

## नेपाल सरकार शिक्षा, विज्ञान तथा प्रविधि मन्त्रालय

## पाठयकम् विकास केन्द्र

मान्यता, सम्बद्धार्मा पूर्ण मूल्याङ्कन् गाखा)

2000/005

फोन नं. ६६३०५८८ ६६३४९१९ ६६३००८८ फ्याक्सः ६६३०७९७

नोटिस बोर्डः १६१८०१६६३०७९७

सानोठिमी, भक्तपुर www.moecdc.gov.np

२०७८/०३/०४

पत्र संख्या:-

विषय : पाठ्यसामग्री स्वीकृति सम्बन्धमा ।

श्री नोभा पब्लिकेसन प्रा.लि.

श्री नोभा पब्लिकेसन प्रा.लि. काठमाण्डौँ ।

प्रस्तुत विषयमा त्यस प्रकाशनवाट मूल्याङ्कन र स्वीकृतिका लागि तोकिएको अवधिभित्र पेस हुन आएका तपसिलबमोजिमका पाठ्यसामग्री आवश्यक निर्णयार्थ पाठ्यसामग्री व्यवस्थापन तथा मूल्याङ्कन समितिमा पेस हुँदा विद्यालय शिक्षाको राष्ट्रिय पाठ्यकम प्रारूप २०७६, आधारभूत शिक्षा ( कक्षा ६-८) पाठ्यकम, पाठ्यसामग्री विकाससम्बन्धी विद्यमान प्रावधान, ऐन, कानुन, निर्देशिका, कार्यविधि, प्रकाशन शैलीका प्रावधान, पठ्यकम विकास केन्द्रले विभिन्न समयमा जारी गरेका र पाठ्यसामग्री सुधार/परिमार्जन/पुनर्लेखनका लागि दिइएका सुभाव र निर्देशनको परिपालना गरी स्वीकृति दिन सिफारिस भएअनुसार यस कार्यालयको मिति २०७८।०३।०४ गतेको निर्णयानुसार तपसिलमा उल्लिखित निर्देशनको पूर्ण परिपालना गरी शैक्षिक वर्ष २०७८, २०७९ र २०८० गरी तीन शैक्षिक वर्षका लागि गुणस्तरीय एवम् बुटिरहित पाठ्यसामग्री विकास गरी प्रकाशन गर्न स्वीकृति प्रदान गरिएको छ। विद्यमान संवैधानिक व्यवस्था, ऐन, कानुन, निर्देशिका, कार्यविधि, पाठ्यकम विकास केन्द्रले विभिन्न समयमा जारी गरेका निर्देशनलगायतका प्रावधानहरूको पूर्ण परिपालना नगरी गुणस्तरहीन पाठ्यसामग्रीको विकास, प्रकाशन र विकीवितरण गरेको पाइएमा, पाठ्यकम परिवर्तन भएमा वा यस केन्द्रबाट अन्य निर्णय भएमा यो स्वीकृति जुनसुकै बेला रद्ध हुने छ।

#### तपसिल:

(क)पाठ्यसामग्रीको नाम :

9 Science and technology

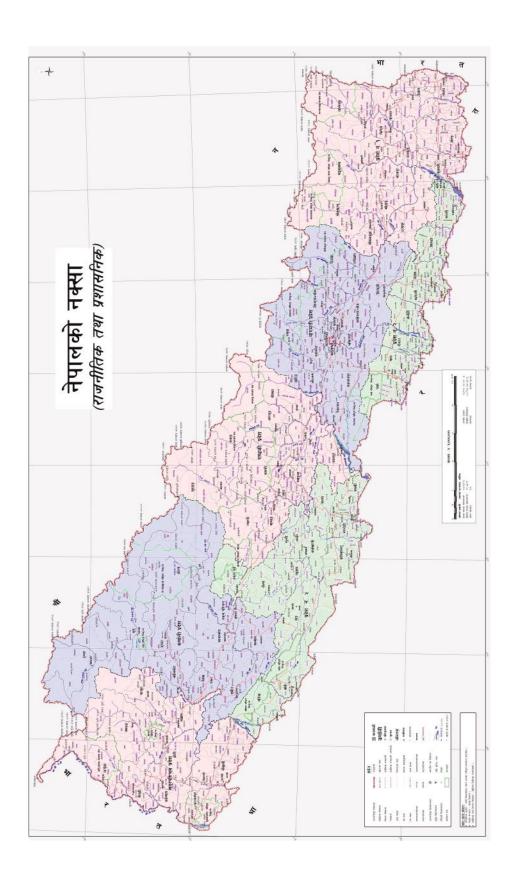
आधारभूत तह/ कक्षा ६

मीनबहादुर थापा पाठ्यक्रम अधिकत

#### (ख) निर्देशन:

- 9.आवरण पृष्ठको अधिल्लो (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 विषयवस्तुमा समावेश गरिने नक्सा आधिकारिक र प्रामाणिक हुनुपर्ने
- २.स्वीकृति पत्र स्वयान गरी पाठ्यसामग्रीको शीर्षक पृष्ठभन्दा पिछ दायाँ (Recto) पृष्ठमा समावेश गर्ने । पाठ्यसामग्रीको प्रत्येक पृष्ठको पुच्छर (Footer) मा पाठ्यकम विकास केन्द्रबाट स्वीकृत भन्ने व्यहोरा उल्लेख गरी प्रकाशन गरेको पाठ्यसामग्रीको तीन प्रति यस केन्द्रमा पेस गरेपिछ मात्र विकीवितरण गर्ने
- ३ शिक्षा, विज्ञान तथा प्रविधि मन्त्रालयको निर्णयअनुसारको मूल्य कायम गर्ने र मूल्य सर्वाधिकार पृष्ठमा राब्नुपर्ने । प्रतिलिपि अधिकार (Copy right) को सम्बन्धमा लेखक र प्रकाशक स्वयम् जिम्मेवार हुने
- ४.पाठ्यसामग्री विकाससम्बन्धी विद्यमान प्रावधान तथा पाठ्यसामग्री सुधार र परिमार्जनका लागि यस अधि दिइएका निर्देशनको पूर्ण परिपालना गर्ने
- ५.तथ्य र प्रमाणमा आधारित अद्यावधिक र आधिकारिक विषयवस्तु, तथ्यतथ्याङ्क एवम् जानकारी समावेश गर्ने
- ६.आधारभूत शिक्षा (६-८) पाठ्यकमका तहगत सक्षमता र कक्षागत सिकाइ उपलब्धि हासिल गर्न सहयोग पुग्नेगरी पाठ्यकमका सम्पूर्ण पक्ष र विषयवस्तुलाई समेटी लम्बीय तथा क्षितिजीय सन्तुलन कायम हुनेगरी पाठ्यसामग्रीलाई पूर्ण रूप दिने
- ७.विद्यार्थीलाई थप भार पर्ने गरी पाठ्यकममा समावेश नगरिएका विषयवस्तु, अभ्यास तथा सिकाइ क्रियाकलाप पाठ्यसामग्रीमा समावेश नगर्ने इ.विज्ञान र प्रविधिको क्षेत्रमा स्थापित सिद्धान्त र मुल्य मान्यतालाई विशेष ध्यन दिई वैज्ञानिक सुभन्वुभ्न सहितको असल, दक्ष र सक्षम नागरिक तयार गर्ने सहयोग पुग्नेगरी पाठ्यसामग्री तयार गर्ने
- ९.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
- 90 जातजाति, भाषा, धर्म, संस्कृति, वर्ण, क्षेत्र, लैङ्गिकता, अपाङ्गता, पेसा, व्यवसाय, सामाजिक सांस्कृतिक अवस्थाका आधारमा भावनात्मक रूपमा चोट पुऱ्याउने, आक्षेप लाग्ने, होच्याउने र विभेदीक्रुरण गर्ने किसिमका विषयवस्तु, उदाहरण, चित्र, अभ्यास, सिकाइ क्रियाकलाप समावेश नगर्ने

पुनश्च : यो स्वीकृति शैक्षिक वर्ष २०७८, २०७९ र २०८० का लागि प्रदान गरिएकाले सोहीबमोजिम प्रकाशन, बिकी वितरण र प्रयोग गर्नु गराउनहुन सम्बन्धित सरोकारवाला सवैमा अनुरोध छ ।





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Satungal, Kathmandu, Nepal Tel: 977-1-4313205 www.novapublication.com.np



### Published by:

Nova Publication Pvt. Ltd.

Satungal, Kathmandu

Tel.: 01-4313205

www.novapublication.com.np

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#### Edition:

First - 2078 Reprint : 2079 Copyright:

Chinta Mani Panthee

#### Layout and Design:

Nova Desktop

Printed in Nepal

## **PREFACE**

**Modern Concept Science and Technology** for grade 6 is written to meet the objectives of the curriculum of class 6 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 learningsin 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 6.
- 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. Megh Raj Poudel, Managing director of Nova Publication Pvt. Ltd. for publishing this book. Similarly, thanks are due to Mr. Deepak Bahadur Bista for his valuable help during the preparation and content editing of the book. Likewise, thanks are due to Mr. Romharsh Panthi for his praiseworthy language editing.

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 Kathmandu, Nepal

# **Table of Content**

Unit	Lesson	Page No.
1.	Scientific Learning	9-38
2.	Information and Communication Technology	39-90
3.	Organisms and Their Structure	91-126
4.	Biodiversity and Environment	127-148
5.	Life Processes	149-163
6.	Force and Motion	164-183
7.	Energy in Our Daily Life	184-230
8.	Electricity and Magnetism	231-260
9.	Matter	261-280
10.	Materials Used in Daily Life	281-304
11.	Earth and Space	305-330



Estimated Tea	ching Periods:
Theory	Practical

## Theory Practical 8 2

## Scientific Learning

## Area and Sequence of Curriculum Issued by CDC

- 1. Introduction to scientific learning process
- 2. Skill and steps of basic scientific learning process
- 3. Introduction to measurement
- 2. Importance of measurement in scientific learning process
- 3. Local and standard units of measurement
- 4. Comparison between local and standard units of measurement
- 5. Multiples and submultiples of units.

## **Learning outcomes**

#### At the end of this unit, students will be able to:

- i. define and adapt to scientific learning process.
- ii. state importance of units in measurement.
- iii. state importance of local and standard units of measurement.
- iv. state and apply multiples and sub-multiples of units.

## Key terms and terminologies of the unit

Science: Science is a systematic study of anything in nature,

as well as events, conditions and natural phenomena.

Observation: Observation is the process of gathering information about

things or events in the surroundings using our sense organs.

Hypothesis: Hypothesis is an educated guess that can be tested with

scientific investigation.

Measurement: Measurement is the comparison of an unknown physical

quantity with the known and standard quantity of the same

kind.

Physical quantities: Those quantities which can be measured by using different

types of physical devices are called physical quantities.

Non-physical quantities: Those abstract things which cannot be measured by using

different types of physical devices are called non-physical

quantities.

Unit: A unit is the standard reference quantity with respect to which

we measure other physical quantities of the same kind.

Standard units: The units of measurement which are used all over the world

and are accepted by the majority of people are called standard

units of measurement.

MKS System: The system of measurement in which length is measured in

metre (m), mass is measured in kilogram (kg), and time is

measured in second is called MKS system.

CGS System: The system of measurement in which length is measured in

centimetre (cm), mass is measured in gram (g) and time is

measured in second (s) is called CGS system.

FPS System: The system of measurement in which length is measured in

foot (ft), mass is measured in pound (lb) and time is measured

in second (s) is called FPS system.

SI (International system of measurement): The system of units which was

introduced by the international convention of scientists held in France in the year 1960 AD and is accepted all over the world

is called SI.

Mass: The amount of matter contained in a body is called its mass.

Sub-multiples of kilogram: The fractions of a kilogram which are used to measure

the small masses are called sub-multiples of kilogram.

Multiples of kilograms: The units bigger than kilogram which are used to measure

the large masses are called multiples of kilogram.

Length: The total distance between any two points is called length

Multiples of metre: The units bigger than metre which are used to measure long

distances are called multiples of metre.

Sub-multiples of second: The fractions of a second which are used to measure the

shorter time interval are called sub-multiples of second.

Area: Area is the total surface covered by an object.

Volume: The total space occupied by a substance is called volume of

that substance.

## 1.1

## Introduction to scientific learning



What is science? How are scientific theories developed and inventions made? Human curiosity has explored many natural phenomena. In science, learning about natural phenomena beings with curiocity and asking questions. So, science is a systematic study of anything in nature, as well as conditions and natural phenomena. Some basic skills that involve scientific activities observing, questioning, measuring, concluding, etc. Scientific activities become easier with the use of manmade tools for observation and measurement. For example, Galileo Galilei developed

one of the first telescopes. He discovered Jupiter's four moons. He also helped to prove that the earth revolves around the sun.



## **Memory Plus**

Galileo Galilei (1564-1642) was one of the principal founders of the scientific method. He used experiment rather than speculation to study nature.

## Science process skills

Science process skills are some broadly transferable abilities. They are applicable in scientific activities. These skills include observing, classifying, measuring, inferring, comparing, evaluating, analyzing, concluding, etc. These skills are reflective of the behaviour of scientists. When scientists carry out an investigation or experiment, they combine these skills. They draw a conclusion based on results and finally put forth a theory. For example, Sir Isaac Newton observed a falling apple. It made him surprised. He did scientific investigation and came up with a theory of gravity. Another scientist, Charles Darwin observed different species of animals with similar characteristics on the earth. Then he gave the theory of evolution through scientific method of exploration.

Scientist's Curiosity	In picture	Theory	
Sir Isaac Newton  What makes the apple to always fall on the earth?	17.2	Objects are pulled toward the centre of a planet (e.g. earth) due to gravity.	
Charles Darwin  What is the cause of similarities between animals of different species?		New species arise naturally by a process of evolution.	

#### **Memory Plus**

Scientific theory is an explanation of the pattern observed repeatedly in the natural world. It is supported by observations and results from many investigations.

#### **Activity**

Look at the given pictures carefully. Collect them in your classroom. Use your senses to observe their shape, size, colour, taste, etc. Make a comparison on the basis of your findings. What conclusion can you draw from your investigation?



## Scientific learning

Scientific learning is a continuous process that involves a number of steps. Initially, it involves observation of the objects, facts, events, etc. Similarly, it involves asking questions, making prediction, conducting experiment and

drawing conclusions. Finally, it involves preparation of a report in a standard format using available technology to present to the audience.

#### Activity

Collect following objects in your classroom: thumb pin, needle, a piece of pencil, eraser, sharpener, marble, pebble, a piece of wood, rubber cork, a piece of glass, ball pen cap, steel spoon, plastic spoon, button, toothpick, paper clip, coin, blade, dice, egg, apple, orange, mango, grapes, chilly, tomato, potato, etc. Make a prediction about whether they float or sink in water. Fill your results in a table as shown below:

Object	Prediction	Experimental result	Conclusion
Thumb pin	Floats in water	Sinks in water	It is heavier than water.

Classify above objects in different groups on the basis of similarities that you observed.

## Steps in scientific learning

## Activity

Observe the ice cubes melting at the room temperature in a baker using heat. Practice the given steps for your scientific learning.





Observation	Ice melting		
Question	Why does ice melt? What causes ice to melt fast? How do ice cubes remain frozen in cooler box?		
Prediction	Heat will cause fast melting of ice in a beaker on the source of heat.  After melting, water will fit in less space than that occupied by ice cubes in the beaker.		

Experiment	Keep some of the ice cubes in cooler box, some others in a beaker without heating, and a few in a beaker where we supply heat.
Collection of data	<ol> <li>Time to melt ice completely</li> <li>Space occupied by ice cubes in the beaker</li> <li>Volume of water during melting of ice in each beaker and after complete melting of ice</li> </ol>
Analysis	Compare the volume of water in beaker during melting of ice, compare the space occupied by the ice cubes and water
Conclusion	Ice cubes in the beaker to which we supplied heat melted in minutes. It was a fast process because of heat. Ice cubes in the beaker without heat melted in minutes. It was a slow melting process because the room temperature has less heat. Room air does not enter into cooler box. So, ice remains frozen in it.  Ice cube occupied space up to in a beaker. After complete melting, water level was up to So, volume of water is less than ice.

Scientific learning method follows a general pattern with following steps:

## 1. Observation

Scientific learning begins with observation of the events in the nature that generates curiosity in observer. It is the process of gathering information about things or events in the surroundings using our sense organs. We can observe in our surroundings to recognize a scientific problem. For example, wilted plants, slow growth of a plant in the shed, unequal growth of two cultivated crop seeds, falling of snow, rain with hailstorm, rainbow formation, wearing of woolen clothes in winter, etc.

## 2. Asking questions

Observation leads to questioning. A scientific question usually starts with why, how, or when. For example, after observing the given figure, we can ask different questions



like: Why does the potted plant wilt? Does the amount of sunlight received by a plant determine its growth rate?



#### **Fact with Reason**

## Why do we need to ask question in scientific learning?

A question asked in scientific learning leads to a hypothesis. It helps us in answering the reason behind a scientific problem. So, a question is asked to figure out reason for some observation in scientific learning.

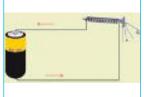
#### **Activity**

Look at the given figures and ask different types of scientific questions.









