, plastic wrappers can be used for decoration. Used plastic containers and bottles can be reused as small plant vases. Waste paper can be used to make envelopes.

reuse

Recycle

Recycling means changing or modification of materials into new ones. Non-degradable wastes can be recycled. Plastic, paper, glasses, metals etc. can be recycled. Recycle of materials reduces the consumption of raw materials. Applying the 3R principle does not only lead to a clean environment but also the control overuse of natural resources. It also saves time and money that is spent on managing waste.

recycle

Memory Tips

One recycled aluminium can save enough energy to light ten 100-watt bulbs for one hour.

Answer writing skill

1. What is biodiversity?

The existing number of living organisms in a particular area is called biodiversity.

2. Define natural resources.

Resources that are directly provided by nature itself are called natural resources.

3. List the importance of natural resources.

The importance of natural resources are mentioned below:

i. It is a source of food and water.

ii. It provides a home for wild animals.

iii. It provides fresh air and water.

4. Differentiate between wetland and watershed.

The differences between wetland and watershed are:

SN	Wetland	SN	Watershed
1	Wetland is the area filled with water temporarily or throughout the year.	**1**	A watershed is an area that drains the water from the rain and melted snow into the water bodies like rivers and lakes.
2	Wetlands are the homes of many plants and animals.	**2**	Watershed gives birth to the river.

5. We should protect the forest of Nepal. Why?

We should protect the forests of Nepal because forest will protect watershed, wild lives, and environment.

6. What is the importance of wetlands?

Below are some of the major importance of wetlands.

i. Wetlands are the homes of many plants and animals.

ii. Animals found in the wetlands like fishes provide food for us.

iii. They attract tourists and produce national income.

EXERCISE

Step 1

1. Fill in the blanks.

non-renewable	wetland	biodiversity	groundwater	renewable

a. Marshy and swampy land is called …….

b. The existing number of living organisms in a particular area is called …….

c. Water under the surface of the earth is called …….

d. Plants, air, water, fertile land etc. are ……. resources.

e. Minerals, diesel, petrol, coal, etc. are …….resources.

2. Tick the correct and cross the false statement.

a. Fossil fuel is a renewable natural resource.

b. Biodiversity is the term used to describe the variety of life found on the earth.

c. Resources that are directly provided by nature itself are called natural resources.

d. Petroleum products are used for many purposes like running vehicles and industries, burning, etc.

e. Natural resources are the backbone of mankind and development.

3. Choose the correct answer from the given alternatives.

a. Which one is a renewable natural resource?

i. Solar energy ii. Forest

iii. Both iv. None

b. What type of natural resource is forest?

i. Both ii. Renewable

iii. Non-renewable iv. None

c. Which one is not a renewable source of energy?

i. Water ii. Sunlight

iii. Petrol iv. All

d. What type of natural resource is petroleum?

i. Both ii. Renewable

iii. Non-renewable iv. None

e. Which one is a non-renewable source of energy?

i. Water ii. Coal

iii. Air iv. All

4. Match the following

Surface water	recycle
Renewable natural resource	pond
Non-renewable natural resource	Air
Places that supply water into river	Fossil fuels
Conversion of waste into goods	watershed

Step 2

5. Answer the following questions in one word.

a. Give an example of wetland.

b. What kind of natural resource is air and water?

c. What kind of natural resource regenerate over time?

d. What kind of natural resource does not regenerate?

e. Give an example of non-renewable natural resource.

6. Differentiate between the following.

a. Renewable resources and non-renewable resources

b. Wetland and watershed

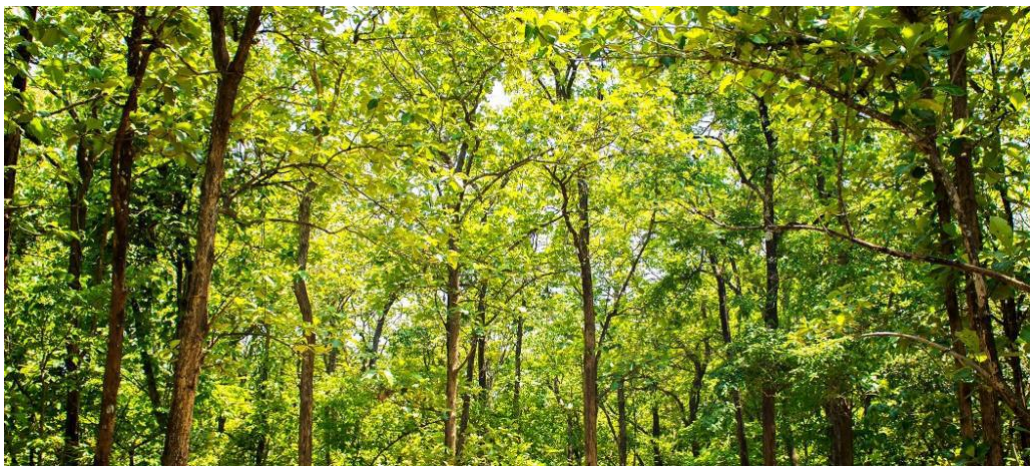
7. Give reason

a. Grass is an example of a renewable resource.

b. Petroleum should be used wisely.

c. Nepal is rich in water resources.

8. Study the given diagram and answer the following question.



i. What is the type of natural resource shown in diagram?

ii. Why should we have these resources near the watershed?

Step 3

9. Answer the following questions.

a. Mention any four importance of natural resources.

b. Describe the role of human beings in the conservation of the environment.

c. Natural resources are depleting in our country? What activities lead to the depletion of natural resources? Explain.

d. List the importance of water resources.

e. What can we do to protect the watersheds of our country?

UNIT

5 LIFE PROCESS

ESTIMATED TEACHING PERIODS	TH	PR
	7	3

Syllabus issued by CDC

- Transportation and absorption in plants and animals
- Excretion in plants and animals
- Respiration in plants and animals
- Importance of respiration

Learning Outcomes

After completion of this unit, students will be able to:

- explain the transportation and absorption in plants and animals.
- comparing and explaining the excretion process of plants and animals.
- understand and explain the respiration process and its importance in plants and animals.

Terms and terminologies

1. **Life process:** The set of all the metabolic activities that are performed by the organisms to stay alive are called life processes.
2. **Transportation system:** The system that transports useful substances to all cells and transports waste from cells to respective organs is called the transportation system.
3. **Absorption:** Absorption is the process of absorbing water and mineral salts from the soil by the roots of a plant.

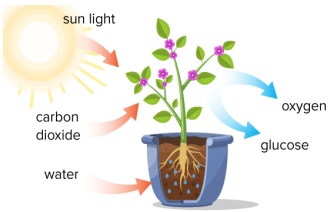
4.	Transport system:	The system that transports substances from one part to other parts of a plant body in the form of a solution is called a transport system.
5.	Xylem:	The conducting tissue which transports water and minerals from the roots to the leaves is called the xylem.
6.	Phloem:	The conducting tissue which carries food materials produced in leaves to different parts of a plant is called phloem.
7.	Diffusion:	The process in which materials pass directly through the cell membrane is called diffusion.
8.	Circulatory system:	The system that circulates blood throughout the body to help in the transportation and absorption of materials is called the circulatory system.
9.	Heart:	The heart is a muscular blood-pumping organ.
10.	Blood capillaries:	Blood capillaries are microscopic blood vessels.
11.	Excretion:	The process of throwing out unwanted and harmful substances from the body through various organs is called excretion.
12.	Transpiration:	The excretion of excess water by plants in the form of water vapour is called transpiration.
13.	Excretory organs:	The organs that help in excretion are called excretory organs.
14.	Kidney:	Kidneys are bean-shaped organs present on either side of the abdomen.
15.	Lungs:	Lungs are the pair of spongy respiratory organs that are situated inside the rib cage.
16.	Respiration:	The process of breaking down food materials in the living cells with the help of oxygen to release energy is called respiration.
17.	External respiration:	External respiration is the process of inhaling oxygen and exhaling carbon dioxide.
18.	Internal respiration:	Internal respiration is the process of oxidation of glucose in the mitochondria of the living cells.
19.	Cutaneous respiration:	The respiration which occurs through a moist body surface is called cutaneous respiration.
20.	Pulmonary respiration:	Respiration through the lungs is called pulmonary respiration.

5.1 Life process

The set of all the metabolic activities that are performed by the organisms to stay alive are called life processes. Respiration, digestion, circulation, transportation, excretion, etc. are examples of life processes.

respiration

digestion



photosynthesis

fig: life processes in animals and plants

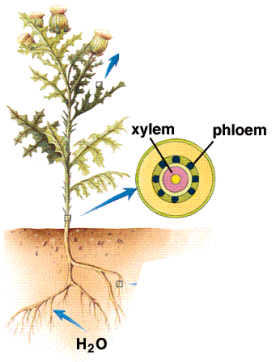
5.2 Transportation and absorption

Living organisms are made up of cells. Each cell is a living unit. Cells need food, oxygen and water to survive. Certain tissues help to supply them to the cells. Different metabolic activities such as respiration, digestion, synthesis etc. occur inside the cell. Waste material is produced during such metabolic activities. Waste is carried away to respective excretory organs. The system that transports useful substances to all cells and transports waste from cells to respective organs is called the transportation system.

The absorption and transportation in plants are different from animals.

5.1.1 Transportation and absorption in plants

Absorption is the process of absorbing water, minerals and salts from the soil by the roots of a plant. Green leaves need carbon dioxide, sunlight, water and minerals to make food. Leaves can trap sunlight and absorb carbon dioxide through stomata. Root hairs present in the roots absorb mineral salts in the form of a solution. The solution gets transported by xylem to the leaves for the preparation of food. The food is prepared



transport system in the plant

in the leaves. Then, it is transported to all parts of the plant by phloem. The system that transports substances from one part to other parts of a plant body in the form of a solution is called a transport system.

The transport system in plants is made of xylem and phloem.The conducting tissue which transports water and minerals from the roots to the leaves is called xylem. The conducting tissue which carries food materials produced in leaves to different parts of a plant is called phloem.

Memory Note

The vascular bundle is absent in Thallophyta and Bryophyta.

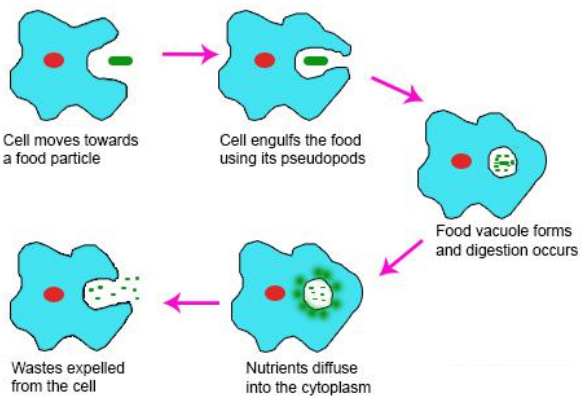
Differences between xylem and phloem:

SN	Xylem	SN	Phloem
1	The conducting tissue which transports water and minerals from the roots to the leaves is called xylem.	1	The conducting tissue which carries food materials produced in the leaves to the different parts of the plant is called phloem.
2	Xylem consists of dead cells.	2	Phloem consists of living cells.

5.1.2 Transportation and absorption in animals

i. Transportation and absorption in unicellular animals

Unicellular organisms absorb oxygen and water directly from their cell membrane. Waste is removed similarly. The procession in which materials pass directly through the cell membrane is called diffusion.



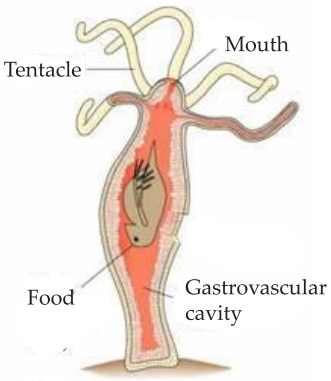
feeding, digesting, absorbing nutrition and removing waste in amoeba

ii. Transportation and absorption in sponges

Sponges do not have specialised tissue for absorption and transportation. The food materials, oxygen and water are collected through ostia. Nutrients are absorbed by diffusion. Waste materials are removed from the osculum.

iii. Transportation and absorption in coelenterate

Coelenterates are made up of two layers. The inner layer helps in digestion, absorption and transportation. The tentacles help the hydra to hunt and eat the prey. It is digested in the coelom. Nutrients are absorbed by the walls of the coelom. Waste is removed from the mouth.



absorption and transportation in hydra

Memory Tips

The hydra has stinging cells in the tentacles that help to paralyse the prey.

Activity

Observe a hydra through the microscope.

iv. Transportation and absorption in human beings

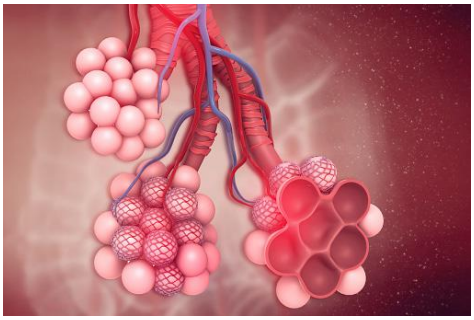
The blood circulatory system is responsible for absorption and transportation in the human body. It collects nutrients from the intestines, hormones from glands and oxygen from the lungs. These useful materials are supplied to the cell. It collects carbon dioxide, excess water and uric acid from the cells and transports them to respective

villi

excretory organs. The system that circulates blood throughout the body to help in the transportation and absorption of materials is called the circulatory system. The heart, the blood and the blood vessels make the circulatory system.

Small projections called villi are present in the inner wall of the small intestine. Villi help to absorb the nutrients present in the digested food and gives to blood. This process is called absorption.

Lungs contain alveoli which are small air sacs rich in blood capillaries. Oxygen diffuses into the bloodstream in alveoli and carbon dioxide is diffused out from blood to alveoli. The blood transports this oxygen throughout the body through the bloodstream.



alveoli

Uric acid and carbon dioxide are collected by blood and transported to the respective excretory organs.

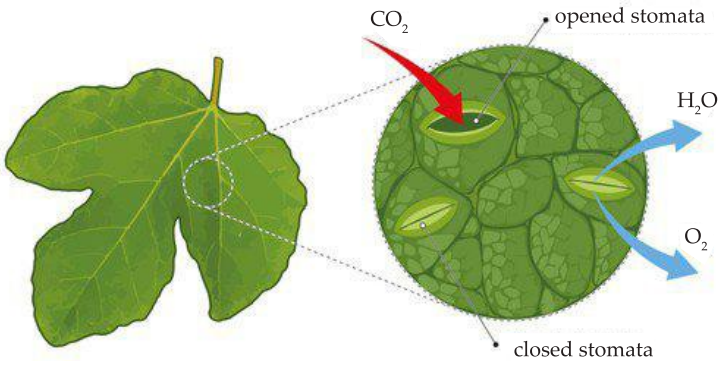
5.2 Excretion

While conducting various metabolic processes, our body produces various useful as well as harmful substances. Our body uses useful substances while eliminating unwanted and harmful substances. Harmful substances include carbon dioxide, excess salts, uric acid, urea, ammonia and faecal waste. The process of throwing out unwanted and harmful substances from the body through various organs is called excretion. Living organisms have various excretory organs or systems to excrete metabolic wastes.

5.2.1 Excretion in plants

Two major wastes that the plants produce are carbon dioxide and water. Plants release carbon dioxide and water vapour into the atmosphere through the stomata present in the leaves. Stomata are the tiny pores

found in the upper and lower surface of the leaves. The excretion of excess water by plants in the form of water vapour is called transpiration. Some inorganic wastes are also produced in the plants which are released in the form of latex, resin, oil, tannin, etc.



exchange of gases through stomata

5.2.2 Excretion in animals

Unicellular animals like an amoeba, paramecium and euglena remove waste materials through their general cell surface. For example, amoeba uses contractile vacuoles to release waste in the water. Similarly, multicellular animals like a hydra, sycon and spongilla also release their metabolic wastes directly into water through their body surface.

Similarly, animals like tapeworms, roundworms and liver-flukes have flame cells for excretion. The earthworm has a specialized organ called nephridia for excretion. Likewise, insects like a butterfly, mosquito, cockroach and grasshopper eliminate wastes through malpighian tubules

Excretory organs like skin, gills, lungs, liver, kidney, large intestine, etc. found in vertebrates are responsible for eliminating various wastes.

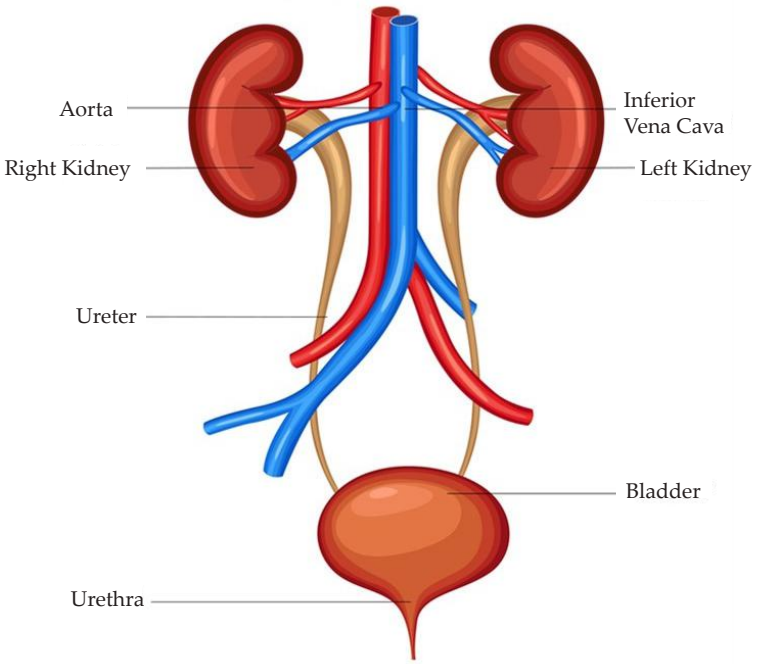
Excretion in Human Body

Several waste materials are produced in the human body. Some of these wastes are carbon dioxide, urea, uric acid, excess minerals and salts, undigested faecal matter, excess water, etc. The organs that help in excretion are called excretory organs. Excretory organs include skin, kidney, lungs, liver and large intestine.

Some of the excretory organs are briefly explained below:

i. Kidney

Kidneys are bean-shaped organs present on either side of the abdomen. They consist of millions of filtration units called nephrons. The main function of nephrons is to filter waste fluid from the blood. The filtration process removes wastes like urea, uric acid, excess mineral salts, water, etc. These wastes excreted by the kidneys get collected in the urinary bladder. Now, these are expelled out from the body in the form of urine through the urethra.



human urinary system

Memory Note

Each kidney consists of at least 1 million to 2 million nephrons. Nephrons are the structural and functional units of kidneys.
The entire blood in the human body gets filtered about 400 times in a day through the kidneys.

Fact with Reason

Kidneys are the major excretory organs of the human body. Give reason

Kidneys are the major excretory organs of the human body because they filter blood about 400 times a day and remove waste materials. The collection of even a small amount of waste in the blood for a long time is harmful to us.

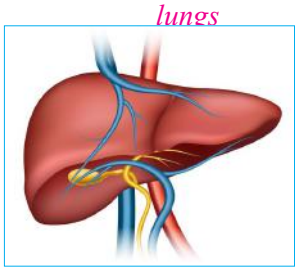
ii. Lungs

Lungs removes carbon dioxide from the body through the nose.

lungs

iii. Liver

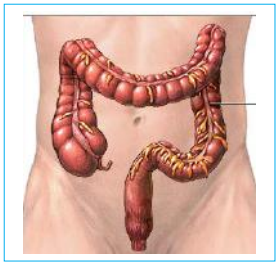
It stores harmful substances like urea, metals, ammonia, etc. and releases them into the bloodstream. Blood is then filtered by kidneys. The liver also gets rid of the medicines and other toxic wastes present in the blood.



liver

iv. Large intestine

The large intestine absorbs water from undigested matter and passes it to the rectum. The undigested matter is then excreted out through the anus.



large intestine

v. Skin

Skin excretes extra water, minerals, fats and salts as a steam through the small pores in them.

5.3 Respiration

The body of living beings needs energy for all the metabolic activities occurring in the body. Food is the main source of energy for our body. It releases energy when it is oxidized in the living cell.

Fact with Reason

Why is respiration essential for living beings?

Respiration is essential for living beings because it releases energy that is required to perform various metabolic activities in the body.

Memory Note

Respiration occurs inside mitochondria.

The process of breaking down food materials in the living cells with the help of oxygen to release energy is called respiration. Simply, respiration is the process of oxidation of food to release energy. The group of organs that are involved in respiration are called respiratory organs. There are two types of respiration. They are external respiration and internal respiration (cellular respiration).

External Respiration

External respiration is the process of inhaling oxygen and exhaling carbon dioxide. It is also called breathing. Energy is not produced in external respiration.

Internal Respiration

Internal respiration is the process of oxidation of glucose in the mitochondria of the living cells. Internal respiration is also called cellular respiration. Internal respiration burns glucose and produces energy in the form of Adenosine triphosphate (ATP). This energy is used for performing various life processes in living organisms. Carbon dioxide and water are also formed as by-products during internal respiration.

Glucose + Oxygen → Carbon dioxide + Water + Energy

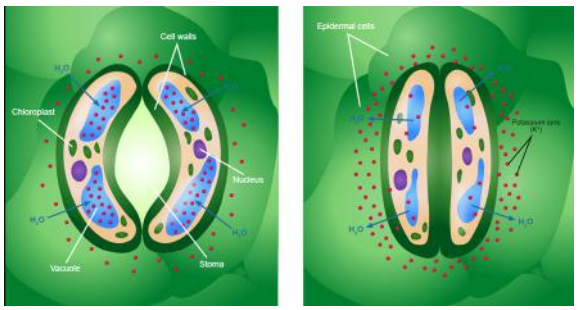
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$

Differences between internal respiration and external respiration:

SN	Internal respiration	SN	External respiration
1	It is the oxidation of glucose in the mitochondria of the cells.	1	It is the inhaling of oxygen and exhaling of carbon dioxide.
2	It releases energy in the form of ATP.	2	It does not release energy.
3	It is also called cellular respiration.	3	It is also called breathing.
4	It takes place inside of a cell.	4	It takes place outside of a cell.

5.3.1 Respiration in plants

Like animals, plants also take in oxygen and throw out carbon dioxide during respiration. Stomata present in the upper and lower surfaces of leaves, lenticular cells and general root surface are the structures for respiration in plants. Respiration is a process just opposite to that of photosynthesis.



open stomata and close stomata

Fact with Reason

Respiration in a plant is known as stomatal respiration. Why?

Respiration in a plant is known as stomatal respiration because the exchange of gases occurs through the stomata.

Memory Note

Plants also need oxygen for respiration.

Activity

OBJECTIVE: To show that germinating seed respires and releases carbon dioxide during respiration.

REQUIREMENT: Two conical flasks, cotton, gram seeds, two test tubes, lime water, two corks

PROCEDURE:

1. Keep some fresh and well-soaked gram seeds on wet cotton in a conical flask.
2. Do the same for the other flask but use boiled gram seeds in this flask.
3. Make the flasks airtight using wooden or rubber corks at their mouth.
4. Keep the flasks in a well-lit room with proper temperature, for a few days.
5. After the germination of seeds in the first flask, transfer the air of this flask to a test tube and add some lime water to it.
6. Do the same process: transfer the air of the second flask to another test tube and add some lime water.

OBSERVATION: It is observed that the air from the flask containing the well-soaked seeds turns lime water into a milky colour. But, the air from the second flask which contains the boiled seeds does not turn lime water into a milky colour.

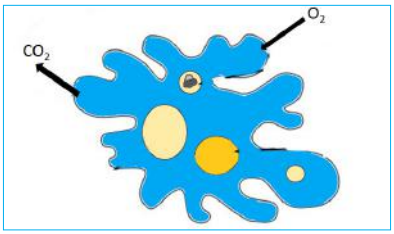
CONCLUSION: Well soaked gram seeds germinate and produce carbon dioxide which turns lime water into a milky colour.

RESULT: Germinating seeds respire and give out carbon dioxide gas.

5.3.2 Respiration in animals

i. Exchange of gases through the general body surface

Unicellular organisms like an amoeba, paramecium and euglena and multicellular organisms like a sponge, sycon, hydra and tapeworm do not have specialized organs or systems for breathing. So, these organisms breathe through their general body surfaces.



exchange of gas in amoeba

ii. Breathing through spiracles

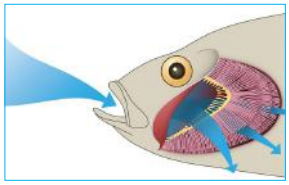
Insects breathe through a set of air-filled tubes called the trachea. Trachea has circular openings called spiracles. Insects


breathing through spiracles

suck oxygen and remove carbon dioxide by squeezing the sacs.

iii. Breathing through gills

Fishes, molluscs and some other water animals breathe through gills. Gills absorb dissolved oxygen from water.



breathing through gills

Memory Note

Whales are aquatic animals but they do not have gills.

iv. Breathing through moist skin

Some animals like frogs, earthworms and leeches can breathe through moist body surfaces. The respiration which occurs through a moist body surface is called cutaneous respiration.

v. Breathing through lungs

Amphibians, reptiles, birds and mammals breathe through their lungs. Respiration through the lungs is called pulmonary respiration. rich in blood capillaries. Oxygen diffuses into the bloodstream in alveoli and carbon dioxide is diffused out from blood to alveoli. Thus, external respiration takes place.

humans breathe through lungs

Answer writing skill

1. **What are life processes?**

   All those essential activities that are performed by living beings for their survival are called life processes.

2. **Write the name of two tissues responsible for transportation in plants.**

   Two tissues responsible for transportation in plants are the xylem and phloem.

3. **Define diffusion.**

   The procession in which materials pass directly through the cell membrane is called diffusion.

4. **Differentiate between excretion and respiration.**

SN	Excretion	SN	Respiration
1	The process of throwing out unwanted and harmful substances from the body through various organs is called excretion.	**1**	The process of breaking down food materials in the living cells with the help of oxygen to release energy is called respiration.
2	Excretion removes waste.	2	Respiration produces energy.
3	It is a physical activity.	3	It is a chemical reaction.

5. **What are the functions of the liver?**

The functions of the liver are:

i. It stores harmful substances like urea, metals and ammonia.
ii. The liver also gets rid of the medicines and other toxic wastes present in the blood.

6. **How does the kidney help in excretion?**

Kidneys consist of millions of filtration units called nephrons. The main function of the nephrons is to filter waste fluid from the blood. The filtration process removes wastes like urea, uric acid, excess salts, water, etc. It is collected in the urinary bladder. It is expelled out from the body in the form of urine through the urethra.

EXERCISE

Step 1

1. **Fill in the blanks.**

oxygen	malpighian	vascular bundle	oxidation	mitochondria

a. Water and minerals are transported by ……in plants.
b. The …….. of food takes place in mitochondria to release energy.
c. Internal respiration takes place in……..
d. Gills are the specialized organs to absorb dissolved …… from water.

e. Insects eliminate wastes through ..... tubules.

2. Tick the correct and cross the false statement.

a. Respiration is the process of oxidation of food.
b. Earthworms can breathe through their moist skin.
c. Lungs contain millions of air sacs called alveoli.
d. The exchange of gases takes place in the skin of human beings.
e. Latex is the most useful substance for plants.

3. Choose the correct answer from the given alternatives.

a. What allows the passage of gases in and out of the leaves?

i. Veins ii. Phloem
iii. Stomata iv. All

b. What transfers food from leaves to the root?

i. Phloem ii. Xylem
iii. Stomata iv. Lenticles

c. What is the set of metabolic activities happening inside our body called?

i. Life process ii. Lifecycle
iii. Metabolism iv. None

d. What is the process in which the root takes water and mineral from the soil?

i. Respiration ii. Digestion
iii. Transportation iv. Absorption

e. Which process helps in absorption in unicellular organisms?

i. Respiration ii. Transportation
iii. Diffusion iv. Excretion

4. Match the following

Sponges	pump blood
Heart	absorbs nutrients
Villi	exchange gases
Alveoli	removal of waste
Excretion	ostia

Step 2

5. Answer the following questions in one word.

a. What is the term used for all those activities that are performed by living beings for their survival?

b. What is the term for oxidation of glucose in mitochondria of a cell?

c. Which organ is involved in cutaneous respiration?

d. What are the filtration units of kidneys called?

e. Which parts of plants are involved in transpiration?

6. Differentiate between the following.

a. Internal respiration and external respiration

b. respiration and excretion

c. xylem and phloem

7. Give reason

a. Respiration is essential to living beings.

b. Kidneys are the major excretory organs in the human body.

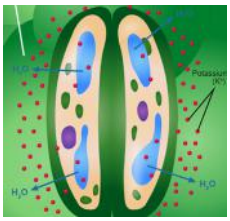
c. Intestine have lots of villi.

d. We should remove waste from our body.

8. Study the given diagram

Identify the following organs or parts and write any two functions of each.

a.



b.

c.

Step 3

9. Answer the following questions.

a. How does a plant collect raw materials for photosynthesis?

b. How do unicellular organisms absorb nutrients and remove waste?

c. How are nutrients absorbed and transported in the human body?

d. What do you mean by internal respiration?

e. Explain respiration in human beings.

f. Write short note on urinary system.

g. Name the respiratory organs of the following animals:

i) Tadpole

ii) Fish

iii) Butterfly

iv) Human beings

10. Draw a well-labelled diagram of urinary system.

UNIT

6 FORCE AND MOTION

ESTIMATED TEACHING PERIODS

TH	PR
10	3

Syllabus issued by CDC

- Introduction to distance, displacement, speed and velocity
- Differences between distance and displacement
- Differences between speed and velocity
- Numerical related to distance, displacement, speed and velocity
- Introduction to gravitational force, gravity and weight and their relation with mass
- Introduction, advantages and disadvantages of friction
- Ways of reducing friction
- Introduction, relationship and numerical of work and power

Learning Outcomes

After completion of this unit, students will be able to:

- describe length, displacement, speed and velocity. Discuss the differences between distance and displacement, speed and velocity.
- solve numerical related to distance, displacement, speed and velocity.
- state and demonstrate the fact that earth pulls all objects towards its centre due to gravity.
- measure the weight of objects using spring balance and calculate weight of an object based on their mass.
- introduce friction and demonstrate the fact that friction depends upon shape of object and nature of surfaces in contact.
- explain the ways of reducing friction, its uses in daily life, its advantages and disadvantages.
- introduce work and power and explain their interrelationships.
- solve simple mathematical problems related to work and power.

Terms and terminologies

1.	Force:	The external factor which changes or tends to change the state of an object from rest to motion or from motion to rest is called a force.
2.	Scalar quantity:	A physical quantity that is described completely by its magnitude only is called a scalar quantity.
3.	Vector quantity:	A physical quantity that requires both magnitude and direction for its complete description is called a vector quantity.
4.	Distance:	The actual length of the path that is covered by a moving body, irrespective of its direction is called the distance.
5.	Displacement:	The shortest distance between the initial position and the final position of a moving body in a particular direction is called its displacement.
6.	Speed:	The distance travelled per unit time is called speed.
7.	Velocity:	The distance travelled by a body per unit time in a particular direction is called velocity.
8.	Gravitational force:	The force of attraction between any two objects because of their masses is called a gravitational force.
9.	Gravity:	The force with which any planet or satellite attracts objects towards its centre is called gravity.
10.	Acceleration due to gravity:	The rate of change in velocity of the freely falling object due to the effect of the earth's gravity is called acceleration due to gravity.
11.	Weight:	The force by which an object , at the surface of the earth is pulled toward the centre of the earth is called weight.
12.	Frictional force:	The force which opposes the relative motion between two bodies in contact is called a frictional force.
13.	Lubricant:	The substances which reduce friction are called lubricants.
14.	Work:	The work is said to be done when a body moves in the direction of force applied.
15.	One joule work:	One joule of work is done when a force of 1N displaces an object through a distance of one meter in the same direction of the force.
16.	Work done against friction:	The work done in pushing or pulling a load by applying force against friction is called work done against friction.
17.	Work done against gravity:	The work done in lifting weights by applying force against gravity is called work done against gravity.
18.	Power:	Power is the rate of doing work.
19.	One-watt power:	Power is said to be one watt when one joule of work is done in one second.