## 3. Forming a hypothesis:

Hypothesis is an educated guess that can be tested with scientific investigation. It is a possible answer of the problem or question. Hypothesis formation depends on prior knowledge and observations of the students. For example,

Observation	Hypothesis
	1. Deficiency of water in soil may cause wilting of a plant.
Wilted plant	2. Deficiency of required nutrients in soil may cause wilting of a plant.
Retarded growth of a plant in shed	1. A plant in sunlight grows faster than that in shed.

Similarly, we can guess different hypotheses for various observations.

## 4. Conducting an experiment

In this step, we conduct a required experiment to test our hypothesis. To carry out an experiment, we need different materials and a continuous process. We should be careful while conducting experiment to get the correct result. For example, to test a hypothesis about wilted plant, we can grow both the plants up to certain height in identical moisture conditions. After that, we keep a potted plant with sufficient moisture in soil and another in dry soil for a few days.

## 5. Collecting data

In this step, we collect data by observing our experiment. Data should be collected accurately during an experiment. One way of collecting data is by making a table. For example, we keep records of potted plant grown in soil with sufficient moisture and that grown in dry soil conditions.

## 6. Analyzing result and drawing conclusion

In this step, we analyze our data. Here, it gets decided that our hypothesis was correct or incorrect. In case of incorrect hypothesis, we restate the hypothesis to repeat this process again. Conclusion summarizes how results support or contradict our hypothesis.

## 7. Reporting results

This is the final step in scientific learning. Here we prepare a final report in a standard format and communicate the results to others.

## Activity

Discuss the steps of scientific learning for each of the following scientific problems.

- a. What happens if a plant is covered to block sunlight for a few days?
- b. What happens when an egg is kept in a sour fruit juice or vinegar for a few days?
- c. What happens when a piece of bone is kept in dilute acid?

## 1.2

## Measurement

Measurement is the most familiar as well as important word in physics. In our daily life, we have to deal with different things. In order to have things in desired and accurate amount, we measure them. A shopkeeper sells rice by measuring on a beam balance, a tailor measures cloth to cut and stitch using a metre rod or a measuring tape, and a school peon rings the bell looking at the time on the watch. Similarly, we measure distance, area, speed, volume, force, pressure, temperature, etc. in our daily life. While measuring, we compare an unknown physical quantity with a known and standard quantity. Therefore, measurement is the comparison of an unknown physical quantity with the known and standard quantity of the same kind. People in different parts of the world use different types of measurement.



## Ouestions

- 1. Why do we measure different things?
- 2. What will happen if we sell and buy things just by guessing instead of measuring?

## **Necessity of measurement**

How long is your classroom? 5 m, 6 m, 7 m or some other size? Take a measuring tape and measure it. Is your guess correct? Similarly, how much is your weight? 30 kg, 50 kg, 60 kg or other? Stand on the weighing tool and measure your weight. Is your guess correct? Therefore, for the correct and valid result we need measurement. Without measurement we cannot conduct fair trade, business, construction, neither can we achieve a perfect composition of the ingredients of food, medicine, etc.



#### **Fact with Reason**

#### Why is measurement necessary?

Measurement is necessary for fair trade, business, construction and perfect composition of the ingredients of food, medicine, etc.

## Physical quantities and non-physical quantities

There are many quantities which can be measured by using different types of physical devices. Thus, those quantities which can be measured by using different types of physical devices are called physical quantities. Mass, length, time, temperature, area, volume, force, pressure, etc. are some examples of physical quantities. Similarly, those abstract things which cannot be measured by using different types of physical devices are called non-physical quantities. For example: pain, happiness, anger, rudeness, pride, respect, love, hate, stupidity, loyalty, etc.



#### **Fact with Reason**

Why are smile, anger, happiness, etc. called non-physical quantities?

Smile, anger, happiness, etc. are called non-physical quantities because such abstract things cannot be measured and cannot be expressed in units.

## Units of measurement

Measurement is expressed by using a 'number' and a 'unit'.

For example, mass = 5 kg.

Here, 'kg' is the unit. 1 kg is the standard reference mass. If quantity of rice is 5 times more than 1 kg, then we say that the mass of rice is 5 kg. Similarly, a carpenter uses ruler, measuring tape, meter rod, etc. to measure the length. A shopkeeper uses different blocks of weight to measure the mass. We use watch to look at time. In every case, there is one reference standard quantity with respect to which we measure other physical quantities of the same kind. These reference quantities are called units. Thus, a unit is the standard reference quantity with respect to which we measure other physical quantities of the same kind. For example: kilogram, metre, second, etc. Various units like mana, pathi, dharni, muri, ghadi, pala, cubit (haat) and outstretched palm (bitta) are used at the local level. Similarly, kilogram, metre, second, kelvin, ampere, mole and candela are

used all over the world. Thus, in measurement there are two systems of units. They are local units of measurement and standard units of measurement.

#### Local units of measurement

Even before the development of scientific system of measurement, people had developed their own system of measurement which is called local measurement. For example, in Nepal people still use mana, pathi, dharni, muri, etc. to measure grains. Thus, the system of measurement which is used by the local people in a certain part of the world is called local system of measurement.



Figure 1.2 Local units of measurement

SN	Local units	Measured quantity
1.	Cubit (Haat), outstretched palm (Bitta)	Length
2.	Mana, pathi, paau, ser, dharni, muri	Mass
3.	Ghadi, pala	Time

## Activity

Hold a discussion on the use of local units of measurement that you have used or heard from your elders. Fill your information in a table as shown below.

Quantity	Length	Mass	Time	Area	Volume
Local units	Cubit (Haat)	Dharni	Ghadi,	Ropani	Mana
			• • • • • • • • • • • • • • • • • • • •		

## Limitations of local measurement system

Local measurement system is not a valid system. Following are some limitations of this system:

- 1. Local units do not give accurate and reliable measurement.
- 2. People throughout the world may not know about all types of local units.

3. It becomes difficult to calculate the cost of goods measured in local unit.

#### **Fact with Reason**



Local units do not give accurate and reliable measurement. Justify with an example.

The local units of measurement vary from country to country and place to place. For example, a cubit of tall person is longer than that of a short one. Thus, local units do not give accurate and reliable result.

## Activity

Objective: To realize the need of standard unit of measurement

Requirement: Rope, scissors

**Methods:** Take a long rope. Measure a cubit (haat) and cut it. Keep the cubit of rope with you and pass the remaining rope to your friends. Ask your friends to measure a cubit of rope and cut. Now, compare each other's cubit of rope. Although, all of you measured a cubit, all the pieces of rope will be of different length.

**Conclusion:** This activity shows that the size of cubit varies from person to person. Using cubit as a unit of measurement creates confusion. Hence, we need to have a standard unit of measurement.

#### Standard units of measurement

As the local units of measurement are incorrect, unscientific and non-reliable, scientists have developed more accurate standard units of measurement. These units are same throughout the world and accepted by the people all over the world. They are called standard units. Thus, the units of measurement which are used all over the world and are accepted by the majority of people are called standard units of measurement. For example: kilogram, metre, second, etc. Some physical quantities and their standard units are given below:

#### Fact with reason



## Standard measurement system is better than the local system of measurement. Why?

Standard measurement system is better than the local system of measurement because a standard reference quantity is scientifically defined which helps to bring uniformity in measurement.

Table 1.1: Some physical quantities and their standard units

S.N.	Physical quantities	Standard units	Symbols
1.	Length	metre	m
2.	Mass	kilogram	kg
3.	Time	second	S
4.	Temperature	kelvin	K
5.	Electric current	ampere	A
6.	Amount of substance	Mole	Mol
7.	Luminous intensity	Candela	Cd

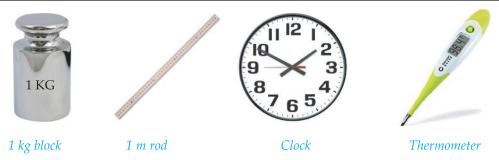


Figure 1.3: Standard units of measurement

## Systems of measurement

There are many standard systems of measurements like MKS system, FPS system, CGS system, etc. These systems are accepted and recognized all over the world. The quantity measured in these systems is the same wherever we go. For example, the quantity of ten kg rice is the same in America as well as in Nepal.

i. MKS System: The system of measurement in which length is measured in metre (m), mass is measured in kilogram (kg), and time is measured in second is called MKS system. It is also called metric system of measurement.

**ii. CGS System:** The system of measurement in which length is measured in centimetre (cm), mass is measured in gram (g) and time is measured in second (s) is called CGS system. It is also called French system of measurement.

**iii. FPS System:** The system of measurement in which length is measured in foot (ft), mass is measured in pound (lb) and time is measured in second (s) is called FPS system. It is also called British system of measurement.

**iv. SI (International system of measurement):** There are different standard systems of measurement. They have different units to measure the physical quantities. To use the same standard units in measurement, SI of measurement had been developed by eleventh conference of weight and measures in France in the year 1960 AD. Thus, the system of units which was introduced by the international convention of scientists held in France in the year 1960 AD and is accepted all over the world is called SI (International system of measurement). It is also called an improved and extended version of MKS system. All the scientific measurements are done in this system.

#### Activity

Collect mana, pathi, measuring cylinder, pan balance or spring balance, water in a bucket, rice grains in a bag, etc. Follow the given procedures to conduct your experiment.

i. Measure one mana of water. Transfer that volume of water into a measuring cylinder. Repeat the same procedure for one pathi of water.



- ii. Measure one pathi of rice grains. Measure the same amount by using a pan balance or spring balance.
- iii. Make a comparison of volume of one pathi of water and the volume of one pathi of rice grains.

Collect data in the given format and analyze your data. Present the conclusion in the classroom.

Tool used	Quantity	Measurement in local unit	Measurement in standard unit	Conclusion
Mana	Volume	One mana	ml	
Pathi	Volume	One pathi	kg	

#### **Fact with Reason**



SI is also called an extended version of MKS system. Give reason.

SI is also called an extended version of MKS system because it contains few more physical quantities other than length, mass and time from the MKS system.

## Question

1. Why is MKS system called metric system of measurement?

#### Mass and its unit

#### Activity

Take two small identical sized buckets. Fill a bucket completely with water and keep another one half-filled with water. Try to lift them one after another. Which one do you find easy to lift?

We experience that a bucket completely filled with water is heavier than the bucket half-filled with water. This is because in half-filled bucket there is less matter than that in the bucket completely filled with water. This shows that more matter has more mass.



According to the given activity, it is clear that the half-filled bucket has less matter than that in the bucket completely filled with water. This shows that more matter has more mass. Thus, the amount of matter contained in a body is called its mass.

In SI, mass is measured in kilogram (kg). Other units like milligram (mg), gram (g), pound, quintal, ton, metric ton, etc. are also used to measure the mass.

#### Measurement of mass

Mass of a substance is measured by using a beam balance. A beam balance consists of two pans suspended on the horizontal rod. In order to measure the mass of a body, it is kept on one of the two pans. The standard labels of kilograms, grams, etc. are kept on the other pan unless the bar of the beam becomes horizontal. Grocers use a beam balance to measure the mass of grocery. For the accurate measurement of mass, goldsmiths and scientists use physical balance. Electronic balance is also used to measure the mass.



Figure 1.4: Some physical devices to measure mass

## Multiples and sub-multiples of kilogram

The SI unit of mass is kilogram (kg). But the mass of light objects is measured by using the units like milligram (mg), centigram (cg), decigram (dg), gram (g), decagram (dag) and hectogram (hg). These units are called sub-multiples of kilogram (kg). Thus, the fractions of a kilogram which are used to measure the small masses are called sub-multiples of kilogram.

## Relation of multiples and sub-multiples of kilogram

10 milligrams (mg) = 1 centigram (cg) 10 centigrams (cg) = 1 decigram (dg) 10 decigrams (dg) = 1 gram (g) 10 grams (g) = 1 decagram (dag) 10 decagrams (dag) = 1 hectogram (hg) 10 hectograms (hg) = 1 kilogram (kg)

To measure a large quantity of mass, we use quintal, metric ton, etc. These are called multiples of kilograms. Thus, the units bigger than kilogram which are

used to measure the large masses are called multiples of kilogram.

100 kilograms (kg) = 1 quintal

10 quintals = 1 metric ton

#### **Fact with Reason**



Mass is also measured in milligram, gram, quintal, etc. Why?

Mass is also measured in milligram, gram, quintal, etc. because these are multiples and sub-multiples of kilogram. Use of multiples and sub-multiples of a unit makes trade easier.

## Activity

**Objective:** To measure the mass of different objects

Requirement: A beam balance, pen, pencil, eraser, calculator, etc.

Methods: Take a pen, pencil, eraser, calculator, etc. Guess their mass and

note it down. Use a beam balance and measure their mass. Now, note the measured value. Compare the guessed value and the

actual measured value of each substance.

**Conclusion:** We find that the guessed value is different from the measured

value. Thus, in order to know the exact mass of different substances,

we must weigh them.

Example 1: Convert 8.5 kg into grams.

**Solution:** 

Here, mass = 8.5 kg

We know that 1 kg = 1000 g

So,  $8.5 \text{ kg} = 8.5 \times 1000 \text{ g} = 8500 \text{ g}$ 

There are 8500 grams in 8.5 kg mass.

#### **Example 2:** Convert 8700 kg into tonne.

Solution:

Here, mass = 8700 kg

We know that 1 tonne = 1000 kg

So, 8700 kg= 8700/1000

=8.7 tonne

The mass of 8700 kg is equivalent to 8.7 tonne.

## Length and its unit

The total distance between any two points is called length. Height, breadth, thickness, depth, distance, etc. are the measures of length. In SI, length is measured in metre (m). It is also measured in millimetre (mm), centimetre (cm), kilometre (km), mile, inch, foot, etc.

## Measurement of length

Generally, length is measured by using metre rod, scale, metre tape, etc. Small scale is used to measure the short distances like length, breadth, thickness, etc. of the book, exercise book, pencil, eraser, etc. Similarly, a metre rod is used to measure the length of certain metre like length of cloth, height of a person, etc. Metre tape is used to measure the length of longer distances like the length, breadth and height of a building, bridge, etc.



Fig. 1.5: Some common instruments to measure the length

## Multiples and sub-multiples of metre

The fractions of a metre which are used to measure the short distances are called sub-multiples of metre. For example: millimetre (mm), centimetre (cm), decimetre (dm), etc. To measure the long distances like the length of roads, rivers, distance between two districts, boundary of a country, distance between two cities, etc.

we use decametre (dam), hectometre (hm), kilometre (km), etc. These are called multiples of metre. Thus, the units bigger than metre which are used to measure long distances are called multiples of metre.

#### Relation of multiples and sub-multiples of metre

10 millimetres (mm) = 1 centimetre (cm)

10 centimetres (cm) = 1 decimetre (dm)

10 decimetres (dm) = 1 metre (m)

10 metres (m) = 1 decametre (dam)

10 decametres (dam) = 1 hectometre (hm)

10 hectometres (hm) = 1 kilometre (km)

#### Activity

- 1. Measure your height in metre scale. Express it in cm, mm, dm and inch.
- 2. Measure the length of your classroom in metre. Convert it into cm, mm, dm and inch.



#### **Fact with Reason**

Why does the government of Nepal frequently check weight blocks, beam balance, metre rod, etc. in the market?

Government of Nepal frequently checks weight blocks, beam balance, metre rod, etc. in the market to prevent the use of fake and defective measuring tools. This makes trade and business fair.

## Activity

**Objective:** To measure the thickness of a piece of paper

Requirement: Scale and a science book

**Methods:** 

Take a science book without its cover. Count the total number of paper sheets of the book. Measure the total thickness of the book by using a scale. Divide the total thickness of the book by the total number of paper sheets. i.e.,

Thickness of a sheet = Thickness of the book/Total number of sheets

**Observation:** For example, thickness of the book = 10 cm

The total number of sheets = 250

Thickness of a sheet 
$$=\frac{250}{10}$$

= 0.04 cm.

**Conclusion:** The thickness of a sheet of paper is 0.04 cm.



#### **Fact with Reason**

SI unit of length is metre (m) but the length of roads is expressed in kilometre (km). Why?

Roads are of long distance. If we measure such length in metres then the number would be very large. So, a bigger unit of measurement of length 'kilometre' (km) is used to express the length of roads.

#### **Example 1:** How many centimeters are in 2.5 m?

Solution:

Here, length = 2.5 m

We know that 1 m = 100 cm

So,  $2.5 \text{ m} = 2.5 \times 100$ 

= 250 cm

There are 250 centimetres in 2.5 m.

## **Example 2:** Convert the length of 600 mm into 'metre'.

Solution:

Here, length = 600 mm

We know that 1 m = 1000 mm

So, 600 mm = 600/1000

 $= 0.6 \, \mathrm{m}$ 

Therefore 600 m is equal to 0.6 m.



#### **Memory Plus**

1 inch = 2.54 centimetres and 1 foot = 12 inches

## Example 3: A piece of iron rod has a length of 25.4 cm. How long is the rod in inches?

#### Solution:

Here, length of iron rod = 25.4 cm

We know that 1 inch = 2.54 cm

So, 25.4 cm = 25.4/2.54

The length of the piece of iron rod is 10 inch.