6.1 Introduction to Force

We have observed that a rolling football on the ground slows down after some time. A football player kicks a rolling football to change its direction. What makes the ball slow down and change its direction of motion? There is an external agent, i.e., the force which causes this. Thus, the external factor which changes or tends to change the state of an object from rest to motion or from motion to rest is called a force. Its SI unit is Newton. It can change the direction, shape, size, speed and the state of rest or motion of a body.

force is necessary to play games

Memory Tips

Force is a derived quantity.

Fact with Reason

Why does a brick break on hammering?

A brick breaks on hammering because force can change the shape, size and structure of a body.

6.2 Scalar quantity and vector quantity

Scalar quantity and vector quantity

A physical quantity that is described completely by its magnitude only is called a scalar quantity. For example, distance, speed, mass, etc.

A physical quantity that requires both magnitude and direction for its complete description is called a vector quantity. For example, displacement, force, weight, velocity, etc.

Fact with Reason

Why is mass a scalar quantity?

Mass is a scalar quantity because it has magnitude but no direction.

Differences between Vectors and Scalars

SN	Vectors	SN	Scalars
1	Vectors have both magnitude and direction.	**1**	Scalars have only magnitude.
2	The sum of vectors may be zero, positive and negative.	**2**	The sum of scalars is always a positive number.
3	We can add or subtract vectors with the rules of the vector method.	**3**	We can add or subtract scalars with the rules of simple algebra.

6.3 Distance and displacement

Distance

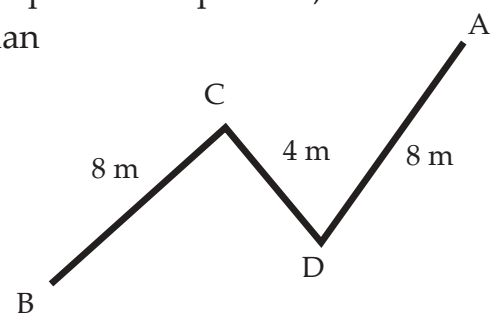
The actual length of the path that is covered by a moving body, irrespective of its direction is called the distance. It is a scalar quantity. The SI unit of distance is meter (m).

For example, when a man travels 8m from point B to point C, 4m from point C to point D and then 8m from point D to point A, then the total length of the path travelled by the man

= BC + CD + DA

or, Distance = 8m + 4m + 8m

= 20m



Displacement

The shortest distance between the initial position and the final position of a moving body in a particular direction is called its displacement. It is a vector quantity. The SI unit of displacement is the meter.

Memory Tips

When a man travels from point A to another point B towards a particular direction and returns to A from the same path, the net displacement is zero.

Differences between Distance and Displacement

SN	Distance	SN	Displacement
1	Distance is the actual length of the path travelled by a body in motion.	1	Displacement is the shortest distance between two positions of a body in motion in a particular direction.
2	Distance is a scalar quantity. It is always positive.	2	Displacement is a vector quantity. It can be positive, negative or zero.

6.4 Speed and velocity

Speed

Whenever we try to find out which of the two or more vehicles is moving faster, then we compare the distances covered by them per unit time. If we know the distance travelled by two cars in a minute then we can tell which car is moving faster. The distance travelled per unit time is called speed. It is a scalar quantity. In SI units, the unit of speed is m/s.

$$\text{speed} = \frac{\text{total distance}}{\text{total time}}$$

Memory Tips

Speed is measured by a speedometer.

When the speedometer of a car indicates 72km/h, it implies that, if the speed remains the same, the car will cover a distance of 72 kilometres in one hour.

Fact with Reason

Speed is a scalar quantity. Why?

Speed of a body has only magnitude but no direction. So, speed is a scalar quantity.

Activity

Calculate the speed of a ball when it is dropped from the height of 2 m. Use a stopwatch to calculate time.

Velocity

Velocity is a physical quantity that has both direction of motion and the magnitude of distance travelled. So, the distance travelled by a body per unit time in a particular direction is called velocity. If a body covers a distance of 's' in time 't' in a specific direction, then its velocity 'v' is given by

$$\text{Velocity} = \frac{\text{displacement}}{\text{time}}$$

It is a vector quantity. In the SI system, the unit of velocity is m/s.

Memory Tips

The displacement travelled by a body per unit time is called velocity.

Fact with Reason

Velocity is a vector quantity. Why?

Velocity has both magnitude and direction. So, it is a vector quantity.

SOLVED NUMERICAL

Find the speed of a car that covers 800 meters in 40 seconds.

Solution

Distance covered by car = 800 m

Time taken = 40 s

According to the formula,

$$\text{speed} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{800\text{m}}{40\text{s}}$$

= 20 m/s

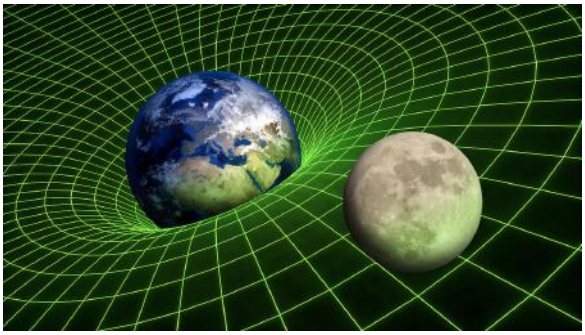
∴ The speed of the car is 20m/s.

Differences between Speed and Velocity

SN	Speed	SN	Velocity
1	Speed is the distance travelled by a body per unit time.	1	Velocity is the displacement travelled by a body per unit time.
2	It is a scalar quantity.	2	It is a vector quantity.

6.5 Gravitational force

Planets revolve around the sun due to a mutual force of attraction between them. This mutual force is called gravitational force. Thus, the force of attraction between any two objects because of their masses is called a gravitational force.



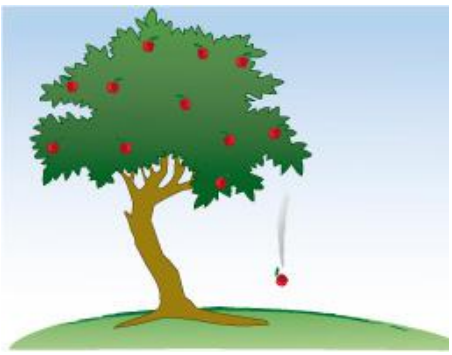
earth and its gravitational force

Memory Tips

Tides occur in the ocean due to the gravitational force between the moon and the ocean.

Gravity

When a ball is thrown up from the surface of the earth, it falls back on the earth. It is due to the force of gravity. The force with which any planet or satellite attracts objects towards its centre is called gravity. It is a vector quantity.



apple falls down due to gravity

Fact with Reason

An apple always falls toward the earth. Why doesn't it fly away?

An apple always falls toward the earth. It does not fly away because it is pulled by the gravity of the earth.

Effects of Gravity

i. An object thrown upward falls back on the surface of the earth.

ii. Rain, snow and hailstone fall on the earth.

iii. Rivers flow from higher to lower altitudes.

When an object falls from a certain height. Its velocity changes continuously. The change in velocity is the effect of the gravity of the earth. The rate of change in velocity of the freely falling object due to the effect of the earth's gravity is called acceleration due to gravity. Its average value on the earth is approximately 9.8m/s^2.

6.6 Load and its measurement

The weight of an object is directly dependent upon the mass. The object which has more mass has more weight. The force of gravity on a body is also known as the weight of the body. Its SI unit is the newton.

spring balance

It is measured by spring balance.

The relation between the weight and mass is shown by the given equation.

Weight = mass x acceleration due to gravity

$\therefore W = m \times g$

SOLVED NUMERICAL

Calculate the weight of 1.5 kg apples.

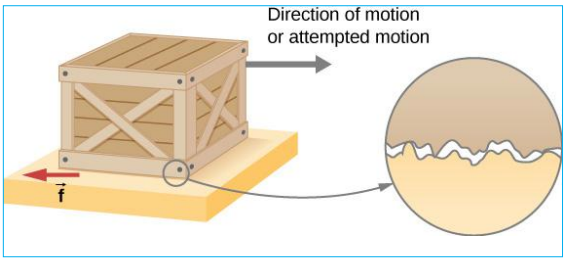
Solution:
Mass of apple(m) = 1.5 kg
Acceleration due to gravity (g) = 9.8 m/s^2
Weight (W) = ?
According to the formula,

$W = mg$
$= 1.5 \times 9.8$
$= 14.7$ N

$\therefore$ The weight of 1.5 kg apples is 14.7 N.

6.7 Friction

When a football is kicked to roll it on the ground, it gradually slows down and finally stops at some distance. This happens due to the opposing forces that are at work between the ground and the football. Such an opposing force is called a frictional force. Hence, the force which opposes the relative motion between two bodies in contact is called a frictional force. The origin of the frictional force lies in the interlocking of uneven projections of two surfaces. Thus, smoother surfaces have less friction and vice versa. Friction is called necessary evil because it helps in walking, holding, writing etc. but causes wear and tear of machines.



friction between the surfaces

Memory Tips

The frictional force always acts in a direction opposite to the motion.

Activity

Observe an old ladder, the pavement on road etc. Are some of them eroded? What might be the cause? Discuss in a group.

Fact with Reason

How are we able to walk? Give Reason.

We can walk because of frictional force between our sole and ground.

Advantages of Frictional Force

i. Friction makes it possible to hold objects, to write or to walk, etc.

ii. Frictional force between the brake pads and wheel stops the bicycle.

iii. It is possible to walk on the ground because of friction.

iv. The friction between the sulphur and the head of the match stick starts fire.

v. It is possible to ride a motorbike due to the friction between the tyres and the road.

friction allows knot bolts to fasten

writing is possible because of friction

friction helps in walking

Fact with Reason

An ink pen does not write on oily paper. Why?

Oil on the surface of oily paper reduces the friction between the nib of the pen and paper, which is essential to write on the paper. So, an ink pen does not write on oily paper.

Disadvantage of friction

i. Friction opposes motion.

ii. Friction causes the wear and tear of machine parts and this leads to the damage of certain machinery.

iii. Heat generated due to friction in machines causes loss of energy and fuel.

Fact with Reason

When two dry blocks of wood are rubbed, it starts to burn. Why?

When two dry blocks of wood are rubbed, it starts to burn because of heat produced due to friction.

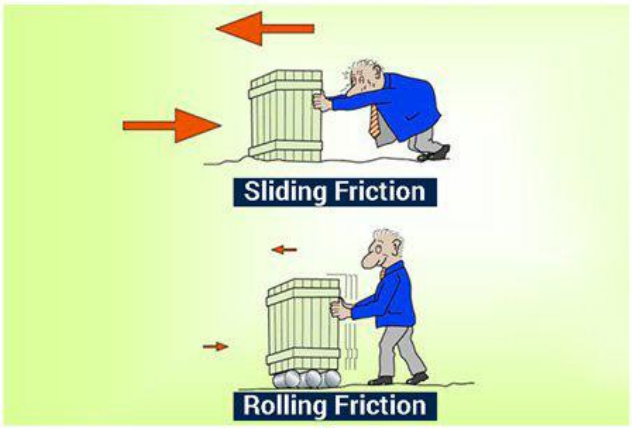
Methods to decrease friction

In some situations, friction is undesirable and we can minimize it by different methods. For example:

stream lined body reduces friction

i. Stream-lined Shape: Automobiles, aeroplanes and ships are specially designed into stream-lined shapes to reduce friction.

ii. Rolling Instead of Sliding: Rolling friction is smaller than sliding friction. Thus, the sliding parts in a machine are fitted with ball bearings.



rolling instead of sliding

iii. Polishing of Rough Surface: Rough surfaces are polished to reduce friction.

For example, the carom board is highly polished to reduce friction.

iv. Oiling and greasing: A few drops of oil or grease is poured on the hinges of a door to move it smoothly.

v. Lubricants: The substances which reduce friction are called lubricants. Lubricants can be in solid, liquid or gaseous forms.

polishing

using Mobil

greasing

fig: methods of reducing friction

Fact with Reason

Why do birds have a boat-shaped body?

Birds have a boat-shaped body to reduce friction with air while flying.

The luggage with wheels underneath is easier to pull. Why?

The friction on rolling wheels is less than that on the luggage without the wheels. So, luggage is provided with wheels.

Boric powder is sprayed on the carom board. Why?

Boric powder reduces the friction between the board and the carom striker and coins. So, boric powder is sprayed on the carom board.

Why do we slip on a clean marble floor?

We slip on a clean marble floor because the marble floor is smooth and provides less friction.

6.8 Work and power

Work

Normally, the word work is used to describe any activity which has been carried out in our day-to-day life. The meaning of work in our daily life is quite different from that in physics.

Fact with Reason

Guarding by standing in front of a gate is not called work in physics, why?

In physics, work is related to the force applied to a body and the corresponding displacement. Guarding by standing in front of a gate is not called work in physics because a standing person does not cover a distance from its position of rest.

Memory Tips

The work is the transformation of energy. Therefore, work and energy have the same units.

In physics, the word 'work' is used only in cases where there is a force acting on a body and the body moves by a certain distance. Work is done whenever a force acting on a body results in a displacement in the direction of the force.

For example:

i. When a ball is thrown horizontally, the ball covers some distance along the direction of the force applied and work is done on the ball.

ii. When we pull a box on the ground, the box covers some distance along the direction of the force applied and work is done on the box

The work is said to be done when a body moves in the direction of force applied. Mathematically, work is the product of force and displacement in the direction of the force. It can be expressed by the given formula.

$$W = F \times S$$

Where "W" is the work done, "F" is the force applied and "S" is the displacement in the direction of the force.

The SI unit of force is joule (J).

Fact with Reason

Work is a scalar quantity.

Although work results from the product of two vector quantities (force and displacement), it has only the magnitude that matters in the description of work, not the direction. So work is a scalar quantity

Factors Affecting Work

i. Work done is directly proportional to magnitude of force applied.

ii. Work done is directly proportional to the magnitude of displacement.

Memory Tips

The unit of work and energy i.e Joule is named after British physicist James Prescott Joule.

Other Units of Work

1 kilo joule (kJ) = 10^3 joule (J) 1 mega joule (MJ) = 10^6 joule (J)

Fact with Reason

A person is pushing a wall but the wall is not moving. Can it be called work? Give reason.

No, it cannot be called a work in the language of physics because no distance is being covered by the wall.

Even when there is no tangible work done, we get tired.

Even when no tangible work is done we get tired because energy is used by our cells for metabolic activities.

SOLVED NUMERICAL

The mass of a car along with the driver is 1000kg and it accelerates with 6m/s^2 within the distance of 500m. Calculate the work done by the engine of the car.

Solution:

Given Here,

Displacement of car (s) = 500m

Mass of the car (m) = 1000kg

Acceleration (a) = $6m/s^2$

Now, Work done (W) = Force × displacement

= m×a × s

= 1000×6×500 J

or, = 3000000 J

= 3000 kJ

∴ The work done by the engine of the car is 3000Kj.

One joule work

One joule of work is done when a force of 1N displaces an object through a distance of one meter in the same direction of the force.

Mathematically,

W = F × S

= 1 N × 1 m

= 1J

∴ 1 J = 1 N × 1 m

Memory Tips

A force does no work when the displacement is zero.

Types of Work

Work Done Against Friction

The work done in pushing or pulling a load by applying force against friction is called work done against friction. For example, pushing a book on a table, pulling a box on the ground, etc.

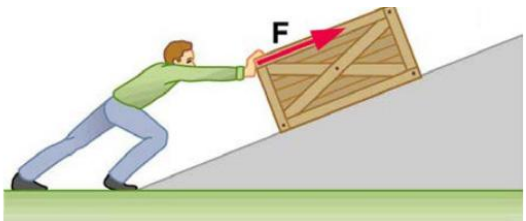


fig. work against friction

If 'F' is the force of friction and 's' is the displacement of a body then the work done against friction is given by W= F × s

Fact with Reason

Pushing a book is work against friction. Why?

Pushing a book is work against friction because the book moves in the opposite direction of the frictional force.

SOLVED NUMERICAL

A box is pushed on the ground for a horizontal distance of 3m and the frictional force experienced by the box is 100N. Calculate the work done to overcome friction.

Solution:

Frictional force (F_f) = 100N

Displacement (s) = 3m

Work done to overcome friction (W_f)=?

Now,

Work done to overcome friction (W_f) = F_f × s = 100 × 3 = 300 J

Work Done Against Gravity

Objects are pulled towards the centre of the earth by gravity. To lift an object, an upward force equal to the weight must be applied to the object. The work done in lifting weights by applying force against gravity is called work done against gravity. For example, throwing a ball up, lifting a load, climbing stairs, etc.

fig: work against gravity

Memory Tips

Total work done = work done overcoming friction + work done against gravity

If a mass 'm' is lifted to a height 'h' then the work done against gravity is given by

Work done against gravity (W) = Force of gravity × displacement

or, W = weight × height

∴ $W = mgh$

SOLVED NUMERICAL

Calculate the work done by a cat of 5kg when it jumps to a height of 4m.

Solution:

Mass of the cat (m) = 5kg

Displacement (s) = height (h) = 4m.

Work done against gravity (W) = ?

Now,

The work done against gravity (W) = mgh = 5 × 9.8 × 4 = 196 J

∴ The work done by the cat is 196J.

Fact with Reason

Climbing a ladder is work against gravity. Why?

Climbing a ladder is work against gravity because we move opposite to the direction of gravity while climbing a ladder.

Power

The time required to complete a work varies as per the worker or the machine. If a machine completes work faster than another machine, then it has more power. So, power is the rate of doing work. It is also defined as the rate at which energy is transferred or converted.

Mathematically,

$$\text{Power (P)} = \frac{\text{work done (W)}}{\text{time taken (t)}}$$

Memory Tips

Power is a scalar quantity.

Units of Power

The SI unit of power is J/s or watt (W)

Unit	Symbol	Equivalence in watt (W)
Horsepower	h.p.	1 h.p.= 746 W
Kilowatt	kW	1kW = 1000W
Megawatt	MW	1MW = 10^6 W

One watt power

$$\text{Power (P)} = \frac{\text{work done (W)}}{\text{time taken (t)}}$$

$$= \frac{1\text{J}}{1\text{s}}$$

$$= 1 \text{ watt}$$

$$\therefore \ 1 \text{ watt} = \frac{1\text{J}}{1\text{s}}$$

Thus, power is said to be one watt when one joule of work is done in one second.

Meaning of Power of Electrical Appliances

60W written on a bulb means, the bulb consumes 60J of electrical energy to convert it into heat and light energy in one second.

SOLVED NUMERICAL

A constant force of 200N pulls a crate for 10m along a level floor in 10s. What is the power used?

Solution,

The force applied (F) = 200N

Displacement (s) = 10m

Time taken (t) = 10s

According to the formula,

$$\text{Power (P)} = \frac{\text{work done (W)}}{\text{time taken (t)}}$$

$$= \frac{F \times s}{t}$$

$$= \frac{200 \times 10}{10}$$

$$= 200 \text{ watts}$$

$\therefore$ The power used to pull the crate is 200 watts.

Factors Affecting Power

i) Work done (W) ii) Time taken (t)

Differences between Work and Power

SN	Work	SN	Power
1	Work is said to be done when the force acting on a body causes displacement in the direction of the force.	**1**	Power is the rate of doing work.
2	The SI unit of work is the joule (J).	**2**	The SI unit of power is the watt (W).

Answer writing skill

1. Write a formula to calculate speed.

$$\text{Speed} = \frac{\text{total distance}}{\text{total time}}$$

2. What is the value of acceleration due to gravity on the earth?

Acceleration due to the gravity on the earth is $9.8 m/s^2$.

3. Define one-joule work.

One joule of work is done when a force of 1N displaces an object through a distance of one meter in the same direction of the force.

4. Differentiate between work against gravity and work against friction.

The difference between work against gravity and work against friction

SN	Work against gravity	SN	Work against friction
1	The work done in lifting weights by applying force against gravity is called work done against gravity.	**1**	The work done in pushing or pulling a load by applying force against friction is called work done against friction.
2	W = mgh	**2**	W= F × s

5. Why is weight a vector quantity?

Weight is a vector quantity because it has magnitude as well as direction (toward the centre of the earth).

6. What are the effects of gravity?

The effects of gravity are listed below:

i. It produces acceleration in falling objects.

ii. We can construct buildings in the earth.

iii. It holds water in ocean and air in atmosphere.

EXERCISE

Step 1

1. Fill in the blanks.

friction	vector	force	746	magnitude

a. Weight is a …… quantity.

b. Use of fine powder on a carom board reduces ……...

c. Speed has …… but no direction.

d. Work depends upon …… and displacement.

e. One horsepower (h.p.) equals to ……. watt.

2. Tick the correct and cross the false statement.

a. An object thrown upward from the earth's surface falls on the ground due to gravity.

b. Rolling friction is more than sliding friction.

c. Aeroplanes are streamlined to reduce friction.

d. Work done is given by, Work = Force × time.

e. Power is measured in J/s.

3. Choose the correct answer from the given alternatives.

a. What is the SI unit of force?

i. Newton ii. Dyne

iii. Joule iv. Watt

b. What is the purpose of using oil in the machine?

i. Reduce friction ii. Increase friction

iii. None iv. Both

c. What is the SI unit of work?

i. Joule ii. Erg

iii. Watt iv. Horsepower

d. What kind of quantity is a mass?

i. Vector quantity ii. Scalar quantity

iii. Both iv. none

e. What quantity has both magnitude and direction?

i. Velocity ii. Speed

iii. Length iv. Distance

4. Match the following

Force	opposing force
Length	Speed

Displacement	newton
Speedometer	vector quantity
Friction	scalar quantity

Step 2

5. Answer the following questions in one word.

a. What is the term for the total distance travelled by a body per unit time?
b. Which force is known as a necessary evil?
c. Which quantity does horsepower measure?
d. What is used to reduce the friction in the machine?
e. What is the rate of doing work called?

6. Differentiate between the following.

a. scalar quantity and vector quantity
b. distance and displacement
c. speed and velocity
d. work and power

7. Give reason

a. Aeroplanes and ships have streamlined shapes.
b. Speed is a scalar quantity but velocity is vector.
c. No work is done when a man pushes against a wall.
d. An object thrown up in the sky falls back on the earth's surface.
e. Friction is a necessary evil.

8. Study the given diagram

What part increases or decreases the frictional force in the following figures?


a


b


c


d

Step 3

9. Answer the following questions.

a. What is force? Write its SI unit.

b. Define gravity. Mention its effects.

c. List two advantages and disadvantages of frictional force.

d. What are the methods to decrease friction?

e. Write formula and SI Unit of work and power.

f. Define one-joule work and show in the formula.

g. Define one watt power and show in the formula.

10. Numerical

a. A car travels a distance of 1600m in 60 s. Calculate its speed. [Ans:26.66m/s]

b. A car is moving at a speed of 25m/s. Calculate the distance travelled by car in 30 seconds. [Ans:750m]

c. A bus travels a distance of 7500m in 5 minutes. Calculate its velocity. [Ans:25m/s]

d. A girl applies a force of 10N to move a box over a 5m distance on a horizontal surface. Find the work done. Which type of work is it? [Ans: 50 J]

e. A boy lifts a 20N bag vertically up through a distance of 1m. Find the work done. Which type of work is it? [Ans: 20 J]

f. A boy does 20J of work in 4s. Find his power. [Ans: 5 W]

g. A pump lifts 200 kg of water to a water tank placed at a height of 25m in 20 s. Find its power. g = 10 m/s^2 [Ans: 2500 W]

UNIT

7 ENERGY IN DAILY LIFE

ESTIMATED TEACHING PERIODS	TH	PR
	19	6

Unit 7.1 Energy	Unit 7.2 Heat and Temperature
	
Unit 7.3 Sound	**Unit 7.4 Light**
	

Unit
7.1

Energy

Syllabus issued by CDC

- Classification of sources of energy: renewable and non-renewable sources of energy
- Introduction, advantages and disadvantages of fossil fuel
- Importance of conservation of sources of energy
- Ways of conserving energy, the wise use of energy and alternative sources of energy

Learning Outcomes

After completion of this unit, students will be able to:

- classify the sources of energy used in daily life.
- introduce fossil fuels and explain their advantages and disadvantages
- explain the importance of conservation sources of energy, measures to conserve them

Terms and terminologies

1. Energy: The capacity of a body to do work is called energy.
2. Sources of energy: The substances that provide energy are called sources of energy.
3. Renewable sources of energy: The energy sources that are being produced continuously in nature and are inexhaustible are called renewable sources of energy.
4. Non-renewable sources of energy: The energy sources that get depleted and cannot be replaced quickly when

	exhausted are called non-renewable sources of energy.
5. Fossil fuel:	The fuel obtained from fossils such as coal is called fossil fuel.
6. Alternative source of energy:	The energy sources which can be used instead of non-renewable sources of energy are called alternative sources of energy.
7. Energy crisis:	The acute scarcity of the essential energy sources on the earth is called the energy crisis.

We can walk and work due to the energy in our bodies. This energy comes from the food we eat. In a machine, there is fuel, which supplies energy for its working. The capacity of a body to do work is called energy. Energy makes our life easier. It is used in houses, industries, hospitals and other places. There are different forms of energy like fossil fuel energy, solar energy, nuclear energy, wind energy, electrical energy, etc.

heat energy helps in cooking

fuel powers machine

computers are powered by electrical energy

7.1 Source of energy

Energy can neither be created nor be destroyed but it can be transformed from one form to another form. Energy can be obtained from various sources. The substances that provide energy are called sources of energy. Firewood is used for cooking in rural areas. Liquefied Petroleum Gas (LPG) gas is used in the kitchen in urban areas. Petroleum powers vehicles. Coal is used in brick factories. All of these substances are sources

of energy. Some of the energy sources can be replenished in a short period. But others cannot be generated in a short time. So, mainly there are two types of energy sources. They are renewable energy sources and non-renewable energy sources.

Fact with Reason

Why is the sun considered the ultimate source of energy?

The sun is called the ultimate source of energy because it provides a large quantity of solar energy. And all other forms of energy are the outcome of solar energy.

Memory Tips

Nuclear energy is used to produce electricity.

Activity

Make a list of energy sources used in your house.

Renewable sources of energy

Some of the sources of energy have unlimited stock in nature. They do not finish compared to the life span of human beings. Some of them do not have unlimited stock but can be replenished shortly. The energy sources that are being produced continuously in nature and are inexhaustible are called renewable sources of energy. For example, solar energy, wind energy, wood, charcoal etc. These sources of energy will never get exhausted and can be used again and again.

renewable sources of energy

Non-renewable Energy Sources

Some of the sources of energy have limited stock in nature. They finish upon continuous use. They do not regenerate. The energy sources that get depleted and cannot be replaced quickly when exhausted are called non-renewable sources of energy. For example, coal, petrol, diesel, etc. They cannot be used again and again.

non-renewable sources of energy

7.2 Fossil fuel

Coal, petroleum and natural gas are called fossil fuels. They are dominant energy sources in the modern age. The fuel obtained from fossils such as coal is called fossil fuel. Fossil fuels are formed from the remains of plants and animals buried inside the earth's crust for millions of years. A large amount of chemical energy is stored in fossil fuels. This stored chemical energy is converted into various other forms of energy such as heat, light and mechanical energy. The demand for fossil fuels is increasing every day.

coal

kerosene

petrol

fig: non-renewable sources of energy

Advantage of fossil fuel

i. It is cheap and easy to extract.

ii. It burns easily.
iii. Electricity can be generated from fossil fuels.
iv. Fossil fuels can be transported from one place to another.
v. It can be stored easily.

The disadvantage of fossil fuel

i. Consumption of fossil fuel mixes smoke into the air.
ii. The supply of fossil fuels is limited and cannot be replenished.
iii. The extraction of fossil fuel destroys a large area of land.
iv. The use of natural gas causes an unpleasant smell in the area.

Memory Tips

Coal can be used to produce electricity.

Fact with Reason

Why is coal called a non-renewable source of energy?

Coal is called a non-renewable source of energy because it cannot regenerate. It has a limited stock.

Activity

Make a pamphlet to show the harmful effects of fossil fuels.

7.3 Alternative source of energy

Fossil fuels like coal, mineral oil, natural gas, etc. are running out because of their excessive use. We need to use other sources of energy to conserve fossil fuels. These other sources are called alternative sources of energy. Thus, the energy sources which can be used instead of non-renewable sources of energy are called alternative sources of energy. For example, solar energy, wind energy, hydroelectricity etc.

hydroelectricity

wind energy

fig: alternative sources of energy

7.4 Ways of saving energy

The world's energy demand is increasing day by day. To meet this high energy demand, non-renewable sources of energy like coal, mineral oil, natural gas, etc. are being used by people rapidly. About 85% of this energy used comes from non-renewable sources. Non-renewable sources of energy cannot last forever. Among these sources, oil and natural gas will be the first to disappear. It causes energy sources to be scarce. This is called an energy crisis. Thus, the acute scarcity of the essential energy sources on the earth is called the energy crisis.

Causes of energy crisis

i. Over-dependence upon fossil fuel
ii. Lack of alternative sources of energy
iii. Overuse and unwise use of energy sources
iv. Increasing world population

Some ways of conserving energy are:

i. Using renewable sources of energy
ii. Replacing fossil fuels with hydroelectricity and solar energy
iii. Using solar cookers and biogas for cooking
iv. Using energy sources wisely
v. Developing alternative sources of energy

Answer writing skill

1. Define energy crisis.

The acute scarcity of the essential energy sources on the earth is called the energy crisis.

2. Wind energy is called a renewable source of energy. Why?

Wind energy is called a renewable source of energy because it can be regenerated shortly.

3. Differentiate between a renewable source of energy and a non-renewable source of energy.

The differences between the renewable source of energy and non-renewable source of energy:

SN	Renewable source of energy	SN	Non-renewable source of energy
1	The energy sources that are being produced continuously in nature and are inexhaustible are called renewable sources of energy.	**1**	The energy sources that get depleted and cannot be replaced quickly when exhausted are called non-renewable sources of energy.
2	These energy sources regenerate shortly.	2	They do not regenerate shortly.

4. What are the advantages of fossil fuels?

Advantages of fossil fuels:

i. They are cheap and easy to extract.

ii. Electricity can be generated from fossil fuels.

iii. Fossil fuels can be transported from one place to another.

iv. They can be stored easily.

5. What are the advantages of an alternative source of energy?

The advantages of an alternative source of energy are:

i. It is a clean source of energy.

ii. It does not pollute the environment.

iii. It helps to prevent an energy crisis.

6. Why is petroleum called fossil fuel?

Petroleum is called a fossil fuel because it was formed from plant remains from millions of years ago.