#### Time and its unit

The interval between any two events is called time. In SI system of units, time is measured in second. It is also measured in minute, hour, day, week, month, year, decade, century, etc.

#### Measurement of time

Time is measured by using different types of watches and clocks. For examples: pendulum clock, quartz clock, mechanical clock, digital watch, etc. Atomic clocks are designed to measure time accurately. But the time measured by pendulum clocks fluctuates with the change in the length of the pendulum used.



endulum clock



Stop watch



Wrist watch



Digital clock

Fig. 1.6: Some time measuring instruments

## Multiples and sub-multiples of second

The fractions of a second which are used to measure the shorter time interval are called sub-multiples of second. For example: milli-second micro-second, nano-second, etc. Similarly, to measure the longer time intervals, we use minute, hour, day, month, year, etc. These are called multiples of second. Thus, the units bigger than second which are used to measure longer time intervals are called multiples of second.

#### Relation of multiples and sub-multiples of time

60 seconds = 1 minute

60 minutes = 1 hour

24 hours = 1 day

7 days = 1 week

365 days = 1 year

#### **Example 6:** Find the number of seconds in a mean solar day.

**Solution:** 1 mean solar day = 24 hours =  $24 \times 60$  minutes =  $24 \times 60 \times 60$  seconds

1 mean solar day = 86,400 seconds



#### **Memory Plus**

One day has 86,400 seconds. It means one second is one part of 86,400 parts of a day.

## Temperature and its unit

In winter we feel cold and in summer we feel hot. The hotness and coldness of a body is called temperature. Temperature of a body is measured with a help of thermometer. It is measured in the units like degree Celsius (°C), degree Fahrenheit (°F) and kelvin (K). Its SI unit is 'kelvin'. We use °F to measure our body temperature.

Laboratory thermometer and clinical thermometer are two common types of thermometers. They are shown in the given figures.

### **Memory Tips**



Normal human body temperature is 98.6°F (i.e. 37°C). Water freezes at 0°C and boils at 100°C.



Fig. Different types of thermometers

#### Area and its unit

## Activity

Collect different objects which have different shapes of base. For example, eraser with rectangular shape, coin with circular shape, etc. Place them on your exercise book and outline with a pencil. Compare the surface covered by different objects on your exercise book.

In the activity, you observe that objects cover a certain surface of your exercise book. That surface gives the area of the base of individual object. Thus, area is the total surface covered by an object. It measures the expanse of surface covered by the body. The SI unit of area is square metres (m²). It is also measured in square kilometres, square centimetres, etc. Area of regular plane surface can be determined by using a formula as shown below.

Object	Shape of the base	Formula	Area
2 m	2 m — † 1 m	Area of rectangular object = length × breadth	$A=1 \times b$ $A=2 \text{ m} \times 1 \text{ m}$ $A=2 \text{ m}^2$

#### Volume and its unit

#### **Activity**

Take a syringe. Press its piston to remove the air inside it. Dip its mouth in a beaker filled with water and gradually pull the piston up. Do you observe the water from the beaker occupying space inside the syringe?



Volume is the measure of the space occupied by a substance. The total space occupied by a substance is called volume of that substance. The SI unit of volume is cubic metre (m³). It is also measured in cubic centimetres, mililetres, litres, etc.



Fig. Different types of devices to measure volume of liquid



## **Memory Tips**

Liquid medication dose is commonly given in milliliters



#### Relation between different units of volume

1 litre (lt) = 1000 milliletre (ml)

1 litre (lt) = 1000 cubic centimetre (cc) (1ml = 1 cc)

1 cubic metre = 1000 litre

Volume of a regular shaped object can be calculated by using a formula as shown below.

Object	Shape	Formula	Volume
		Volume of cube = side × side × side = l³	$V = 1 \times 1 \times 1 = 1^3$ $V = 1 \text{ m}^3$ = 100 cm ×100 cm ×100cm = 1000000 cm <sup>3</sup> = 1000000 ml Volume of water in the tank = 1000 lt



#### 1. Why is scientific learning encouraged nowadays?

Scientific learning is encouraged nowadays because:

- i. It is reliable as it is based on experiment, observation, analysis, and conclusion.
- ii. The fact concluded by scientific learning processes is true and can be replicated by another person.
- 2. Give examples of local units that are replaced by kilogram.

Two local units that are replaced by kilogram are mana, pathi, sher, dharni, etc.

3. Name the device shown in the given figure. Which physical quantity is measured by it? Also name two similar devices.



The device shown in the given figure is measuring jug. It measures volume of liquids. Two similar devices are measuring cylinder and beaker.

## 4. Local units do not give accurate and reliable measurement. Why?

The local units of measurement vary from country to country and place to place. For example, a cubit of tall person is longer than that of a short one. Thus, local units do not give accurate and reliable result.

#### 5. Why is the use of an appropriate unit necessary in measurement?

During measurement we need to compare an unknown quantity with a known quantity of the same kind. Otherwise, the measurement becomes meaningless. For example, if we say two metre rice, it does not give any sense. So, there is necessity of an appropriate unit to express the measurement of the physical quantities.

6. Look at the given picture and complete the first three steps of scientific method.



*Step-1 Observation:* One of the tomato plants is grown well but not another.

*Step-2 Question:* Do nutrients in soil affect the growth and development of plants?

*Step-3 Hypothesis:* Variation in amount of fertilizer might affect the growth and development of the tomato plant.

#### 7. If SI unit of time is second, what is its CGS unit?

The CGS unit of time is also second.

## 8. Scientists mostly prefer using atomic clocks inspite of other clocks. Why?

Scientists mostly prefer using atomic clocks inspite of other clocks because it gives accurate measurement of time.

## 9. Time measured by pendulum clock fluctuates with change in season. Why?

Time measured by pendulum clock fluctuates with change in season because length of pendulum changes with change in season.

## 3 Step Exercise

## STEP 🙀

### 1. Fill in the blanks with appropriate words.

(last, hundred, observing, hypothesis, second)

- a) Collection of the information is called......skill.
- b) Asking question is the .....step in scientific learning method.
- c) We communicate our results to others in the...... step of scientific learning method.
- d) ..... is an educated guess that can be tested.
- e) One quintal has a . . . . . kilograms.

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

- a) In scientific learning method we do analysis before collecting the data.
- b) We use current knowledge and data to make a prediction.
- c) 'Mana' and 'pathi' are standard units of measurement.
- d) Area of a box is 2 m<sup>2</sup>. It indicates the total space occupied by the box.
- e) There are 86,400 seconds in a mean solar day.

## 3. Select the best answer from the given alternatives.

- a) Which is the correct order of steps in scientific learning method?
  - i) Question, observation, hypothesis, experiment
  - ii) Observation, question, data collection, hypothesis
  - iii) Question, hypothesis, observation, data collection
  - iv) Observation, question, hypothesis, experiment
- b) Which of the following measurements is not expressed in SI?
  - i) 2 m long piece of cloth
- ii) 5 mana wheat

iii) 25 kg rice

iv) 45 seconds

- c) What is the relation between the unit 'inch' and 'cm'?
  - i) 1 cm = 2.54 inch

ii) 2.54 cm = 1 inch

iii) 1 in = 2.45 cm

- iv) 2.45 in = 1 cm
- d) Which of the given quantities is measured in pathi?
  - i) Mass

ii) Volume

iii) Time

- iv) Both 'i' and 'ii'
- e) What is the volume of water in a completely filled cubic tank with length of a side 1m?
  - i) 1000 l

ii) 1000 ml

iii) 1000 cm<sup>3</sup>

iv) 1000 m<sup>3</sup>

## 4. Match the following:

energy

i. cubic metre

mass

ii. kilogram

area

iii. kelvin

volume

iv. joule

temperature

v. square metre

## STEP 🎇

## 5. Answer the following questions in one word.

- a) Rohan compares his data with his friend's finding while doing an experiment in his class. What is this process called in scientific learning method?
- b) What is the possible answer of problem or question called in scientific method?
- c) What is the SI unit of temperature?
- d) Which quantity is measured in milliliter?
- e) In a relation 1mg = 0.001 g, which one is a bigger unit?

#### 6. Give reasons.

a) We need to ask questions in scientific learning method.

- b) Measurement is necessary in daily life.
- c) The use of an appropriate unit is necessary in measurement.
- d) We need standard units of measurement.
- e) SI unit of length is metre (m) but the length of roads is expressed in kilometre (km).

#### 7. Differentiate between:

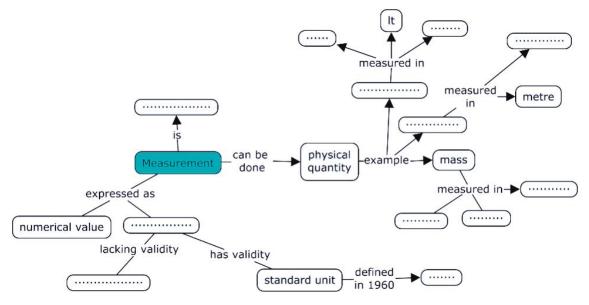
- a) Local unit of measurement and standard unit of measurement.
- b) MKS system of unit and CGS system of unit
- c) FPS system of unit and SI

#### 8. Figure based questions

a) Look at the given devices. Name the quantity that can be measured with them. Also write the corresponding units of measurement.



b) Copy and complete the given concept map.





#### 9. Answer the following questions.

- a) Define the following terms.
- i) Science ii) S
  - ii) Scientific learning
- iii) Measurement

iv) Unit

v) Standard unit

vi) SI unit

- vii) Mass
- viii) Length

- ix) Time
- b) Mention any two difficulties that will arise in daily life in absence of measurement.
- c) How does the use of standard units of measurement solve problems in measurements regarding validity and reliability?
- d) List four units that are used to measure the mass. Write the corresponding relation between units of mass.
- e) Present scientific method in a flow chart with a brief explanation of each step.
- f) Convert the following:
  - i) 20 m into cm
  - ii) 250 g into kg
  - iii) 45 minutes and 20 seconds into seconds

## **Project Work**

Work in a group to search for local units of measurement that are used in Nepal to measure different quantities. For example, land area is measured in ana, ropani, kattha, etc. Gold is measured in laal, ana, etc. Collect information from your elders or by using the internet to find the relation of such units with SI units.

Theory	Practical
20	10

## Information and Communication Technology

#### Area and Sequence of Curriculum Issued by CDC

- 1. Local (simple) and modern technology with examples
- 2. Use of mobile phone and computer in our daily life
- 3. Parts of computer

Unit

4. General use of word processer table, spreadsheet and presentation software

#### **Learning outcomes**

At the end of this unit, students will be able to:

- i. define local technology and modern technology with examples.
- ii. state the use of mobile phone and computer in our daily life.
- iii. define laptop, desktop, tablet, iPad and smart phone as computer.
- iv. identify parts of a computer.
- v. use word processer table, spreadsheet and presentation software.

#### Key terms and terminologies of the unit

ICT: ICT (Information, Communication and Technology) is the

integration of technological tools that are used to communicate,

create, store, disseminate and manage information.

**Technology:** Technology refers to the construction and use of tools that

make practical work easier.

Simple technology: Construction and use of simple tools from the available

resources to make our work easier and faster is called simple

technology.

Modern technology: Construction and use of efficient tools to make our work easier,

faster and convenient is called modern technolgy.

Technology shift: Transformation of tools, technique and technology from

simple, local and traditional form to modern form is called

technology shift.

#### Introduction

What helps you to communicate with your friends or relatives around the world? Is cell phone used just for communication? Do you store some kind of information in the cellphone with your parents? Why do you need computers? How do you get information about happenings in your surroundings? Is computer and internet used for teaching and learning in your school? All of these questions are related with Information and Communication Technology



(ICT). ICT is the integration of technological tools that are used to communicate, create, store, disseminate and manage information. Such technological tools include computer, internet, camera, microphone, radio, television, telephone, etc.

## 2.1

### **Technology**











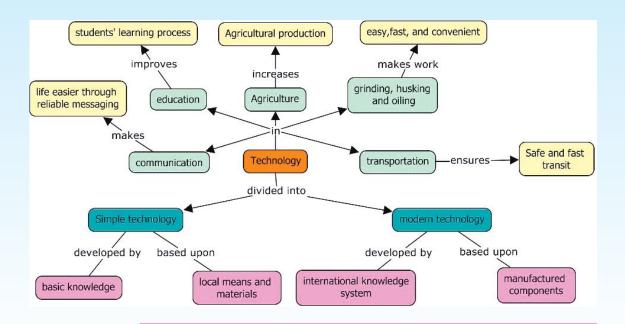


Chulesi Knife Peller Phone Call

Observe the above figures. What makes peeling the potato easy and fast from among the chulesi, knife, or peeler? Obviously, peeling potato with peeler is easy and fast. Peeler is more advanced tool than knife for peeling purpose. Here, peeling with peeler is use of an advanced technology. Similarly, video calling is

We use many tools in our daily life. We use bicycles, motorbikes, cars, buses, etc. to move around. Chulesi, knife, etc. are used to cut vegetables. Kuto and kodalo are used for digging the field. The application of tools and techniques is called technology. Technology refers to the construction and use of tools that make practical work easier. It originates and develops from knowledge and skills of people. On the basis of knowledge, skills and the resources used, technology can be classified as simple technology and modern technology.

more advanced technology than phone call.





#### **Fact with Reason**

#### Why do we need technology?

We need technology to make our work easier, faster, and more convenient. It saves our time, labour and cost.

#### Simple (local) Technology

#### Activity

Observe the given pictures. Think about them and share with the friend next to you. Finally, state the answer of the given questions in the classroom. Take help from your teacher if required.







































- i. What are the tools shown above called in your local language?
- ii. For which purpose do we use these tools?
- iii. Why do people use these tools?

All the above pictures are simple tools. Most of the people in our country still use a number of simple tools in their daily life. There is an idea or technique behind a simple tool to make it a workable device. This kind of knowledge and technique belongs to simple technology. Construction and use of simple tools from the traditional knowledge and available resources to make our work easier and faster is simple technology. For example, the use of simple technology for digging field and ploughing farm are kuto, kodalo, halo, etc. Similarly, people use sickle (hasiya) for crop harvesting and grass cutting. We use belna and chauki to make breads. Similarly, chopping wood is easy with axe, cracking 'betel nut' is easy with nut cracker (sarauto), etc.

#### **Memory Tips**



First knives, axes and cutting tools made by our ancestors of the stone age indicate the origin of simple technology. Such simple tools helped them to hunt animals and defeating enemies more quickly and effectively.

#### Simple (local) Technology Used in Nepal

Nepal is rich in traditional technologies. People in different geographic localities have some special kind of traditional knowledge. They have been utilizing natural resources to support their livelihood. Use of simple technology is found in many fields like agriculture, food and beverage (Gundruk, Sinki, wine), grinding, construction, pottery (gamala, diyo, gagri), metal-wares (karuwa, bowls, charas plates), fabrics (radi, pakhi), etc. Such technical knowledge is transferred from one generation to the next.

#### Activity

Study the use of simple technology in your surroundings. Take support from your parents, neighbours and relatives. Fill your findings in a table as shown below.

Tools of simple technology	Materials used in construction	Use
Gagri	Soil	To keep water

#### **Modern Technology**

#### Activity

Observe the given pictures. Think about them and share with the friend next to you. Finally, state the answer of the given questions in the classroom. Take help from your teacher if required.































- i. Name the devices given above.
- ii. For what purpose do people use these tools?
- iii. Why do people prefer to use these tools?

Observe the tools used in your kitchen. Is there use of firewood, electricity or gas stove to cook food? Most of the tools that we use in our daily life are getting

advanced day by day. For example, some people use induction stove for cooking purpose, some others use rice cooker or gas stove for the same purpose. Similarly, use of roti maker to make bread, electric iron to iron clothes, electric heater for room heating, air conditioner (AC) to regulate room temperature, refrigerator to keep goods fresh, robot to serve us, etc. are some examples of modern technology. So, modern technology is the construction and use of efficient tools to make our work easier, faster and convenient. We prefer use of modern tools and machines to perform our works rather than using simple tools.

#### Activity

Study the use of modern technology in your surroundings. Take support from your parents, neighbours and relatives. Fill your findings in a table as shown below.

Tools of modern technology	Use	
1. Excavator	for digging, lifting loads, landscaping, demolition, etc.	

#### Differences between simple technology and modern technology

S. N.	Simple Technology	S. N.	Modern Technology
1.	Simple technology is developed by using the traditional knowledge of the individuals.		Modern technology is developed by using the international knowledge system (universities, research or innovation centres , industries).
2.	It is based upon local knowledge, means and materials.	2.	It is based upon advanced components manufactured in factories.
3.	Simple technology is environment friendly, simple and suitable for a specific local condition.	3.	Some of the modern technologies may not be suitable in mountainous region, remote areas in our country.
4.	Most of the simple technology tools are operated with human power. E.g. jato, dhiki, etc.	4.	Most of the modern technology tools are operated with electric power. E.g. Rice mills, mixture grinder, etc.

#### Technology (Simple and Modern) in Agricultural Practices

#### Activity

Two of your friends will play the role of Ram and Shyam in the given dialogue within the classroom.