EXERCISE

Step 1

1. Fill in the blanks.

renewable source of energy	fossil fuels	sources of energy	alternative sources of energy	non-renewable

a. The substances that provide energy are called …….

b. Coal, petroleum and natural gas are …….

c. About 85% of the energy comes from the …… sources of energy.

d. Solar energy, wind energy, wood, charcoal etc. are …….

e. The energy sources which can be used instead of non-renewable sources of energy are called ……

2. Tick the correct and cross the false statement.

a. The capacity of a body to do work is called energy.

b. Coal is used in brick factories.

c. Renewable sources of energy can be replenished in a short period.

d. LP gas is used in the kitchen in urban areas.

e. A large amount of chemical energy is stored in fossil fuels.

3. Choose the correct answer from the given alternatives.

a. Which source of energy can regenerate shortly?

i. Hydroelectricity ii. Coal

iii. Diesel iv. All

b. Which source of energy cannot regenerate shortly?

i. Solar energy ii. Wind energy
iii. Hydroelectricity iv. Coal

c. Which one is a fossil fuel?

i. Petroleum ii. Water
iii. Air iv. All of them

d. Which one is an alternative source of energy?

i. Hydroelectricity ii. Coal
iii. Diesel iv. Petrol

e. What should be done to save energy?

i. Use solar energy ii. Use electricity
iii. Turn off the lights iv. All of them

4. Match the following.

Solar energy	energy
Diesel	energy crisis
An alternative source of energy	renewable source of energy
Ability to do work	electricity
Shortage of energy	non-renewable source of energy

Step 2

5. Answer the following questions in one word.

a. What is the substance that produces energy called?
b. What source of energy has an unlimited stock?
c. What source of energy does not regenerate?
d. Give an example of fossil fuel?
e. What is the shortage of energy called?

6. Differentiate between the following.

a. Renewable sources and non-renewable sources of energy
b. Hydroelectricity and fossil fuel

7. Give reason.

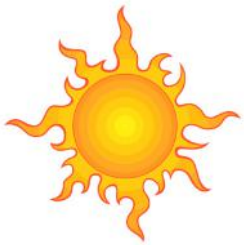
a. Diesel is called the non-renewable source of energy.

b. Petroleum is called fossil fuel.

c. Fossil fuel is widely used as a source of energy.

d. Hydroelectricity is called a renewable source of energy.

8. Study the given diagram and answer the following question.



i. What type of energy is shown in the diagram?

ii. What other energy is formed because of the solar energy?

Step 3

9. Answer the following questions.

a. What is energy?

b. Our community is heavily dependent upon fossil fuel. What kinds of harmful effects are observed in our community due to the use of fossil fuel?

c. We should use renewable sources of energy for domestic and industrial purposes. Explain the statement.

d. Why should the government invest more in the development of alternative sources of energy?

e. Despite the harmful effects, fossil fuel is widely used. What might be the reason for the wide use of fossil fuel?

f. What kinds of activities cause an energy crisis?

g. There is a lack of energy in the country. What should be done to avoid an energy crisis?

10. Discuss with your teacher about alternative sources of energy. At the end of the discussion, decide which one is the best alternative source of energy for Nepal?

Unit
7.2

Heat and Temperature

Syllabus issued by CDC

- Temperature and its unit
- Different scales of temperature and interconversion
- Structure and working mechanism of laboratory thermometer
- Relation between heat and temperature

Learning Outcomes

After completion of this unit, students will be able to:

- define temperature and tell its units
- to identify and convert different units of temperature.
- introduce a thermometer and use it to measure temperature.
- explain the structure and working method of the laboratory thermometer.
- to describe the temperature of pure melting ice and pure boiling water at sea level and discuss the temperature of the human body.
- experiment to show the fact that heat flows from an object with high temperature to the object at low temperature.
- demonstrate the fact that the temperature of an object rises on heating and fall on cooling.

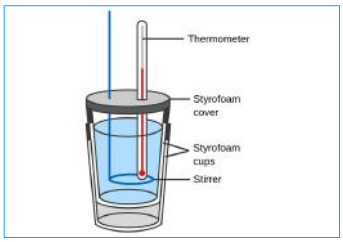
Terms and terminologies

1. Heat:	Heat is a form of energy that gives us the sensation of warmth. The sum of the kinetic energy of all the molecules in a substance is also called heat.
2. Source of heat:	The substance or medium which gives us heat is called a source of heat.
3. Temperature:	The degree of hotness or coldness of a substance is called its temperature.
4. Thermometer:	A thermometer is an instrument that measures the temperature.
5. Thermal expansion:	Thermal expansion states that "matter expands when its temperature increases and contracts when its temperature decreases."
6. Clinical thermometer:	The thermometer which is used to measure the temperature of the human body is called a clinical thermometer.
7. Kink:	A narrow constriction near the bulb of the clinical thermometer is called a kink.

8. Laboratory thermometer:	A thermometer that is used to measure the temperature of different substances in a laboratory is called a laboratory thermometer.
9. Capillary tube:	A very small bore in the stem is called a capillary tube.
10. Stem:	The long cylindrical or prismatic glass of thermometer is called stem of thermometer.
11. Bulb:	The thin glass at end of the thermometer that absorbs heat is called a bulb.

7.1 Heat

Heat is a form of energy that gives us the sensation of warmth. A body is made up of a large number of particles called molecules. Due to the motion of molecules in a substance, they have some kinetic energy which is called heat. Thus, the sum of the kinetic energy of all the molecules in a substance is called heat. The greater the kinetic energy of the molecules of a body, the greater is the heat. The average kinetic energy of the molecules in a substance determines its degree of hotness or coldness, i.e., temperature.



calorimeter

When we rub or strike a substance, the kinetic energy of the molecules increases. This results in an increase in heat as well as temperature.

Fact with Reason

A match stick produces a flame when its head is rubbed sharply against the side of a matchbox.

When the head of a match stick is rubbed sharply against the rough surface on the side of a matchbox, the kinetic energy of the molecules on the surface increases due to friction. The surface gets heated and produces a tiny spark. This spark ignites the chemical substance on the head of the match stick. Thus a match stick produces a flame when its head is rubbed sharply against the side of a matchbox.

Memory Tips

Heat is measured by a calorimeter.

Sources of Heat

The substance or medium which gives us heat is called a source of heat. Some important sources of heat are the sun, bio-fuel, fossil fuel and electricity.

Activity

Make a list of sources of heat energy used in your house.

Uses of Heat

Heat is required for a variety of reasons. Some of them are mentioned below.

i. Heat is an essential form of energy for all plants and animals to perform various metabolic activities.
ii. We require heat to cook food, to light a lamp, to iron clothes or to take a hot water bath.
iii. Goldsmiths use heat from a flame to design ornaments.
iv. In most industries and factories, heat is the main source of energy to operate machines.

Effects of Heat

When an object is heated various changes occur in the object.

i. Heat changes the state of matter.
ii. Heat changes the temperature of a body.
iii. Matters expand on heating and contract on cooling. It is called thermal expansion.

Fact with Reason

A metal becomes hot when it is struck with a hammer. Why?

When a metal surface is struck with a hammer, it causes the molecules in the metal to vibrate faster. Such vibrations increase the kinetic energy of the molecules. Therefore the heat energy is produced in a metal and its temperature increases slowly.

Units of Heat

Calorie and joule are the two commonly used units of heat.

For example, the energy of food is specified in kilocalories (kcal).

Memory Tips

1 calorie heat is equal to 4.2 joules

7.2 Temperature

In our daily life, when we touch a bottle of cold drink, a milk pouch, etc. which are kept in a refrigerator, we feel cold. On the other hand, when we touch hot cooking pots, boiled water, etc. we can feel its hotness. The degree of hotness or coldness of a substance is called its temperature.

The temperature of a body is an indicator of the average kinetic energy of the molecules of the body. The greater the average kinetic energy of the molecules of a body, the greater is the temperature of the body.

Fact with Reason

We feel cold on touching ice and hot on touching heated objects.

i. When we touch a cold body, such as ice, heat transfers from our hand to the ice and we feel cold.

ii. When we touch a hot body, such as a hot potato, heat transfers from the hot potato into our hands and we feel hot.

Differences between Heat and Temperature

SN	Heat	SN	Temperature
1	Heat is a form of energy that gives a sensation of warmth.	1	Temperature is the degree of hotness and coldness of a body.
2	Heat is measured by a calorimeter.	2	Temperature is measured by a thermometer.
3	It measures the total kinetic energy of all the molecules in a substance.	3	It measures the average kinetic energy of all the molecules in a substance.

4	Heat is the cause of temperature change.	4	Temperature change is the effect of heat.

Thermometer

A thermometer is an instrument that measures the temperature. A thermometer is based on the principle that matter expands when its temperature increases and contracts when its temperature decreases. The commonly used thermometer is the liquid thermometer. A thermometer consists of a long, narrow and uniform glass tube. It has a bulb at one end. This bulb contains a thermometric liquid like mercury or alcohol. In the glass tube, a small shiny thread of mercury can be seen. Based on use, thermometers are of two types. They are laboratory thermometers and clinical thermometers.

Memory Tips

The liquid used inside the thermometer is called thermometric liquid.

Activity

Measure the temperature of melting ice.

Clinical thermometer

The thermometer which is used to measure the temperature of the human body is called a clinical thermometer. It has a narrow range. That is, from 35 °C to 42°C. This is because the normal temperature of the human body is 37 °C. It does not vary much. In a clinical thermometer, there is a narrow constriction near the bulb. It is called a kink. Kink prevents a sudden fall of the raised mercury in the capillary tube back to the bulb.

clinical thermometer

Nowadays, a digital thermometer is used to measure the temperature. It is an electronic thermometer. It shows reading in numbers. It is easy to use.

digital thermometer

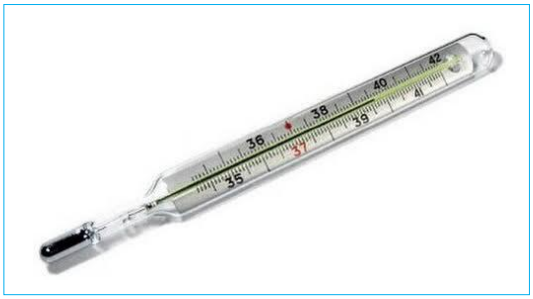
Fact with Reason

Why is a clinical thermometer short?

The clinical thermometer is short because human body temperature does not change much.

Laboratory thermometer

A thermometer that is used to measure the temperature of different substances in a laboratory is called a laboratory thermometer. A laboratory thermometer does not have a kink. A common laboratory thermometer can measure the temperature from -10°C to 110°C.



laboratory thermometer

Construction of a Thermometer

a. Capillary Tube: The thermometer consists of a very fine glass tube having a very small bore, called a capillary tube.

b. Stem: The capillary tube is protected by a thick glass tube called the stem.

c. Bulb: At one end of the capillary tube, a very thin-walled glass called a bulb is provided. It is filled with a thermometric liquid.

Memory Tips

The stem of a clinical thermometer is of prismatic shape.

Fact with Reason

The bulb of a thermometer is made of thin wall. Why?

The bulb of a thermometer contains a thermometric liquid. The thin wall of the bulb helps the flow of heat from outside to the thermometric liquid inside

The thermometric liquid is filled in the bulb of this thermometer. When the bulb comes in contact with a hot surface, the thermometric liquid in the bulb expands and its volume increases. As the temperature increases, the mercury is forced to rise in the capillary tube. The rise in the level of thermometric liquid depends on the degree of hotness. The temperature is measured by reading the rise in the level of the thermometric liquid column in degrees.

Units of temperature

Temperature is measured generally in the three different scales with the help of thermometers. The SI unit of temperature is kelvin. There are three different scales of temperature. These are the Kelvin scale, Fahrenheit scale and Celsius scale.

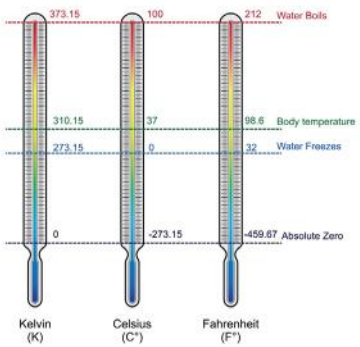
Memory Tips

The normal temperature of the human body is 37°C or 98.6°F.

Relationship between different scales of temperature

Based on the freezing point and boiling of water, three scales of temperature are compared to each other.

	Celsius scale	Fahrenheit scale	Kelvin scale
The freezing point of water	0°C	32°F	273 K
The boiling point of water	100°C	212°F	373 K



Conversion of Celsius scale, Fahrenheit scale and kelvin scale

The following relation can be used to find any conversion relation:

$$\frac{C-0}{100-0} = \frac{F-32}{212-32} = \frac{k-273}{373-273}$$

$$\therefore \quad \boxed{\frac{C}{100} = \frac{F-32}{180} = \frac{k-273}{100}}$$

i. Conversion of Celsius scale into Fahrenheit scale.

$$C = \frac{5}{9}(F\text{-}32)$$

ii. Conversion of Celsius scale into kelvin scale.

$$K = C + 273$$

iii. Conversion of Fahrenheit scale into kelvin scale

$$\frac{F-32}{9} = \frac{k-273}{5}$$

SOLVED NUMERICAL

Convert 37°C into °F

From the relation,

$$C = \frac{5}{9}(F-32)$$

$$\text{or, } 37 = \frac{5}{9}(F-32)$$

$$\text{or, } 37 \times \frac{9}{5} = F-32$$

$$\text{or, } \quad 66.5 = F-32$$

$$\text{or, } \quad F = 66.5 + 32$$

$$\therefore \quad F = 98.6°F$$

SOLVED NUMERICAL

A temperature 'x' is recorded both on Celsius and Fahrenheit scale. Find the value of x. Or, calculate the temperature at which the Fahrenheit and Celsius scales show the same reading.

Solution

Celsius temperature (C) = Fahrenheit temperature (F) = x

From the relation,

$$C = \frac{5}{9}(F - 32)$$

or, $x = \frac{5}{9}(x - 32)$

or, $9x = 5x - 160$

or, $4x = -160$

or, $x = -40$

Therefore, at -40^0, both Celsius and Fahrenheit scales show the same reading.

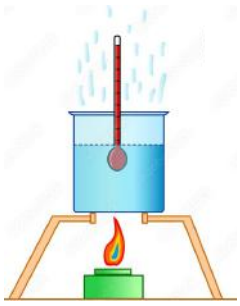
Activity

OBJECTIVE: To show that heat causes a temperature change.

REQUIREMENT: Beaker, stand, bunsen burner, tripod stand, water, thermometer, etc.

PROCEDURE:

1. Take a beaker filled with some amount of water.
2. Measure the temperature of the water with the help of a thermometer.
3. Note the reading of the thermometer in your exercise book.
4. Now, supply heat with the help of a bunsen burner and measure the temperature of the water again.



OBSERVATION:

We find that the temperature of the water after supplying heat is more than that before supplying heat.

CONCLUSION:

The above experiment proves that the temperature of a body increases on supplying heat.

Relation between heat and temperature

i. The heat flows from objects at higher temperatures to objects at a lower temperature.

Let's hold an ice cube for a minute. It feels cold. Let's put hand in luke warm water now (hot water can burn hands). It feels warm. From this activity, we can tell that we feel cold if the heat flows out of our bodies. Similarly, we feel hot if the heat flows into our bodies.

When a bucket of hot water is mixed with a bucket of cold water, the heat flows from hot water to cold one. The temperature of hot water decreases and the temperature of cold water rises. Heat flows until the water from both bucket have an equal temperature.

Activity

To show heat flows from a body at a higher temperature to one at a lower temperature.

1. Take some hot water in a tumbler.
2. Dip a metal spoon in that water for some time. Notice the time taken for the spoon to become hot.
3. Leave the tumbler for 20 minutes. Do you feel the water cooling down? It becomes uncomfortable to hold the hot spoon due to the heat transferred from the hot water in the tumbler to the spoon. This is due to the flow of heat from a body at a higher temperature to one at a lower temperature.

ii. Heat depends upon the mass of objects but the temperature does not.

There are more molecules in a bucketful of lukewarm water than that in a cupful of boiling water. As the sum of kinetic energy is more, there is more heat in the bucketful of lukewarm water than in the cupful of boiling water.

However, the average kinetic energy of the molecules in a bucketful of lukewarm water is less than that in a cupful of boiling water. So, the temperature of a bucketful of lukewarm water is less than the cupful of boiling water.

Answer writing skill

1. Why does ice feel cold?

Ice feels cold because it is at a lower temperature than our body. The heat flows from our body into the ice.

2. What is the range of the clinical thermometer?

The range of the clinical thermometer is 35 °C to 42°C.

3. Differentiate between clinical thermometer and laboratory thermometer.

The differences between clinical thermometer and laboratory thermometer are:

SN	Clinical thermometer	SN	Laboratory thermometer
1	The thermometer which is used to measure the temperature of the human body is called a clinical thermometer.	**1**	A thermometer that is used to measure the temperature of different substances in a laboratory is called a laboratory thermometer.
2	It is short.	2	It is long.
3	It has a kink.	3	It does not have a kink.

4. Why does a clinical thermometer have a kink?

The clinical thermometer has a kink to prevent the backflow of mercury in the capillary tube. It will be easy for reading.

5. What are the uses of heat?

The uses of heat are:

i. Heat is necessary to warm water for domestic uses such as cooking, bathing etc.

ii. It is used to make cements and bricks.

iii. It is used to melt ores of metal, run steam engine etc.

6. Describe the structure of the laboratory thermometer.

The laboratory thermometer consists of a very fine glass tube having a very small bore, called a capillary tube. It does not have a kink. A common laboratory thermometer can measure the temperature from -10°C to 110°C. At one end of the capillary tube, a very thin-walled glass called a bulb is provided. It is filled with a thermometric liquid.

EXERCISE

Step 1

1. Fill in the blanks.

kink	heat	thermometer	capillary tube	37 °C

a. The sum of the kinetic energy of all the molecules in a substance is called …….
b. The instrument that measures the temperature is called …….
c. A clinical thermometer has …….. in a capillary tube.
d. The normal temperature of the human body is…….
e. Kink stops sudden back flow of mercury from ……. to bulb.

2. Tick the correct and cross the false statement.

a. Heat is a form of energy.
b. Heat always transfers from a body at a low temperature to a body at a high temperature.
c. A clinical thermometer is an electronic thermometer.
d. A laboratory thermometer does not contain a kink.
e. Goldsmiths use heat from a flame to design ornaments.

3. Choose the correct answer from the given alternatives.

a. What is the form of energy that gives the sensation of warmth?
   i. Heat
   ii. Light
   iii. Sound
   iv. Magnetism

b. What is the degree of hotness and coldness of a body called?

i. Temperature ii. Heat
iii. Thermometer iv. All

c. Which device measures the heat?

i. Calorimeter ii. Thermometer
iii. Speedometer iv. Manometer

d. What is the principle of a thermometer?

i. Thermal expansion ii. Calibration
iii. Kelvin iv. None

e. Which one is a source of heat?

i. Sun ii. Thermometer
iii. Tube light iv. All

4. Match the following

Average kinetic energy	heat
Sum of kinetic energy	device to measure heat
Calorimeter	SI unit of temperature
Unit of heat	temperature
Kelvin	Joule

Step 2

5. Answer the following questions in one word.

a. What instrument is used to measure the temperature?

b. What is the term for the degree of hotness or coldness of an object?

c. Which thermometer is used to measure the body temperature?

d. What happens to the volume of a liquid on heating it?

e. What is the bent at end of the capillary tube of a clinical thermometer called?

6. Differentiate between the following.

a. Heat and temperature

b. Clinical thermometer and laboratory thermometer

7. Give reason

a. On touching an object, we feel cold in the winter season and hot in the summer season.

b. A matchstick burns when rubbed against the sulphur on the side of the matchbox.

c. There is a kink in the clinical thermometer.

d. A clinical thermometer is short.

8. Study the given diagram and answer the following questions.

i. What is shown in the diagram?

ii. Mention its range.

iii. Write the use of this device.

Step 3

9. Answer the following questions.

a. What are the sources of heat? Give examples.

b. What are the effects of heat?

c. What is a thermometer? On which principle is it constructed?

d. What is a thermometric liquid?

e. Explain the construction of a thermometer.

f. How is the temperature measured by using a thermometer?

g. Convert 357°C into °F.

10. Explain the relation between heat and temperature.

Unit
7.3

Sound

Syllabus issued by CDC

- Waves and their types
- Formation of waves and terms related to the waves: wavelength, amplitude, frequency and wave velocity

Learning Outcomes

After completion of this unit, students will be able to:

- introduce the wave and type of wave.
- perform practical activities to show the origin of a wave.
- define wavelength, amplitude, frequency and wave velocity.

Terms and terminologies

1.	Sound:	The sound is a form of energy, which produces the sensation of hearing in our ears.
2.	Source of sound:	The different objects which produce sound from their vibration are called sources of sound.
3.	Propagation of sound:	The transmission of sound from one place to another is called the propagation of sound.
4.	Wave:	A wave is a periodic disturbance in a medium that carries energy from one place to another without transferring the matter.
5.	Transverse wave:	The wave in which vibration of the particles of the medium is perpendicular to the direction of the propagation of the wave is called a transverse wave.
6.	Crest:	The maximum displacement of particles above the mean position of propagation is called crest.
7.	Trough:	The maximum displacement of particles below the mean position of propagation is called a trough.
8.	Amplitude:	The maximum height of the crest or trough is called amplitude of transverse wave.
9.	The wavelength of transverse wave:	The length between two consecutive crests is called wavelength.
10.	Frequency:	The number of cycles formed by the wave per unit time is called frequency.
11.	Longitudinal wave:	The wave in which the vibration of the particles of the medium is parallel to the direction of the propagation of the wave is called a longitudinal wave.
12.	Compressions:	In a longitudinal wave, compressions are the regions where density, as well as pressure, is high.
13.	Rarefactions:	In a longitudinal wave, rarefactions are the regions of low pressure and low density where particles are spread apart.

Introduction

We hear sound with our ears. Sound is a form of energy, which produces the sensation of hearing in our ears. It creates a sensation in our auditory nerves. In everyday life, we encounter different types of sounds. For example, sounds from television, barking dogs, loudspeakers, chirping birds, vehicle horns, etc. The sound from our vocal cord helps us to communicate with one another.

Fact with Reason

Why do we need sound?

In humans, sound is produced from the vocal cord, which we need to communicate with others. It is also required to hear other different kinds of sound.

Fact with Reason

The sound from a ringing bicycle bell ceases when it is caught by our hand.

Vibration in a body is the cause of its sound. When a ringing bell is caught by our hand, the vibration stops and as a result sound also stops.

Memory Tips

The tuning fork is a source of sound in a science laboratory. Tuning forks of different frequencies are available.

Activity

Sound is produced by vibrations.

1. Take a steel plate and a spoon. Strike the plate by the spoon. Place your finger on the plate.
2. Pluck a string of the guitar. Touch it with your finger.
3. Strike the drum by a drum beater. Place your hand over the membrane of the drum. Do you feel vibrations in all of the above cases? It shows that vibrating bodies produce sound.

Source of sound

The different objects which produce sound from their vibration are called sources of sound. For example, sitar, guitar string, flute, tabala, bell, madal etc.

bell

guitar

tuning fork

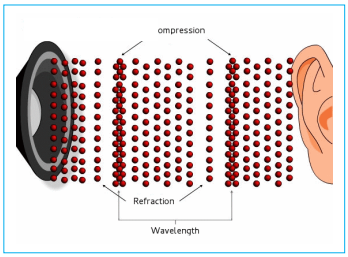
fig: source of sound

Fact with Reason

Why is the flute called a source of the sound?

The flute is called a source of sound because the vibration of the air column in it produces sound.

Sound wave



sound wave is a longitudinal wave

Sound is produced by a vibrating body. It travels in all directions from the source. Sound waves are mechanical waves because they need a material medium to propagate. Sound waves are longitudinal waves because they move in the direction of wave propagation making compression and rarefaction. Sound can propagate through solids, liquids and gases. But it cannot propagate through a vacuum. The sound waves produced from a vibrating body propagate through the air and reach our ears. As a result, we hear the sound.

Transmission of sound

The transmission of sound from one place to another is called the propagation of sound. For example, sound propagates through the air and reaches up to our ears.

Memory Tips

In comparison to light, sound has a very low velocity. When the speed of any object exceeds the speed of sound then it is said to be travelling at supersonic speed.

Activity

Objective: To observe that sound propagates through a solid

Materials required: desk, pencil

Procedure:

1. Keep your head on a table resting one ear on its side.
2. Ask your friend to scratch at the other end.
3. Now, remove your ear from the desk and again ask your friend to scratch on the table and listen to the sound.

Observation: Scratching is more clearly audible through the desk than that through the air.

Conclusion: Sound propagates faster through the desk than through the air. Hence, sound propagates faster in solids than in gases.

Activity

Objective: To observe the propagation of sound through liquid

Materials required: a bucket, water, bell.

Procedure: Take a bucket and fill it with water. Immerse a bell into the water and ring it.

Observation: The sound of the ringing bell is heard outside of the water. The sound comes out through the water.

Conclusion: Sound travels through the liquid.

Sound can travel through solids, liquids and gases. When the molecules of a solid, liquid and gas vibrate, they push around the nearby molecules.

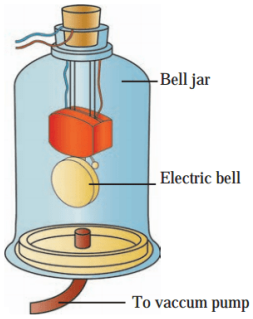
This makes compressions and rarefactions possible and the sound wave propagates in different media. Sound travels fastest in solid medium and slowest in gas medium. Sound cannot propagate through a vacuum. On the surface of the moon, there is a vacuum due to the lack of atmosphere. Thus, communication on the surface of the moon is not as easy as it is on the earth. Electronic devices are used for communication on the surface of the moon.

Activity

Objective: To observe that sound does not propagate through a vacuum.

Materials required: bell jar, electric bell, airtight cork.

Procedure: Take a bell jar and fit an electric bell in it through an airtight cork as shown in the given figure. Fit the vacuum pump at the bottom of the bell jar. Connect the bell to the battery and switch. Switch on the bell and observe the sound outside. Next time repeat the process by removing the air inside the bell jar.



Observation: The sound of the bell is heard outside when there is air inside the bell jar. When a vacuum is created inside the bell jar, no sound is heard.

Conclusion: Sound cannot travel through a vacuum. It needs a material medium for propagation.

Fact with Reason

Sound doesn't propagate on the surface of the moon. Why?

A material medium is essential for the propagation of sound. But due to the vacuum, that is the lack of air, on the surface of the moon, sound does not propagate there.

Electronic devices are used for communication on the surface of the moon. Why?

Electronic devices are used for communication on the surface of the moon because sound waves cannot travel through a vacuum on the surface of the moon but receive communication signals in the form of electromagnetic waves.

Waves

ripples in the water

When a pebble is thrown into still water, circular ripples form and spread out in all directions on the surface of the water. These ripples carry energy from stone to all parts without actual movement of the water from one point to another. A ripple carries energy from one location to another without transferring water.

Thus, a wave is a periodic disturbance in a medium that carries energy from one place to another without transferring the matter. It is the fine path through which energy, light or sound gets transmitted from one place to another.

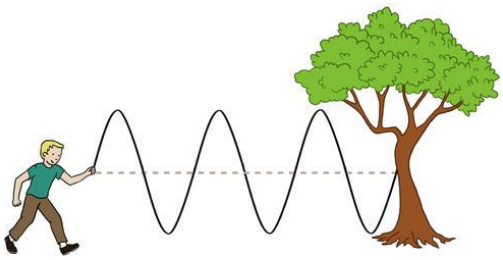
Types of Waves

When a wave travels through matter, particles of the matter vibrate. Based on the direction of vibration of the particles of a medium there are two types of waves, viz. transverse waves and longitudinal waves.

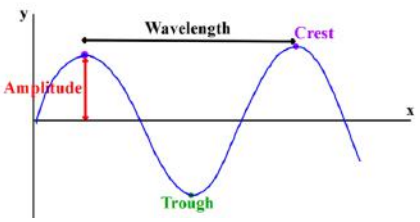
1. Transverse wave

Activity

Take a rope and attach it to a tree as shown in the given figure. Shake the rope up and down. Observe the up-and-down motion of the rope creating high points and low points.



The periodic motion set in the rope is called a transverse wave. The wave in which vibration of the particles of the medium is perpendicular to the direction of the propagation of the wave is called a transverse wave. For example, ripples on the water surface, light waves, a wave pattern set in a stretched string, etc. The motion of particles is an up-and-down motion in a transverse wave. When waves propagate through water, the molecules of water vibrate just up and down from their respective positions. Waves move forward without the transfer of water molecules.



transverse wave

Memory Tips

Light is a transverse wave.

Terms used in a transverse wave

i. **Crest and trough :** During the propagation of the transverse wave, particles vibrate up and down from the mean position. Some particles travel upward. The maximum displacement of particles above the mean position of propagation is called crest. Some of the particles travel downward. The maximum displacement below the mean position of propagation is called a trough.

ii. **Amplitude :** The loudness of sound is directly proportional to the amplitude. The sound wave from a larger source of sound has more amplitude, therefore the sound is heard louder. The maxixmum height of the crest or trough is called amplitude. Its SI unit is a meter.

iii. **Wavelength:** The transverse wave travels as a crest and trough. There are multiple crests and troughs. The length between two consecutive crests is called wavelength.

iv. **Frequency:** The sharpness of sound depends upon frequency. A set of a crest and a trough is called a complete cycle. The number of cycles formed by the wave per unit time is called frequency. Its SI unit is hertz.

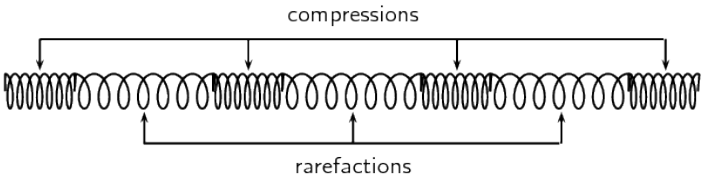
v. Wave velocity:

Wave velocity (v) = Frequency (f) x wavelength (λ)

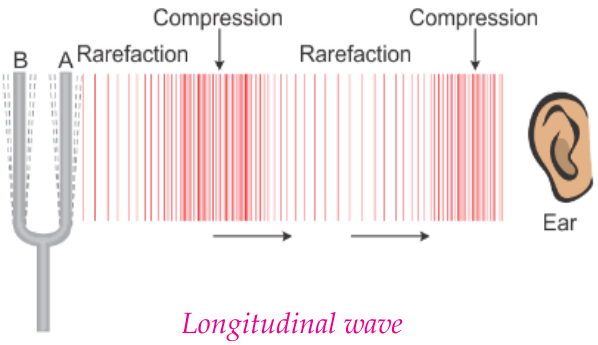
2. Longitudinal wave

Activity

1. Take a slinky and ask one of your friends to hold one of its ends. You hold the other end.
2. Stretch the slinky and give it a sharp push towards your friend.
3. What do you notice? If you move your hand pushing and pulling the slinky alternatively, what will you observe?
4. If you mark a dot on the slinky, you will observe that the dot on the slinky will move back and forth parallel to the direction of the propagation of the disturbance.



The wave in which the vibration of the particles of the medium is parallel to the direction of the propagation of the wave is called a longitudinal wave.



Longitudinal wave

For example, a sound wave, a wave pattern set in a stretched spring, etc. In a longitudinal wave, the motion of particles is back-and-forth. When a stretched spring is released then waves propagate through it in the form of compression and rarefaction.

Fact with Reason

The sound waves that we hear are longitudinal waves. Why?