Ram: (one hand on his back, ploughing field with the plough talking on his own) Got tiered. It's time consuming work to plough the field with halo.

Shyam: Hello, Ram. You look tired. I told you to replace your tool to do farming but you did not follow my idea last year. Look at me, I completed planting paddy all over my farmland. Two-wheeler hand tractor is simple to run and it is easy to plough the field by using it.

Ram: Yes Ram, I also should have a tractor as yours. Next year I will buy it too.

Shyam: Next year, I am planning to buy crop harvesting tool and threshing tool too. I get tired while harvesting crops with sickle and threshing rice with hands. Such tools make our work easier and faster than traditional methods. Let's buy it together.



Pharuwa (Spade)



Ploughing field with the plough



Hasiya (Sickle)



Tilling by a tractor



Doko (Basket)



Threshing by a thresher

Kuto, kodalo, pharuwa (spade), plough, etc. are used for digging the field and tilling land. They are simple tools. These tools were invented by local people in the ancient time. Similarly, dalletho (wooden mallet) is used to break up lumps of clay. Use of these tools in agricultural practices falls under local technology.

Nowadays, modern tools and techniques are used in agricultural sector. For example, tilling by a tractor, harvesting by a machine, threshing by a thresher, etc. These are some examples of modern technology.

#### Technology (Simple and Modern) in Dehulling, Grinding and Oiling







Dhiki



Pani Ghatta



Mixer and Grinders



Rice Mills



*Iato* 

In remote areas dhiki and jato are common tools for husking rice and grinding grains. Similarly, in hilly areas grinding of wheat, maize, millet, etc. can be done in a water mill (pani ghatta) too. With access to modern technology, people go to rice mills for husking and flour mills for grinding. In our society, we still use silauto and lohoro for grinding garlic, ginger, chilli, spices, etc. It takes a lot of strength and time. In place of silauto and lohoro, mixer and grinders can be used for grinding above things.

#### **Memory Tips**



**DHIKI:** A long, heavy pivoted beam used for de-husking rice grains by pounding.

**JATO:** A manual grinding-stone mill in which one wheel is made to rotate over another by hand.

**PANI GHATTA:** A kind of mill based on simple technology that is powered by stored water energy.

The simple technology for extracting oil by crushing mustard (lahi), chiuri, etc. is done by using kol. It is still dominant in remote areas where electric power supply is not possible. Nowadays an electric oil extracting machine is available in the market. Such machines extract oil form the seeds.

#### **Fact with Reason**



Tools based on simple technology for grinding, husking and oiling are being replaced by the tools or machines that run with electricity, why?

Tools based on simple technology for grinding, husking and oiling take a lot of human power and time to run whereas machines of modern technology run with electric power. They have a high speed. They are easier, faster and cost-effective. So, people prefer such machines for grinding, husking and oiling.

#### **Technology (Simple and Modern) in Transportation**













Rus

Cable Car

Aeroplane

Wooden boat, bull cart, tuin are some examples of tools of simple technology in transportation. Nowadays, they are almost totally replaced by the tools of modern technology. Transportation by bicycle, scooter, motorbike, car, truck, bus, rope way (cable car), aeroplane, etc. are some examples of modern technology in transportation.

#### Activity

Observe the means of transportation in your surroundings and fill in the table as shown below.

Tool	Technology involved	Use
1. Bull cart	Simple technology	To carry load (grains, crop harvest, etc.)

#### **Technology Shift in Our Society**

Technology is developed to meet our needs. For example, farmers prefer to cultivate crops and harvest them in an easy, fast, and cost-effective way. Similarly, construction workers prefer to construct modern houses, buildings, bridges, etc. in an efficient way. Manufacturing of bicycle, motorcycle, telephone, mobile, computer, etc. are the result of advancement in technology. Simple technologies are being replaced by modern technologies. It is called technology shift. Thus, transformation of tools, technique and technology from simple, local and traditional form to modern form is called technology shift. For example, dhiki and jato have been replaced by rice mills and flour mills respectively.



Cutting wood with axe



Cutting wood using a machine



Husking in a rice mill



Harvesting rice crop using a sickle



Threshing with hand



Harvesting rice crop using a cutter (Reaper)



Husking with a dhiki



Threshing with a thresher

#### Activity

Observe the technology shift in your surroundings and fill in the table given below.

Work	How people used to do it earlier?	How people do it at present?
1. Husking rice	Using dhiki	Using dehulling mills (rice mills)
2. Grinding grains		
3. Extracting oil form seeds		
4. Cooking food		
5. Ploughing field		
6.		
7.		



### 1. Why are people still using local technologies though modern technologies are developed?

People still using local technologies though modern technologies are developed because of the following reasons:

- i) Modern technologies need skilled or semi-skilled manpower to run and repair them.
- ii) They are expensive.
- iii) Some of them may not be suitable for particular place. For example, ploughing by tractor is less suitable for mountain and hilly regions.

#### 2. What is technology shift? Explain with example.

Transformation of tools, technique and technology from simple, local and traditional form to modern form is called technology shift. For example, dhiki and jato have been replaced by rice mills and flour mills respectively.

3. Write two differences between dhiki and rice mill.

Dhiki	Rice mill
1. It is a tool based on simple technology.	1. It is a tool based on modern technology.
2. It runs with our muscular power.	2. It runs with an electric power.

## 4. Use of silauto and lohoro for grinding does not add to our electric bill but using mixture grinder increases the electric bill. Why do people prefer to use mixture grinder?

Grinding spices on silauto and lohoro needs muscular energy. It needs more energy and time. On the other hand, mixture grinder has grinder connected with motor that runs with electricity. It easily grinds at an instant without loss of our muscular energy. So, people prefer to use mixture grinder for grinding without considering the increase in electric bill.

- 5. 'Flour mills are developed forms of pani ghatta.' Justify this statement in two points.
  - i) On the basis of construction: Both flour mills and pani ghatta have two grinding stones, a pivot and a shaft to rotate grinder.
  - ii) On the basis of operation: In pani ghatta, force of water is used to operate. In this case, one of the two stones is made to rotate over another for grinding. On the other hand, electric power rotates the grinder in flour mills.
- 6. Present your view on use of modern technology in agriculture.
  - i) Farmers waste their energy and time with the use of traditional technology. For example, digging field with kodalo needs more muscular energy as well as longer time to complete work.
  - ii) Agricultural works become easier and faster with the use of modern technology. Farmers can complete their work in time. They can grow seasonal crops and vegetables.
- 7. Why are people attracted to modern technologies?

People are attracted to modern technologies because they make our work easier, faster, and cheaper. They also need less manpower.

#### 3 Step Exercise



#### 1. Fill in the blanks with appropriate words.

(simple, telephone, simple, silauto and lohoro, modern, mixture grinder, simple and local)

a) ..... is a tool of modern technology for communication. b) Nowadays......technologies are being replaced by modern technologies. c) People prefer to use......for instant grinding rather than d) ..... technology makes work easier and cost-effective than ............ technology. e) Water mill (pani ghatta) is based on ......

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

- a) Harvesting crop with sickle (hasiya) is a simple technology.
- b) Ploughing with a harrow pulled by a tractor is faster than ploughing with halo.
- c) Construction of tools from the available resources in community is modern technology.
- d) Use of belna and chauki to make bread is a simple technology.
- e) Potters make earthen pots by using modern technology.

#### 3. Select the best answer from the given alternatives.

- a) Which of the following does not fit in a modern technology in the kitchen?
  - i) Induction stove

ii) Mixture grinder

iii) Refrigerator

- iv) Chulesi
- b) Farmers are planning to replace halo with two-wheeler tractor
  - i) To make ploughing faster ii) To show interest in modern technology
  - iii) To make farming work easier
- iv) Both 'i' and 'iii'
- c) Iron smiths have their business in remote communities because
  - i) Aaran is a simple technology
  - ii) Most of the people lack modern technology tools
  - iii) People in remote area use hasiya, kuto, kodalo, etc.
  - iv) All of the above
- d) What is the reason behind saying dhiki is a tool of local technology?
  - i) It doesn't have iron made body
  - ii) It is not based on scientific principle
  - iii) Husking with dhiki is easier
  - iv) It is made from wood using traditional knowledge
- e) Which of the following groups is not a perfect set of modern technology?
  - i) Heater, smart phone, bus, car

- ii) iPad, tablet, smartphone, laptop
- iii) Bicycle, scotter, motorbike, boat
- iv) Camera, scanner, projector, printer

#### Match the following according to technology shift:

**KOL** i. Harrow

HALO ii. Rice mill

PANI GHATTA iii. Roti maker

**DHIKI** iv. Flour mill

BELNA CHAUKI v. Electric oiling machine



#### Answer the following questions in one word.

- a) Name a tool of simple technology used for husking rice grains by pounding.
- b) Which type of technology was developed earlier than modern technology?
- c) Name the modern technology machine that resembles human beings.
- d) Give an example of a modern technology tool that you use in everyday life.
- e) Which type of technology makes our work easier, faster and cost-effective?

#### 6. Write any two differences between:

- a) Simple (local) technology and Modern technology
- b) Pani ghatta and Flour mill
- c) Coal used iron and electric iron

#### 7. Give reasons:

- a) We need technology.
- b) Aaran is a tool of local technology.
- c) Husking rice in a rice mill is faster than husking with dhiki.
- d) Grinding grains with jato is being replaced by flour mills.
- e) Ploughing field with harrow pulled by a tractor is a modern technology.

#### 8. Figure based questions

a) Observe the given pictures carefully. Identify the simple (local) technology tools and the corresponding modern technology tools for the same use.













b) Observe the pictures shown below. Identify the technology involved (local technology or modern technology) and write their use.













Name	Technology Involved	Use



#### 9. Answer the following questions.

- a) Define technology. Write its types with two examples of each.
- b) Make a list of tools of modern technology in each of transportation sector and communication sector.
- c) What would you suggest to your friend who wants to shift his local technology in kitchen into modern technology?
- d) Make a comparison of local technology and modern technology in agricultural sector.
- e) 'Use of modern technology in agricultural sector must be promoted'. Justify this statement with examples.
- f) There are still pani ghatta in remote areas of our country but people go to flour mills for grinding their grains. Analyze advantages and disadvantages behind this move.

#### **Project Work**

Work in a group to make a model of each of the following local technology tools and present them in your classroom.

a. DHIKI b. JATO

c. SILAUTA AND LOHORO d. HALO

e. KODALO f. KUTO

g. DATE h. HASIYA

## Use of smartphone and computer in our daily life

#### Key terms and terminologies of the unit

Computer is an electronic device that accepts input data and

processes it to give an output data.

Output devices: Output devices are the components of a computer that present

processed data to the user.

Storage device: A storage device is a computer part which is used for saving

data.

Programme: A set of instructions given to a computer is called programme.

Software: A set of programme is called software.

Hardware: Physical parts of a computer are called hardware.

Word processor: Word processor is a computer programme to create, edit and

format documents like letters, tables, reports, handouts, etc.

Multimedia: Multimedia is a combination of text, graphic, audio and video

for getting knowledge or information.

Spreadsheet: Spreadsheet is an electronic file with a grid of columns and

rows.

Columns: Columns run vertically across the worksheet in excel.

Rows: Rows run horizontally across the worksheet in excel.

Cell: Cell is the intersection of a row and a column in a worksheet.

#### Activity

Raise your hand to state a use of smartphone and computer. The student who raises the hand first will have the chance to say at first. Don't repeat the same use that was stated earlier. After everyone gets their turn, make a



discussion about the use of smartphone and computer in our daily life. You can give examples of people or places using these devices. Finally, note down the devices and corresponding uses in your exercise book in the given format.

Device	Used at/by	Use
1. Computer	Home	To read and watch online news
2. Smartphone	Home, office, outside	To take photos, video call, etc.

Nowadays, use of smartphones and computers is common in our society. In city areas, people tend to use smartphones and computers with latest technology. Along with the internet, people use these devices to remain connected with other people around the globe through social media. In smartphones and computers, people watch and listen to online news, compose and check emails, get entertainment, etc.



Smartphone has taken the place of computers. Most of the work based on computer can be done with a smartphone. Most people prefer smartphones for their personal purpose. On the other hand, computers are preferred for official use. There are different programmes that work on both smartphone and computer. Some programmes are designed especially for computer, laptop or smartphone. Such programmes do not run on one another.

#### **Fact with Reason**

Smartphones can also work as computer. Why are computers (desktop/laptop) used at office and home instead of smartphones?



Computers have large workspace on their screen. There is more storage space for official data or personal data in computer than that in smartphone. Computers can perform multiple tasks at the same time. Some programmes only function on computers. These features are preferred by the people using computers in office or at home.

#### Use of Smartphone in Our Daily Life

Smartphones are being an essential part of our daily lives. The main purpose of smartphone is phone call. Apart from this, there is a wide range of their uses.



Communication: phone calls, text messaging, email, etc.



**Internet surfing:** Google search



Connectivity: Social media



Education:
Online learning, school
management app, reading
books, etc.



Entertainment: music, games, videos, take photos, watch TV, etc.



**Navigation**: navigation through Google map, etc.

Mobile banking is another important use of smartphones. If our smartphone is connected to internet, we can access our bank account via smartphone easily and safely at any time. For this purpose, our smartphone should be installed with an application designed for our bank. Every bank has its own application. Apart from these,





smartphones have some common uses as clock, alarm clock, calendar, calculator, FM radio, etc. Smartphones also have storage to store important data, documents, photos, etc.

#### **Fact with Reason**



What could be the reasons behind increasing demand for smartphones?

Smartphone can be used as a computer. There are wide varieties of applications of smartphones. Smartphones are attractive in appearance, light in weigh, small in size. So, people prefer to buy a smartphone with advanced features.

#### Activity

Ask your parents, seniors and relatives to collect information about the uses of smartphone and fill in the table as shown below.

Person	Use
Father	Read online newspaper, mobile banking

#### Use of Computer in Our Daily Life

Computers are used in various fields such as education, health, communication, business, etc. Initially, computer was invented for calculation purpose in accounting. Today, we can hardly find a field without scope of computers. The use of computers in education is transforming the traditional education system into a modern one. There is effective use of computers in hospitals, TV/FM control rooms, banks, different kinds of office, businesses and at home.

#### Application of Computer







Communication



Bank



Hospital



Office



Home



School

#### Fact with Reason



Why are computers used as essential component in different fields?

A computer can keep a lot of information safely stored in it. People can use such information time and again in their need. Computers perform tasks quickly and reliably. So, computers are widely used in homes, schools, offices, banks, hospitals, media centres, security agencies, entertainment, etc.

#### Activity

At how many places have you seen computers (desktop/laptop) in use? Fill in a table with the given format.

Place	Use
1. Ticket counter	To sell/purchase bus ticket
2. Electricity office	To calculate monthly electricity bill

#### Things to Remember While Using Smartphone and Computer

#### Activity

Look at the given pictures. What do the pictures depict? First, think on your own. Then, share with the friend next to you. Finally, explain in the classroom.











It is important to use computers and smartphones in our daily life without impact on physical and mental health. We need to maintain a proper distance from the computer or smartphone screen. We should avoid prolonged use of computer and smartphone without rest. Continuously viewing digital screens for a long period of time creates a vision problem, headache, eye strain, blurred vision, dry eyes, burning sensation, etc. One must care about brightness of the digital screen. Both high brightness and low brightness create stress on eye muscles. We need to adjust the font size of the text in a document according to our comfort. Prolonged use of digital devices creates other physical and mental problems. It can affect mental cognition, mood and overall behaviour of a child. It also makes difficult to fall asleep. Improper posture while working on computers for a long period of time results in back pain.



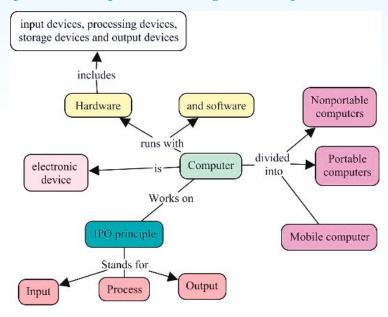
#### **Fact with Reason**

Why is it suggested to blink eyes more often when looking at smartphone screen or computer screen?

Non-blinking can cause dry eyes. Blinking eyes more often moistens our eyes to prevent dryness and irritation. So, it is suggested to blink eyes more often when looking at digital screens to prevent eye strain.

#### 2.3 Computer

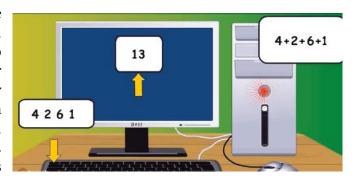
The word 'computer' is derived from the Latin word 'computare' which means to calculate. Computer works with the help of programmes. Users provide raw data as input to the computers. This data gets processed under controlled set of instructions (i.e. programme) and present as a result (i.e. output). This result remains saved in memory for future use. Thus, computer is an electronic device that accepts input data and processes it to give an output.



#### **Working Principle of a Computer**

#### Activity

Visit the computer lab to observe a computer working for you. Take help of your teacher to identify the parts of a computer shown in the given figure. For calculation, press the button on keyboard to add 4, 2, 6 and 1. When you press the buttons, your input data transfers



through wire to central processing unit (CPU) of the computer. After processing, data from CPU moves towards monitor through a wire for display. In an instant, the sum appears as an output on the computer screen.