Vibrations in the air consist of areas of high pressure called compressions and areas of low pressure called rarefactions. So, the sound waves that we hear are longitudinal waves.

Differences between Transverse Waves and Longitudinal Waves

SN	Transverse wave	SN	Longitudinal wave
1	The wave in which vibration of the particles of the medium is perpendicular to the direction of the propagation of the wave is called a transverse wave.	**1**	The wave in which the vibration of the particles of the medium is parallel to the direction of the propagation of the wave is called a longitudinal wave.
2	A complete transverse wave consists of a crest and a trough.	**2**	A complete longitudinal wave consists of compression and rarefaction.
3	It travels at a high speed.	**3**	It travels at a low speed.
4	It can travel through a vacuum.	**4**	It cannot travel through a vacuum.

Terms used in a longitudinal wave

i. Compressions

In a longitudinal wave, compressions are the regions where density, as well as pressure is high. They are represented by the letter "C".

ii. Rarefactions

In a longitudinal wave, rarefactions are the regions of low density and low pressure where particles are spread apart. They are represented by the letter "R".

Answer writing skill

1. **What is sound?**

   A sound is a form of energy that causes a sensation of hearing through the vibration of the eardrum.

2. **Define wave.**

   A wave is a periodic disturbance in a medium that carries energy from one place to another without transferring the matter.

3. **What is a crest?**

   The maximum displacement of particles above the mean position of propagation is called a crest.

4. **What are longitudinal waves? Write down their examples.**

   If the direction of the vibrating particle of the medium is parallel to the direction of the wave propagation, the wave is called a longitudinal wave.

   For example, sound waves, etc.

5. **What is the wavelength of longitudinal wave?**

   The distance between two consecutive compressions (C) or two consecutive rarefactions (R) is called the wavelength of longitudinal wave.

6. **Astronauts use electronic devices to communicate in space. Why is it not possible to talk normally? Discuss.**

   Space is empty. It does not have a matter to transfer sound. Therefore, we cannot communicate in space normally. Astronauts should use electronic devices in space because they produce transverse waves. These waves can travel even in a vacuum.

EXERCISE

Step 1

1. Fill in the blanks.

propagation	vacuum	transverse wave	moon	sound

a. Light wave is …….
b. The vibration of the medium produces …….
c. Medium is essential for …… of sound.
d. Sound cannot travel in …….
e. Electronic devices are used for communication on the surface of the …….

2. Tick the correct and cross the false statement.

a. Sound propagates in the form of longitudinal waves.
b. Objects should vibrate continuously to produce sound.
c. Vibrating guitar string produces a sound.
d. Sound transmits in a vacuum.
e. The speed of sound in solids is more than that in liquids.

3. Choose the correct answer from the given alternatives.

a. Which one is a source of sound?
   i. Loudspeaker ii. Tube light
   iii. Bulb iv. Dry cell
b. What is the disturbance in the medium called?
   i. Wave ii. Energy
   iii. Frequency iv. All
c. Which wave has a crest?
   i. Transverse wave ii. Longitudinal wave
   iii. Sound wave iv. None
d. Which wave has compression?
   i. Transverse wave ii. Longitudinal wave
   iii. Heatwave iv. None

e. What is the total number of cycles per unit time called?

i. Frequency ii. Amplitude

iii. Wavelength iv. Wave velocity

4. Match the following

Sound wave	amplitude
Electromagnetic wave	path of energy
Wave	transverse wave
Height of crest	solid medium
Sound travels fastest	longitudinal wave

Step 2

5. Answer the following questions in one word.

a. What type of wave is a sound wave?

b. In which medium does sound have the highest speed?

c. Which type of wave is generated in water when a stone is dropped in it?

d. In which medium does sound have the lowest speed?

e. What is the path in which energy travels?

6. Differentiate between transverse wave and longitudinal wave.

7. Give reason

a. Sound doesn't propagate on the surface of the moon.

b. Sound stops when a ringing bell is caught.

c. Electronic devices are used for communication on the surface of the moon.

d. A sound wave is called a longitudinal wave.

8. Study the given diagram

Identify the type of waves shown in the given figures and write the name of sources from which those waves are generated.

fig. A

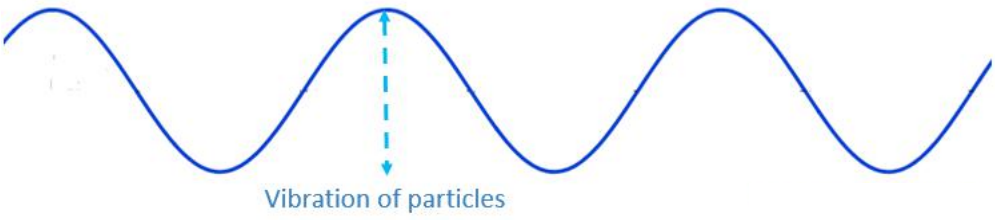


fig. B

Step 3

9. Answer the following questions.

a. What is sound? How is a sound produced?

b. What is sound used for?

c. What is meant by the source of sound? Give an example.

d. What is a wave? Mention its types.

e. What is the transmission of sound? Explain the transmission of sound in different media.

f. What are crest and trough?

g. Define frequency. Write its SI unit.

10. Draw a well-labelled diagram of a longitudinal wave.

Unit
7.4

Light

Syllabus issued by CDC

- Introduction of light, the reflection of light, uses of reflection of light
- Laws of reflection of light
- Reflection in a plane mirror and nature of the image
- Periscope

Learning Outcomes

After completion of this unit, students will be able to:

- define reflection of light and identify its usefulness and effects in daily life.
- state and verify the laws of reflection.
- show the reflection of light in a plain mirror by ray diagram.
- make a model of periscope and to show its working method and to find its uses.

Terms and terminologies

1.	Light:	Light is a form of energy that gives the sensation of vision to us.
2.	Source of light:	Those bodies which emit light are called the sources of light.
3.	Ray of light:	The narrow path along which light travels through a medium is called a ray of light.
4.	A beam of light:	A group of light rays originating from a source is called a beam of light.
5.	Reflection of light:	The bouncing of light on the same medium after striking a surface is called the reflection of light.
6.	Incident ray:	The light ray which falls upon a reflecting surface is called an incident ray.
7.	Point of incidence:	The point on the reflecting surface where an incident ray strikes is called the point of incidence.
8.	Reflected Ray:	The light ray which bounces away from the reflecting surface is called a reflected ray.
9.	Normal ray:	A ray of light perpendicular at the point of incidence on a reflecting surface is called the normal ray.
10.	The angle of incidence:	The angle made by the incident ray with the normal is called the angle of incidence.
11.	The angle of reflection:	An angle made by the reflected ray with the normal is called the angle of reflection.
12.	Regular reflection:	If a parallel beam of light falls on a reflecting surface and the reflected light is also a parallel beam, then the reflection is known as a regular reflection.

13.	Irregular reflection:	If a parallel beam of light falls on a reflecting surface and the reflected light is not a parallel beam, then the reflection is known as an irregular reflection.
14.	Periscope:	A periscope is an optical device that allows us to see over walls.

Objects are not visible in a dark room. However, if we switch on a bulb, these objects become visible. When light falls on the objects, it bounces off their surfaces. We can see things around us because light enters our eyes and forms an image of these things on our retina. Thus, light is a form of energy that gives the sensation of vision to us. Objects are not visible without light. The study of light and vision is called optics.

Memory Tips

Light travels at a speed of 300,000,000 m/s in air or vacuum.

Source of light

fig: sources of light

Those bodies which emit light are called sources of light. For example, Sun, electric bulb, lamp etc. are some sources of light. Sources of light are of two types. They are self-luminous and non-luminous sources. Self-luminous sources of light emit light; for example, the sun, the stars, the firefly, etc. On the other hand, objects like the moon, soil, rock, plastic, glass, etc. do not emit light. They are called non-luminous objects.

Memory Tips

The moon reflects the light of the sun.

Fact with Reason

The sun is called a luminous body. Why?

The sun releases a huge amount of heat and light through thermonuclear fusion. So, the sun is a luminous body.

Ray and beam of Light

The narrow path along which light travels through a medium is called ray of light. It is represented by an arrowhead on a straight line. A group of light rays originating from a source is called a beam of light.

ray of light beam of light

Activity

Make a small hole at the middle of the chart paper. Wrap the front of the torch with it. Switch on the torch in a dark room. What do you see? Do you see a ray?

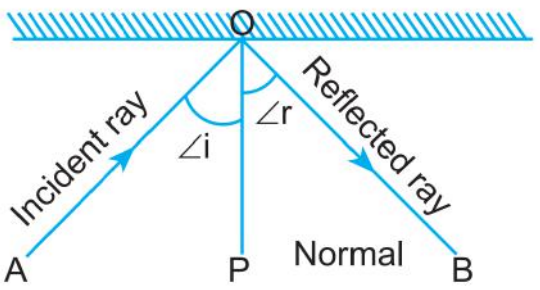
Reflection of light

Fact with Reason

Why do mirrors reflect light?

Mirrors reflect light because they have a very smooth surface

When the rays of light fall on a smooth surface, the rays of light return to the same medium. This phenomenon is called the reflection of light. Thus, the bouncing of light on the same medium after striking a surface is called a reflection of light.



i. **Incident ray:** The light ray which falls upon a reflecting surface is called an incident ray. In the given figure AO is an incident ray.

ii. **Point of incidence:** The point on the reflecting surface where an incident ray strike is called the point of incidence. In the given figure, 'O' is the point of incidence.

iii. **Reflected Ray:** The light ray which bounces away from the reflecting surface is called a reflected ray. OB is the reflected ray in the given figure.

iv. **Normal:** A perpendicular line drawn at the point of incidence on a reflecting surface is called the normal. In the given figure, OP is the normal line.

v. **The angle of incidence:** The angle made by the incident ray with the normal is called the angle of incidence. ∠AOP = i is the angle of incidence in the given figure.

vi. **The angle of reflection:** The angle made by the reflected ray with the normal is called the angle of reflection. ∠BOP = r is the angle of reflection in the given figure.

Memory Tips

We see things in daylight due to the reflection of light.

Laws of reflection of the light

1. The incident ray, the reflected ray and the normal at the point of incidence all lie in the same plane.
2. The angle of incidence is equal to the angle of reflection.

Activity

1. Take a plane mirror and erect it on a stand.
2. Put a pencil perpendicular to the mirror surface.
3. Take two short pieces of a pipe and incline them equally from the normal in front of the mirror.
4. Put a burning candle at the edge of one tube and observe it from the opening of another tube. Do you observe the flame of the candle through another tube?

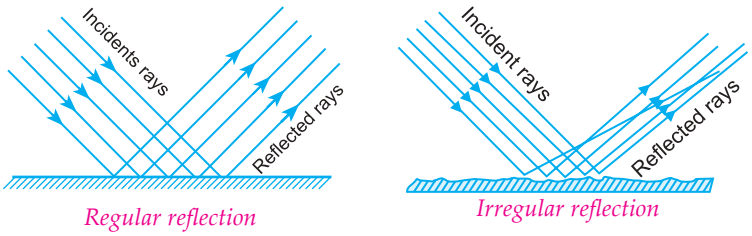
Types of reflection of light

i. Regular reflection of light

In a regular reflection, light is thrown back in a well-defined direction. If a parallel beam of light falls on a reflecting surface and the reflected light is also a parallel beam, then the reflection is known as a regular reflection. Regular reflection is possible on smooth surfaces. For example, there is a regular reflection on a still water surface, polished metallic surface, etc.

ii. Irregular reflection of the light

If a parallel beam of light falls on a reflecting surface and the reflected light is not a parallel beam, then the reflection is known as an irregular reflection. This type of reflection takes place when the surface is not smooth, such as walls and trees.



Memory Tips

In the absence of irregular reflections, the object would appear either bright or dark and it is not easily seen.

Fact with Reason

Why does a reflection in a plane mirror form an image?

Reflection in a plane mirror forms an image because of the regular reflection.

Some applications of the reflection of light

i. It provides vision.

ii. Side mirrors of vehicles help to see traffic behind us.

iii. The endoscope helps to view inside the intestine.

iv. Light pipe helps to transfer data.

v. Kaleidoscope and periscope are based on the reflection of light.

4.5 Periscope

A periscope is an optical device that allows us to see over walls. It is based on the laws of reflection.

Construction

It is made from a tube or cardboard bent twice at right angle. Such double bending makes two openings at both upper and lower ends facing opposite of one another. Two plane mirrors are adjusted at the end of each opening in such a way that the light rays fall on them at an angle of 45°as shown in the given figure.

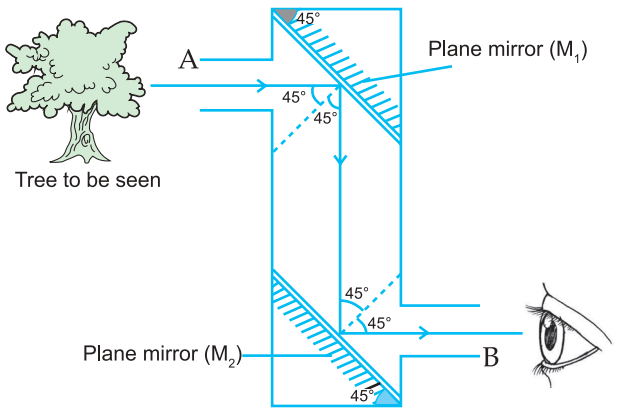


fig: periscope

Working mechanism of periscope

The light rays falling at an angle of 45° on the mirror facing the upper opening get reflected downward. These rays again fall at an angle of 45° on the mirror facing the lower opening. Finally, the light rays from the upper opening enter the eyes of an observer through the lower opening.

Memory Tips

The word periscope is derived from two Greek words. peri means "around," and scopus means "to look"

Fact with Reason

Periscopes is used in submarines. Why?

Periscopes are used in submarines because they reflect light and help to observe objects at the surface of the water.

Activity

Make a model of a periscope.

Uses of periscope

A periscope is used to observe objects at a height over an obstruction.

i. Periscopes are used in submarines: Submarines can run inside water in a submerged condition. The ships and other bodies over the surface of the water are observed from a submarine through a periscope.

ii. Periscope is used for security purposes: Soldiers stationed in a trench observe the activities of enemies over the ground through a periscope.

Answer writing skill

1. **What is light?**
   Light is a form of energy that makes objects visible to us.
2. **What is the normal ray?**
   A ray of light that falls perpendicularly at the point of incidence on a reflecting surface is called the normal.
3. **Differentiate between regular reflection and irregular reflection.**
   The differences between regular reflection and irregular reflection are:

SN	Regular reflection	SN	Irregular reflection
1	If a parallel beam of light falls on a reflecting surface and the reflected light is also a parallel beam, then the reflection is known as a regular reflection.	1	If a parallel beam of light falls on a reflecting surface and the reflected light is not a parallel beam, then the reflection is known as an irregular reflection.
2	It makes images.	2	It does not make images.

4. Why do submarines have periscopes?

Submarines have periscopes to observe the higher surface from underwater.

5. What are the uses of the reflection of light?

The uses of the reflection of light are:

i. It provides vision.

ii. Side mirrors of vehicles help to see traffic behind us.

iii. The endoscope helps to view inside the intestine.

6. A clear and sharp image is formed on calm water. Why?

A clear and sharp image is formed on calm water due to the regular reflection of light from the water surface. If the water surface is disturbed, an irregular reflection occurs and the sharp image gets blurry.

EXERCISE

Step 1

1. Fill in the blanks.

smooth surfaces	regular	sun	light	angle of reflection

a. Objects are not visible without ……...

b. The main natural source of light is …….

c. There is ……. reflection from the still surface of water.

d. Angle of incident is equals to ……. during the reflection of light.

e. Regular reflection is possible on ……

2. Tick the correct and cross the false statement.

a. The candle is a source of light.

b. Light travels in a curved line.

c. Objects are visible due to light reflected from them.

d. A regular reflection occurs from a plane mirror.

e. A periscope is a device used to see objects from under the water.

3. Choose the correct answer from the given alternatives.

a. Which one is a source of light?

i. Tube light ii. Tuning fork

iii. Speakers iv. All of them

b. Which one is a non-luminous body?

i. The moon ii. The sun

iii. The star iv. The fire

c. What is a collection of rays called?

i. Ray ii. Incident ray

iii. Beam iv. Parallel ray

d. Where can we observe regular reflection?

i. Smooth surface ii. Rough surface

iii. Both iv. None

e. What is the principle of periscope?

i. Reflection of light ii. Refraction of light

iii. Thermal expansion iv. All of them

4. Match the following

Incident ray	luminous body
Smooth surface	ray
Star	ray that falls on the mirror
Narrow path of light	irregular reflection
Rough surfaces	regular reflection

Step 2

5. Answer the following questions in one word.

a. What is the term for the objects that emit light?

b. Which type of reflection occurs from a rough surface?

c. What is the returning of the ray of light back to the same medium after striking a surface called?

d. What is the angle between the normal ray and reflected ray called?

e. What ray falls perpendicularly on the mirror?

6. Differentiate between the following.

a. ray of light and beam of light

b. incident ray and reflected ray

c. regular reflection and irregular reflection

7. Give reason

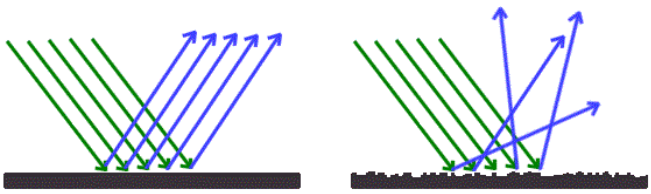
a. A smooth surface can make images.

b. Irregular reflection is important for vision.

c. The stars are called luminous bodies.

d. The moon is a non-luminous object.

8. Which type of reflection is shown in the figures?



a b

Step 3

9. Answer the following questions.

a. Define light. What are the sources of light? Give any four example.

b. What is the reflection of light?

c. Define angle of incidence. If angle between an incident ray and the normal ray is 40°. What is the magnitude of the angle of reflection?

d. Write the laws of the reflection of light.

e. What is a periscope? Write its uses.

10. Draw the schematic diagram of the periscope.

UNIT

8

ELECTRICITY AND MAGNETISM

ESTIMATED TEACHING PERIODS

TH	PR
7	3

Syllabus issued by CDC

- Introduction of static electricity
- Introduction of lightning
- Current electricity
- Combination of cells: series combination and parallel combination
- Effects of the combination of cells in series and parallel

Learning Outcomes

After completion of this unit, students will be able to:

- demonstrate the fact that friction between two insulators generates electrostatic force.
- introduce static electricity and explain general effects.
- explain the causes of lightning and describe the function of a lightning rod.
- introduce current electricity.
- introduce combinations of cells and discuss uses of series connection and parallel connection.

Terms and terminologies

1. Charge: The electric property of a body is called a charge.
2. Electricity: The energy produced on a body by the accumulation of charges on it or by the flow of charges through it is called electricity.
3. Static electricity: The electrical energy developed on insulators due to the change in the number of electrons after rubbing is called static electricity.
4. Lightning: The electric spark which occurs due to the sudden flow of a huge quantity of charge in charged clouds is called lightning.

5.	Thunder:	Thunder is the loud noise followed by a flash of lightning.
6.	Lightning rod:	A conducting rod installed to redirect lightning is called a lightning rod.
7.	Current electricity:	The energy produced due to the continuous flow of electrons through a conductor is called current electricity.
8.	Combination of cells:	The grouping of two or more cells is called the combination of cells.
9.	Battery:	A group of cells is called a battery.
10.	Series combination of cells:	The grouping of cells in which the negative terminal of the first cell is connected to the positive terminal of the second cell, and so on is called a series combination of cells.
11.	Parallel combination of cells:	The grouping of cells in which positive terminals of all cells are connected to one point and negative terminals are connected to another point is called a parallel combination of cells.

Introduction

In today's world, electricity is the most useful and convenient form of energy. Electricity is used in our homes for lighting bulbs, heating rooms, running fans, etc. It is easy to convert electricity into different forms of energy. Electricity can be stored and transmitted over a long distance.

Memory Tips

An atom is the smallest unit of matter that has the properties of a chemical element.

computers are powered by electricity

street lights are powered by electricity

Structure of an atom

The matter is made up of atoms. Electron, proton and neutron are subatomic particles. The nucleus is the centre of an atom. Positively charged protons and charge-less neutrons are present in the nucleus of

an atom. Negatively charged electrons revolve around the nucleus of the atom. The protons and electrons of an atom attract each other. In a neutral atom, there is an equal number of protons and electrons.

Activity

Use clay to make a model of an atom.

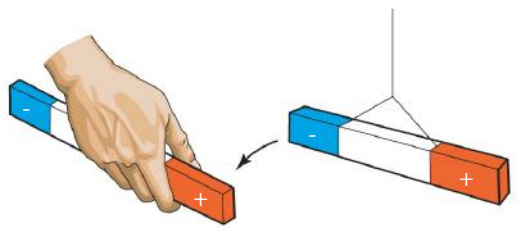
Charge

The electric property of a body is called a charge. It is the property of the body due to which the body feels the force of attraction and repulsion. There are two types of charges. They are positive and negative.

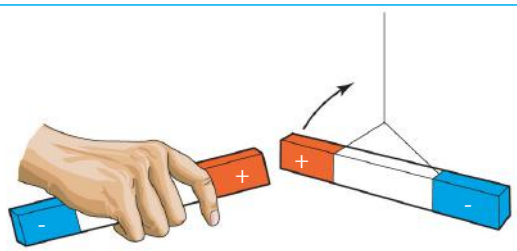
Properties of Electric Charges

i. Like charges repel each other.

ii. Unlike charges attract each other.



Unlike charges attract each other



Like charges repel each other

Memory Tips

The electron is a negatively charged particle whereas the proton is a positively charged particle.

Fact with Reason

Why do two glass rods rubbed against fur repel each other?

Two glass rods rubbed against fur repel each other beca em have the same kind of charge that repels each other.

Electricity

Electricity is the result of the movement of electrons. Thus, the energy produced on a body by the accumulation of charges on it or by the flow of charges through it is called electricity. Electricity can be either static or current electricity.

Static electricity

Activity

1. Take a plastic comb and rub it against your dry hair or some woollen material for a while.
2. Make small pieces of paper and bring the comb near them. Do you see that the pieces of paper fly and stick to the plastic comb as shown in the figure alongside?

negatively charged comb attracts the paper

This happens because of the charges developed on the plastic comb by rubbing it against the dry hair or wool.

Sometimes, electric charges accumulate on an object. A comb rubbed against hair is an example. Electrons move from hair and deposit on the comb to develop a negative charge. The electric charge is developed on the insulator following the rubbing. Such a charge does not move through metallic wires. These charges are called static electric charges. The electrical energy developed on insulators due to the change in the number of electrons after rubbing is called static electricity.

Fact with Reason

Why does a rubbed plastic ruler attract paper pieces?

A rubbed plastic ruler attracts paper pieces because it has a negative charge on it.

Cause of Static Electricity

Atoms of objects have an equal number of protons and electrons in them. An atom is, therefore, electrically neutral. Objects can acquire static charge through friction, conduction, and induction.

Memory Tips

Unit of charge is coulomb. Unit of current is ampere.

Fact with Reason

A body is charge-less in a normal condition. Why?

In a normal condition, atoms of a body have an equal number of oppositely charged electrons and protons. It neutralizes the net effect on each other. So, a body in a normal condition is chargeless.

Some Effects of Static Electricity

a. A comb rubbed against hair attracts paper pieces:

When a negatively charged comb is brought closer to a paper piece, there is an induction of positive charge at one end of the paper piece and accumulation of negative charge at the other end. Due to the attraction between the two opposite charges, the negatively charged comb attracts paper pieces.

Fact with Reason

A balloon rubbed against our hair sticks to the wall.

A balloon rubbed against our hair acquires a negative charge. The balloon then induces a positive charge on the wall and sticks to the wall.

b. A cracking sound comes from clothes of nylon, polyester or wool when we remove them from our bodies:

On being rubbed against our body, nylon, polyester or woollen

clothes develop charges. When we remove the charged clothes from our body, it causes a transfer of charges and causes a cracking sound. In the dark, we can even see the sparks.

c. **An object which contains static electricity can pull other nearby objects.** For example, a rubbed balloon has negative charge and can attract our hair.

rubbed ballon develops static electricity due to friction and can attract our hair

Properties of static electricity

i. It is produced from friction, conduction and induction.

ii. It is produced on insulators.

iii. It can be used to run electronic devices.

Uses of static electricity

i. It helps in printing and photocopying.

ii. It is also used in cement factories to separate dust from smoke.

iii. To make an air filter.

paint sprayer

printer

fig: uses of static electricity

Introduction to lightning

Lightning occurs due to the electric discharge between clouds or between clouds and the ground. The electric spark which occurs due to the sudden flow of a huge quantity of charge in charged clouds is called lightning.

Lightning

Memory Tips

Benjamin Franklin in 1752 A.D. discovered that lightning is due to the transfer of electric charge. Static electricity is the cause of lightning.

Cause of Lightning

Water droplets formed by the condensation of water vapours in clouds slowly come down towards the ground. Hot air and water vapour move up through the air. These two motions cause friction and charge develops in clouds. Clouds have a huge amount of static electric charges, which may be positive or negative. Generally, the clouds of the upper region are positively charged and the clouds in the lower region are negatively charged.

A negatively charged cloud formed above buildings and tall trees induces a positive charge over them. If positively charged cloud forms above buildings and tall trees, then there is an induction of negative charge over them. As the positive charges attract negative charges, the free electrons from the cloud start pushing their way through the moist air. When these electrons reach the buildings or trees, suddenly all the charges in the cloud flow into the buildings or trees. Thus, lightning strikes with a devastating effect due to the attraction between a sudden and huge flow of opposite charges.

Cause of Thunder

Thunder is the loud noise followed by a flash of lightning. Enormous heat gets produced by the transfer of electrons from the negatively charged cloud to the positively charged cloud. This causes the instantaneous expansion and contraction of air. It causes thunder to occur.

Lightning rod

The best method to protect buildings from lightning is to install a lightning rod. It is installed on the top of tall buildings. A lightning conductor is made of a copper rod with sharp points at one end. A conducting rod installed to redirect lightning is called a lightning rod. A copper conductor, with copper wire, is connected to the ground. It is placed over the roof of the building. The lower end of the wire is connected to a flat copper plate and buried deep inside the earth. If lightning occurs on a building, then it gets discharged into the ground through the copper wire connected to the lightning rod avoiding any damage to the building.

Fact with Reason

It is not wise to take shelter under a tall tree during lightning. Why?

It is not safe to take shelter under a tall tree during lightning because tall trees often attract lightning. It can kill us.

Activity

Observe a lightning rod.

Current electricity

Elements are made up of atoms. Each atom has electrons revolving around its nucleus. The electrons from the outer shell move from one atom to another. In the case of metals like silver, copper, aluminium etc., these electrons can flow continuously when connected to a source of electricity. Thus, the energy produced due to the continuous flow of electrons through a conductor is called current electricity. It can be converted to different forms of energy easily. It can be stored and transmitted over a long distance.

Properties of current electricity

i. It is produced due to the flow of electrons.

ii. It can flow from source to load.

iii. It is used to run electronic devices.

Uses of current electricity

i. Current electricity is used for lighting purposes.

ii. It is used for heating purposes.

iii. It is used for operating electronic devices.

iv. It is used to run machines.

v. It is used to run electric cars and trains.

Differences between Static Electricity and Current Electricity

SN	Static electricity	SN	Current electricity
1	It is due to the accumulation of electrons.	1	It is due to the flow of electrons through wires.
2	It is produced in insulators.	2	It occurs in good conductors.
3	It does not need a circuit.	3	It needs a closed circuit to flow.
4	It cannot be transported from one place to another through a conducting wire.	4	Its transmission is possible through a conducting wire.

Combination of cells

Sometimes a higher voltage or a current for a longer duration is required. In such situations, the grouping of the sources of electricity in a particular way can solve the problem. The grouping of two or more cells is called the combination of cells. For example, there is a combination of cells in a torchlight, radio etc. A group of cells is called a battery.

Fact with Reason

Why do we need to combine cells?

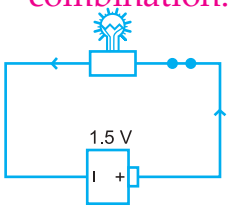
We need to combine cells to draw large voltage or to keep the current flow for a longer time.

Types of the combination of cells

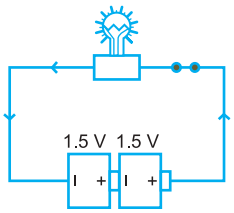
There are mainly two types of combinations of cells. They are series combination and parallel combination.

1. Series combination of cells

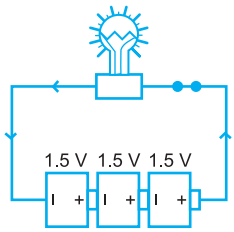
When we need a voltage higher than what a single cell provides, many cells are connected in a series. In such a combination, the cells are connected end to end one after another. The grouping of cells in which the negative terminal of the first cell is connected to the positive terminal of the second cell, and so on is called a series combination.



one cell in circuit



two cells in series



three cells in series

Characteristics of series combination

i. The voltage of all cells is added in a series combination. Total voltage, $V = V_1 + V_2 + V_3 + \ldots\ldots$

ii. The current in the electric circuit increases with the increase in the number of cells.

Memory Tips

The combination of cells in which opposite terminals of the cells are connected is called a series combination of the cells.

Fact with Reason

The brightness of a bulb connected in a series combination of cells increases on increasing the number of cells. Why?

In a series combination, all the cells are connected one after another. The total e.m.f of the combination is equal to the sum of e.m.f. of the individual cells. i.e., $V = V_1 + V_2 + V_3 + \ldots$. Thus, e.m.f. increases in a series combination of cells.

Activity

Combine two cells in a series.

Uses of a series combination of cells

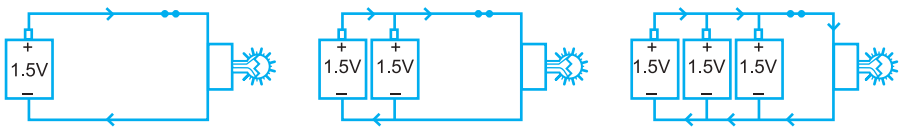
i. Series combination of cells is used to increase the voltage.

ii. It is used to increase the brightness of the bulb.

iii. It is used to run torchlight and remote.

2. Parallel combination of cells

If we need current for a longer duration, several cells are joined in parallel to one another. The grouping of cells in which positive terminals of all cells are connected to one point and negative terminals are connected to another point is called a parallel combination. The parallel combination is equivalent to a single cell.



one cell in circuit *two cell in parallel* *three cell in parallel*

Characteristics of a Parallel Combination

i. The total voltage of the parallel combination is equal to the voltage of a cell. Total voltage, $V = V_1 = V_2 = V_3 = \ldots\ldots$

ii. The current in the electric circuit does not change with the change in the number of cells.

Uses of the parallel combination of cell

i. Parallel combination of cells is used to get the constant brightness of the bulb.

ii. It is used to save the life of the battery.

Memory Tips

Cells in parallel combinations last longer.

Fact with Reason

The cells connected in a parallel combination should have the same voltage. Why?

If the cells connected in a parallel combination have different voltages, then the cells with a higher voltage will supply current to the cells with a lower voltage. It will damage the cell.

Answer writing skill

1. **What is a charge?**

   The electric property of the object is called a charge.

2. **What is conduction?**

   The process in which charges transfer from one object to another when they are in contact is called conduction.

3. **Define static electricity.**

   The electrical energy developed on insulators due to the change in the number of electrons after rubbing is called static electricity.

4. **Why is it necessary to install lightning rods on buildings?**

   It is necessary to install a lightning rod on buildings because it redirects the lightning discharge into the earth. It keeps us safe.

5. **A hair comb attracts paper after we use it to comb hair. Explain.**

   When a negatively charged comb is brought closer to a paper piece, there is an induction of positive charge at one end of the paper piece and accumulation of negative charge at the other end. Due to the attraction between the two opposite charges, the negatively charged comb attracts paper pieces.

EXERCISE

Step 1

1. Fill in the blanks.

series	unlike	charge	lightning	negatively

a. The electric property of the object is called……
b. There is an attraction between …..... charges.
c. The upper layer of cloud is ……. charged.
d. The discharge of charges from the cloud causes ……
e. Electric current increases in ……. combination of cells.

2. Tick the correct and cross the false statement.

a. Metallic wires are the conductors of electricity.
b. An electric bulb is a source of electricity.
c. The number of electrons is more in a positively charged cloud.
d. A parallel combination of cells is used in a torchlight.
e. The voltage increases in a parallel combination of cells.

3. Choose the correct answer from the given alternatives.

a. Which charge is present in the electron?
   i. Positive ii. Negative
   iii. No charge iv. Both
b. What charge is found in the proton?
   i. Positive ii. Negative
   iii. Both iv. Chargeless
c. What charge is produced in the comb after combing hair?
   i. Positive ii. Negative
   iii. No charge iv. All
d. What electricity is produced from friction?
   i. Current electricity ii. Static electricity
   iii. Both iv. none

e. Which activity produces static electricity?

i. Conduction ii. Induction

iii. Friction iv. All of them

4. Match the following

Like charges	constant voltage
Flow of electron	lightning
Static electricity	current electricity
Natural discharge of charge	air filter
Parallel combination	repel

Step 2

5. Answer the following questions in one word.

a. What is the term used for the electrical property of an object?

b. Which current develops on an insulator after rubbing?

c. How many types of electricity are there?

d. What is the term for the material which allows electric current to pass through it?

e. In which type of combination of cells is electric current obtained for a longer period?

6. Differentiate between the following.

a. Static electricity and current electricity

b. Series combination of cells and parallel combination of cells

7. Give reason

a. A body is neutral in normal conditions.

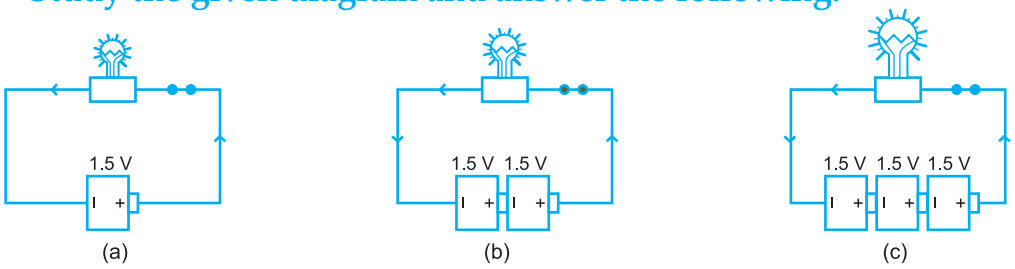
b. Negative charges develop on an ebonite rod when it is rubbed against fur.

c. A negatively charged comb attracts paper pieces.

d. Thunder occurs during lightning.

e. Lighting rod is installed on the top of the building.

8. Study the given diagram and answer the following.



(a) (b) (c)

i. Identify the combination of the cells.

ii. What happens to the brightness of the bulb if a cell is added?

iii. What is the formula to calculate total voltage in this combination?

Step 3

9. Answer the following questions.

a. What is a charge?

b. What is electricity? Write its types.

c. How does a charge develop on a comb rubbed against hair?

d. Explain two effects of static electricity.

e. What is lightning? Write its causes.

f. How can we protect houses and buildings from lightning?

g. Write uses and characteristics of series combination of cells.

h. Write uses and characteristics of parallel combination of cells.

10. You are given four cells of 1.5V each. How would you combine them to obtain a voltage of 6V? Show it in a diagram.

UNIT

9 MATTER

ESTIMATED TEACHING PERIODS	TH	PR
	12	3

Syllabus issued by CDC

- Density and numerical related to them
- Relative density
- Atoms and elements
- Properties of electron, proton and neutron: mass and charge
- Name, symbol and number of subatomic particles of first 20 elements of the modern periodic table
- Compound and molecules
- Introduction, examples and properties of physical change and chemical change

Learning Outcomes

After completion of this unit, students will be able to:

- introduce density and solve mathematical problems related to it.
- find the relative density of the object by comparing it with the density of water and discuss sinking and floatation.
- introduce atoms and elements.
- mention mass and charge of subatomic particles.
- learn name, symbol and number of subatomic particles of the first 20 elements.
- introduce compound and molecules.
- introduce physical and chemical changes that occur in matter, describe their features and demonstrate.

Terms and terminologies

1. Matter:	Anything that has mass and occupies space is called matter.
2. Mass:	Mass is the amount of matter contained in a body.
3. Volume:	Volume is the total space occupied by the body.
4. Solid:	The matter which has a definite shape, size and volume is called a solid.
5. Liquid:	The matter that has fixed volume but no fixed shape is called a liquid.
6. Gases:	Gases are the matter which do not have a definite shape, size and volume.
7. Density:	The mass per unit volume of a substance is called density.
8. Relative density:	Relative density of a substance is the ratio of the mass of a substance to the mass of the same volume of water at 4°C.
9. Element:	A pure substance that cannot be divided into other simpler substances is called an element.
10. Atom:	An atom is the smallest particle of an element that takes part in a chemical reaction without division.
11. Protons:	Protons are positively charged particles that are present in the nucleus (centre) of an atom.
12. Neutrons:	Neutrons are those particles of an atom that have no charge.
13. Electrons:	Electrons are negatively charged particles that revolve around the nucleus in different shells (orbits).
14. Compound:	A compound is a pure substance formed by the combination of two or more elements in a definite proportion by their weight.
15. Molecule:	The smallest particle of a compound that can exist freely in nature is called a molecule.
16. Physical change:	The temporary and reversible change in which no new substance is formed is called a physical change.
17. Chemical change:	The permanent irreversible change in which a new substance is formed is called a chemical change.
18. Rusting:	The process in which iron forms reddish-brown powder due to the action of moist air is called rusting.

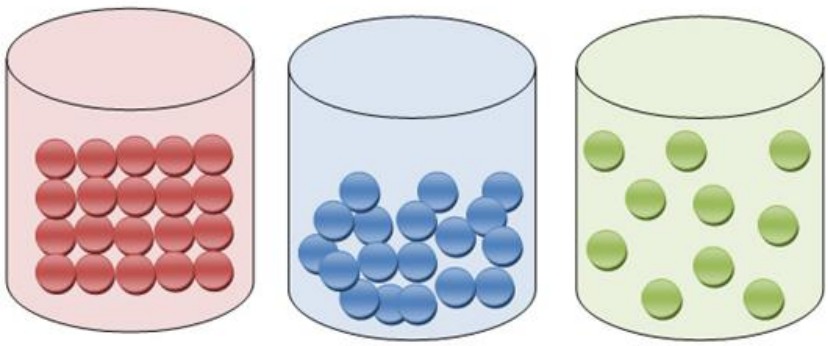
Introduction

There are different types of things around us. Some of these things are books, bricks, tables, etc. Anything that has mass and occupies space is called matter. A matter has certain properties. Mass is the amount of matter contained in a body and volume is the space occupied by that body. Different matters have different physical and chemical properties.

States of matter

Matter can be traditionally categorized into three major physical states. They are solid, liquid and gas. However, there are two other unique states of matter such as plasma and Bose-Einstein condensate (BEC) that occur in extreme conditions. It was first produced in a lab in 1995.

Plasma is a hot ionized state of matter, which requires extremely high temperature. Stars are made of plasma.



solid *liquid* *gases*

fig: molecules of solid, liquid and gas states of matter

Memory Tips

The flame produced in electric arc welding is an example of plasma.

1. Solid

The matter which has a definite shape, size and volume is called a solid. Ice, rock, wood, etc. are examples of solid matters. Solid

molecules have a strong intermolecular force of attraction compared to liquid or gas molecules.

ice cubes

rock

diamond

fig: solids

Common characteristics of solids

i. They are usually hard.

ii. They have definite shapes, size and volume.

iii. Solids cannot be compressed because their molecules are densely packed.

iv. The intermolecular force of attraction is very high in solids. Therefore, they do not flow.

Memory Tips

Solid molecules, compared to liquid or gas molecules, have a strong intermolecular force.

Fact with Reason

Why can't solid molecules flow?

Solid molecules cannot flow because they have a strong intermolecular force between the molecules.

2. Liquid

The matter that has fixed volume but no fixed shape is called a liquid. It has a less intermolecular force than that of solids but more than that of gases.

For example, milk, water etc.

water

milk

oil

fig: liquids

Common characteristics of liquids

i. Liquids do not have a definite shape and size and take the shape of the container.

ii. They have a definite volume. They cannot be compressed.

iii. Molecules of liquids are loosely packed in comparison to solids.

iv. They flow from a higher level to a lower level.

Memory Tips

Liquid molecules flow downward due to less intermolecular force of attraction.

3. Gas

Gases are the matter which do not have a definite shape, size and volume. They spread in any direction. Oxygen, carbon dioxide, water vapour, ammonia, etc. are some examples of gases.

smoke

vapour

spray

fig: gases

Common characteristics of gases

i. They do not have a definite shape, size and volume.

ii. They are highly compressible.

iii. They easily flow or spread in the air.

iv. They have the lowest intermolecular force.

Memory Tips

Gas molecules move here and there due to a weaker intermolecular force among the molecules.

Activity

Take a brick, a glass of water and a bottle of body spray. Observe the properties of these matters and compare how they differ from each other.

Density

One kilogram of iron occupies less space but cotton of the same mass occupies much more space. So, iron has more density. Similarly, mercury is heavier than the same volume of water. It means that mercury has more mass than the same volume of water. It suggests that mercury has more density than water. Thus, the mass per unit volume of a substance is called density.

Mathematically,

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Units of density

The SI unit of density is kg/m^3 or kg m^{-3}. Similarly, the CGS unit of density is g/cm^3 or g cm^{-3}.

Densities of the some common substances

Substance	Density (in kg m^{-3})	Substance	Density (in kg m^{-3})
Alcohol	790	Aluminium	2700
Petrol	800	Steel	7800
Ice (at 0°C)	920	Mercury	13600
Water (at 4°C)	1000	Gold	19300

SOLVED NUMERICAL

1. The density of aluminium is 2700 kg/m³. Calculate the volume of 1350 kg of aluminium.

Solution,

Density (d) = 2700 kg/m³

Mass (m) = 1350 kg

Volume (V) = ?

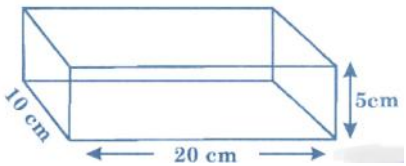
Using formula,

$$\text{Volume} = \frac{\text{mass}}{\text{density}} = \frac{1350}{2700} = 0.5\text{m}^3$$

∴ Volume of the aluminium is 0.5m³.

2. The mass of the brick shown in the given figure is 2.4 kg. Find its density.

Solution,



Mass of the brick (m) = 2.4 kg = 2400 g

Length of the brick (l) = 20 cm

Breadth of the brick (b) = 10 cm

Height of the brick (h) = 5 cm

From the formula,

Volume of the brick (V) = l × b × h

or, V = 20 × 10 × 5 = 1000 cm³

Now, the density of the brick is given by

$$d = \frac{m}{v} = \frac{2400}{1000} = 2.4 \text{ g/cm}^3$$

∴ Density of the brick is 2.4 g/cm³.

Relative density

Relative density is the measurement that shows how many times denser the substance is than pure water at 4°C. It is the ratio of the density of a

substance to the density of pure water at 4°C.

$$\text{Relative density} = \frac{\text{density of the substance}}{\text{the density of pure water at 4°C}}$$

Memory Tips

Relative density is also called specific gravity.

Fact with Reason

Relative density is a unit less quantity, why?

Relative density is a ratio between densities or masses of the substances and water at 4°C; therefore, it has no units.

Thus, the relative density of a substance is the ratio of the mass of a substance to the mass of the same volume of water at 4°C. Mathematically:

The density of a body = R.D. of the body × Density of pure water at 4°C.

The relative density of any substance is constant. If there is any change in the density of the substance at a given temperature, the substance is impure.

Floating and sinking

An iron nail sinks in water but floats in mercury because the density of iron (i.e., 7.8 g/cm^3) is more than that of water (i.e., 1.0 g/cm^3) and less than that of mercury (i.e., 13.6 g/cm^3). Therefore, the floating or sinking of a body depends on the density of the body and the density of the liquid in which the body is kept.

For floatation, the density of a body must be less than that of the liquid. For example, kerosene has less density than that of water so it floats in water.

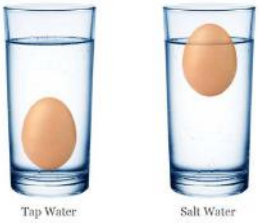
For sinking, the density of the body must be more than that of the liquid. For example, a stone has more density than that of water, so it sinks in water.

Memory Tips

1. *The density of an object > density of the liquid; object sinks in the liquid.*
2. *The density of an object < density of the liquid; object floats in the liquid*

Activity

Objective: To show that object with less density floats in water and the object with more density sinks in water .



Methods:

1. Take a beaker and fill two-third of it with water.
2. Keep an egg in water and observe. Does the egg sink in water?
3. Now, make a saturated solution of salt in water and again repeat the process. Does the egg float in the salt solution?

Explanation:

Pure water has less density but the salt solution has more density. Therefore, an egg sinks in pure water but floats in a salt solution.

Fact with Reason

An ice cube floats in water, why?

Ice has less density (i.e., 0.9 g/cm^3) than that of water (i.e., 1.0 g/cm^3). So, an ice cube floats in water.

Elements and compounds

Elements

A pure substance that cannot be divided into other simpler substances is called an element. Each element is composed of the same type of smallest particles known as atoms. The atoms of an element are always identical while the atoms of different elements differ from each other. For example, gold is made up of only gold atoms, carbon is made up of only carbon atoms, etc.

Ninety two elements occur naturally. Scientists have also synthesized some elements in the laboratory. There are 118 elements discovered

till now. Hydrogen, helium, oxygen, carbon, etc. are some examples of natural elements.

At standard temperature and pressure, different elements are found in different chemical and physical states. Elements like carbon, copper, gold, iron, etc. occur in solid-state. Elements like bromine, mercury, caesium, gallium, etc. occur in liquid state. Similarly, elements like hydrogen, oxygen, nitrogen, etc. occur as gases.

Memory Tips

Promethium, technetium, curium, plutonium, etc. are examples of synthesized elements.

Fact with Reason

Why is sodium called an element?

Sodium is made up of only one type of atoms and it cannot be split into other simple forms. So, sodium is called an element.

Atom

Elements are made up of atoms. An atom is the smallest particle of an element that takes part in a chemical reaction without division. Atoms cannot be seen with our naked eyes. They can neither be created nor be destroyed. An atom shows all the properties of the element it belongs to.

Memory Tips

The smallest particle of an element is called an atom and the smallest particle of a compound is called a molecule.

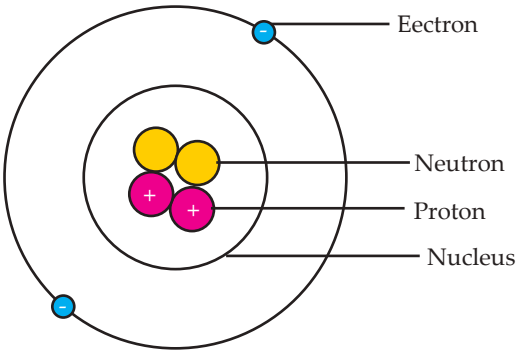
Some of atoms do not take part in a chemical reaction. They make inert elements. Atoms of gases like helium, neon, argon, etc. do not take part in a chemical reaction and thus exist freely. So, they are also known as inert gases. Atoms of other elements like hydrogen, oxygen, nitrogen, etc. cannot exist freely.

Activity

Observe the modern periodic table. In which side are metals kept in the modern periodic table?

Structure of an atom

An atom is made up of three major sub-atomic particles called protons, electrons and neutrons. Protons are positively charged particles that are present in the nucleus (centre) of an atom. Neutrons are chargeless particles of an atom. They are present along with the protons in the nucleus. Electrons are negatively charged particles that revolve around the nucleus in different shells (orbits). Shells are imaginary spheres where electrons revolve around the nucleus.



structure of an atom

Fact with Reason

An atom is electrically neutral, why?

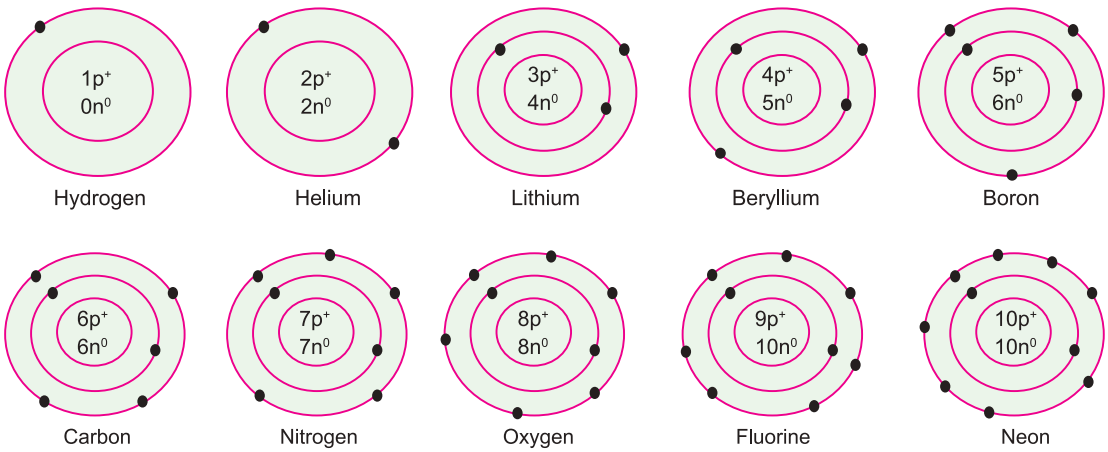
An atom is electrically neutral as the number of positively charged protons is equal to the negatively charged electrons in an atom.

sub-atomic particles	location	Symbol	Charge	Mass
Electron	Orbit	e^-	Negative	$\frac{1}{1837}$ amu
Proton	Nucleus	P^+	Positive	1 amu
Neutron	Nucleus	n^0	Charge less	1 amu

The symbol of the first twenty elements is provided in the table below:

SN	Element	Symbol	No. of electron	No. of proton	No. of neutron
1	Hydrogen	H	1	1	0
2	Helium	He	2	2	2
3	Lithium	Li	3	3	4
4	Beryllium	Be	4	4	5
5	Boron	B	5	5	6
6	Carbon	C	6	6	6
7	Nitrogen	N	7	7	7
8	Oxygen	O	8	8	8
9	Fluorine	F	9	9	10
10	Neon	Ne	10	10	10
11	Sodium	Na	11	11	12
12	Magnesium	Mg	12	12	12
13	Aluminium	Al	13	13	14
14	Silicon	Si	14	14	14
15	Phosphorus	P	15	15	16
16	Sulphur	S	16	16	16
17	Chlorine	Cl	17	17	18
18	Argon	Ar	18	18	22
19	Potassium	K	19	19	20
20	Calcium	Ca	20	20	20

The atomic structure of the first ten elements is shown below.



Compound

A compound is a pure substance formed by the combination of two or more elements in a definite proportion by their weight. A compound is a completely new substance that has different properties than its combining elements. For example, hydrogen gas and oxygen gas are combined to form a compound called water. Here, hydrogen and oxygen are gases while the product formed is liquid in nature.

Fact with Reason

A compound is a pure substance although it has two or more elements. Why?
A compound is a pure substance although it has two or more elements because it has two or more atoms or elements combined in a fixed ratio by their weight.

Memory Tips

A compound may be either a covalent compound or an electrovalent compound.

Fact with Reason

Sodium chloride is a compound.
Sodium chloride is a compound because it is formed by the combination of sodium and chlorine in a definite ratio by weight.

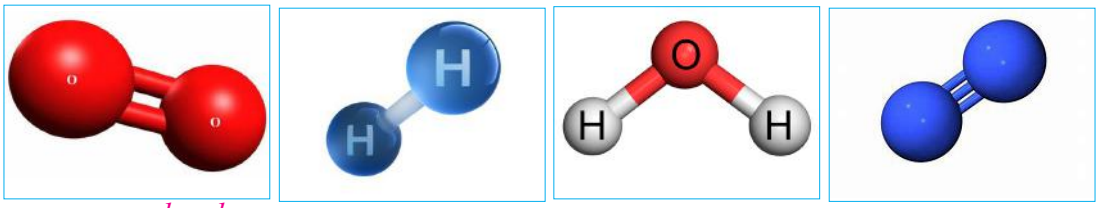
Molecule

The smallest particle of a compound that can exist freely in nature is called a molecule. Molecules of the same compounds are alike while molecules of different compounds are different in their properties.

Memory Tips

The symbol of the molecular formula of a compound and molecule is the same.

A molecule of hydrogen gas (H_2) is formed by the combination of two similar atoms. Other such examples are nitrogen gas (N_2), oxygen gas (O_2), etc.



oxygen molecule *hydrogen molecule* *water molecule* *nitrogen molecule*

fig: model of certain molecules

Activity

Make a clay model of the hydrogen molecule.

Differences between elements and compounds

SN	Element	SN	Compound
1	An element is a pure substance that cannot be broken down into other simpler substances.	**1**	The compound is a pure substance that can be broken down into its constituent elements.
2	An element contains only one type of atom.	**2**	A compound contains one, two or more types of atoms.
3	An atom is the smallest unit of an element.	**3**	A molecule is the smallest unit of a compound.
4	Only 118 elements are discovered so far.	**4**	Thousands of compounds have been discovered so far.

Change in matter

Based on the effect there are two types of changes. They are physical change and chemical change.

1. Physical change

Heat an ice cube in a beaker. The ice melts on heating and changes into water. Again, freeze the water in a refrigerator. It changes back into ice. Here, the state of ice changes temporarily from solid to liquid and

melting ice *heating iron*

fig: physical change

back to solid again. Other properties of the ice are not changed. Such type of changes is called physical changes. The temporary and reversible change in which no new substance is formed is called a physical change.

Examples of physical changes are boiling of milk, melting of wax, melting of metals, heating of water, cooling water, etc.

Memory Tips

A physical change involves a change in the physical properties of matter like its physical state.

Characteristics of a physical change

i. It is a temporary change.
ii. It is a reversible change.
iii. No new substances are formed.
iv. Properties of matter like the taste and odour are not changed.

Fact with Reason

The melting of iron is a physical change. Why?

When iron melts its state changes from solid to liquid but its composition remains the same without the formation of a new substance. So, the melting of iron is a physical change.

2. Chemical change

burning wood is a chemical change

Take a piece of wood and burn it. After burning, the solid wood turns into smoke and ashes. Smoke and ashes have different physical and chemical properties compared to the wood. Can you change ashes and smoke to make wood again? It is not possible because this change is permanent and cannot be reversed back. Such a type of change is called a chemical change. The permanent

irreversible change in which a new substance is formed is called a chemical change. Examples of a chemical change are burning of woods, rusting of iron, burning of fuels, forming of butter and yoghurt from milk, etc.

Characteristics of chemical change

i. It is a permanent change.
ii. It is generally irreversible.
iii. New substances are formed.
iv. Both physical and chemical properties of the matter are changed.

Differences between a physical change and chemical change

SN	Physical change	SN	Chemical change
1	A physical change is a temporary change and therefore is reversible.	1	A chemical change is a permanent change and therefore is irreversible.
2	In this change, only physical properties change.	2	In this change, both chemical and physical properties change.
3	No new substances are formed.	3	New substances are formed.

Rusting of iron

Iron is a reactive metal. It can form rust by reacting with moist air. The process in which iron forms reddish-brown powder due to the action of moist air is called rusting. It can be prevented by polishing, galvanizing and colouring.

Fact with Reason

The rusting of iron is a chemical change. Why?

The rusting of iron is a chemical change because it is a permanent, irreversible change, out of which a new substance, i.e., rust is formed.

Memory Tips

Chemical change involves a change in the chemical properties of matter.

Activity

Take a small piece of magnesium ribbon. Hold the ribbon with the help of tongs. Burn it with the help of a burner. What do you observe? Discuss with your friends.

Answer writing skill

1. **Define density. Write its SI unit.**

   The mass per unit volume of a substance is called density. Its SI unit is kg/m^3.

2. **Why does a wooden block float in water?**

   The wooden block can float in water because its density is lesser than the water's density.

3. **Differentiate between the melting of iron and rusting of iron.**

   The differences between the melting of iron and rusting of iron are:

SN	Melting of iron	SN	Rusting of iron
1	It is a physical change.	1	It is a chemical change.
2	It is a temporary change.	2	It is a permanent change.

4. **The density of ice is 920 kg/m^3. Calculate the volume of 1350 kg of ice.**

   Solution

   Density (d) = 920 kg/m^3

   Mass (m) = 1350 kg

   Volume (V) = ?

   Using formula,

   $$\text{Volume} = \frac{\text{mass}}{\text{density}} = \frac{1350}{920} = 1.46 m^3$$

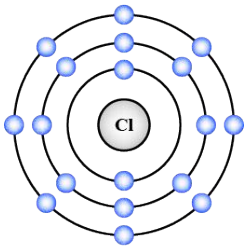
   $\therefore$ The volume of the ice is 1.46 m^3.

5. **Gold has a relative density of 19.3. What does it mean?**

   Gold has a relative density of 19.3. It means that gold is 19.3 times denser than water.

6. **Write a brief information about chlorine and draw its atomic structure.**

Element	: Chlorine
Symbol	: Na
Atomic number	: 17
Number of protons	: 17
Number of neutrons	: 18
Number of electrons	: 17



Chlorine atom

EXERCISE

Step 1

1. Fill in the blanks.

volume	mass	K	weaker	gas

a. The amount of matter present in the body is called ……...
b. The space occupied by a body is called …….
c. Solid, liquid and ……. are three states of matter.
d. Liquid molecules have ……. intermolecular force.
e. The symbol of potassium is …….

2. Tick the correct and cross the false statement.

a. Matter has mass and occupies space.
b. Carbon dioxide is an element.
c. Physical change is irreversible.
d. A body with lesser density than water floats in water.
e. The mass per unit volume is called density.

3. Choose the correct answer from the given alternatives.

a. What is the substance with mass and volume called?
   i. Physical quantity ii. Vector
   iii. Scalar iv. Matter
b. What is the substance with fixed size and volume called?
   i. Solid ii. Liquid
   iii. Gas iv. Plasma

c. Which one is a liquid?

i. Mercury ii. Iron

iii. Rock iv. Gold

d. What is the density of water?

i. 7800 kg/m^3 ii. 19300 kg/m^3

iii. 2780 kg/m^3 iv. 1000 kg/m^3

e. Which one is a compound?

i. Hydrogen ii. Water

iii. Oxygen iv. Nitrogen

4. Match the following

Burning fuel	collection of identical atoms
Wood	kg/m^3
Water vapour	solid
Density	gas
Element	chemical change

Step 2

5. Answer the following questions in one word.

a. What kind of change is the burning of paper?

b. Which one is chemically active: an atom or a molecule?

c. How many naturally occurring elements are there?

d. Write the symbol of an oxygen atom.

e. In which condition does an object float in water?

6. Differentiate between the following.

a. Density and relative density

b. Atoms and molecules

c. Element and compound

d. Physical change and chemical change

7. Give reason

a. Sodium is an element.

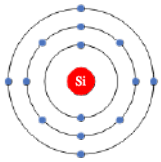
b. The burning of paper is called a chemical change.

c. The melting of iron is a physical change.

d. Sodium chloride is a compound.

e. An egg sinks in pure water but floats in salt water.

8. Study the given diagram and answer the following questions.



i. What is shown in the diagram?

ii. Is it an element or a compound?

iii. Write its atomic number and number of electrons.

Step 3

9. Answer the following questions.

a. What are solids? List any three important properties of solids.

b. Define liquids and mention their three properties.

c. What are gases? Write any three properties of gases.

d. List any two important properties each of physical change and chemical change.

e. Write the symbol of the following elements.

i) Magnesium ii) Silicon iii) Potassium

f. Identify whether the following represent a physical or a chemical change.

i. Burning of paper
ii. Boiling an egg
iii. Melting of ice
iv. Formation of curd
v. Heating ice
vi. Boiling of water
vii. Burning of wood
viii. Formation of ice

g. What is an atom? Why is it neutral?

h. Draw the atomic structure of hydrogen, oxygen and neon.

10. Numerical

a. The mass of an iron object is 16,000 kg and its volume is 2 m^3. Find the density of iron. [Ans: 8000 kg/m^3]

b. A golden ring of mass 38.6 g has a volume of 2 cm^3. Calculate its density. [Ans: 19.3 g/cm^3]

c. 10 kg petrol has a density of 800 kg/m^3. Find its volume in cm^3. [Ans:12500 cm^3]

d. The density of copper is 8900 kg/m^3. If the volume of a piece of copper is 2 m^3, find its mass. [Ans: 17800 kg]

e. The density of mercury is 13600 kg/m^3 and that of water is 1000 kg/m^3. Calculate the relative density of mercury. [Ans: 13.6]

UNIT

10

MATERIALS USED IN DAILY LIFE

ESTIMATED TEACHING PERIODS	TH	PR
	12	3

Introduction

We use different types of materials in our daily life. They are different in shape, size, colour, odour, taste and texture. Among them some are regular in shape and some are irregular; some are small and some are big; some are colourful and some are colourless; some have pleasant smell and some have unpleasant; some have bitter taste and some have sour taste. Similarly some are soft and some are hard. On the basis of these characteristics, we can classify matter in different categories.

lemon

orange

soap

common salt

iron nail

cotton

fig: materials used in our daily life

Unit
10.1

Acid, Base and Salt

Estimated teaching periods	
Th	Pr
7	2

Syllabus issued by CDC

- Introduction, examples and physical properties of acid, base and salt
- Indicators and its types: litmus paper, phenolphthalein and methyl orange
- Making of homemade indicators and their use

Learning Outcomes

After completion of this unit, students will be able to:

- mention the physical properties of acid, base and salt.
- introduce indicators and use them to identify whether the given solution is either acid, base or salt.
- use local ingredients to make indicators.

Terms and terminologies

1. Indicators:	Indicators are those chemical substances that are used to indicate whether the given substance is acid or base or salt.
2. Homemade indicators:	The indicators made from red rose flower, red cabbage, onion, turmeric etc. are called homemade indicators.
3. Acids:	Acids are those chemical substances that give hydrogen ions when dissolved in water.
4. Strong acid:	Acids that undergo almost complete dissociation in an aqueous solution and produce a high concentration of hydrogen ions are called strong acids.
5. Weak acid:	Acids that undergo a partial dissociation in an aqueous solution and produce a low concentration of hydrogen ions are called weak acids.
6. Organic acids:	Acids that are obtained from living organisms and contain carbon atoms are called organic acids.
7. Inorganic acids (Mineral acids):	Acids that are obtained from minerals are called inorganic acids or mineral acids.
8. Bases:	Metallic oxides and hydroxides that give hydroxyl ion in solution are called bases.
9. Alkali:	The bases that dissolve in water and produce hydroxyl (OH-) ions are called alkalis.
10. Strong base:	Bases that give more amount of hydroxyl ions (OH^-) in an aqueous solution are called strong bases.
11. Weak base:	Bases that give a very little amount of hydroxyl ions (OH^-) in an aqueous solution are called weak bases.