#### **Memory Tips**

Basically, building blocks of a computer are 'input device', 'processing device', 'memory and storage device', and 'output device'.

**Input (I):** It is an instruction given to a computer. In this phase, the raw data to be processed is entered into a computer. Input is added by means of input devices. The device through which data and instructions enter into a computer is called input device. Common input devices are keyboard and mouse. Microphone, web camera, scanner, etc. are also examples of input devices.

**Process (P):** This is the phase of getting desired information by modifying or processing the data. The process of converting data to information is called data processing. Data processing is done in CPU. CPU, Graphics Card, Sound Card, etc. are examples of processing devices in computer. It is the brain of a computer.

**Output (O):** It is the result after processing the data accepted by computer in the form of input. Computer gives a result when data processing gets accomplished in CPU. Output devices are the components of a computer that present processed data to the user. For example, display screen, speaker, printer, etc.



#### **Memory Tips**

Data processing by a computer in three basic steps: Input—Process—Output is called a data processing cycle.

#### Memory and Storage Device

#### Activity

Take help from your teacher to get a pen drive with data. Connect that to your computer's USB port. Double click on 'This PC' ( ) icon to open it. You will see your USB device icon as shown in the given figure. Double click on the device icon to open it. Select the file in pen drive and right click on it to copy. Finally, right click on desktop to paste the file. Here you have pasted data from the pen drive to desktop of your computer. Can you copy data from the pen drive to other drives of hard disk?











A computer has temporary memory and permanent memory units. RAM (Random Access Memory) is a temporary storage unit to store working data. Permanent storage devices allow a computer to keep data permanently stored in them for future use. A storage device is a computer part which is used for saving data. Storage devices are both internal and external to a computer. Hard disk drive, pen drive, compact disk (CD), digital versatile disk (DVD) are examples of permanent storage unit for a computer.













Memory Card

Hard Drive

External Hard Drive

Pen Drive

DVD

**RAM** 





#### Why do computers need storage device?

Computer needs programmes stored in it to run. Users also need to save their data in a computer for future use. So, computers need storage devices to save programme data and user data.

#### Activity

Request your teacher to take a photo of your class through smartphone. It gets automatically stored in smartphone memory. Observe the image file location in smartphone. Was that stored in phone memory or memory card? Discuss about the importance of storage unit in computers and smartphones.

#### Components of a computer

Software and hardware are the basic components of a computer. A computer cannot run without software. A set of instructions given to a computer is called programme and a set of programme is called software. For example, 'Windows' is a system of software to run computer. Microsoft Word is a software to



prepare our documents. Physical parts of a computer are called hardware. Hardware components can be categorized as input devices, processing devices, memory and storage devices, and output devices.



#### **Fact with Reason**

A computer hardware cannot function without a software. Why?

Computer needs a set of instructions in order to make hardware functioning. Software consists of a set of instructions that computer understands. So, a computer hardware cannot function without a software.

#### **Computer Parts**

#### Activity

Discuss about the different parts of computer shown in the given figure.

i. Which of them are used by users to give command to the computer?



- ii. From which of the devices do users get output?
- iii. Which devices are used as data storage devices?
- iii. Complete the table with the given format.

S.N.	Computer part	Use	Type of device
1	CPU	Data processing (e.g. adding, multiplying)	Processing device
2			Output device
3	Speaker		
4		To print documents	
5			

#### **Types of Computers**

Mostly earlier computers were desktop computers. As technology advanced, people got opportunity to carry computers with them on hands, in pocket, or even by wearing on wrist. We can classify computers on the basis of their portability.

#### Do You Know?

Computers have become very small to wear.





Non-portable computers (e.g. Desktop computers)



Portable computers (e.g. Laptop, notebook, etc.)



Mobile computers (e.g. iPad, Tablet, smartphones)

#### **Fact with Reason**



#### Why are smartphone, iPad and tablet called computers?

Smartphone, iPad, and tablet consist of basic building blocks of a computer, i.e. 'input device', 'processing device', 'memory and storage device', and 'output device'. In smartphones input is given through touchscreen with touch. They also work on IPO principle. So, they are also a kind of computers.

#### Differences between non-portable and portable computers

S.N.	Non-portable computers	S.N.	Portable computers
1.	These are heavier and larger in size.	1.	These are light in weight and small in size. They can easily fit in briefcase.
2.	These computers need constant electric power supply or battery backup to use.	2.	These are battery-operated computers. So, they can be used even when power supply is cut off.
3.	They require large space as they are fixed to sit on a desk.		They can be adjusted on an individual's lap, or palm while working.

## Office Applications (Word Processor, Presentation Software, Spreadsheets)

#### **Word Processor**

Word processor is a computer programme to create, edit and format documents like letters, tables, reports, hand outs, etc. Word processing software have features to organize an attractive document in a simple way. New features are updated in such software in a certain interval of time. A number of word processors developed by different software companies are available in market. For example, Microsoft Word (), 'Google Docs' (), LibreOffice Writer (), WPS Word () etc.

#### The basic operations in word processor

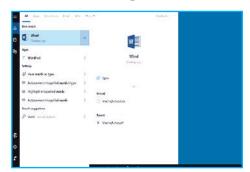
Creating a new document, typing a text, formatting the text, inserting images and charts, inserting tables, saving the document in computer's hard disk, printing, etc. are some basic operations in word processor.

#### Activity

Open Microsoft word on your computer to create a new document. Observe elements in 'Microsoft word interface'. Save word document with your name in computer's hard disk and close Microsoft word. Reopen the word document with your name in Microsoft word.

#### Steps to create a new document

i. Open computer. Click on start (■) on the taskbar search box on your computer screen. Type 'word' from keyboard. It displays a box with word file icon at the top.

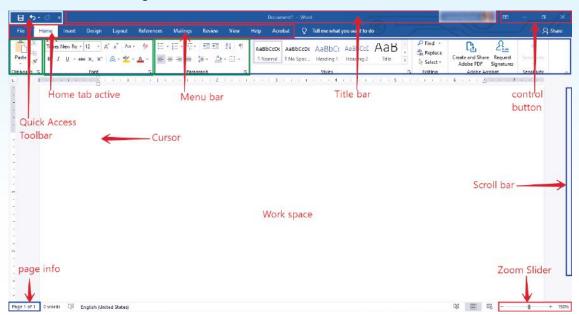




- ii. Click on 'word'. A number of options appears on computer screen.
- iii. Click on blank document to create a new document.

#### Microsoft Word interface elements

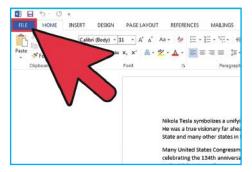
The word application shows different elements which are shown in the figure. Observe the arrow pointed elements on the word document.



#### Steps to save and close a word document

We need to save the content in our word file to use it time and again. Following are the steps to save a file.

i. Click on the file tab on menu bar.





ii. Click on save option {or directly click on save button (■) on quick access toolbar}. Select 'Save As' to save an already saved document with new name.





- iii. Select a location from the list displayed or click browse to find file storage location in your computer hard disk. For example, select computer and then current folder Desktop. Type the file name with which you want to save it. Finally, click on save. Here, you had selected desktop as location. So, your file got saved on computer desktop. When you try to reopen the document then you need to know the location where you had saved it earlier.
- iv. To close your document, click on the cross sign  $(\boxtimes)$  at upper right corner of the window application.

#### Steps to open a word file

- Click on file menu and select open.
   It opens an open dialog box.
- ii. Click on the location for your file (e.g. Desktop) or click on browse to select location.
- iii. Select the file to be opened by clicking on it. After that click on open.





#### **Memory Plus**

Search the location of folder or file in your computer then double click on a folder icon ( ) or file icon ( ) to open it.

#### Text formatting in a Word document

In some cases, we need to place our title at the centre of the document. Similarly, we want to change alignment, font size, font colour, etc. These are some common customizations in word documents.

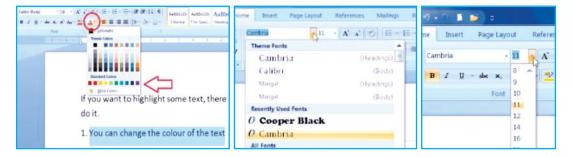
#### **Memory Plus**



Place the cursor before the first character of text. Drag through the text you want to select. Text gets highlighted on its selection.

**Quick Selection:** To select a word: *double-click it,* to select a sentence: *ctrl* + *click anywhere in the sentence,* to select a paragraph: *triple-click it.* 

## Steps to change font colour, font family and font size of the selected text



#### Click on Home tab. Click the drop-down arrow ( $^{\triangle}$ ) on following commands:

- **i. Font colour command**: Select the colour of your choice from colour window.
- **ii. Font command**: Select the desired font from the font family drop-down menu.
- **iii. Font size command**: Select the suitable font size from the font size drop-down menu.

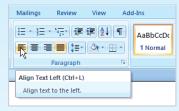
#### Steps to use bold, italic and underline commands

- i. Select the text first.
- ii. Click on Home tab. Look at the font group then click on Bold, Italic or Underline command.



#### Steps to change text alignment

- i. Select the text you want to modify.
- ii. Click on Home tab. Select the paragraph. Click any one of the four alignment options Align Text Left (■), Center (■), Align Text Right (■), Justify (■).





#### **Memory Plus**

Select certain text within a word document and move the pointer slightly within the selected text to display a mini toolbar for quick formatting.



#### Cut, copy and paste a text in word document

We need to select a text before giving command of cut and copy.

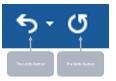
	Method 1	Method 2	Method 3		
Command	Click buttons on the ribbon	Use keyboard shortcut	Right-click the selection		
Cut	Click cut ( ¾) in clipboard group	Press Ctrl+X	Right-click selection and select cut		
Сору	Click copy ( in clipboard group	Press Ctrl+C	Right-click selection and select copy		
Paste	Click at destination location and select paste (Park ) in clipboard group	Click at destination then press Ctrl+V	Right-click at destination and select paste option		



#### **Memory Plus**

Undo (to go into back steps) - Press Ctrl+Z, or click on Undo on the quick access toolbar.

Redo (to bring back undone steps) - Press Ctrl+Y, or click on Redo on the quick access toolbar.



#### Working with tables in word document

A table consists of rows and columns. Intersection of the rows and columns is called a cell.

# ROWS >

#### Steps to insert a table

- i. Place cursor at the place where you want to insert table. Click on insert tab.
- ii. Click on table icon. It displays a grid popup Move mouse pointer over cells and click to select the number of rows and columns from the grid {e.g. insert a table of 5 columns and two rows (5×2 Table)}.



iii. Click on a cell and type from keyboard to fill data. You can use arrow keys ( ) from the keyboard to shift cells in the table.

#### Working with table layout

#### Activity

Insert a table with the given format in your word document. Look at the steps given in succeeding sections to practice following commands:

- a. Select first row of the table to change font into bold face.
- b. Select second column of the table. Copy it to paste at another place in the document.
- c. Insert a new row below the second row of the table. Fill with data in the same pattern.
- d. Select the whole table. Cut it to paste at another place in the document.
- e. Delete last column of the table.

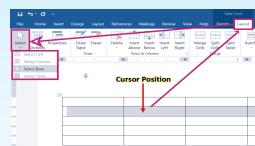
S.N.	Name	Class	Age	Weight
1	Narayan Parajuli	6	11	28 kg
2	Basanta Bhatta	7	12	35 kg
3	Rabindra Maharjan	5	10	25 kg

#### Steps to select cell, rows, columns and whole table

There are follwing methods:

#### Method 1 - Using Menu bar

- i. Click on a cell of your table. Click on table layout tab.
- ii. Click on to get the drop-down list. Select a command from the list.



#### **Method 2 - Using Mouse pointer**



- i. Select a cell: Click on a cell. Move mouse pointer at left edge of the cell. Click to select the cell when a diagonal pointer (1) appears at its edge.
- ii. Select column/s: Move the mouse pointer at upper edge of a column. The pointer inverts with dark arrow (i). Click to select the corresponding column. If you want to select other columns on left/right, keep holding the left mouse button and move the pointer left/right.
- iii. Select a row: Place mouse pointer infront of the row which you want to select. Here, it changes to back pointer (ຝ). Click to select the row. If you want to select row above/below the current row, then keep holding the left mouse button and move the pointer up/down.
- **iv. Select whole table**: Click inside the table to get 4 headed arrows ( ) at upper left corner of the table. Click on the arrows to select the whole table.

#### Steps to insert a new row or a new column

- i. Click in a cell of a table above/below or left/right of which you want to insert a row/column.
- ii. Click on table layout tab. Look at rows and column group. Click on one of



the four insert left ( ), insert right ( ), insert above ( ), and insert below ( ).



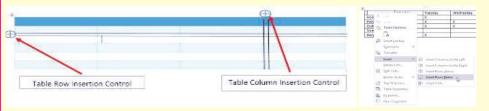


#### **Memory Plus**

**Add a row at the end of a table:** Click the last cell of the row and press TAB key.

**Row/Column insertion controls:** Click inside a table. Move pointer to insertion control position. Click on the plus sign to add a new row or column.





**Right-click to add row or column:** Right-click on a cell and hover over insert to select an option.

#### Steps to delete row or column in a table

- i. Click on a cell of the row that you want to delete. Click on table layout tab.
- ii. Click on delete icon. Select an option from the delete options appeared in the list.





#### Steps to merge cells of a table

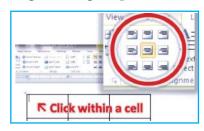


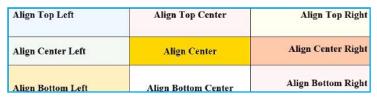


- i. Select the cells to be merged by dragging across them. Click on Table Layout tab.
- ii. Look at the merge group. Click on merge cells.
- iii. Alternatively, it can be done with right-click on selected cells. Select merge cells option from the list to merge selected cells.

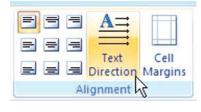
#### Text alignment in a cell

Click on a cell with text to be aligned. Click on table layout tab. Look at the alignment group to select an alignment option.





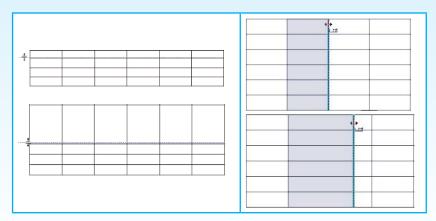
i. Change text direction: Click on a cell containing text to change its direction. Look at alignment group under layout tab. Click on text direction to rotate the text by 90 degrees. Click again to rotate text by another 90 degrees.



**ii. Adjust cell margin**: Select a cell or table to adjust margin around text inside the cell. Click on 'Cell Margin' icon under layout tab to set margin values.

## Adjustment of column width and row height

Move pointer over the border between two rows or columns that you want to adjust. Arrow gets changed into double headed arrow pointer (†). Drag it to adjust the height or width.



## Activity

Create a new word document and save it with your roll number. Insert a table with the given format in your document and fill data in it.

		SHREESCHOOL								
	(font - Arial black, font size -12)									
									email:	
	Students' Individual Progress Record-2078									
Nan	ne:					Class:			Sec.:	
	Ne <sub>l</sub>	oali	Eng	lish	Ma	ath	Science and Technology		Social Studies	
S.N.	I Term	II Term	I Term	II Term	I Term	II Term	I Term	II Term	I Term	II Term

## 2.5

## Multimedia Uses

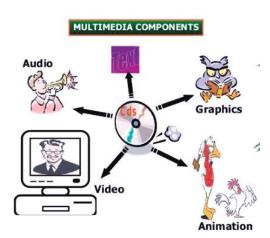
#### **Activity**

Discuss about any health message video (e.g. coronavirus health message), educational video, informative video, advertisement, etc. that you watched. Was there text, voice, animated characters, video, etc.? What was the purpose of mixing all?

Multimedia is a combination of text, graphic, audio and video for getting knowledge or information. For example, a PowerPoint presentation with animated text, audio and video clips presented in a classroom through projector is a use of multimedia. Multimedia in education helps to get information



in a simple way. Many complex concepts get simplified when students watch content with animation. Not only in education, there is wide application of multimedia in business, communication, entertainment, etc.



Text, graphics, audio, video, and animation are the five components of multimedia. We need a computer programme (i.e. software) to combine these components while creating a multimedia product. 'Microsoft PowerPoint is an example of a software to create multimedia presentation. 'Google slides' is a web-based software to create multimedia presentation. There are other commercial multimedia software too. 'Filmora' is a multimedia software used for mixing text, audio, video and to give animation effects. 'Adobe premiere pro' is

an advanced multimedia software for video editing. '3D Studio Max' is used to create 3D animations.

## Make a PowerPoint presentation

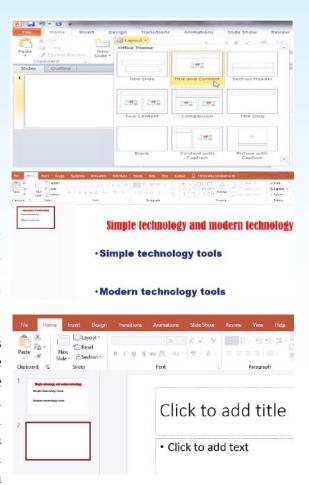
#### Activity

Search images or videos of simple (local) technology tools and modern technology tools. Store them in your computer's hard disk. Look at the steps in succeeding sections to create a power point presentation on 'local technology and modern technology'. Present your PowerPoint presentation in the classroom.