12. Salt: Salt is a chemical substance that is formed by the chemical reaction between acid and base.

Introduction

We eat different types of foods, fruits and vegetables. We also use different chemicals in our daily life such as soap, detergent, baking soda etc. These materials are either acid, base or salt.

fruits and vegetables contain certain acid, base or salt

Indicator

Indicators are those chemical substances that are used to indicate whether the given substance is acid or base or salt. Indicators, when treated with an acidic or basic solution, change their colour. Litmus paper, methyl orange and phenolphthalein are some common indicators. They are obtained from different parts of plants like roots, flowers, leaves, etc. These are collected, crushed and mixed with an organic solvent to obtain indicators. Red rose flower, red cabbage, onion, turmeric etc. can be used to make an indicator. They are called homemade indicators. The colour change of different indicators with acidic, basic and salt solution is given in the table:

S.N.	Indicators	Colour in acid solution	Colour in basic solution	Colour in neutral salt solution
1)	Red litmus paper	No change in colour	Changes into blue	No change in colour
2)	Blue litmus paper	Changes into red	No change in colour	No change in colour
3)	Methyl orange	Changes into red	Changes into yellow	No change in colour
4)	Phenolphthalein	No change in colour	Changes into pink	No change in colour
5)	Red cabbage juice	Changes into red	Changes into green	Changes into rose red
6)	Onion juice	Red	Green	Purple
7)	Turmeric juice	Yellow	Red	Yellow


blue litmus

red litmus


phenolphthalein

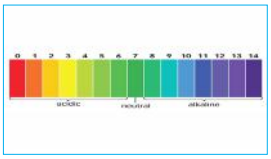

universal indicator

fig: indicators

Memory Tips

The universal indicator can tell the strength of acid and base.

Acid

sulphuric acid

The word "acid" is derived from the Latin word *acidus*, which means sour. Most acids, edible or non-edible, are sour. But it is dangerous to touch or taste acids in the laboratory. According to Swedish chemist Arrhenius, acids give hydrogen ions when dissolved in water and conduct electricity. So, acids are those chemical substances which give hydrogen ions when dissolved in water.

Memory Tips

1. *Milk also contains acid called lactic acid which helps to form yoghurt.*
2. *Proteins are made up of amino acids.*
3. *Vitamin C is also an acid called ascorbic acid.*

Classification of acid

Classification of acids based on strength:

a. Strong acids: Acids that undergo almost complete dissociation in an aqueous solution and produce a high concentration of hydrogen ions are called strong acids. Due to more hydrogen ion concentration, they are good conductors of electricity and have low pH values. Examples: Hydrochloric acid, Sulphuric acid, Nitric acid, etc.

b. **Weak acids:** Acids that undergo a partial dissociation in an aqueous solution and produce a low concentration of hydrogen ions are called weak acids. Due to the low concentration of hydrogen ions, they do not conduct electricity easily and have a high pH value. Examples: Acetic acid, Carbonic acid, Formic acid, Ascorbic acid, etc.

Fact with Reason

Why is hydrogen sulphate called an acid?

Hydrogen sulphate is called an acid because it gives hydrogen ions when dissolved in water.

Classification of acids based on chemical nature:

a. Organic acids: Acids that are obtained from living organisms and contain carbon atoms are called organic acids. Examples: Acetic acid, Formic acid, Malic acid, Ascorbic acid, Citric acid, etc. These are weak acids and produce less concentration of hydrogen ions in an aqueous solution.

b. Inorganic acids (Mineral acids): Acids that are obtained from minerals are called inorganic acids or mineral acids. Inorganic acids may be strong or weak. Inorganic acids are commonly used in laboratories. Examples: Hydrochloric acid, Nitric acid, Sulphuric acid, Carbonic acid, etc.

Physical properties of acid

i. Acids have a sour taste due to the presence of hydrogen ions (H^+).

ii. Acids can burn our skin, tongue, etc.

iii. Acids change blue litmus paper into red and methyl orange into red.

iv. Strong acids are corrosive.

Fact with Reason

Hydrochloric acid is a strong acid but acetic acid is a weak acid, why?

Hydrochloric acid is a strong acid because it undergoes almost complete ionization to give a large number of hydrogen ions.

But acetic acid is a weak acid because it does not ionize completely in water.

Memory Tips

Acid can dissolve metal.

Activity

Wash an old metal pot with lemon juice. Does it shine? What is the reason? Discuss in a group.

Uses of acids

i. Sulphuric acid is used in industries for making drugs, detergents and chemical fertilizers. It is widely used in laboratories and industries. Therefore, sulphuric acid is also called the king of chemicals.

ii. Hydrochloric acid is used in laboratories, tanning and printing industries.

iii. Nitric acid is used for making explosives, plastics and dyes.

iv. Carbolic acid (Phenol) is used to kill germs.

v. Boric acid is used for washing eyes and wounds.

vi. Acetic acid (vinegar) is used for preserving and flavouring foods.

vii. Citric acid is used in medicines as a source of vitamin C and also used for flavouring drinks.

viii. Carbonic acid is used in soft drinks and soda water.

ix. Oxalic acid is used to remove ink-stain.

x. Tartaric Acid is added to baking soda for making baking powder.

xi. It neutralizes the bitterness produced by baking soda.

SN	Organic acid	Source
1	Citric acid	 lemon  orange  tomato
5	Lactic acid	 milk  curd
2	Ascorbic acid	 amala  sour fruits
3	Tartaric acid	 grapes  banana
4	Oxalic acid	 chariamilo  potato
5	Formic acid	 red ant  nettle (sisno)
6	Acetic acid	 pickle  vinegar

Base

Metallic oxides and hydroxides are called bases. Most bases or metal oxides dissolve in water and give hydroxyl ions. The bases that dissolve in water and produce hydroxyl (OH^-) ions are called alkalis. Sodium hydroxide, Potassium hydroxide, etc. are some examples of alkalis.

Some bases like Lead oxide, Barium oxide, etc. do not dissolve in water. So, these compounds are bases but not alkalis. Therefore, all alkalis are bases but all bases are not alkalis.

Fact with Reason

Ferrous oxide is a base but not an alkali, why?

Ferrous oxide is a base because it is a metal oxide but it is not an alkali as it does not dissolve in water to give hydroxide.

Sodium hydroxide is an alkali, why?

Sodium hydroxide is an alkali because it dissolves in water and produces hydroxyl ions.

All alkalis are bases but all bases are not alkalis, why?

All alkalis are bases because all alkalis are metal oxides or metal hydroxides.
All bases are not alkalis because some bases do not dissolve in water.

Differences between bases and alkalis

SN	Bases	SN	Alkali
1	All metallic oxides are called bases.	1	Only water-soluble metallic oxides or bases are called alkalis.
2	Some bases do not give hydroxyl ions when dissolved in water.	2	All alkalis give hydroxyl ions when dissolved in water.
	Examples: Magnesium oxide, Iron oxide, etc.		Examples: Sodium hydroxide, Potassium hydroxide, etc.

Strong bases and weak bases

Bases (alkalis) that give more amount of hydroxyl ions (OH^-) in an aqueous solution are called strong bases. Sodium hydroxide, Potassium hydroxide and Calcium hydroxide are a few examples of strong bases. They undergo almost complete dissociation and have a high pH value. Bases (alkalis) that give a very little amount of hydroxyl ions (OH^-) in an aqueous solution are called weak bases. Examples are Ferric hydroxide, Cupric hydroxide, etc. They have a very less degree of ionization and have a low pH value.

Physical properties of bases

i. Bases are soapy in touch and bitter in taste.

ii. Bases turn red litmus paper into blue, methyl orange into yellow and phenolphthalein into pink.

iii. Strong bases or alkalis like NaOH and KOH dissolve in oil and grease.

iv. Strong bases or alkalis burn our skin.

Uses of Bases

i. Sodium hydroxide is used to make soaps, detergents, papers, etc. and purify petroleum products.

ii. Calcium hydroxide or slaked lime is used to make mortar and bleaching powder, to reduce the hardness of water and to neutralize the acidity of soil.

iii. Potassium hydroxide is used in alkaline batteries and to make soft soap.

iv. Aluminium hydroxide and magnesium hydroxide are used to reduce hyperacidity of the stomach.

v. Ammonium hydroxide is used to remove grease and stains from clothes and to make fertilizers.

vi. Calcium oxide or quick lime is used for softening hard water, purification of sugar and production of cement.

Salt

Salt is a chemical substance that is formed by the chemical reaction between acid and base. In general, salts are neutral compounds but some may be acidic or basic. The process by which acid and base react together to produce salt and water is called a neutralization reaction.

Memory Tips

Table salt is a neutral substance.

Properties of salts

i. Generally, salts are neutral but some may be acidic or basic.

ii. Most of the salts are water-soluble but chloride salts of silver and lead and sulphate salts of lead and barium are insoluble.

iii. Salts of metals like Na, K, Mg, Ca, Al and Ba are white or colourless whereas salts of Cu, Co, Mn, Ni, Fe and Cr are colourful.

iv. Some salts are salty but most salts are bitter.

v. Salts conduct electricity in a molten or solution state.

vi. Some salts are amorphous whereas some are crystalline.

Uses of salts

i. Table salt (NaCl) is used in our food and also used as a preservative.

ii. Sodium carbonate is used to manufacture soaps, detergents and glasses. It is also used to reduce the hardness of water.

iii. Calcium sulphate is used in the medical field for plastering fractured bones and is mixed in cement.

iv. Sodium bicarbonate is used as baking powder, for reducing hyperacidity and in the fire extinguisher.

v. Copper sulphate is used for making fungicides and in copper plating.

vi. Ammonium chloride is used in dry cells as an electrolyte.

vii. Ammonium sulphate is used as chemical fertilizer.

viii. Ferrous sulphate is used as a medicine to treat iron deficiency in anaemia patients.

Answer writing skill

1. Define acid.

Acids are those chemical substances that give hydrogen ions when dissolved in water.

2. Why is amala sour?

Amala is sour because it contains acid.

3. Define salt.

Salt is a chemical substance that is formed by the replacement of the hydrogen ion of an acid molecule by a metal.

4. Write any two differences between acid and base.

Differences between acid and base are:

SN	Acid	SN	Base
1	Acids are those chemical substances that give hydrogen ions when dissolved in water.	**1**	Metallic oxides and hydroxides are called bases.
2	Acids have a pH value of less than seven.	**2**	Bases have a pH value of more than seven.

5. Nettle stings and ant bite is painful. Why?

Stinging hairs of a nettle and saliva of an ant contain formic acid. As this acid enters our skin, we have a painful burning sensation.

6. We use aluminium hydroxide and magnesium hydroxide to reduce acidity in our stomach, why?

Aluminium hydroxide and magnesium hydroxide are alkalis. They neutralize the excess amount of hydrochloric acid present in our stomach. So, acidity can be controlled by using these alkalis.

EXERCISE

Step 1

1. Fill in the blanks.

pink	water-soluble	hydrogen	weak acids	conductor

a. Acid gives ..... ions in a solution.

b. Alkalis are ..... bases.

c. The colour of phenolphthalein in the basic medium is.....

d. The acid solution is a good ……. of electricity.

e. Acids that undergo a partial dissociation in an aqueous solution are called …….

2. Tick the correct and cross the false statement.

a. Citric acid is an organic acid.

b. Sodium hydroxide is a weak base.

c. Potassium nitrate is used in fertilizers.

d. Acids can burn our skin, tongue, etc.

e. Oxalic acid is used to remove ink-stain.

3. Choose the correct answer from the given alternatives.

a. Which is an acid?

i. Hydrogen chloride ii. Sodium hydroxide

iii. Calcium oxide iv. Rust

b. Which one is a strong acid?

i. Hydrochloric acid ii. Acetic acid

iii. Lactic acid iii. Formic acid

c. Which one is an organic acid?

i. Sulphuric acid ii. Hydrochloric acid

iii. Nitric acid iv. Oxalic acid

d. Which one is a weak base?

i. Sodium hydroxide ii. Calcium oxide

iii. Calcium hydroxide iv. Rust

e. Which is an alkali?

i. Base ii. Water-soluble base

iii. Acid iv. Salt

4. Match the following

NaOH	calcium oxide
Table salt	milk
Indicator	strong base
Lactic acid	litmus paper
Quick lime	sodium chloride

Step 2

5. Answer the following questions in one word.

a. Which chemical species are called proton donors?

b. What is the taste of acid?

c. Which chemical species taste bitter?

d. Which salt is used in our diet?

e. What are the chemical species that change colour in acid or base?

6. Differentiate between the following.

a. Acid and base

b. Organic and inorganic acids

c. Strong acid and weak acid

d. Base and alkali

7. Give reason

a. Hydrogen sulphate is an acid.

b. Sodium hydroxide is an alkali.

c. Ferrous oxide is a base but not an alkali.

d. Hydrochloric acid is a strong acid but Acetic acid is a weak acid.

e. All alkalis are bases but all bases are not alkalis.

8. Study the given diagram

i. What is the chemical nature of the solution in the diagram?

ii. What colour would appear if phenolphthalein was dropped in water?

Step 3

9. Answer the following questions.

a. List three physical properties of acids.

b. Mention three important physical properties of bases.

c. Write any three uses of acid.

d. What are the uses of base?

e. What is salt?

f. Write down uses of salts.

g. Define an indicator.

10. "A" denotes a salt solution, "B" denotes an acid solution and "C" denotes an alkali solution. Based on this information, complete the table given below:

S.N.	Indicators	Substance A	Substance B	Substance C
1	Red litmus paper			
2	Blue litmus paper			
3	Methyl orange			
4	Phenolphthalein			

Unit
10.2 Metals and non-metals

Estimated teaching periods	
Th	Pr
5	1

Syllabus issued by CDC

- Introduction of metals and nonmetals
- Physical properties and use of aluminium, zinc, gold, copper and silver
- Physical properties and uses of sulphur and iodine

Learning Outcomes

After completion of this unit, students will be able to:

- mention the physical properties and uses of aluminium, zinc, silver, iron, copper and gold.
- mention the physical properties and uses of sulphur and iodine.

Terms and terminologies

1. **Metals:** Metals are generally hard and shiny substances that are good conductors of heat and electricity.
2. **Gold:** Gold is a soft and yellow shiny metal.
3. **Silver:** Silver is a soft metal with a white shiny lustre.
4. **Copper:** Copper is a reddish-brown metal.
5. **Iron:** Iron is a useful metal extracted from haematite.
6. **Aluminium:** Aluminium is the most abundant bluish-white metal in the earth's crust.
7. **Zinc:** Zinc is a useful metal that has a bluish lustre.
8. **Non-metal:** Non-metals are generally soft substances that are bad conductors of heat and electricity.
9. **Sulphur:** Sulphur is a tasteless, odourless, light yellow, non-metallic element.
10. **Iodine:** Iodine is a volatile shiny non-metal.

Introduction

We use a variety of substances in our daily life. They occur in different forms like solids, liquids and gases. Some of them are hard and others are soft. Some of them conduct heat and electricity and others do not. Some of them are opaque or translucent and yet others are transparent. We can also differentiate them based on their appearance. Some of them are shiny while others are dull.

Elements are divided into three broad groups; namely, metals, metalloids and non-metals. Sodium, magnesium, potassium, etc. are metals. Similarly, silicon, germanium, arsenic, etc. are metalloids. Chlorine, neon, carbon, etc. are some of the examples of non-metals.

Metal

Metals are generally hard and shiny substances that are good conductors of heat and electricity. Elements like gold, copper, sodium, magnesium, calcium, tin, iron, etc. are examples of metals.

Memory Tips

Metals that are liquids at room temperature are mercury (Hg) and gallium (Ga). Bromine is a liquid non-metal at room temperature.

If we observe the utensils in our kitchen, most of them are shiny, hard and difficult to break. They also produce a tinkling sound when we hit them gently with a hammer. They have a high melting point. So, we use them for cooking food. Metals are very strong and do not break into pieces easily. So, they are also used for making buildings, bridges, weapons, etc. Some metals are also used for making jewellery, idols, coins, etc. Metals like iron and aluminium are widely used for making engines, weapons etc.

Properties of metals

i. Most of the metals are hard and strong.

ii. They have high melting and boiling points.

iii. They are good conductors of heat and electricity.

iv. Metals possess a metallic lustre (i.e., shine).

v. They are malleable (i.e., metals can be converted into thin sheets when beaten).

vi. They are ductile (i.e., metals can be drawn into wires).

vii. They are sonorous (i.e., metals produce tinkling sound on hitting.

Activity

Get any piece of metal. Observe its physical properties.

Fact with Reason

Copper is used for making electrical wires. Why?

Copper is used for making electrical wires because it is a malleable, ductile and good conductor of electricity.

a. Gold

Gold is a soft and yellow shiny metal. It is found in quartz veins and alluvial soil as a free metal or sometimes in a combined state. It is widely distributed but a rare metal on the earth crust.

gold

ornaments of gold

Properties of gold

i. Pure gold is most malleable and ductile.

ii. It has a yellow bright lustre.

iii. It is one of the softest metals (hardness, 2.5 to 3 on the Mho scale).

iv. It is a good conductor of heat and electricity.

v. It melts at about 1064°C, boils at about 2856°C and has a specific gravity of 19.3.

vi. Gold is an extremely inactive metal. It is also called a noble metal. It does not react with air, moisture, acid, alkali and most solvents.

Memory Tips

Aquaregia is a mixture of three parts of concentrated hydrochloric acid and one part of concentrated nitric acid.

Uses of gold

i. Gold is widely used for making coins, idols, statues, medals, jewellery, etc.

ii. It is used to make gold leaf electroscopes and in the arts of gilding and lettering.

iii. Radioisotopes of gold are used in biological research and the treatment of cancer.

iv. It is also required in the manufacturing of televisions, video cassette recorders, cell phones and computers.

v. Gold is highly resistant to bacteria. So, dentists use it to repair or replace damaged or decayed teeth.

Fact with Reason

Gold is also used in dentistry, why?

Gold is also used in dentistry to make teeth because it is highly resistant to air, water, chemicals and bacteria.

b. Silver

Silver is a soft metal with a white shiny lustre. It occurs naturally in both pure states and combined states. The important ore of silver is argentite.

silver

silver dinner set

Properties of silver

i. Pure silver has the highest electrical and thermal conductivity among all metals.

ii. After gold, silver is the most malleable and ductile metal.

iii. Silver melts at about 962°C, boils at about 2162°C and has a specific gravity of 10.5.

iv. It does not react with oxygen or water at ordinary temperatures.

v. It does not react with dilute acids.

Memory Tips

Ore is a naturally occurring solid material from which a metal can be extracted profitably.

Uses of silver

i. Silver is used for making jewellery, coins, idols, statues, etc.

ii. It is used to coat smooth glass surfaces for mirrors.

iii. It is used in the circuit of electrical and electronic components.

iv. Compounds of silver are used in medicines.

v. It is used to fill cavities caused by tooth decay.

c. Copper

Copper is a reddish-brown metal. It is the 25th most abundant element in the earth's crust. It also occurs freely in nature but is mostly found in combined states. The major ore of copper is chalcopyrite.

copper

copper pots

Properties of copper

i. It is a good conductor of heat and electricity.

ii. It melts at about 1085°C, boils at about 2562°C and has a specific gravity of 8.95.

iii. It is malleable and ductile.

iv. It turns into black oxide on heating.

v. It reacts with an acid to form salt and hydrogen gas.

Uses of copper

i. Copper is used for making household cooking utensils.

ii. It is widely used for making electric wires in house wiring, lamp cords, electrical devices such as generators, motors, controllers, signalling devices, electromagnets, communications equipment, etc.

iii. It is used for making coins, medals, statues, etc.

iv. It is used for making alloys like brass, bronze, etc.

v. Copper compounds are used in medicines for making fungicides and germicides.

d. Iron

Iron is one of the oldest metals discovered and used by mankind. It is the most popular metal for making different things. Iron does not occur in a free state but mainly occurs in a combined state making different ores. Haematite is a major ore of iron. A very small amount of iron occurs in natural water, plants' body and even in human blood. Red blood cells contain iron in haemoglobin which makes our blood red.

iron

steel dinner set

Memory Tips

Humans' blood looks red due to the presence of an iron-containing compound called haemoglobin.

Fact with Reason

Why is iron used for construction?

Iron is used for construction because it is rigid and tensile.

Properties of iron

i. Pure iron is a greyish-white metal.

ii. Pure iron melts at about 1538°C, boils at about 2861°C and has a specific gravity of 7.87.

iii. It is malleable, ductile and good conductor.

iv. When a piece of iron is exposed to moist air for a long time, a layer of reddish-brown substance is formed on its surface called rust.

v. It reacts with oxygen to form iron oxides.

Use of iron

i. Iron is used for manufacturing machines, vehicles, arms and bullets, etc.

ii. Iron is used for making cooking utensils and household utensils.

iii. Iron rods and wires are used in the construction of buildings, bridges, hydropower stations, tunnels etc.

iv. Iron is used for manufacturing stainless steel which is widely used for making various domestic, medical and industrial equipment and utensils.

v. Iron compounds are used for medicinal purposes in the treatment of anaemia.

e. Aluminium

Aluminium is the most abundant metal in the earth's crust. It is the third most plentiful chemical element on our planet (after oxygen and silicon). Bauxite is a hydrated oxide of aluminium. It is a major ore of aluminium.

aluminium

aluminium engine blocks

Fact with Reason

Aluminium is preferred for long-distance high voltage transmission lines, why?

Aluminium is preferred for long-distance high voltage transmission lines because it is lighter in comparison to copper.

Aluminium reacts with air but rusting does not occur on aluminium, why?

Aluminium reacts with air but rusting does not occur because once it reacts with air, a thin film of aluminium oxide is formed over its surface. This thin film covers aluminium from its outer surface. As a result, it prevents further rusting.

Memory Tips

Aluminium is present in more than 270 minerals. It is the most abundant element on the earth's crust after oxygen and silicon. It is also the most abundant metal found naturally on the earth.

Properties of aluminium

i. Aluminium is a silvery-white metal with lightweight.

ii. It melts at 660°C, boils at 2519°C and has a specific gravity of 2.7.

iii. It is highly malleable and ductile.

iv. It does not rust.

v. It is a good conductor of heat and electricity.

Uses of aluminium

i. Aluminium is used in the construction of aircraft, trains, automobiles, etc.

ii. It is used for making cooking utensils and other household utensils.

iii. It is used for making electric wires and overhead electric cables.

iv. It is used for making coins and alloys.

v. It is used for making foils and food wrappers.

Fact with Reason

Aluminium is widely used in aircraft, trains and vehicles, why?

Aluminium is widely used for making parts of aircraft, trains and vehicles because it is a light metal and does not get rusted. It is highly malleable and ductile.

f. Zinc

Zinc is a useful metal. It has a bluish lustre. It is obtained from zinc blende. It is malleable and ductile. It forms rust in moist air but it takes decades. A little amount of zinc is necessary for the human body.

zinc

Zinc roofing plates

Properties of zinc

i. It is malleable and ductile at a higher temperature.

ii. It reacts with dilute hydrochloric acid to produce hydrogen.

iii. Zinc is a lustrous bluish-white metal.

iv. Its melting and boiling points are 420°C and 907°C respectively.

v. Its specific gravity is 7.133.

Uses of zinc

i. It is used to make medicines.

ii. It is mixed with copper to make brass and bronze.

iii. Zinc is used to make roofing materials.

iv. It is used to make batteries.

v. Hydrogen gas can be produced by using zinc in the laboratory.

Activity

List the various metallic equipment used in your home. Identify the metals and mention their name.

Non-metals

Non-metals are generally soft substances that are bad conductors of heat and electricity. Examples of non-metals are sulphur, iodine, chlorine, carbon, etc. Hydrogen, which is a non-metal, is used to prepare vegetable ghee. Carbon is used for making electrodes in a cell. Nitrogen is used by plants to synthesize protein. Oxygen gas is the most important non-metal that we need for respiration.

Properties of Non-metals

i. Non-metals are relatively soft in comparison to metals and they occur as solids, liquids or gases.

ii. Non-metals are bad conductors of heat and electricity (except graphite which conducts heat and electricity).

iii. Non-metals do not have a metallic lustre and are dull.

iv. Non-metals are neither malleable nor ductile.

v. Hard non-metals are brittle (i.e., breaks into pieces).

vi. Non-metals usually have low melting and boiling points.

vii. Non-metals do not produce tinkling sounds on hitting.

Activity

Take some connecting wires, a cell, switch and a bulb. Insert different pieces of substances in the plug like a piece of iron, paper, plastic, wood and glass to make the circuit closed. Does the bulb glow? What type of substances glows the bulb and what type do not glow the bulb? Conclude.

Activity

Burn a candle. Take a spoon and heat its one end. Does the heat transfer to your fingers? Again, take a stick, wood, plastic, etc. to do the same. Do they conduct heat? Write down which substances conduct heat and which do not.

Differences between metals and non-metals:

SN	Metals	SN	Non-metals
1	Metals are malleable and ductile.	1	Non-metals are non-ductile and brittle.
2	They are good conductors of heat and electricity.	2	Non-metals are bad conductors of heat and electricity.
3	Metals are solids at room temperature.	3	Non-metals are found in all three states at room temperature.
4	They have a metallic lustre.	4	They do not have lustre.

a. Sulphur

Sulphur is a tasteless, odourless, light yellow, non-metallic element. Free sulphur occurs due to the weathering of sulphur-containing rocks. In a combined state, sulphur is found as sulphide of lead, zinc, silver, etc. Sulphur is found mixed with gypsum and pumice stone especially in volcanic regions. It is present in the molecules of many organic substances such as mustard, egg, hair, proteins and oil of garlic, etc.

sulphur

sulphur based antifungal cream

Memory Tips

Vulcanization is a chemical process for converting natural rubber into more durable materials by the addition of sulphur.

Properties of sulphur

i. It is insoluble in water.
ii. It is a tasteless and odourless element.
iii. It is a poor conductor of heat but a bad conductor of electricity.
iv. It reacts with oxygen to give sulphur dioxide.
v. It melts at 115.21°C and boils at 444.6°C.

Uses of sulphur

i. Sulphur is used to produce sulphuric acid.
ii. It is used in the manufacturing of sulpha drugs and many skin ointments.
iii. It is used in the production of matchsticks, firecrackers, dyes, gunpowder, etc.
iv. Sulphur is used for making fungicides, germicides and insecticides.
v. It is used for the hardening of rubber by heating rubber with sulphur.

b. Iodine

Iodine is a volatile non-metal. Its symbol is 'I'. Iodine is one of the important trace elements needed for the human body. It has a growth controlling and metabolic function. The deficiency of iodine in the diet of a pregnant woman disturbs the mental growth of a foetus.

sulphur

iodex ointment antiseptic

Iodine deficiency also causes goitre. A goitre is a swelling in the neck resulting from an enlarged thyroid gland. Iodised salt is the major source of iodine for us. Open and sunlight exposed salts contain no or less iodine. So, we should not consume such salts.

Properties of iodine

i. It is a blue-black solid at room temperature.
ii. It is slightly soluble in water.
iii. Its melting point is 113.7°C and its boiling point is 184.3°C.
iv. It has lustre.
v. Its density is 4.93 g/cm^3 at room temperature.

Uses of iodine

i. Iodine along with potassium iodide is dissolved in an alcohol solution to make a tincture of iodine.
ii. It is used as an antiseptic and disinfectant. A disinfectant kills micro-organism and an antiseptic prevents the growth of micro-organisms.
iii. Iodine is also used to make iodex ointment. Iodex ointment contains 4.7% iodine which is commonly used as a topical antiseptic.
iv. It is used to make iodex balm. Iodex Balm is an ayurvedic pain relief balm. It provides a warm and peaceful effect that relieves pain.

v. Compounds of iodine are used in photography, making dyes, germicides, etc.

Fact with Reason

We should use Iodised salt. Why?

Iodised salt contains iodine. It is an important nutrient in our body for our physical and mental development. The thyroid gland in our body uses iodine to make thyroid hormones. If the salt is kept open for a long time or cooked at a higher temperature then the volatile iodine might evaporate entirely.

Answer writing skill

1. Define malleability.

The property of metals to be beaten into a thin sheet is called malleability.

2. What disease is caused by a deficiency of iodine?

The disease caused by a deficiency of iodine is goitre.

3. Why is gold used for making ornaments?

Gold is used for making ornaments because it is a yellow shiny metal with high malleability and ductility. It also does not react with air, water, acids, base and other chemicals in ordinary conditions.

4. Copper is used for making cooking utensils, why?

Copper is used for making cooking utensils because it is a good conductor of heat. Copper is also highly malleable and ductile, making it possible to give design to cooking pots.

5. Iron does not occur in a free state in nature, why?

Iron is a reactive metal. It reacts with air, water, acid, base and other elements in normal conditions to form various compounds. So, iron does not occur in a free state in nature.

6. Differentiate between gold and iodine.

Differences between gold and iodine are:

SN	Gold	SN	Iodine
1	Gold is malleable and ductile.	1	Iodine is brittle and non-ductile.
2	It is good conductors of heat and electricity.	2	It is bad conductors of heat and electricity.
3	It melts at about 1064°C, boils at about 2856°C.	3	Its melting point is 113.7°C and its boiling point is 184.3°C.

EXERCISE

Step 1

1. Fill in the blanks.

sulphur	wires	gold	electrum	lustre

a. Pure …….. has the highest malleability and ductility.

b. Copper …….. are used for making high voltage transmission lines.

c. Gun powder is made from …….

d. Metals possess a metallic …….

e. The naturally occurring gold-silver alloy is called …….

2. Tick the correct and cross the false statement.

a. Mercury is a solid metal.

b. Non-metals are bad conductors of heat and electricity.

c. Argentite is an ore of gold.

d. Aluminium is used to make body parts of aircraft.

e. Sulphur is widely used as a semiconductor.

3. Choose the correct answer from the given alternatives.

a. What is used to make gun powder?

i. Sulphur ii. Copper

iii. Gold iv. Iodine

b. Which metal has a specific gravity of 2.7 and is used to make parts of aircraft?

i. Gold ii. Aluminium

iii. Copper iv. silver

c. What is used to make iodized salt?

i. Sulphur ii. Iodine

iii. Chlorine iv. Zinc

d. What is obtained from argentite ore and used to make coins and medals?

i. Copper ii. Silver

iii. Gold iv. Aluminium

e. What is a yellow shiny metal used to make jewellery?

i. Copper ii. Sulphur

iii. Gold iv. Iron

4. Match the following

Silver	7.13
Melting point of copper	Ag
Iron	aluminium
Bauxite	haematite
specific gravity of zinc	1085°C

Step 2

5. Answer the following questions in one word.

a. Give an example of metal.

b. Write down the name of the non-metal which is insoluble in water and used for making gun powder?

c. Which side of the modern periodic table contains metals?

d. Which metal is present in human blood?

e. What is the ability of a metal to be drawn into wires called?

6. Differentiate between the following.

i. Metal and non-metal

ii. Haematite and bauxite

iii. Gold and Silver

7. Give reason

a. Metalloids are used in electronic devices.

b. Aluminium is widely used in aircraft, trains and vehicles.

c. Silver is also used in dentistry.

d. Gold is used to make jewellery.