## Change layout of a new presentation

Follow the procedures in Microsoft Word to run Microsoft PowerPoint on your computer. Create a new presentation and save it with your name into computer's hard disk.

On a new presentation, slide appears with 'Title Slide' layout. Click on 'Title and Content' slide layout to change the default layout. Click on Title box and add your title 'Simple technology and Modern technology. Similarly, click on content box to add content that you want to write about your title. You can format font (font family, font size, font colour, etc.) of the title and content.



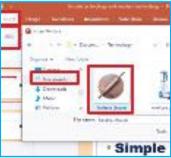
#### Insert a new slide

Click on 'Home' tab and click on 'new slide' button. Top half (with red boundary) on the given figure directly adds a new slide. You can add more and more slides in your need by the same procedure.

## Choose theme of your slides

Click on Design tab. It displays a number of themes. Select a theme for your slides.

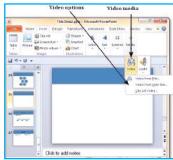




#### Insert picture, audio and video in your slides

We need to know location of picture, audio and video in our computer to insert them in a PowerPoint slide. Click on insert menu. Look for picture icon and click on it. It displays a picture selection window. Select location of picture in your computer (e.g., Documents). Click on picture to be inserted. At last, click on insert. You may need to adjust the picture size on your slide. Move pointer at the edge of picture. Pointer turns into double headed pointer. Click hold and drag to adjust size of the picture inserted in your slide. Follow this procedure to insert audio and video in your slides.





## Add transition to your slides

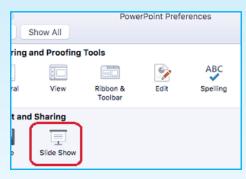
A slide show presentation can be made attractive with transition effect and animations. Adding slide transition gives special appearance effect when we move from one slide to the next in a slide show.

Select a slide to be given transition effect. Click on transition tab. It displays a number of transition effects. Click on an icon to select the transition effect (e.g. push).

## Run your presentation in slide show mode

PowerPoint displays the slides on the full screen during slide show mode. Click on 'Slide Show' tab to run presentation in slide show mode. Click on the 'Start from Beginning' button. It starts your PowerPoint presentation from the first

slide. If you want to start your presentation from the slide displayed on application window, click on 'From Current Slide'. Click with mouse to shift into the next slide. If you want to return back to previous slide, then click on back button on slide show toolbar at lower left corner of the application screen. Press escape 'Esc' button from keyboard to end slide show.'





#### **Memory Plus**

Open a PowerPoint presentation file. Press 'F5' button from keyboard to run presentation in slide show mode from the first slide.

## Spreadsheets

Spreadsheet is an electronic file with a grid of columns and rows. It is a computer programme to store quantitative data. There are multiple worksheets in a workbook created with spreadsheet programme. We can use excel to perform accurate and rapid calculations. Schools use spreadsheets to keep students' records, account details, etc. Spreadsheets also have wide application to keep business data records. Microsoft excel (\*), Googlespreadsheet (\*), Libre Office Calc (\*), etc. are examples of spreadsheet software.

#### **Fact with Reason**



## Spreadsheets are suitable for organizing numerical data. Why?

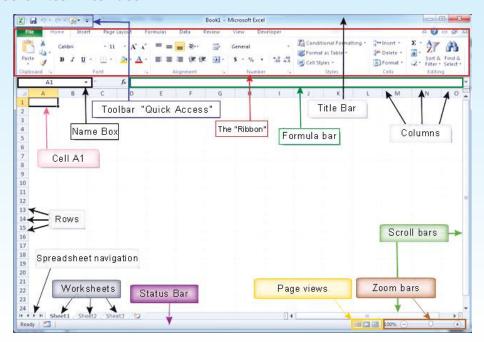
There are readymade rows and columns in a spreadsheet file. Data entry are easy in excel. In case of an incorrect input, a single input value can be updated. We don't need to repeat the overall process of calculation. Results recalculate automatically. It saves time as well as reduces possible errors in calculations.

## **Microsoft Excel interface**

## Activity

Run Microsoft Excel application on your computer. Create a new spreadsheet to observe elements in Microsoft Excel interface. Save it with your name on computer's hard disk. Fill data in your worksheet.

#### Microsoft Excel interface

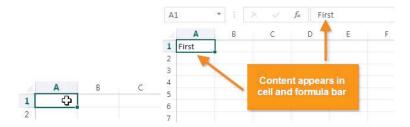


**Columns:** Columns run vertically across the worksheet in excel. Heading of a column is given by using an alphabet like A, B, C, ... etc.

**Rows**: Rows run horizontally across the worksheet in excel. Heading of a row is given by using a numeric value like 1, 2, 3, ...etc.

**Cell:** Cell is the intersection of a row and a column in a worksheet. Every cell has its unique address. Cell address is given from the intersected 'column letter' and 'row number'. For example, the address of a cell at the intersection of 'column A' and 'row 1' is A1.

#### Fill data (Insert content)



Select a cell. Type content into the selected cell. Finally, press enter from the keyboard to insert content. Your content appears in the cell as well as on the formula bar. Repeat it to fill data vertically in a column. Use keyboard arrows ( ) to shift cells in your worksheet.

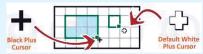


#### **Memory Plus**

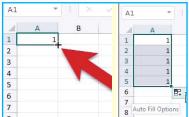
**Edit cell content:** Double click in the cell to edit content in it.

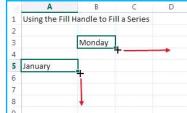
#### Auto fill content using fill handle

Fill handle is a small square at lower right corner of a cell. Fill a number in a cell (e.g. 1). Move pointer over the fill handle. Observe the change in white cross ( $\mathfrak{P}$ ) into black cross ( $\mathfrak{P}$ ) as shown in the figure.



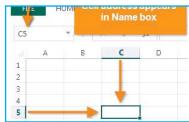
Click, hold and drag down in column to copy the same content throughout the range. In case of days and months, it fills a series. To fill data in a sequential order, move white cross over fill handle and press control. Observe a small plus over black cross. Click with control button, hold and drag to fill a series.

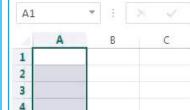


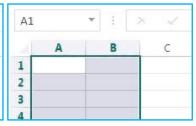




#### Cell, column, and row selection

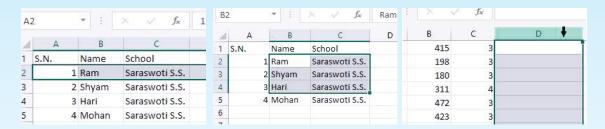






## a. Select a cell, cell range, row, column and whole spreadsheet

Click a cell to select it. Cell range is a group of cells. Cell range is represented as first cell: last cell (e.g. A2:D2 or B2:C4). Click on first cell, hold and drag the mouse up to the last cell. Release the mouse to select the desired cell range. To select whole column, move pointer over heading of the column. Observe the change in white cross  $(\mathfrak{P})$  into dark down arrow  $(\mathbf{I})$  as shown in the figure. Click with down arrow to select whole column. If you want to select multiple columns left or right of the current column, then keep holding the mouse button and move the pointer left or right. Similarly, you can select whole row from row heading.



#### b. Delete cell content

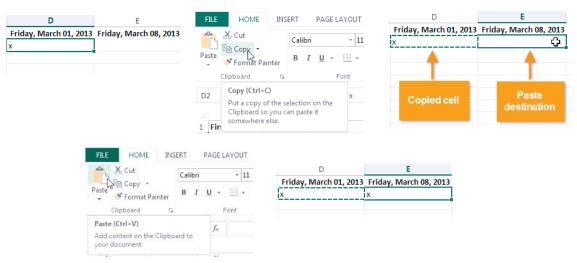
Select the cell or cell range which consists the content to be deleted. Press 'Delete' or 'Backspace' key on your keyboard. It deletes the content in the selected cell or cell range.



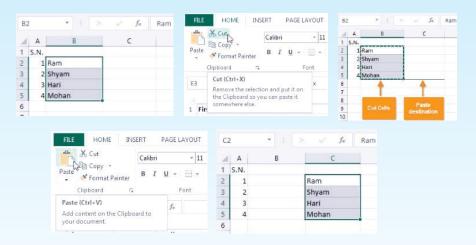
## Cut, copy and paste the content

#### **Activity**

Observe the action performed in the given figures and identify different commands (Cut, Copy, Paste) given by the user. Fill the action in the corresponding blank space. Run MS Excel in your computer and you also perform the same action on your excel worksheet.



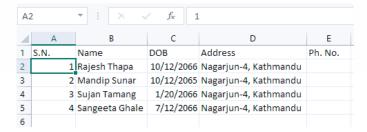
Action 1: Content 'X' is copied from cell 'D2' and ..... into cell ......



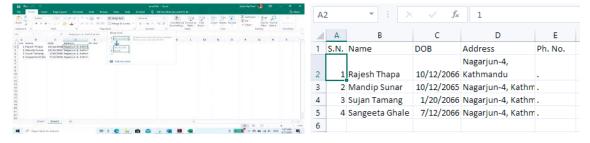
Action 2:

#### Adjust width of a column

When our content in a cell exceeds the boundary then some content gets hidden. In such case, we need to adjust the column width.



Place mouse pointer over the column line in the column heading. Observer the change in white cross  $(\Phi)$  into double arrow  $(\Phi)$  as shown in the figure above. Click, hold and drag the mouse to adjust the column width. As an alternative method, we can double click on the column line when the white cross gets changed into double arrow. It adjusts the width automatically up to content limit.



## Merge cells in a worksheet

#### Activity

Create an excel worksheet with content as shown in the given figure.

Select cell range from A1:L1. Select 'Home' Tab and click on 'merge and center' command button. All cells get merged into

- 1	<b>∃ 5</b> - 0											
	File Hor	me Insert Page	Layout F	ormulas	Data F	leview V	fiew Hel	p Acrot	est ♀ Te	I me what you wan	t to do	
ľ	Ď	Times New Roi ✓ 12	V A	- = =	= 89	- 85 W	rep Text	Ge	neral	✓		<b>7</b>   8
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1				Shree	·	Sec	ondary	School				
2	Roll.N.	Name of the Studer	Ne	pali	Eng	zlish	M	ths	Science at	d Technology	Social St	ndies
3									Octence an		SOCIAL ST	
			F.M.	M.O.	F.M.	M.O.		M.O.	F.M.		F.M.	M.O.
4	1	Rajkumar Neupane	F.M. 20		F.M. 20				F.M.			M.O.
5		Rajkumar Neupane Sagar Tamang					F.M.		F.M. 2	M.O.	F.M.	M.O.
	2		20		20		F.M. 20		F.M.	M.O.	F.M. 20	M.O.
5	2	Sagar Tamang	20 20		20 20		F.M. 20 20		F.M.	M.O.	F.M. 20 20	M.O.
5	2	Sagar Tamang	20 20 20		20 20 20		F.M. 20 20 20		F.M.	M.O.	F.M. 20 20 20	M.O.

one and the content gets centred. Similarly, merge and centre the cells in range C2:D2, E2:F2, G2:H2, I2:J2, and K2:L2.

#### Sort data in a worksheet

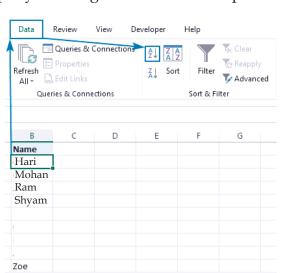
Select a cell in the column with data you want to sort. For example, select cell 'A2' as shown in the given figure.

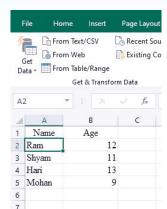
Click on Data tab. Look on 'Sort and Filter group' and follow the following steps:

Sort in ascending order (sort A to Z): Click on ascending command ( $^{2}\downarrow$ ).

Sort in descending order (sort Z to A): Click on descending command ( $^{\chi\downarrow}$ ).

Repeat these steps by selecting cell 'B2' for further practice.







1. Give an example each of input device, output device, processing device and storage device.

i. Input device - Keyboard

ii. Output device - Printer

iii. Processing device - CPU

iv. Storage device - Hard disk

2. A column in worksheet has data as Harish, Dinesh, Riyan, Manish and Rajan. Write steps to sort content in the ascending order. Show the result that you get after sorting the list.

#### Steps to sort in ascending order:

- i. Select a cell in the column.
- ii. Click on Data tab.
- iii. Click on ascending (A to Z) command button.
- iv. Result Dinesh, Harish, Manish, Rajan and Riyan
- 3. Write two differences between hardware and software.

S.N.	Hardware	S.N.	Software
1.	It is physical part of a computer to run software.	1.	It is a set of instructions that tells computer to work under user commands.
2.	Hardware can be touched and seen.	2.	Software cannot be touched.

4. Why is use of multimedia preferred in classroom?

Multimedia is the combination of text, audio, video and graphics. Use of multimedia catches attention of students. It increases concentration in the learning process. Use of multimedia in classroom is preferred to make the learning process more effective.

5. A person in your village bought a computer for the first time. He is a new learner to use computer. Suggest him the essential components to compose a letter using the computer.

Computer needs software to work for its users. Users cannot compose a letter on a computer without word processor software in it. So, he must have a word processor software (e.g. Microsoft Word) installed in his computer first.

#### 5. Why should children use smartphone less?

Children should use smartphone less because of the following reasons:

- i. Smartphone makes their brain so happy that regular life activities seem boring.
- ii. They become sleepless.
- iii. Their eyes become dry.
- iv. Avoid physical activities and suffer from obesity.

#### 6. CPU is considered the brain of the computer. Give reason.

CPU is considered the brain of a computer because it performs the activities of receiving, processing and expressing information.

## 7. Why is a keyboard called an input device?

A keyboard is called an input device because it helps to supply letters, numbers, symbols and other commands into the CPU.

## 8. Why does using phone or PC for a longer time burn eyes?

While using a mobile or a PC, people blink less than usual time, which results drying and burning of eyes.

## 3 Step Exercise



## 1. Fill in the blanks with appropriate words.

(screen, raw data, spreadsheet, smartphone, output, computers)

- i. Computer accepts ...... and processes it to give .....
- ii. ...... are used in places like schools, hospitals, banks, office, etc.
- iii. People can access their bank accounts using......
- iv. We need to maintain a proper distance from the computer .....
- v. ..... is used to store and organize numerical data.

- 2. Write 'True' for the correct and 'False' for the incorrect statements.
- i. Most of the laptop based tasks can be done with tablet.
- ii. Mouse is an output device.
- iii. Word processor is used to compose official documents.
- iv. The word 'computer' is derived from Greek word 'computare'.
- v. Worksheet is with a grid of columns and rows.
- 3. Select the best answer from the given alternatives.
- a) A computer works on the principle
  - i. Input, Output, Process ii. Output, Input, Process
  - iii. Input, Process, Output iv. Process, Input, Output
- b) Full form of CPU is
  - i. Center process unit ii. Central process unit
  - iii. Central processing unit iv. Center processing unit
- c) Prolonged use of computer and smartphone can cause......
  - i. Blurred vision ii . Dry eyes
  - iii. Headache iv. All of the above
- d) Which one is used to make presentation slides?
  - i. MS PowerPoint ii. MS Excel
  - iii. MS Word iv. MS Windows
- e) Which one is the correct step to type 'school' exactly in the middle of the cell in a table?
  - i. Click on cell, click design, click align centre
  - ii. Click layout, click on cell, click align centre
  - iii. Click design, click on cell, click align centre
  - iv. Both i and iii.

#### 4. Match the following:

Projector i. Input device

Graphics card ii. Permanent memory device

Keyboard iii. Temporary memory device

RAM iv. Processing device

SD card v. Output device

# STEP 🦃

## 5. Answer the following questions in one word.

- a) What are the widely used handheld computers?
- b) What is the set of instruction given to a computer called?
- c) How many components are involved in multimedia?
- d) What command is given with Ctrl+X?
- e) What is the intersection of rows and columns called?

#### 6. Give reasons.

- a) Computers are widely used for official use even though smartphones can also work as computers.
- b) Smartphone, iPad, and tablet are also a kind of computer.
- c) Computers need storage device.
- d) Spreadsheet is used to store and organize numerical data.

## 7. Write any two differences between:

- a) Input devices and output devices
- b) Desktop computer and laptop
- c) Smartphones and keypad phones
- d) Word processor and spreadsheet

## 8. Figure based questions

a) Observer the given figures of digital devices and answer the following questions.









- i. Write the name of the above devices.
- ii. Write down two common features present in them.
- iii. Write two specific features of each of them.
- b) Observe the given figure and answer the questions.
  - i. What is shown in the given figure?
  - ii. Write its address.
  - iii. Write steps to fill data in it.
  - iv. How can you edit data entered in it?
- c) Look at the data filled in a worksheet. Write steps to sort numerical data from the largest value to the smallest value.