8. Study the given diagram.

i. What is shown in the diagram?

ii. What is its source?

iii. What is it used for?

Step 3

9. Answer the following questions.

a. What are metals? Give four examples.

b. Write any four properties of metals.

c. Define non-metals. Give four examples.

d. What are the properties of non-metals?

e. Write down any three properties of the following elements.

i. Silver
ii. Aluminium
iii. Iron
iv. Sulphur
v. Copper
vi. Gold
vii. Iodine

f. Write down any four uses of the following elements.

i. Silver
ii. Aluminium
iii. Iron
iv. Sulphur
v. Copper
vi. Gold
vii. Iodine

10. What happens if we do not consume sufficient iodine?

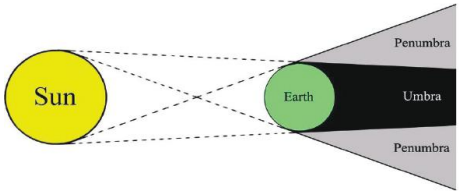
UNIT

11 EARTH AND SPACE

ESTIMATED TEACHING PERIODS	TH	PR
	8	4

Introduction

Space is the vast region that lies beyond the atmosphere of the earth including all the celestial bodies. In this space, an uncountable number of celestial bodies are present. These celestial bodies form clusters of different shapes and sizes called galaxies. Our solar system is a small portion of the Milky Way galaxy. In the solar system, there are eight planets and their satellites, comets, meteors, meteorites, asteroids, etc. In the solar system, life exists only on the earth. The age of the earth is estimated to be 4.5 billion years. In this unit, there are four sub-units. They are:

Unit 11.1 Rocks	Unit 11.2 Planets
	
Unit 11.3 Moon	**Unit 11.4 Eclipse**
	

Unit
11.1

Rocks

Estimated teaching periods	
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2	1

Syllabus issued by CDC

- Rocks and their formation
- Types and importance of rocks
- Useful rocks found in Nepal

Learning Outcomes

After completion of this unit, students will be able to:

- introduce rock and describe its types.
- describe the importance of rock and identify the rocks found in Nepal.

Terms and terminologies

1. **Space:** Space is the vast region that lies beyond the atmosphere of the earth including all the celestial bodies.
2. **Lithosphere:** The solid portion of the earth's crust is called the lithosphere.
3. **Soil:** Soil is unconsolidated material of the earth's surface made from weathered rock.
4. **Hydrosphere:** The watery portion of the earth that includes the seas and the oceans is called the hydrosphere.
5. **Rocks:** Rocks are solid aggregates of one or more minerals.
6. **Weathering of rock:** Breaking down of rocks due to the effect of various physical and chemical activities is called the weathering of rocks.
7. **Sedimentary rock:** The rocks that are formed by the accumulation and cementing of deposited sediments are called sedimentary rocks.

8.	Conglomerate:	It is a sedimentary rock that contains large round particles.
9.	Limestone:	It is a rock that is composed mainly of calcium carbonate.
10.	Shale:	It is a sedimentary rock that is made up of clay and silt granules.
11.	Sandstone:	It is a sedimentary rock that is made up of mainly sand-sized granules.
12.	Igneous rocks:	Rocks that are formed by the solidification of magma are called igneous rocks.
13.	Granite:	Granite is a coarse-grained plutonic igneous rock with visible crystalline formation.
14.	Obsidian:	Obsidian is a volcanic rock that forms from the very rapid cooling of molten rock material.
15.	Pumice:	Pumice is a very light and porous volcanic igneous rock having a spongy texture.
16.	Metamorphic rocks:	The rocks that are formed by the modification of pre-existing rocks as a result of heat, pressure and chemical processes are called metamorphic rocks.

Introduction

Our earth is made up of natural elements and their compounds. All these elements and their compounds exist in three major forms: solid, liquid and gas. The solid portion of the earth's crust is called the lithosphere. Oxygen, silicon, aluminium and iron are the major elements that are found in the lithosphere. The lithosphere is made up of rocks. The upper thin part of the lithosphere is covered by a weathered rock called soil. Soil is unconsolidated material of the earth's surface. Rocks are consolidated materials that form the lithosphere. The watery portion of the earth that includes the seas and the oceans is called the hydrosphere.

Memory Tips

Ocean crust is made up of denser minerals than the continental crust.

Rocks

Rocks are solid aggregates of one or more minerals. Minerals are inorganic substances that have specific chemical compositions and characteristics.

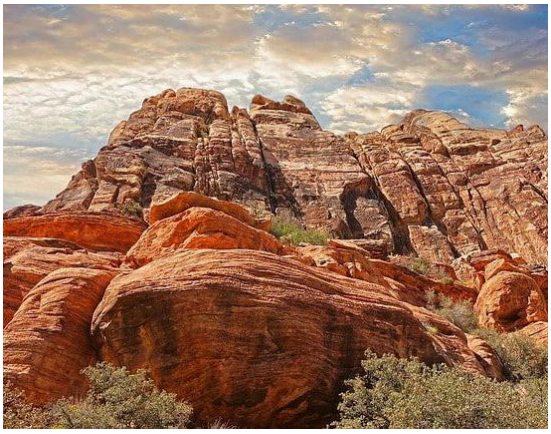


fig. rocks

Example: Talc, gypsum, calcite, apatite, topaz, diamond, etc. Breaking down of rocks due to the effect of various physical and chemical activities is called the weathering of rocks. It takes hundreds of years to weather rocks. Weathered rocks form pebbles, gravel, sand, silt and clay. In simple words, soil forms due to the weathering of rocks.

Memory Tips

Earth's outer solid layer, the lithosphere, is made up of rocks.

Fact with Reason

Rock is an important natural resource, why?

Rock is an important natural resource because it can be used in construction, making of idols, decoration, etc.

Activity

Find a rock from your surroundings. Observe its property.

Types of rocks

Based on their formation, rocks can be divided into three major types. They are sedimentary rocks, igneous rocks and metamorphic rocks.

a. Sedimentary Rocks

The lithosphere of the earth is continuously weathered and eroded by the action of heat, water, wind and ice. The fine eroded materials

resulting from the weathering of rocks are called sediments. These sediments get accumulated at the bank or bottom of lakes, seas and oceans layer by layer and get cemented to form rocks. The rocks that are formed by the accumulation and cementing of deposited sediments are called sedimentary rocks. Sometimes, the remains of dead plants and animals also get trapped during the formation of sedimentary rocks. Due to this reason, we find remains or imprints of organisms preserved as fossils in sedimentary rocks. Sedimentary rocks with smooth faces and fossils in them are called *Shaligrams*. They are found in Nepal.

Memory Tips

The Taj Mahal in India is made entirely out of marble.

Some of the examples of sedimentary rocks are shale, conglomerate, sandstone, limestone, dolomite, halite, gypsum, etc.

fig. different sedimentary rocks

Fact with Reason

Fossils may be present in sedimentary rocks. Give reason.

Fossils may be present in sedimentary rocks because organic matters are trapped during the sedimentation of sand particles, mud, etc.

Activity

Observe the surroundings. Is there any structure made on sedimentary rock? Make a list.

Some important sedimentary rock

i. Conglomerate

It is a sedimentary rock that contains large round particles. The space between the pebbles is generally filled with smaller particles like sand and chemical cement that bind the rock together. Silica is the common cementing material in such rocks.

fig. conglomerate

Memory Tips

Conglomerate rocks are colourful and attractive; however, they are rarely used as ornamental stones for interior use because of their unreliable physical strength and durability.

Fact with Reason

The conglomerate is a sedimentary rock, why?

The conglomerate is a sedimentary rock because it is formed by the deposition of pebbles, cement etc.

ii. Limestone

It is a rock that is composed mainly of calcium carbonate. It can be formed by the accumulation of shells, coral, algae and other organic matters. Limestone is used in the production of cement, crushed stone, etc.

fig. limestone

Memory Tips

Limestone turns into metamorphic rock marble when subjected to high amounts of pressure and heat.

iii. Shale

fig. shale

It is a sedimentary rock that is made up of clay and silt granules. Shale typically breaks into thin flat pieces and is famous roofing and paving material.

iv. Sandstone

sandstone

It is a sedimentary rock that is made up of mainly sand-sized granules. The cementing material that binds together the grains of sand is usually composed of silica, calcium carbonate or iron oxide.

b. Igneous rock

The mantle is the layer of the earth below the crust. Due to its high temperature, rocks and minerals are found in a molten form. Such a mixture of molten rocks and minerals is called magma. Rocks that are formed by the solidification of magma are called igneous rocks. As igneous rocks are formed from molten magma, they do not bear fossils in them.

Fact with Reason

Igneous rocks are called granular rocks, why?

Igneous rocks are called granular rocks because they contain granules formed during the rapid crystallization of magma.

Memory Tips

There are over 700 different kinds of igneous rocks that have been identified.

Fact with Reason

Igneous rocks do not have fossils, why?

Igneous rocks do not have fossils because they are formed when hot magma solidifies. So, any plant parts will be burnt away.

Some important Igneous rock

i. Granite

Granite is a coarse-grained plutonic igneous rock with visible crystalline formation. It mainly contains minerals like quartz, feldspar and mica. It is an important building material.

fig. granite

Memory Tips

Granite has been used for thousands of years as a building material for bridges, paved roads, monuments, granite slabs, tiles and many others.

Fact with Reason

Granite is an igneous rock. Why?

Granite is an igneous rock because it is formed by the solidification of magma.

ii. Obsidian

Obsidian is a volcanic rock that forms from the very rapid cooling of molten rock material. It cools so rapidly that there is no formation of crystals. Obsidian is usually black, red or brown. Obsidian is a glassy igneous rock.

fig. obsidian

Memory Tips

Obsidian is also known as "nature's glass" because of its glassy appearance.

ii. Pumice

Pumice is a very light and porous volcanic igneous rock having a spongy texture. It is composed largely of glass. It is formed by the very rapid solidification of lava. A form of fine-grained pumice is used in cement.

fig. pumice

Memory Tips

Ninety Five percent of the earth's crust is made of igneous rock.

Differences between igneous rock and sedimentary rock are:

SN	Igneous rock	SN	Sedimentary rock
1	Rocks that are formed by the solidification of magma are called igneous rocks.	1	Rocks that are formed by the accumulation and cementing of deposited sediments are called sedimentary rocks.
2	Igneous rocks do not contain fossils. Example: pumice	2	Sedimentary rocks may contain fossils. Example: limestone

c. Metamorphic rock

In nature, sedimentary or igneous rocks buried deep below the earth's surface area are exposed to various extreme conditions like high temperature, pressure and chemical changes. These conditions alter the texture, minerals and chemical composition of the rocks. The rocks that are formed by the modification of pre-existing rocks as a result of heat, pressure and chemical processes are called metamorphic rocks.

Memory Tips

Metamorphic rocks are so called because they always begin as another type of rock.

The chart below is of some of the metamorphosed forms of pre-existing rocks.

S.N.	Metamorphic rocks	Parent rock
1.	Marble	Limestone or dolestone
2.	Slate	Shale
3.	Quartzite	Sandstone
4.	Gneiss	Granite or diorite
5.	Schist	Shale or mudstone
6.	Phyllite	Slate

Fact with Reason

Why is slate used to pave paths?

Slate is used to pave paths because it is thin, flat and strong.

Memory Tips

Diamond is the hardest mineral.

Useful rocks found in Nepal

Nepal is a mountainous country with rocky terrain. Hence, there is a large deposit of different types of rocks. Some of the common rocks found in Nepal are discussed below:

i. Conglomerate

The conglomerate is a coarse-grained sedimentary rock formed by the aggregation of rocks fragments. These rock fragments are held together by cementing materials like clay. It is a low-quality rock as it has low strength. It is a common rock of Nepal and is found in rivers.

ii. Sandstone

Like conglomerates, sandstone is also a sedimentary rock formed by the binding of sand particles. Sand particles are bound by a mineral

cement. It is a low-quality rock as it has low strength. In Nepal, sandstone is usually found in a flood plain. It is used as building material mainly for flooring and pavements.

Memory Tips

It takes thousands of years to form sandstone.

iii. Silica

Silica itself is not a rock but a mineral compound formed from silicon and oxygen. High-quality silica is present in a place called Karrakhola in the Makwanpur district of Nepal. Silica is an important material used in the manufacture of cement and glass.

iv. Limestone

Limestone is a sedimentary rock formed by the accumulation of the mineral called calcium carbonate. It is one of the most extracted minerals of Nepal used for the manufacturing of cement. Nepal has large deposits of limestone. Places like Godavari (Lalitpur), Bhainse (Makwanpur), Jogimara (Dhading), Sindhuli (Udaypur), Kakarukhola (Sindhuli), Gandari (Dang), etc. have deposits of limestone.

v. Marble

Marble is a high-quality metamorphic rock. It is widely used for construction purposes especially in indoor decoration in the staircase, toilets, room floors, etc. Some of the major deposits of marble in Nepal are in Godavari (Lalitpur), Anekot (Kavre) and Chhatre Deurali (Dhading).

vi. Slate

Slate is a fine-grained metamorphic rock formed by the metamorphosis of mudstone or shale. Deposits of slate are present in many districts of Nepal, among which Tanahun, Nuwakot,

Sindhupalchok, Dhadhing, Baglung, Parbat, Jajarkot, Accham, Doti, Dadeldhura, etc. are a few to name.

Memory Tips

Slate is used for different varieties of flooring and roofing.

Answer writing skill

1. What rocks are found in Nepal?

Some important rocks found in Nepal are sandstone, silica, limestone, marble and slate.

2. Write any two differences between sandstone and granite.

Differences between sandstone and granite are:

SN	Sandstone	SN	Granite
1	Sandstone is a sedimentary rock formed by the binding of sand particles.	1	Granite is a coarse-grained plutonic igneous rock with visible crystalline formation.
2	Sandstone is made up of sand particles bound by chemical cement.	2	Granite contains mainly quartz, feldspar, and mica minerals.

3. Pumice floats in water. Why?

Pumice floats in water because it is very porous and contains air inside it.

4. What do you mean by weathering of rock?

Breaking down of rocks due to the effect of various physical and chemical activities is called weathering of rocks.

5. What is a metamorphic rock? Give two examples.

The rocks that are formed by modification of pre-existing rocks as a result of heat, pressure and chemical processes are called metamorphic rocks.

Examples: marble, quartzite

6. How fossils are trapped in sedimentary rocks? Give reason.

Fossils are trapped in sedimentary rocks because they are formed by sedimentation of soil, organic materials, sand and minerals for millions of years.

EXERCISE

Step 1

1. Fill in the blanks.

lava	4.5 billion years	igneous	Makwanpur	soil

a. The age of the earth is estimated to be ..... .

b. The eroded rock is called ..... .

c. The mixture of molten rocks and minerals is called ..... .

d. Granite is a coarse-grained ..... rock with visible crystalline formation.

e. Silica is available in ..... of Nepal.

2. Tick the correct and cross the false statement.

a. Rocks are consolidated materials that form the lithosphere.

b. Rocks are the solid aggregates of one or more minerals.

c. Breaking down of rocks is called weathering of rocks.

d. Crystals are substances with a definite geometrical arrangement.

e. The fine eroded materials resulting from the weathering of rocks are called sediments.

3. Choose the correct answer from the given alternatives.

a. What one is a mineral?

i. Talc ii. Gypsum

iii. Topaz iv. All

b. Which one is not a sedimentary rock?

i. Sandstone ii. Shale

iii. Slate iv. Limestone

c. Which one is an igneous rock?

i. Granite ii. Slate

iii. Mudstone iv. Diamond

d. Which one is a metamorphic rock?

i. Gneiss ii. Phyllite

iii. Slate iv. All

e. What rock is formed when dolomite changes?

i. Marble ii. Graphite

iii. Diamond iv. Schist

4. Match the following

Shale	Shaligram
Magma	slate
Rock with fossil	Sandstone
Sedimentary rock	metamorphic rock
Gneiss	Igneous rock

Step 2

5. Answer the following questions in one word.

a. Name the hardest rock.

b. Write the name of one mineral deposit found in Godavari (Lalitpur) of Nepal.

c. What is a hard solid substance made of minerals called?

d. What type of rock is pumice?

e. Give an example of metamorphic rock.

6. Differentiate between the following.

a. Sedimentary rocks and igneous rocks

b. Marble and conglomerate

7. Give reason

a. Sedimentary rocks may have fossils in them.

b. Igneous rocks are important for the scientist.

c. Obsidian is an igneous rock.

8. Write the name of the rock shown in the diagram.




Step 3

9. Answer the following questions.

a. What is a rock?

b. List any four importance of rocks.

c. How is soil formed?

d. How are sedimentary rocks formed?

e. Explain how igneous rocks are formed.

f. What is metamorphic rock? Describe the process of formation of metamorphic rocks.

g. Name any four major rocks found in Nepal. Where are they found?

10. Complete the table.

S.N.	Metamorphic rocks	Parent rock
1.	Marble	.....
2.	Slate	.....
3.	Quartzite	.....
4.	Gneiss	.....
5.	Schist	.....
6.	Phyllite	.....

Unit
11.2

Planets

Estimated teaching periods	
Th	Pr
2	1

Syllabus issued by CDC

- Comparative study of planets: shape, distance from sun, rotation and revolution

Learning Outcomes

After completion of this unit, students will be able to:

- make a general comparative study of planets based on details including shape, distance from the sun, duration of rotation, duration of revolution etc.

Terms and terminologies

1. **Solar system:** The solar system is the family of the sun including the planets and their satellites, asteroids, meteors, comets, interplanetary dust and gas.
2. **Planets:** The heavenly bodies that revolve around the sun in their elliptical orbit are called planets.
3. **Inner planets:** The planets that lie inside the asteroid belt are called inner planets.
4. **Outer planets:** The planets that lie outside the asteroid belt are called outer planets.
5. **Satellite:** A heavenly body that revolves around a planet is called a satellite.
6. **Mercury:** Mercury is the smallest planet in the solar system.
7. **Venus:** Venus is the hottest and brightest planet in the solar system.
8. **Earth:** Earth is the third planet from the sun which is also our home planet.
9. **Mars:** Mars is the fourth, cold, dusty and red terrestrial planet.
10. **Jupiter:** Jupiter is the largest planet in our solar system.
11. **Saturn:** Saturn is the sixth planet from the sun and it is the second-largest planet in the solar system.
12. **Uranus:** Uranus is the seventh planet from the sun.
13. **Neptune:** Neptune is the eighth and the farthest planet from the sun.
14. **Stars:** Stars are extremely hot masses of gases that produce heat and light.

Solar system

solar system

The solar system is the family of the sun including the planets and their satellites, asteroids, meteors, comets, interplanetary dust and gas. The force of gravitation between the heavenly bodies helps them to maintain their position in the solar system. The sun is the main member of the solar system which remains at the centre.

Memory Tips

Almost all life on earth is supported by the sun through photosynthesis.

Fact with Reason

Why is the sun called the father of the solar system?

The sun is called the father of the solar system because its gravity pulls every planet around it and thus helps to create the solar system.

Eight planets revolve around the sun. The first four planets Mercury, Venus, Earth and Mars, have land. Their crust is made of rock and soil. Therefore, these are called terrestrial planets. The remaining four planets Jupiter, Saturn, Uranus and Neptune do not have rocky land. These are gigantic planets. They are made up of gases and liquid. They may have a solid core. They are called gas giants. The region between Mars and Jupiter has at least 1 million of asteroids. This region is called the asteroid belt. These asteroids revolve around the sun. The planets that are inside the asteroid belt are called inner planets. Mercury, Venus, Earth and Mars are inner planets. Jupiter, Saturn, Uranus and Neptune are outside the asteroid belt. They are called outer planets. The planets that lie outside the asteroid belt are called outer planets.

Activity

Draw a diagram of the solar system on chart paper.

Fact with Reason

The first four planets are called terrestrial planets. Why?

The first four planets are called terrestrial planets because they are made up of rocks and soil.

2.2 Planets

The heavenly bodies that revolve around the sun in their elliptical orbit are called planets. There are eight major planets in the solar system. They are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. There are also several small, dwarf planets in the solar system. Some of the dwarf planets are Pluto, Eris and Ceres. Planets revolve around the sun and at the same time rotate around on their axes.

Memory Tips

Planets do not have their own light as nuclear fusion does not occur in them.

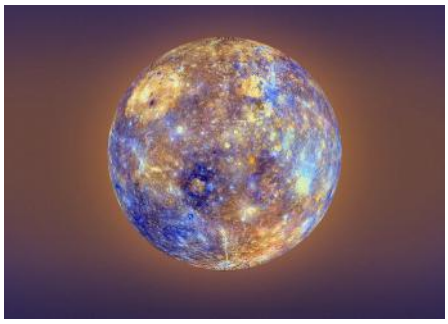
A heavenly body that revolves around a planet is called a satellite. Planets are different from asteroids and comets. Asteroids and comets are smaller bodies that also orbit the stars. Planets do not emit light as the stars do but reflect the light of the sun. This makes planets shine in the dim sky.

Fact with Reason

Earth is a planet. Why?

Earth is a planet because it is a huge round heavenly object revolving around the sun.

Mercury



Mercury

It is the closest planet to the sun. It is also the smallest planet of the solar system which is only a bit larger than the moon. The side of Mercury facing the sun is very hot as the temperature reaches up to 427 °C. But the side facing away from the sun is very cold. The temperature on this side drops far below the freezing point. Mercury has no water and atmosphere to sustain life.

Memory Tips

Mercury is made up of mostly rock and heavy metals.

Venus

Venus

Venus is the second closest planet to the sun. It is the brightest planet in the solar system. Venus is the hottest planet because of the thick gases that trap solar heat. It does not support life. Venus spins slowly from east to west while most other planets revolve from west to east. It is also called morning star and evening star because it appears in the early morning in the eastern sky and evening in the western sky. It has also been discovered by the ancient people.

Memory Tips

Venus does not have any satellites.

Fact with Reason

Venus is called the evening star. Why?

Venus is called the evening star because it is seen in the western sky of the earth in the evening.

Earth

Earth

Earth is the third planet from the sun. About 71% of the earth is covered by water and the remaining 29% by land. It has an atmosphere primarily of nitrogen, oxygen and inert gases. It appears blue from the space due to the reflection of blue light by water. Therefore, this planet is also known as the blue planet. It is the only planet known to sustain life.

Memory Tips

Earth is the only planet in the solar system where life exists.

The important reasons for the survival of living beings on the earth are mentioned below:

i. The atmosphere of the earth contains nitrogen, oxygen and carbon dioxide that are vital for animals and plants.

ii. It contains an ozone layer in the atmosphere that protects us from harmful ultraviolet rays coming from the sun.

iii. Its atmosphere contains greenhouse gases like carbon dioxide, methane, water vapour, etc. that keep the earth's temperature constant.

iv. Plenty of salt water and fresh water is available for living organisms.

Fact with Reason

Earth is also known as the only living planet. Why?

Earth is also known as the only living planet because it is the only planet where life is present due to water, appropriate temperature and suitable atmosphere.

Mars

Mars is the fourth planet from the sun. It is a cold and dusty terrestrial planet. The dust of iron oxide, i.e., Limonite rock, gives the planet its reddish appearance. So, it is also known as the red planet. Mars shares similarities with Earth as it has mountains, valleys and storm systems. Its polar regions are capped by water ice and frozen carbon dioxide. Its atmosphere does not have sufficient oxygen for the survival of living beings. Mars is visible to the naked eye.

Mars

Memory Tips

The atmosphere of Mars contains a thin layer of carbon dioxide.

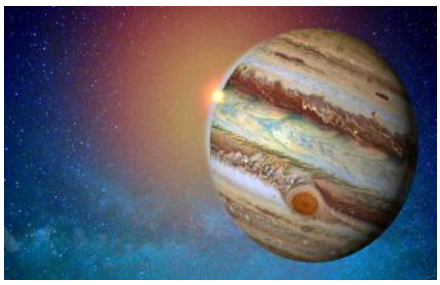
Fact with Reason

Mars is called a red planet.

Mars is called a red planet because of its reddish appearance due to limonite rocks.

Jupiter

Jupiter is the fifth planet from the sun and is the first outer planet. It is the largest planet in our solar system. It is a gaseous planet composed mostly of hydrogen and helium and other trace gases. Giant Red Spots are seen due to a giant storm on the surface of Jupiter. This planet has 67 satellites. It is also visible to the naked eyes.



Jupiter

Memory Tips

Jupiter is the fastest rotating planet in our solar system. Its days are only 10 hours long.

Activity

Jupiter is the fastest rotating planet in our solar system. Its days are only 10 hours long.

Saturn

Saturn is the sixth planet from the sun and it is the second-largest planet in the solar system. It is also a Jovian planet and is composed of mostly hydrogen and helium gases. This planet is well known for its beauty due to the presence of attractive rings. It has 62 satellites. It appears as one of the brightest yellowish objects in the night sky.

Saturn

Memory Tips

As the 5th brightest object in our solar system, Saturn can be seen with the naked eye and by using binoculars.

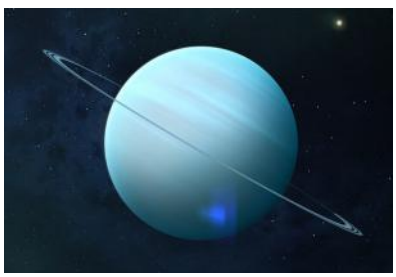
Fact with Reason

Saturn is called a Jovian planet.

Saturn is called a Jovian planet because it is a massive planet made up of gases and liquids.

Uranus

Uranus is the seventh planet from the sun. Uranus also rotates on its axis from east to west. It has an atmosphere of hydrogen, helium, methane and other gases. It has 27 satellites and faint rings.



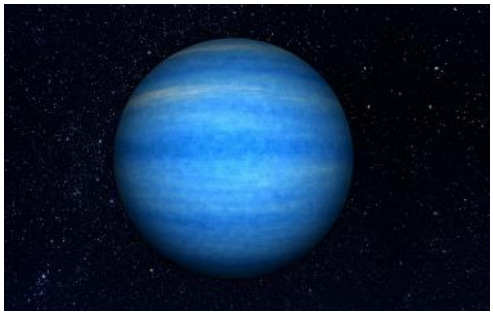
Uranus

Memory Tips

Uranus is the first planet to be discovered by the use of a telescope.

Neptune

Neptune is the eighth and the farthest planet from the sun. It is known for the strong winds which sometimes blow faster than the speed of sound. This cold planet has a rocky core. Its atmosphere is composed of hydrogen, helium, neon, etc.



Neptune

Memory Tips

Neptune is not visible to the naked eye.

Some important information on planets are tabulated below:

S. No.	Name of the planet	The average distance from the sun (In km)	Average diameter (In km)	Period of rotation (hour, days)	Period of revolution (days/years)	Number of satellites (Until 2017)
1.	Mercury	5.76×10^7	4851.2	58.85 days	87.97 days	0
2.	Venus	10.7×10^7	12035.2	243.02 days	224.7 days	0
3.	Earth	14.88×10^7	12672	23 hrs. 56 min.	365.25 days	1
4.	Mars	22.56×10^7	6742.4	24 hrs. 37 min. 22 sec.	286.98 days	2
5.	Jupiter	76.8×10^7	1139040	9 hrs. 55 min. 30 sec	12 years	67
6.	Saturn	144×10^7	115811.2	10 hrs. 30 min.	29.5 years	62
7.	Uranus	288×10^7	50441.6	17 hrs. 14 min. 24 sec.	84 years	27
8.	Neptune	448×10^7	48972.8	16 hrs. 6min 36 sec.	164 years	14

Stars

Stars are extremely hot masses of gases. The gases are primarily hydrogen and helium. Each light hydrogen nucleus fuses with another hydrogen nucleus and forms a heavier helium nucleus. This reaction is called nuclear fusion. Nuclear fusion releases a tremendous amount of energy in the form of heat and light.

Memory Tips

The sun is also a star which is the only source of heat and light energy for all the members of the solar system.

Fact with Reason

Why is the sun a star?

Sun is a star because the sun produces heat and light through nuclear fusion.

Answer writing skill

1. **Jupiter is a planet. Why?**

   Jupiter is a planet because it has no nuclear fusion and it revolves around the sun.

2. **Though mercury is nearest to the sun, it is not the hottest planet. Give reason.**

   Mercury is nearest to the sun but it is not the hottest planet because it has no atmosphere. It does not trap heat energy as Venus does.

3. **Which planet has the most distinct rings?**

   Saturn has the most distinct rings.

4. **Write a short note on the sun.**

   Sun is the hot burning ball of gases. Nuclear fusion releases an enormous amount of heat and light energy from the sun. The surface temperature of the sun is about 5500°C while its inner core may have a temperature up to 15.6 million degree celsius.

5. Differentiate between the inner planet and outer planet.

The differences between the inner planet and outer planet are:

SN	Inner planet	SN	Outer planet
1	The planets that are inside the asteroid belt are called inner planets.	1	The planets that lie outside the asteroid belt are called outer planets.
2	Inner planets are rocky.	2	Outer planets are gas giants.
3	They are smaller.	3	They are bigger.

6. Classify the sun, earth and moon as star, planet and satellite.

Sun: star Earth: planet Moon: satellite

EXERCISE

Step 1

1. Fill in the blanks.

gravity	planets	outer planets	mercury	asteroids

a. The heavenly objects that revolve around the sun are called ……

b. The solar system is held together by the ……. of the sun.

c. The region between Mars and Jupiter has more than a million ……

d. The planets that lie outside the asteroid belt are called …….

e. The closest planet to the sun is …….

2. Tick the correct and cross the false statement.

a. Mercury has water and atmosphere to sustain life.

b. Saturn is the largest planet.

c. Neptune takes the longest time for the completion of one revolution around the sun.

d. Venus spins slowly from east to west while most other planets revolve from west to east.

e. The atmosphere of the earth contains nitrogen, oxygen and carbon dioxide that are vital for animals and plants.

3. Choose the correct answer from the given alternatives.

a. How many satellites were discoverd around Jupiter by 2017?

i. 67 ii. 62

iii. 27 iv. 14

b. Which one is the smallest planet?

i. Mercury ii. Venus

iii. Earth iv. Mars

c. Which is an outer planet?

i. Mercury ii. Venus

iii. Earth iv. Jupiter

d. Which is an inner planet?

i. Jupiter ii. Earth

iii. Saturn iv. Neptune

e. What is the hottest planet?

i. Mercury ii. Venus

iii. Earth iv. Pluto

4. Match the following

Sun	revolves around sun
Planets	fusion of light hydrogen nuclei
Earth	brightest planet
Venus	blue planet
Nuclear fusion	medium sized star

Step 2

5. Answer the following questions in one word.

a. Which planet has a giant red spot?

b. Which is the largest planet in our solar system?

c. Write the name of the red planet.

d. How many satellites are there around Uranus?

e. How far is the earth from the sun?

6. Differentiate between the following.

a. Planets and stars

b. Inner planets and outer planets

7. Give reason

a. Earth is a terrestrial planet.

b. Venus is an inner planet.

c. Jupiter is called a Jovian planet.

d. Mars is a red planet.

e. Earth is a living planet.