	А	В	С	D
1				
2	(		<b>l</b> )	
3				
4				
5				
5				
7				
8				
9				

B1		* : ×	√ f <sub>x</sub> N	ame
4	Α	В	С	D
1		Name	Weight (in kg)	)
2		Shyam	35	;
3		Ram	20	)
4		Mohan	29	)
5		Hari	27	7
6				
7				

## STEP 3



## 9. Answer the following questions.

a) Define the following:

i. Input

- O
  - ii. Output iii. Input devices
- iv. Output devices
- b) What is a computer? Write in short about its working principle.
- c) List the uses of computers in different sectors.
- d) Write any four specific uses of smartphones.
- e) Make a list of different types of computers.
- f) Make a comparison between smartphones and computers.

- g) One of your friends becomes aggressive in normal stressful conditions, complains about headache, dry eyes and blurred vision. What question will you ask to his parents to know about his problem? Suggest some points to overcome this problem.
- h) You are asked to make your class routine for a week using a computer. Which computer programme (software) will you use? Write the corresponding steps involved in it.
- i) What is multimedia? Explain in short about its uses.
- j) How can we make an attractive PowerPoint presentation? Write about the steps to make a PowerPoint presentation on the topic 'Modern Technology'.
- k) Define row, column and cell in worksheet. How is address given to each of them? Write with an example of each.
- 1) Which software is suitable to store student's exam records? Write steps to create a file to keep such records.

#### **Project Work**

- 1. Work in a group to make table formats for each of the following purpose using word processor.
  - a. Weekly class routine
  - b. Students records (Name, address, parents, contact,...)
  - c. Weekly assignment
  - d. Grade sheet
- 2. Work in a group to make presentation on the topic 'our country'.
- 3. Collect students' marks record of your class. Fill data in a worksheet and sort the data alphabetically as well as on the merit basis.



# Organisms and Their Structure

3.1 Adaptation of organisms	3.2 Classification of animals on the basis of food
3.3 Vertebrates	3.4 Flowering and non-flowering plants

There are different types of animals and plants around us. Some animals and plants are big while some are small. Some are found on land and some are found in water. They differ in size, shape, colour, habitat and way of life. Each and every animal has some special features which help them in their development and survival. For example, birds have wings which help them to fly. Sheep and yak have thick furs which protects them from cold. Fish live in water. They have wings which help them to swim.

3.1

Estimated Teaching Periods:
Theory Practical
3 1

# **Adaptation of Organisms**

## Area and Sequence of Curriculum Issued by CDC

- 1. Introduction to adaptation of organisms
- 2. Adaptation features of aquatic animals and their organs
- 3. Adaptation features of terrestrial animals and their organs
- 2. Adaptation features of aquatic plants and their parts
- 3. Adaptation features of terrestrial plants and their parts

## **Learning outcomes**

#### At the end of this unit, students will be able to:

- 1. explain special adaptation features of animals and plants.
- 2. identify special adaptation organs of animals and plants.

## Key terms and terminologies of the unit

Habitat: Habitat is the place where organisms live, get food,

grow, reproduce and continue their life cycle.

Adaptive features: The features that enable organisms to live in a

particular environment are called adaptive

features.

Adaptation of organisms: The process of organisms adjusting themselves in a

particular environment or habitat is called

adaptation of organisms

Terrestrial animals: Animals that are adapted to live on the land are

called terrestrial animals

Cursorial animals: The animals which can run fast on the ground are

called cursorial animals

Arboreal animals: Animals that are adapted to spend most of their

life on trees are called arboreal animals.

Desert animals: Animals that are adapted in dry and hot climate

are called desert animals.

Polar animals: Animals that are able to live in cold polar region of

the earth are known as polar animals.

Terrestrial plants: Plants that are adapted to grow on land are called

terrestrial plants.

Xerophytes: Plants that are adapted to live in deserts are called

xerophytes or desert plants

Creepers: Plants that are adapted for creeping on the ground

are called creepers.

Climbers: Plants that are adapted for climbing over external

support for their growth are called climbing plants

or climbers

#### Introduction

We see different animals and plants in different environments. A deer survives in grassland and forests while a fish needs water for its survival. Similarly, a sparrow flies in the sky while an ostrich runs on the land. A lotus grows on muddy water while a cactus grows on dry land. Different organisms have different body features and habits that help them adjust in a particular habitat. Habitat is the place where organisms live, get food, grow, reproduce and continue their life cycle. In other words, there are different habitats of different organisms.

What makes organisms fit in a particular habitat? Nature has given each organism special features. With the help of their specific features of the body and habits, they can survive and develop themselves in a particular habitat. They can adjust themselves with the environment they live in. Organisms with specific features, modifications and behaviours can adapt well in a particular environment. Such features that enable organisms to live in a particular environment are called adaptive features.

## Some examples of adaptive features

Presence of thick, dry skin and fat storing tissues in the body are the examples of adaptive features of a camel. These features help the camel to check water loss and adapt well in a dry environment. Similarly, polar bears have thick furs and skin with thick layer of fat below the skin. It keeps their body always warm even in the cold environment. So they are adapted in the cold polar region of the earth. The process of organisms adjusting themselves in a particular environment or habitat is called adaptation of organisms. In other words, organisms maintain their adaptation by their specific features of body structures, organs and behaviours.

## Activity

Observe the adaptive features of some organisms given in the table and discuss with your friends. Name at least two organisms and their habitat found in your environment.

S.N.	Adaptive Features	Animal	Habitat
1	<ul><li>Sharp claws and strong paws in the limbs</li><li>Feeds on the flesh of other animals only</li></ul>	Tiger, Lion, etc	Grasslands

2	<ul><li>Fore limbs are modified into wings</li><li>Have hollow spongy bones in their body</li></ul>	
3	<ul><li>Breathe through gills</li><li>Limbs are modified into fins</li></ul>	
4	<ul><li>Long, slender and strong limbs fit for running</li><li>Feed on plants</li></ul>	
5	<ul><li>Creep on land</li><li>Rough and dry skin with scales</li></ul>	
6	<ul><li>Leaves are modified into thorns/spikes</li><li>Green fleshy stem to store water</li></ul>	

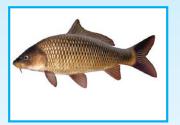
## Classification of Organisms on the Basis of Adaptation

Based on the adaptive features, animals can be broadly classified into two groups. They are aquatic animals and terrestrial animals.

## **Aquatic Animals**

Some animals are found in water. They can survive in water. They have the ability of adaptation in water environment. So, animals that are adapted to live in water are called aquatic animals.

Aquatic animals can be fresh water animals or salt-water (marine) animals. Animals that live in fresh water bodies like river, lake, pond, spring, etc. are fresh water animals such as trout, eel, crocodile, carp, silverfish, etc. Similarly, animals that live in sea and ocean are called salt-water (marine) animals. Some examples of marine animals are octopus, shark, seal, sea horse, starfish, whale, etc.





Carp

Trout Fish







Dolphin

Shark

Octopus

## **Adaptive Features of Aquatic Animals**

Most of the aquatic animals have boat-shaped body, fins, gills, air bladder, scales, etc. They help them to adjust themselves in water environment in many ways. The boat-shaped body helps them float in water easily. Presence of gills in them helps them to breathe in water. However, animals like crocodile, salamander, frog, dolphin, etc. breathe through lungs. Some animal's body is covered with scales. Such scales protect their body from predators and external injuries. They also have webbed feet or fins. Such fins and webbed feet help them in swimming. Some of the aquatic animals have air bladder in their body. Air bladder maintains water pressure when swimming at different depths. Fish have caudal fin (tail) that helps their body to push from side to side and change direction while moving. Frogs have long sticky tongues to catch the prey.



## **Memory Tip**

## **Salient Adaptive Features of Aquatic Animals:**

- Boat-shaped body for floating
- Gills for breathing
- Scales for safety and security
- Webbed feet for swimming
- Air bladder to maintain pressure
- Fin (tail) to change direction

#### Do You Know?

Ocean water is salty because it contains more than 0.5 grams of salt in a litre of water.

#### Activity

Observe the mentioned adaptive features of a frog and fish. Name their organs that are modified for such adaptation.





S.N.	Features	Frog	Fish
1	Protects from external injuries and predators	Moist skin	Scales
2	Hopping on land and swimming in water	Hind limbs and fore limbs	
3	Breathing in land and water		
4	Shape of body for floating in water		

## **Terrestrial Animals**

Animals that are adapted to live on the land are called terrestrial animals. Lions, tigers, deer, bears, rabbits, horses, dogs, cats, camels, polar bears, etc. are some examples of terrestrial animals. Different terrestrial animals have different adaptive features based on their habits and habitats. Terrestrial animals can be classified as cursorial animals, fossorial animals, arboreal animals, aerial animals and desert animals.

#### **Cursorial Animals**

Deer, wild buffaloes, lions, tigers, dogs, leopards, kangaroos, horses, zebras, etc. are some examples of cursorial animals. These animals can run on the ground. They are adapted for running ability. Thus, the animals which can run fast on the ground are called cursorial animals. Herbivore cursorial animals have long and slender limbs with hoofs for running. They also have flat jaws for chewing plants. Carnivore cursorial animals have strong paws with sharp claws for hunting and running. They also have sharp canines (teeth) to pierce and tear the flesh.











Kangaroo

Deer

Zebra

Leopard

Tiger

## **Arboreal Animals**

Animals that are adapted to spend most of their life on trees are called arboreal animals. Monkey, lizard, chameleon, squirrel, sloth, etc. are its examples. Arboreal animals have semi-circular body with curved ribs which enables them to climb trees effectively. They have strong chest muscles that support them while swinging from branch to branch. Animals like lizard and chameleon have adhesive pad in their limbs which holds them on hard vertical surfaces.

## **Adaptive Features of Arboreal Animals**

- Semi-circular body
- Curbed ribs for climbing
- Strong chest for swinging
- Adhesive pad in limbs









Monkey

Squirrel

Lizard

Chameleon

## **Aerial Animals**

Birds like sparrows, pigeons, crows, owls, eagles, vultures, etc. are aerial animals. So, the animals that are adapted for flying mode of life are called aerial animals.

Aerial animals have streamlined (boat-shaped) body that reduces air resistance during flying. Fore limbs are modified into wings which help them to take a flight. They have light body as hollow and spongy bones form their skeleton. They also have air sacs in their body which further helps them float in the air. Their body is covered with fluffy feathers. All these features support them for flying. Their teeth are modified into beak. Grain and insects eaters hve small and pointed beak while carnivores like eagle have curved and sharp beak. Birds like swan, duck, etc. have flat beaks to catch worms.

### **Adaptive Features of Aerial Animals**

- Boat-shaped body reduces air resistance
- Fore limbs as wings to fly
- Light body to float in the air
- Fluffy feathers to fly









Sparrow

Crow

Eagle

Duck

#### **Desert Animals**

Desert has extreme hot and cold climate. Camels, snakes, desert foxes, kangaroo rats, etc. are the examples of desert animals. These animals have such adaptive features to survive in desert environment. So, the animals that are adapted in dry and hot climate are called desert animals. Camels have a hump in their body which stores fat for longer time. They also have thick and dry skin to check water loss from the skin. Camels can also store water in their specialized tissue and urinate less frequently. These adaptive features avoid dehydration. Camels have strong leg muscles and hoofs to walk in sandy areas. Other desert animals like snake, kangaroo, rat, fox, scorpion, etc. are active during night time to avoid exposure to hot environment.









Camel

Snake

Kangaroo Rat

Scorpion

#### **Adaptive Features of Desert Animals**

- Ability to bear extreme hot
- Ability to avoid dehydration
- Ability to survive extreme cold
- Ability to store fat and water in their body

#### **Polar Animals**

Some animals live in cold climate like in poles and mountains. The environment of these areas is very cold. Seal, polar bear, walrus, arctic fox, etc. are examples of polar animals. Animals like snow leopard, Himalayan bear, yak, etc. live in cold mountainous areas. They have the ability to adjust themselves with extreme cold environment. For this, they have thick fur covering their body to protect them from extreme cold. Some animals like polar bears also have thick layer of fat below the skin. Thick fur protects the body from cold while thick fat layer keeps the body warm. Animals that are able to live in cold polar region of the earth are known as polar animals.









Yak

Polar Bear

Arctic Fox

Seal

## **Adaptation of Plants**

On the basis of habitat, plants can be classified into two groups. They are aquatic plants and terrestrial plants.

## **Aquatic Plants**

Some plants grow in water. They are called aquatic plants. Aquatic plants are adapted to live in water habitat. They are also known as hydrophytes. Algae, duck weed, hydrilla, lotus, water lily, water hyacinth, etc. are some examples of aquatic plants. Algae have no roots, stems and leaves. Floating plants like water lily and water hyacinth have flat leaves to absorb more sunlight. They have spongy stem. But their roots are free below the water surface and, therefore, float with the water current. Submerged plants like hydrilla and bog moss are rooted in the floor of the water body. They have thin and narrow leaves and spongy stem. Lotus, redroot, etc. have their root in the bottom of the water body while their flat leaves and flower emerge out of the water surface. They have long, slender and spongy stem.









Duckweed

*Water Hyacinth* 

Hydrilla

Lotus

The body of most aquatic plants is covered with waxy substances to avoid decaying. Most aquatic plants have weak root system as water is easily available.

#### **Activity**

Visit a nearby pond with your teacher or guardian and note down the local name and body features of at least three aquatic plants.

S.N.	Common Name or Local Name	Root	Stem	Leaves
1.	Lotus	Rooted in soil	Spongy and slender	Flat and floating
2.				
3.				
4.				

#### **Terrestrial Plants**

Some plants grow in land. Plants that are adapted to grow on land are called terrestrial plants. Most of the terrestrial plants have developed root and shoot system. The body features of different terrestrial plants differ from each other.

Mango, sal, palm, coconut, ashoka, rubber, etc. are plants adapted in hot and wet habitat. They have strong and woody stem. They have flat leaves packed at the crown. The rate of photosynthesis is high in such plants as they receive sunlight for longer time.









Sal

Coconut

Ashoka

Mango

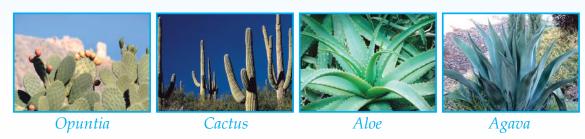
Plants like mushroom, mucor, yeast, fern, moss, lichen, etc. grow in moist and shady places. Such plants do not bear flowers. Most of the plants adapting in shady and moist areas do not have developed roots, stems and leaves in them.



## **Xerophytes or Desert Plants**

#### Plants that are adapted to live in deserts are called xerophytes or desert plants.

Aloe, Opuntia, Cactus, Agava, etc. are some examples of xerophytes. Xerophytes have spiny and thorny leaves to reduce loss of water. They have fleshy and green stem to store water and carry photosynthesis. Some desert plants have deep roots to absorb moisture underneath.



Plants like pine, fir, deodar, cycas, spruce, etc. are adapted in cold climate. They are inverted cone in shape. They have hard and woody stem with short branches. They bear cones instead of flowers. They have long and pointed needle-shaped leaves which easily pass down the snow and rainfall.



## **Creeping Plants**

Plants that are adapted for creeping on the ground are called creepers. Watermelon, strawberry, sweet potato, pumpkin, etc. are the examples of creepers. Creepers have very fragile, long and thin stems. The stem cannot stand erect and support its own weight.









Watermelon

Strawberry

Sweet Potatoes

Pumpkin

## **Climbing Plants**

Plants that are adapted for climbing over external support for their growth are called climbing plants or climbers. Pea, gourd, grapevine, money plant, runner bean, etc. are the examples of climbers. They have thin, long and weak stem unable to grow upright. However, they have special structures called tendrils. Tendrils help in climbing over external support.









Gourd Plant

Grapevine Plant

Money Plant

## **Project Work**

Observe 5 plants and 8 animals found in your surroundings. List a body feature and its function.

S.N.	Plants	Body feature	Function
1	Pine (Sallo)	Needle-shaped leaves	Reduce water loss and help mist, dew, snow flow downward
2			
3			
4			
5			
6			

S.N.	Animals	Body feature	Function
1	Mosquito	Proboscis	Sucks fruit juice and blood from mammals
2			
3			
4			
5			
6			
7			
8			
9			

## 3 Step Exercise

## Step



## 1. Fill in the blanks with appropriate words.

- a) Trout, eel, crocodile, ..... are some fresh water animals.
- b) Carnivore cursorial animals have strong ....... and sharp ...... for hunting.
- c) Lizard has ..... pad in its limbs to hold and crawl on vertical surface.
- d) Presence of ...... and ..... bones in bird make their body light.
- e) Floating plants have ..... leaves and spongy stem.
- f) Cactus is a xerophyte while ..... is a hydrophyte.

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

- a) Habitat is the home of organisms in which they get food and live their life.
- b) Monkeys are found in aquatic habitat.
- c) The jaws of zebra are adapted for eating grass.
- d) Eagles have sharp and strong claws for holding their prey.

- e) Aloe is a desert plant.
- f) Hydrophytes have fleshy stem.