8. Write the names of planets shown in the diagram.




Step 3

9. Answer the following questions.

a. What is the solar system?

b. Name the eight planets in the order of increasing distance from the sun.

c. What are terrestrial planets?

d. Define asteroid.
e. What supports life on the earth?
f. Write the names of the following planets.
    i. The hottest planet
    ii. Nearest planet from the sun
    iii. Farthest planet from the sun
    iv. Red planet

10. Draw a diagram of the solar system.

Unit
11.3

Moon

Estimated teaching periods	
Th	Pr
2	1

Syllabus issued by CDC

- Introduction of moon
- Phases of the moon
- Lunar calendar: bright half, dark half, a synodic month, sidereal month, adhikmaas and Kshaya maas

Learning Outcomes

After completion of this unit, students will be able to:

- explain the shape size and distance of the moon and discuss the revolution of the moon around the earth.
- demonstrate the phases of the moon and lunar calendar.

Terms and terminologies

1. **Moon:** Moon is the only natural satellite of the earth.
2. **Sidereal month:** The time taken by the moon to complete one revolution around the earth is called the sidereal month.
3. **Phases of the moon:** The different shapes of the illuminated portion of the moon as seen by an observer on the earth are called phases of the moon.
4. **Synodic month:** The time interval between two successive full moon days or new moon days is called synodic month.
5. **New moon:** A phase of the moon when the reflected light from its surface does not reach the earth and hence the moon is invisible is called the new moon.
6. **Waxing crescent:** The phase of the moon in increasing order of brightness from the new moon when less than

half of its face gets illuminated is called waxing crescent.

7. **First-quarter:** The phase of the moon in increasing order of brightness from the new moon when half of its face gets illuminated is called the first quarter.

8. **Waxing gibbous:** The phase of the moon in increasing order of brightness from the new moon when more than half of its face gets illuminated is called the waxing gibbous.

9. **Full moon:** A phase of the moon when the reflected light from its full face reaches the earth and hence the moon is completely visible is called the full moon.

10. **Waning gibbous:** The phase of the moon in decreasing order of brightness from the full moon when less than half of its face gets darkened is called the waning gibbous.

11. **Third-quarter:** The phase of the moon in decreasing order of brightness from the full moon when half of its face gets darkened is called the third quarter.

12. **Waning crescent:** The phase of the moon in decreasing order of brightness from the full moon when more than half of its face gets darkened is called the waning crescent.

13. **Shukla Pakshya:** The duration of increasing order of brightness of the moon after the new moon to the full moon is called the bright half (Shukla Pakshya).

14. **Krishna Pakshya:** The duration of decreasing order of brightness of the moon after the full moon to the new moon is called the dark half (Krishna Pakshya).

15. **Solar calendar:** The calendar which shows dates and seasons based on the apparent position of the sun relative to the star is called the solar calendar.

16. **Lunar calendar:** The calendar which shows dates and seasons based on the phases of the moon is called the lunar calendar.

17. **Adhik maas:** When two lunar months are named after the same solar month, second one is called adhik maas.

18. **Kshay maas:** The condition in which no lunar months are named after a short solar month is called kshay maas.

Introduction to the moon

moon

Moon is the only natural satellite of the earth. It is about 3,84,400 km away from earth. It is the nearest heavenly body to the earth. Moon does not have an atmosphere and water. There are no weather activities on the moon. Days will be very hot and the night will be very cold. It has many craters. It has rocky land. There are no living things on the moon. Its diameter is 3,476 km long. Its gravity is lesser than that of the earth. Its gravity can create tides in the ocean. The moon is tidally locked to the earth. Therefore, only one side of the moon is visible from the earth. The moon does not have a magnetic field. The full moon is the brightest heavenly object in the night sky.

Memory Tips

The moon is bigger than dwarf planets.

Fact with Reason

Why is the moon called a satellite?

The moon is called a satellite because it revolves around the earth.

Activity

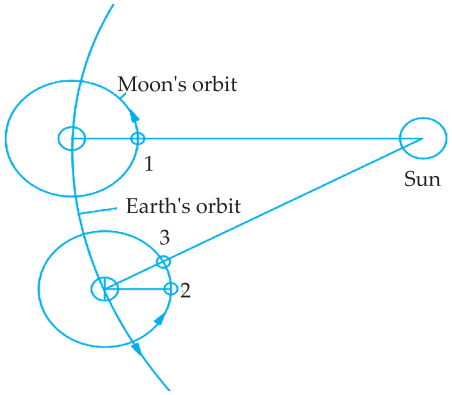
Observe the phases of the moon.

Sidereal month

The moon revolves around the earth in its orbit. The time taken by the moon to complete one revolution around the earth is called the sidereal month. It is 27.3 days long.

Synodic month

Even though the moon completes one revolution, it won't come back to its original phase because earth travels forward in its orbit. Therefore, the moon has to travel an extra distance to return to its original phase. It takes extra 2 days and 5 hours to cover that extra distance. Therefore, the moon takes 29.5 days to return to its original place. That duration is called the synodic month.



Phases of the moon

The moon is a non-luminous body. It looks bright because it reflects sunlight towards the earth. We see the portion of the moon that reflects sunlight towards the observers on the earth.

As the moon revolves around the earth, the earth is also revolving around the sun. Due to this reason, sunlight falls on the moon at different angles. This creates different shapes of the moon while observing it from the earth. Thus, the different shapes of the illuminated portion of the moon as seen by an observer on the earth are called phases of the moon. They change cyclically as the moon orbits the earth. The moon takes 29.5 days to come to the same phase after a complete revolution. This period is called a synodic month. Therefore, the time interval between two successive full moon days or new moon days is called synodic month. The difference between sidereal and synodic months causes a delay in the rising of the moon every day by 50 minutes.

Different phases of the moon are described below:

fig: eight major phases of the moon

Memory Tips

Earth's moon is the fifth largest satellite of the solar system.

a. New moon:

When the moon and the earth both come on the same side from the earth. The moon comes in between the sun and the earth. The sunlight falling on the moon reflects away from the earth. People on the earth do not receive the reflected light from the moon. At this time, we cannot see the moon from the earth. This event is called new moon. A phase of the moon when the reflected light from its surface does not reach the earth and hence the moon is invisible is called the new moon.

Fact with Reason

Why can't we see the moon on a new moon day?

We cannot see the moon on a new moon day because the moon does not reflect sunlight toward the earth during the new moon.

b. Waxing crescent:

The order of brightness gradually increases after the new moon. The phase of the moon in increasing order of brightness from the new moon when less than half of its face gets illuminated is called waxing crescent.

c. First-quarter:

When the moon is perpendicular to the earth and the sun, the sunlight from half of its part gets reflected towards the earth. The phase of the moon in increasing order of brightness from the new moon when half of its face gets illuminated is called the first quarter.

d. Waxing gibbous:

When the moon moves further in its orbit, we see more than half-bright part of the moon. The phase of the moon in increasing order of brightness from the new moon when more than half of its face gets illuminated is called the waxing gibbous.

e. Full moon:

Almost after 15 days from the new moon, the moon rises just after the sunset. That is, the sun and the moon come on the opposite side of the earth. The sunlight falling on the moon is reflected towards the earth. People on the earth receive the reflected light from the moon. At this time, we can see the full moon. A phase of the moon when the reflected light from its full face reaches the earth and hence the moon is completely visible is called the full moon.

f. Waning gibbous:

After the full moon, the bright face of the moon goes on decreasing in the coming days. The phase of the moon in decreasing order of brightness from the full moon when less than half of its face gets darkened is called the waning gibbous.

g. Third-quarter:

After waning gibbous, the moon becomes perpendicular to the sun and the earth. At this stage, the bright part decreases by half. The phase of the moon in decreasing order of brightness from the full moon when half of its face gets darkened is called the third quarter.

h. Waning crescent:

The phase of the moon in decreasing order of brightness from the full moon when more than half of its face gets darkened is called the waning crescent. Finally, the moon comes in between the sun and the earth again and the moon becomes dark. It is again called the new moon.

In this way, the phases of the moon change cyclically within a synodic month as the moon orbits the earth.

Shukla Pakshya (Bright half)

The duration of increasing order of brightness of the moon after the new moon to the full moon is called the bright half.

Krishna Pakshya (Dark half)

The duration of decreasing order of brightness of the moon after the full moon to the new moon is called the dark half.

Fact with Reason

Why is a synodic month longer than a sidereal month?

The sidereal month is the duration of the revolution of the moon. However, as the moon revolves around the earth, the earth also moves ahead in its orbit around the sun. So, some extra time is required for the moon to come into its initial phase. So, there is a difference between the synodic and sidereal months.

Solar calendar

The calendar which shows dates and seasons based on the apparent position of the sun relative to the star is called the solar calendar. The earth covers 360° while revolving around the sun. If it is divided into 12 equal parts, each part will be 30°. The time taken by the earth to cover 30°during the revolution is called one month in the solar calendar.

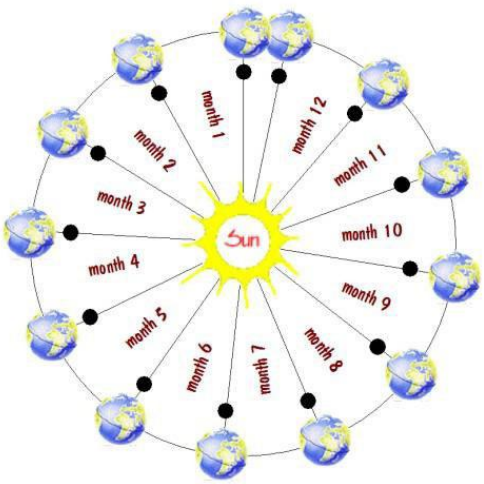


fig: solar calendar

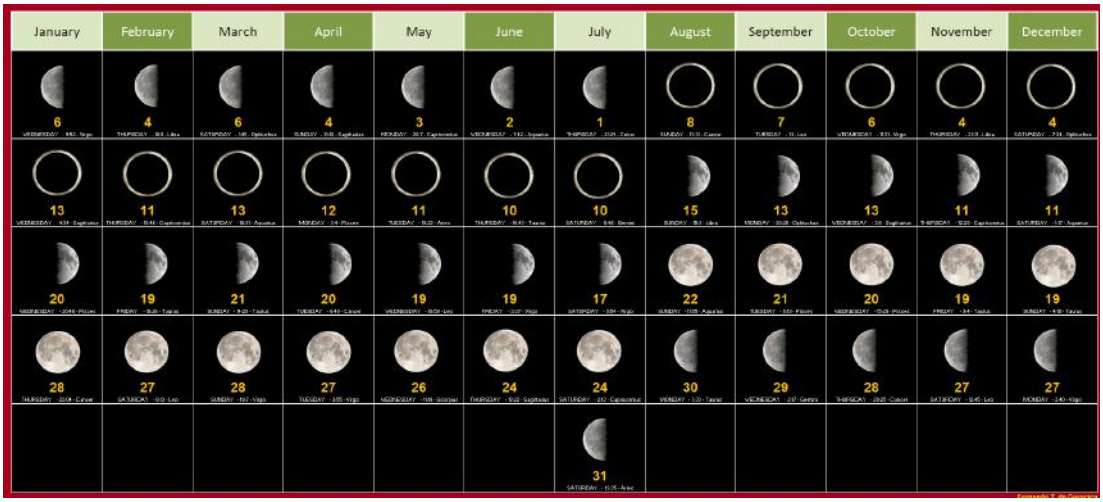
Memory Tips

The solar calendar has a leap year.

Lunar calendar

The calendar which shows dates and seasons based on the phases of the moon is called the lunar calendar. The lunar calendar is widely used in

our country to mark festivals. The duration between two successive new moons is called one month in the lunar calendar.



lunar calendar

Adhik Maas

Lunar months begin from the new moon. They are named after solar months. Some of the solar months have two consecutive new moons. Therefore, two lunar months are named after the same solar month. Such a condition is called *adhik maas*. It is also called *malamaas* or *purusottam mahina*. For example, it was a new moon on 2077 B.S. *Ashoj* 1 and 2077 B.S. *Ashoj* 30. Therefore, the lunar month that started from 2077 B.S. *Ashoj* 1, as well as the lunar month that started from 2077 B.S. *Ashoj* 30, were named *Ashoj* in the lunar calendar of that year. So, the second lunar Ashoj month of lunar calendar was called adhik maas. When two lunar months are named after the same solar month, second one is called *adhik maas*.

Kshay maas

Some of the solar months are very short. If the moon stays far away from the earth the lunar months will be longer. Sometimes a short solar month and a long lunar month coincide. In such a case there will be no new moon within that short solar month. Therefore, there won't be a lunar month named after that solar month. Such a situation is called

kshay maas. The condition in which no lunar months are named after a short solar month is called *kshay maas*.

Activity

Observe a calendar of the current year. Does it have adhik maas and kshay maas?

Answer writing skill

1. What are the phases of the moon?

The different shapes of the illuminated portion of the moon as seen by an observer on the earth are called phases of the moon.

2. The moon does not have its light but seems brighter, why?

The moon does not have its light but it seems brighter because it reflects the light of the sun.

3. Differentiate between bright half and dark half.

Differences between the bright half and the dark half are:

SN	Bright half	SN	Dark half
1	The time taken by the moon from new moon to full moon is called the bright half.	**1**	The time taken by the moon from full moon to new moon is called the dark half.
2	At this stage, the brighter face of the moon goes on increasing.	**2**	At this stage, the brighter face of the moon goes on decreasing.

4. Why do solar months have unequal number of days?

The solar months have unequal number of days because earth takes different duration to cover 30° during the revolution in its orbit each month.

5. Why is there *kshay maas* in the lunar calendar?

Some of the solar months are very short. If the moon stays far away from the earth, the lunar month will be longer. Sometimes a short solar month and a long lunar month coincide. In such a case there will be no new moon within that short solar month. Therefore, there won't be a lunar month named after that solar month. Such a situation is called *kshay maas*.

6. Write a short note on the structure of the moon.

The moon does not have an atmosphere and water. There are no weather activities on the moon. It has many craters. It has rocky land. Its diameter is 3,476 km. Its gravity is lesser than that of the earth. The moon does not have a magnetic field.

EXERCISE

Step 1

1. Fill in the blanks.

new moon	phases of the moon	first quarter	29.5 days	natural satellite

a. The moon is the only ……. of the earth.

b. The synodic month is ……. long.

c. The different shapes of the illuminated portion of the moon as seen by an observer on the earth are called …….

d. A phase of the moon when the reflected light from its surface does not reach the earth and hence the moon is not visible is called …….

e. The phase of the moon in increasing order of brightness from the new moon when half of its face gets illuminated is called ……...

2. Tick the correct and cross the false statement.

a. The moon is not seen during full moon.

b. The changing shapes of bright part of the moon is called phases of the moon.

c. Two lunar months have same names during adhik maas.

d. The duration of synodic month is 27.33 days.

e. The time taken by the earth to cover 30°during the revolution is called one month in the solar calendar.

3. Choose the correct answer from the given alternatives.

a. How long is a sidereal month?

i,. 25 days ii. 27.3 days

iii. 29.5 days iv. 32 days

b. How long is a synodic month?

i. 24 days ii. 27.3 days

iii. 29.5 days iv. 28 days

c. how many days are there in the solar calendar?

i. 365.25 days ii. 354.37 days

iii. 637 days iv. 256 days

d. How many days are there in the lunar calendar?

i. 365.25 days ii. 354.37 days

iii. 29.5 days iv. 256 days

e. At what phase does the lunar month start?

i. New moon ii. Full moon

iii. Waning gibbous iv. Waxing gibbous

4. Match the following

Diameter of the moon	no moon
Sidereal month	29.5 days
Synodic month	3476 km
Changing shape of the moon	27.3 days
New moon	phases of the moon

Step 2

5. Answer the following questions in one word.

a. How long is the bright half?

b. What is the brightest heavenly object in the night sky of bright half?

c. What is the duration in which the moon revolves around the earth once called?

d. What is the duration in which the illuminated area of the moon keeps increasing?

e. Which calendar is based on the apparent position of the sun relative to the star?

6. Differentiate between the following.

i. Dark half and bright half

ii. Synodic month and sidereal month

iii. Full moon and new moon

iv. Solar calendar and lunar calendar

7. Give reason

a. We cannot see the moon on a new moon day.

b. There is a difference between the synodic and sidereal months of the moon.

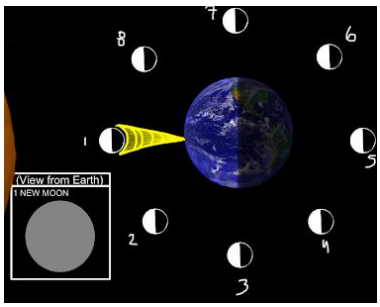
c. Some lunar years have *malamaas*.

8. Observe the diagram and answer the following questions.

i. If position 1 is new moon, what is position 5?

ii. What phase of the moon is seen during position 6?

iii. Which number represents waning crescent?



Step 3

9. Answer the following questions.

a. Write a short note on the structure of the moon.

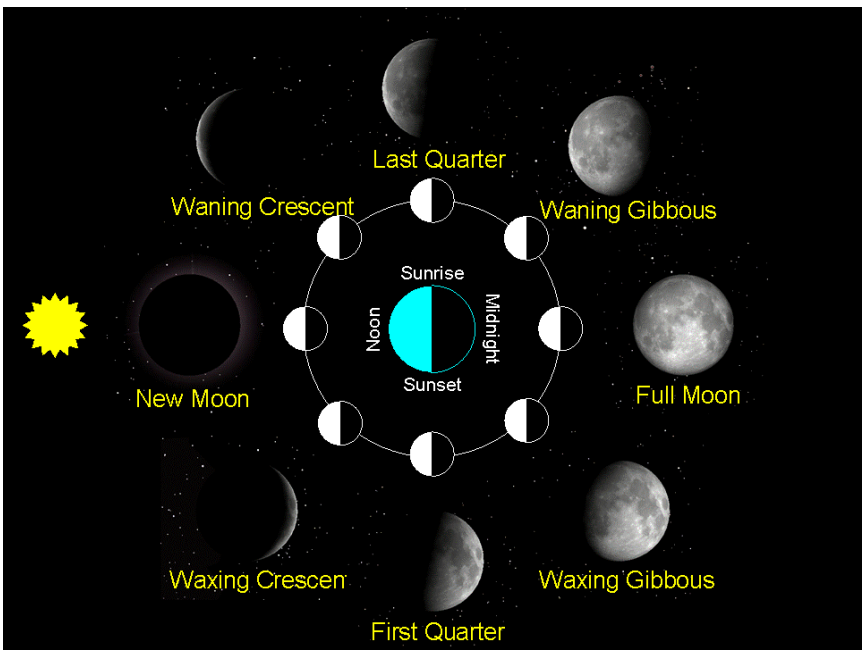
b. Explain the phases of the moon with a labelled diagram.

c. What do you mean by the phases of the moon? What causes them?

d. What is *malamaas*?

e. Write a short note on *kshay maas*.

10. Observe the phases of the moon shown in the diagram below and a make a model by using cotton and colours.



Unit
11.4

Eclipse

Estimated teaching periods	
Th	Pr
2	1

Syllabus issued by CDC

- Introduction of the solar eclipse and lunar eclipse
- Causes and process of the solar eclipse and lunar eclipse

Learning Outcomes

After completion of this unit, students will be able to:

- introduce the eclipse and demonstrate the process of the solar and lunar eclipse.

Terms and terminologies

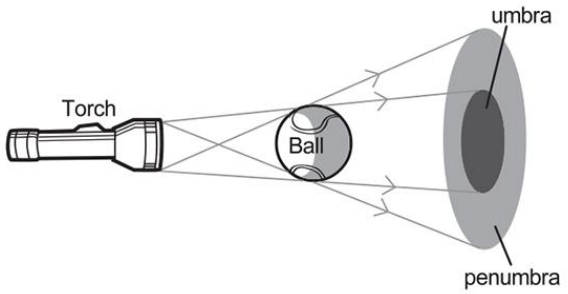
1. **Shadow:** A shadow is a dark patch that forms on the surface behind an opaque body when it blocks light.
2. **Umbra:** The completely dark central patch of the shadow is called the umbra.
3. **Penumbra:** The lighter patch of the shadow which surrounds the umbra is called the penumbra.
4. **Eclipse:** The state in which the shadow of one heavenly body falls on another heavenly object is called an eclipse.
5. **Lunar eclipse:** The lunar eclipse is the phenomenon in which the shadow of the earth is cast on the moon.
6. **Total lunar eclipse:** When the moon lies in the umbra cone of the earth, the moon does not get any light and becomes coppery red. This phenomenon is called a total lunar eclipse.
7. **Partial lunar eclipse:** When the moon lies in the penumbra zone of the earth, it gets some light from the sun and becomes partially visible. This phenomenon is called a partial lunar eclipse.
8. **Solar eclipse:** A solar eclipse is a phenomenon in which the shadow of the moon is cast on the earth.
9. **Partial solar eclipse:** The state in which a certain part of the sun is blocked by the moon as viewed from the earth is called a partial solar eclipse.
10. **Total solar eclipse:** The state in which the sun is blocked completely by the moon as viewed from the earth is called a total solar eclipse.

Shadow

Luminous objects like the sun, light bulbs, etc. spread light in all directions. When the light coming from a source falls on an opaque object, the light gets blocked. This results into the formation of a shadow. A shadow is a dark patch that forms on the surface behind an opaque body when it blocks light.

Types of shadows

When an opaque object blocks the light coming from a source, two types of shadows are formed behind the object. They are umbra and penumbra.



formation of shadow (umbra and penumbra)

The completely dark central patch of the shadow is called the umbra. It appears completely dark as it does not get any light. Similarly, the lighter patch of the shadow which surrounds the umbra is called the penumbra. It does not appear completely dark as it receives some light.

Activity

Observe your shadow on a bright sunny day at different times (morning, mid-day and evening). Measure the length of the shadow each time. What can you conclude from this activity?

Memory Tips

Air cannot cast shadow because it is a transparent object.

Activity

1. Go into a dark room with a lighted candle and a rock. Keep the glass and the candle on a table. The rock casts its shadow on the wall.
2. Observe the central dark portion of the shadow. It is called the umbra. The lighter portion of the shadow outside the umbra is called the penumbra.

Eclipse

The earth revolves around the sun and the moon revolves around the earth. The sun is a luminous object, whereas the moon and the earth are non-luminous and opaque objects. On certain occasions when the sun, the moon and the earth are in a straight line, the moon or the earth casts its shadow on the other body. This phenomenon is called an eclipse. The state in which the shadow of one heavenly body falls on another heavenly body is called an eclipse. There are two types of eclipses. They are the lunar eclipse and solar eclipse.

a. Lunar eclipse

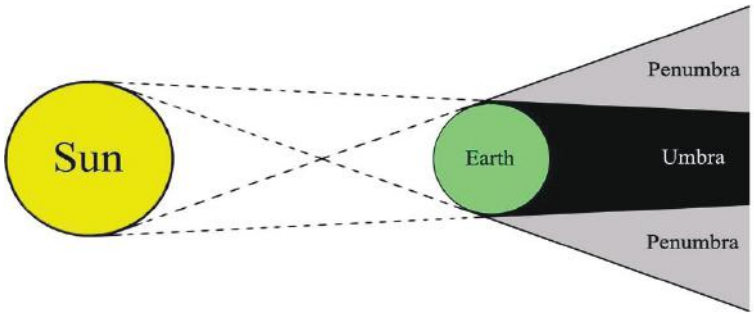
The lunar eclipse is the phenomenon in which the shadow of the earth is cast on the moon. When the earth comes between the moon and the sun in a straight line, the earth blocks the light of the sun and a shadow of the earth is cast on the moon. In this condition, we cannot see all or a part of the moon for a certain period. The lunar eclipse occurs on a full moon day. It lasts for a longer duration because the earth and the moon revolve in the same direction when such an eclipse occurs.

Causes of lunar eclipse

i. The sun, the earth and the moon lie in a straight line.
ii. Earth casts a shadow on the moon.
iii. Light travels in a straight line.

Memory Tips

A lunar eclipse occurs only on a full moon night.



lunar eclipse

Fact with Reason

A lunar eclipse occurs only at full moon, why?

A lunar eclipse occurs only at full moon because only on such a night the earth comes in a straight line between the sun and the moon.

When the moon lies in the umbra cone of the earth, the moon does not get any light and becomes invisible. This phenomenon is called a total lunar eclipse.

When the moon lies in the penumbra cone of the earth, it gets some light from the sun and becomes partially visible. This phenomenon is called a partial lunar eclipse.

Activity

Use a torchlight, table tennis ball and cardboard to make a model of the lunar eclipse.

b. Solar eclipse

A solar eclipse is a phenomenon in which the shadow of the moon is cast on the earth. When the moon comes in between the earth and the sun in a straight line, the moon blocks the light of the sun and a shadow of the moon is cast on the earth. A solar eclipse occurs on a new moon day. It lasts for about 8 minutes because the earth and the moon revolve in opposite directions during the solar eclipse.

Fact with Reason

A solar eclipse occurs only at new moon, why?

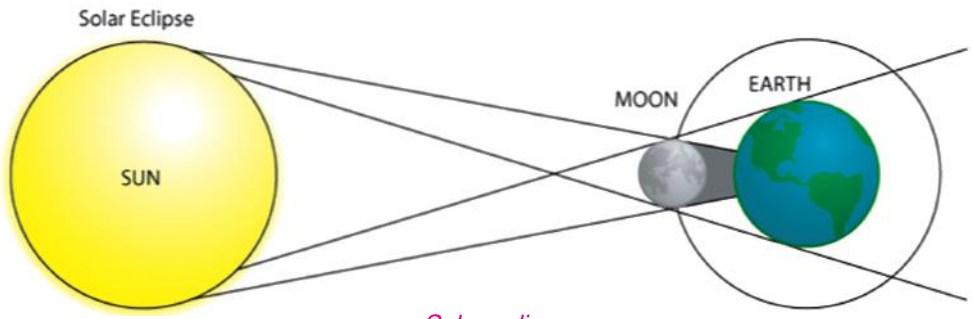
A solar eclipse occurs only at new moon because on that day the moon lies in a straight line between the sun and the earth. So, the shadow of the moon falls on the earth on a new moon day.

Causes of solar eclipse

i. The sun, the moon and the earth lies in a straight line on a new moon day.
ii. The moon lies between the sun and the earth.
iii. Shadow of the moon reaches the earth.

Memory Tips

A solar eclipse occurs only on a new moon day when the moon lies in between the sun and the earth in a straight line.



Solar eclipse

The region of the earth that falls in the penumbra cone has a partial solar eclipse. The state in which a certain part of the sun is blocked by the moon as viewed from the earth is called a partial solar eclipse. Similarly, the region of the earth that falls in the umbra region has a total solar eclipse. The state in which the sun is blocked completely by the moon as viewed from the earth is called a total solar eclipse. During an annular solar eclipse, the sun appears as a black circular disc with a ring of light.

Fact with Reason

A total solar eclipse is important to scientists, why?

A total solar eclipse is important to scientists because, in this state, the layers of the sun can be seen from the earth. So, the scientific study of the sun is possible at that time.

Differences between a solar eclipse and lunar eclipse

SN	Solar eclipse	SN	Lunar eclipse
1	The eclipse in which the moon casts a shadow on the earth is called a solar eclipse.	1	The eclipse in which the earth casts a shadow on the moon is called a lunar eclipse.
2	A solar eclipse occurs on a new moon day.	2	A lunar eclipse occurs on a full moon night.

Fact with Reason

Eclipses do not occur on every full moon day or new moon day, why?

Eclipses do not occur on every full moon day or new moon day because the plane of the moon makes an angle of 5.15° with the orbital plane of the earth. So, the sun, the moon and the earth do not come in a straight line on every full moon day and new moon day.

Answer writing skill

1. What is a shadow?

A shadow is a dark patch of a body that is formed on the surface behind the opaque body.

2. The solar eclipse is shorter. Why?

The solar eclipse is shorter because the moon and the earth travel in opposite directions during the solar eclipse.

3. What do you mean by a partial lunar eclipse?

When the moon lies in the penumbra cone of the earth, it gets some light from the sun and becomes partially visible. This phenomenon is called a partial lunar eclipse.

4. Define a total solar eclipse.

The state in which the sun is blocked completely by the moon as viewed from the earth is called a total solar eclipse.

5. The solar eclipse is useful for a scientist. Give reason.

A solar eclipse is useful for scientists because they can study the outer layer of the sun.

6. What are the causes of the solar eclipse?

The causes of the solar eclipse are:

i. The moon lies between the sun and the earth in a straight line.

ii. The shadow of the moon reaches the earth.

1 EXERCISE

Step 1

1. Fill in the blanks.

eclipse	moon	umbra	earth	penumbra

a. In a solar eclipse, ... lies in between the sun and the earth.

b. In a lunar eclipse, ... lies in between the sun and the moon.

c. The lighter patch of the shadow which surrounds the umbra is called the…….

d. The completely dark central patch of the shadow is called the…….

e. The state in which shadow of a heavenly body falls on another heavenly object is called an …….

2. Tick the correct and cross the false statement.

a. In a solar eclipse, the moon lies in between the sun and the earth.

b. The umbra is darker than the penumbra.

c. A lunar eclipse occurs on a new moon day.

d. The moon is invisible during no moon day.

e. A solar eclipse occurs on a full moon day.

3. Choose the correct answer from the given alternatives.

a. What is formed when light is blocked?

i. Light ii. Shadow

iii. Rainbow iv. All of them

b. When does a lunar eclipse occur usually?

i. New moon ii. Full moon

iii. Waxing crescent iv. Gibbous

c. When does a solar eclipse occur usually?

i. New moon ii. Full moon

iii. Waxing crescent iv. Gibbous

d. What is a dark shadow called?

i. Penumbra ii. Shade

iii. Umbra iv. Dark

e. What is a faint shadow called?

i. Penumbra ii. Shade

iii. Umbra iv. Dark

4. Match the following

Faint shadow	moon gets darker
Dark shadow	umbra
Shadow	sun is blocked
Solar eclipse	dark patch when light is blocked
Lunar eclipse	penumbra

Step 2

5. Answer the following questions in one word.

a. What is it called when the shadow of one heavenly object falls on another?

b. How long do solar eclipses last?

c. What blocks light during the solar eclipse?

d. What blocks light during a lunar eclipse?

e. What is it called when only a portion of the sun is blocked?

6. Differentiate between the following.

a. Umbra and penumbra

b. Partial solar eclipse and total solar eclipse

c. Solar eclipse and lunar eclipse

7. Give reason

a. A solar eclipse occurs only at the new moon.

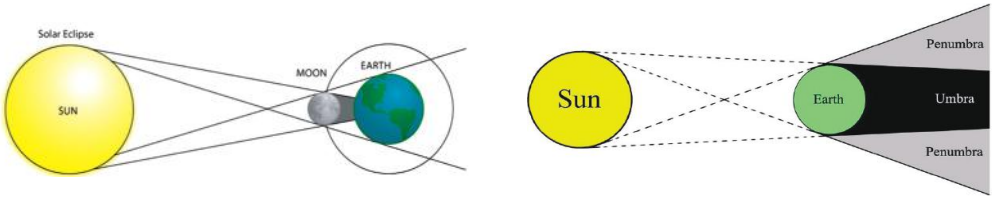
b. A lunar eclipse occurs only at full moon.

c. A total solar eclipse is important to scientists.

d. Moon is reddish brown during a total lunar eclipse.

e. Lunar eclipse lasts longer than the solar eclipse.

8. Write one main characteristic of the given diagram.



a *b*

Step 3

1. Answer the following questions.

a. What is a shadow?

b. What is an eclipse? How does it occur?

c. What is a lunar eclipse?

d. What are the causes of the lunar eclipse?

e. What are the causes of the solar eclipse?

2. Draw a diagram of the lunar eclipse.