## 3. Select the best alternatives from the given options.

- a) Fore limbs of aerial animals are modified into ........
  - i. feathers
- ii. wings
- iii. beak
- iv. claws
- b) Which animal has thick layer of fat below its skin to keep the body warm?
  - i. seal

- ii. ostrich
- iii. fish
- iv. deer
- c) Thorns in the cactus are the modified form of.......
  - i. stem
- ii. leaf
- iii. branch
- iv. flower

- d) Rat is an example of .......
  - i. cursorial animal
- ii. fossorial animal
- iii. aerial animal
- iv. arboreal animal
- e) Which is a hydrophyte?
  - i. water hyacinth
- ii. lily
- iii. coconut
- iv. pine
- f) Which plant grows in moist and shady environment?
  - i. mango
- ii. rubber
- iii. mushroom
- iv. cactus

## 4. Match the following:

a. Cursorial

i. Animals adapted for flying

b. Fossorial

ii. Plants adapted in deserts

c. Arboreal

iii. Animals adapted in running

d. Aerial

- iv. Plants adapted in water
- e. Xerophytes
- v. Animals adapted to live on trees
- f. Hydrophytes
- vi. Animals adapted for living in burrows

## Step



- 5. Answer the following questions in one word.
  - a. It is the process by which the organism fits itself in a particular environment.

- b. Another popular name of desert plants.
- c. Aquatic plants are also known as this.
- d. What are animals adapted to grow on land called?
- e. What is an example of carnivore aerial animal?

#### 6. Write any two differences between:

- a. Aquatic and terrestrial animals
- b. Gills and lungs
- c. Aerial and arboreal animals
- d. Camel and yak
- e. Hydrophytes and xerophytes
- f. Creepers and climbers

#### 7. Give reasons.

- a. Leaves of cactus are modified into spines.
- b. Frog has webbed feet.
- c. Leopard has canine teeth.
- d. A deer adapts to arboreal mode of life.
- e. Hydrilla is called a hydrophyte.
- f. Lizard has adhesive pad in its limb.

# 8. Identify the following body features from the figure and write down one function of each:











## Define the following terms.

Adaptation, Adaptive features, Aquatic animals, Terrestrial animals Hydrophytes, Xerophytes, Climbers, Creepers

#### 10. Contrast the adaptive features of the following animals.

Body parts	Tiger	Deer
Leg shape		
Teeth		
Paw/Hoof		

## 11. Answer the following questions.

- a. List any three adaptive features of leopard.
- b. What features make fish suitable to live in water? Write any four.
- c. Note down any three features of animals living in cold areas.
- d. How is camel adapted to living in desert? List three features.
- e. Write any three features of an eagle that enable it for flying mode of life.
- f. Draw a figure of fish and label gills, scales, fins and tail.

3.2

stimated Teaching Periods:				
Theory	Practical			
3	1			

# Classification of Animals on the Basis of Food

## Area and Sequence of Curriculum Issued by CDC

1. Characteristics and examples of herbivores, carnivores and omnivores

## **Learning outcomes**

At the end of this unit, students will be able to:

1. classify animals on the basis of food along with their examples.

## Key terms and terminologies of the unit

Herbivores: The animals that eat only plants or plant products to live are

called herbivores or herbivorous animals.

Carnivores: Animals that eat flesh or flesh products are called carnivores

Omnivores: Some animals eat both plants and flesh of other animals. They are

called omnivores.

All organisms need food to survive. They take food to get energy. Food provides them energy. This energy comes after the digestion of food. Different animals need different kinds of food according to their body structure and habitat. Animals like cows and buffaloes eat plants. Birds eat insects and grains. Tigers and leopards eat flesh of other animals.

#### **Activity**

List the name of some living organisms found around your locality. Note their habitat and food they eat.

S.N.	Living Organisms	Habitat	Food
1	Mushrooms	Moist shady places	Decayed plant and animal parts
2	Grasshoppers	Grassland	Leaves
3			
4			
5			
6			
7			

Based on the feeding habits, animals can be divided into three major groups. They are herbivore, carnivore and omnivore.

#### a. Herbivores

Some animals eat only plants or plant products to live. They are called herbivores or herbivorous animals. It includes many insects, birds, mammals, etc. Insects like butterflies, grasshoppers, snails, etc. are herbivores. Similarly, birds like pigeons, parrots, hummingbirds, waterfowls, etc. are herbivores. Mammals like rabbits, deer, goats, bisons, giraffes, kangaroos, horses, buffaloes, cows, etc. are the developed herbivores. Grass eating animals have flat jaws for chewing.









**Butterfly** 

Humming Bird

Giraffe

Cow

## b. Carnivores

Some animals do not eat plants or plant products. They eat flesh of other animals to survive. Animals that eat flesh or flesh products are called carnivores. They include animals from small insects, birds to large mammals. Small carnivores include ladybirds, spiders, frogs, bats, etc. Medium-sized carnivores are snakes, eagles, hawks, etc. Similarly, large carnivores include lions, tigers, leopards, sharks, etc. Carnivore birds like eagles and hawks have curved and pointed beaks to tear the flesh and sharp claws to catch their prey. Similarly, tigers, lions, leopards, etc. have sharp claws to catch and scratch their prey and sharp canines to tear the flesh. They also have long digestive tract as they need to digest food of similar nature.







Eagle



Spider Frog

Leopard

#### **Omnivores**

Some animals eat both plants and flesh of other animals. They are called omnivores. For example, dogs, crows, sparrows, cats, pigs, humans, etc. Such animals are adapted to eat both plants and animals. Omnivore animals have sharp canines as well as flat jaws. Canines help them in tearing flesh while flat jaws help in grinding and chewing grains. Omnivores have digestive tract suitable to digest both plants and animal products. Dogs and cats are carnivores in the wild while they are omnivores as pets.









Crow

Pig

Bear

Human

#### Do You Know?

Animals that take dead and decayed animals and plants as their food material are called detrivores. Examples, vultures, crabs, etc. They are the cleaners of the environment.



## 3 Step Exercise

# Step 🧗

#### 1. Fill in the blanks.

- a) All animals need ..... to continue their life.
- b) Animals that eat plants or plant products are called .....
- c) Leopard is an example of .....
- d) Crow is an ..... because it eats both plants and animal products.
- e) Herbivores have longer ..... tract than carnivores.

## 2. State whether the following statements are True or False.

- a) Food gives energy.
- b) Cows and buffaloes have flat jaws for chewing plants.
- c) Tiger has a very long digestive tract.
- d) Omnivores can also have canine teeth for tearing flesh.
- e) Cats are omnivore in wild habitat.

## 3. Match the following with best alternatives.

Food Dead and decayed plants and animals

Elephant, cow, goat Detrivores

Lion and tiger Omnivores

Cat, man and dog Carnivores

Vultures, crabs Herbivores

Mushrooms Required for all animals and plants

# Step 🎇

## 4. Answer the following questions in one word.

- a) Name a bird with sharp claws and curved pointed beak to tear flesh.
- b) What is the name of the tooth that is used for tearing flesh?

- c) Name the insect that feeds on grass.
- d) Name one animal that is carnivore in nature and omnivore as pet.
- e) Write the name of an animal with flat jaws for chewing plants.

#### 5. List down any two differences between:

- a) Carnivore and herbivore
- b) Leopard and bear
- c) Eagle and pigeon

#### 6. Give reasons.

- a) Lion is a carnivore.
- b) Rabbit is an herbivorous animal.
- c) Bear is known as omnivore.

#### 7. Look at the figures and list two features that support their feeding habit.







## Step

- 8. Define the following with their special features for their adaptation.
  - a) Carnivore
  - b) Herbivore
  - c) Omnivore
  - d) Detrivore

## 9. Answer the following questions.

- a) How is a horse adapted for eating grass? List three features.
- b) Write down any two features of detrivores.

**Estimated Teaching Periods:** Theory Practical 3 1

## **Vertebrates**

## Area and Sequence of Curriculum Issued by CDC

Characteristics and examples of pisces, amphibians, reptiles, aves and mammals

## **Learning outcomes**

At the end of this unit, students will be able to:

- 1. classify vertebrates into different classes.
- 2. state characteristics and examples of different classes of vertebrates.

## Key terms and terminologies of the unit

Vertebrates: Those animals which have backbone in their body are called

vertebrates.

Pisces: The class Pisces includes different types of fishes which breathe

through gills and have fins for swimming.

Amphibia: The class Amphibia includes those vertebrates which can live

both in water and on land.

The class Aves consists of birds which have strong wings for Aves:

flight.

Mammalia: The class Mammalia includes the animals which have mammary

glands in the females and give direct birth to their young ones.

#### Introduction

We see different types of animals in our surroundings. Among them, some are small and some are big, some have backbone and some have no backbone. Animals like fish, frogs, tortoises, birds, dogs, cows, buffaloes, human beings, etc. have backbone. So, they are called vertebrates. Thus, those animals which have backbone in their body are called vertebrates. Most of the vertebrates live on land, but some vertebrates live in water. They have well-developed body organs and body systems such as respiratory system, digestive system, reproductive system, circulatory system, nervous system, etc.

On the basis of structure and development, vertebrates are divided into five different classes. They are Pisces, Amphibia, Reptilia, Aves and Mammalia.

#### i. Pisces

Pisces are aquatic vertebrates. Their body is divided into head, trunk and tail. These animals have boat-shaped body. They have fins for swimming and tail for changing the direction. Their body is covered with waxy scales that save them from decaying in water. They are oviparous and cold-blooded animals. For example, salmons, sharks, sea horses, eels, carps, ray fish, etc.



## **Memory Tip**

Pisces have two chambers in their heart.









Carp

Shark

Sea Horse

Ray Fish

## ii. Amphibia

The class Amphibia includes those vertebrates which can live both in water and on land. Their body is divided into head and trunk. They have strong limbs for swimming in water and jumping on the land. Their hind limbs are longer and stronger than their fore limbs. They have sticky tongue to catch the prey. They have soft and moist skin with glands. They breathe through gills in water and through lungs on land. They are oviparous and cold-blooded animals. Some examples of the phylum Amphibia are frog, salamander, toad, etc.



#### **Memory Tip**

Pisces and Amphibia show external fertilization. It means that fusion of sperm and ovum takes place out of female body in water.







Frog

Salamander

**Toad** 

## iii. Reptilia

The class Reptilia includes cold-blooded, crawling animals. The body of reptiles is divided into head, neck, trunk and tail. Most of the reptiles live on land while some live in water. They have two pairs of limbs for locomotion except in snakes. They have dry, rough and scaly skin. They breathe through lungs. They are oviparous animals. Some examples of reptiles are snakes, crocodiles, turtles, etc.



## **Memory Tip**

Amphibia and Reptilia have three chambers in their heart.







Snake

Crocodile

Turtle

#### iv. Aves

The class Aves consists of birds which have strong wings for flight. Body of aves is divided into beak, head, neck, trunk and tail. They have hollow bones which makes them light for flying. They have light and fluffy feather to keep them warm and light. They have air sacs in their body. They breathe through lungs. They are oviparous and warm blooded animals. Some examples of aves are pigeon, hen, sparrow, ostrich, parrot, etc.



## Memory Tip

Aves and mammals have four chambers in their heart.







Pigeon

Hen

Ostrich

#### iv. Mammalia

The class Mammalia includes the animals which have mammary glands in the females and give direct birth to their young ones. The body of mammals is divided into head, neck, trunk and tail. Most of the mammals live on land while very few live in water. They are warm-blooded animals and their body is covered with hairs. They have limbs for locomotion. But, in water-living mammals the limbs are modified into paddles for swimming. Some examples of mammals are human beings, rat, cat, dog, bat, whale, dolphin, hippo, etc.

#### **Memory Tip**



- i. Reptiles, Aves and Mammalia show internal fertilization. It means that fusion of sperm and ovum takes place inside the female body.
- ii. Mammals are viviparous. It means that they give direct birth to their young ones.
- iii. Bat is a flying mammal because it gives direct birth to the young ones.









Woman

Bat

Whale

Dog

## Activity

- i. Observe in your surroundings and list any five animals of each class.
- ii. Write down any three features of each class.
- iii. Draw well-labeled diagram of each and show to your teacher.

## 3 Step Exercise

## Step 🧗

1. Tick (✓	) the correct statement and cross	(×	) the false one.
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- a. Vertebrates have vertebral column.
- b. Jelly fish is an example of vertebrate.
- c. Sea horse belongs to the class pieces.
- d. Amphibians have horny and rough skin.
- e. Aves show external fertilization.
- f. Mammals have four-chambered heart.

#### 2. Fill in the blanks with appropriate words.

- a. The body of fish is covered with .....
- b. Amphibians can live both on.....and in.....
- c. Crocodile belongs to the class.....
- d. The class ..... includes the animals which have mammary glands.
- e. Bat and whale belong to the class.....
- f. ..... are viviparous.

## 3. Match the following.

Vertebrates have ( ) Bat

An example of Pisces ( ) Toad

An example of Mammal ( ) Snake

An example of Amphibia ( ) Salmon

An example of Reptile ( ) Ostrich

An example of Aves ( ) Vertebral column

## 4. Tick ( $\checkmark$ ) the best answer from the given alternatives.

- a. The body of ..... is covered with hairs.
  - i. Mammals ii. Aves iii. Reptiles

iv. Pisces

- b. Which of the following is a reptile?
  - i. Bat
- ii. Whale
- iii. Rat
- iv. Crocodile
- c. Which of the following is a viviparous animal?
  - i. Snake
- ii. Turtle
- iii. Lizard
- iv. Whale
- d. Which of the following is not a cold-blooded animal?
  - i. Frog
- ii. Parrot
- iii. Rabbit
- iv. Monkey
- e. Which of the following is a cold-blooded animal?
  - i. Lizard
- ii. Duck
- iii. Whale
- iv. Dolphin

## Step



#### 5. Differentiate between:

- a. Invertebrates and vertebrates
- b. Salmon and Whale
- c. Lizard and Frog
- d. Bat and Pigeon
- e. Amphibia and Reptilia
- f. Horse and Sea horse

#### 6. Give reason:

- a. Whale is a mammal.
- b. Reptiles are cold-blooded animals.
- c. Bat is a viviparous animal.
- d. Snake is grouped in the class reptiles.
- e. Frog shows external fertilization.

## 7. Name any one organism which shows the following features.

- a. It has fins and tail for locomotion.
- b. It has sticky and rolling tongue to catch the prey.
- c. It has horny scales on its body.

- d. It has hollow and light bones.
- e. It has mammary glands in its body.

#### 8. Name the class and write down any two features of each.













#### Answer the following questions.

- a. Define vertebrates with any four examples.
- b. List any two salient features of the vertebrates.
- c. What are Pisces? Write down any three salient features and three examples of Pisces.
- d. What are Amphibians? Write down any three salient features and three examples of Amphibians.
- e. What are Reptiles? Write down any three salient features and three examples of Reptiles.
- f. What are Aves? Write down any three salient features and three examples of Aves.
- g. What are Mammals? Write down any three salient features and three examples of Mammals.

## 10. Draw the following figures:

Fish, Frog, Lizard, Pigeon and Cow

3.4

Estimated Teaching Periods:		
Theory	Practical	
2	1	

# Flowering and Non-Flowering Plants

## Area and Sequence of Curriculum Issued by CDC

- 1. Introduction to flowering and non-flowering plants
- 2. Differences between flowering and non-flowering plants

## **Learning outcomes**

At the end of this unit, students will be able to:

1. state similarities and differences between flowering and non-flowering plants

## Key terms and terminologies of the unit

Non-flowering plants: Plants that do not bear flowers are known as non-flowering

plants (cryptogams).

Thallophytes: Those plants whose body cannot be divided into roots,

stems and leaves (thallus body) are known as thallophytes.

Algae: Green plants whose body cannot be divided into roots,

stems and leaves are called algae.

Fungi: Non-green plants whose body cannot be divided into

roots, stems and leaves are called fungi

Bryophytes: Plants with flat, green and leafy body without distinct

roots, stems and leaves are called bryophytes.

Pteridophytes: Non-flowering plants with distinct roots, stems and leaves

are called pteridophytes

Flowering plants: Plants that bear flowers in them are known as flowering

plants or phanerogams

Angiosperms: Flowering plants with closed seed are called angiosperms.

Monocot: Plants that have only one cotyledon in their seed are

known as monocotyledonous plants(monocot).

Dicot: Plants having two cotyledons in their seed are called

dicotyledonous plants(dicot).

Gymnosperms: Plants having naked or open seeds are called gymnosperms

We see different kinds of plants around us. Plants like mushroom are non-green plants. Green plants like algae, lichens, etc. have no roots, stems and leaves. Plants like moss, fern, etc. do not have flowers. Plants like rose, lily, apple, pear, etc. bear flowers and fruits. On the basis of flowers, all plants are scientifically classified into two groups. They are **flowering plants** and **non-flowering plants**.

#### **Activity**

Visit a nearby garden and observe flowering and non-flowering plants. List their names and other external features like leaves, root, stem, flower, etc.

Plants	Root	Stem	Leaves	Flower
Mushroom	Yes	No	No	No
Algae				

## **Non-Flowering Plants (Cryptogams)**

Plants that do not bear flowers are known as non-flowering plants (cryptogams).

Algae, mucor, moss, mushroom, fern, etc. are its examples. Cryptogams include tiny microscopic plants to medium-sized plants. This group contains primitive and least developed plants. Based on the parts of plant, cryptogams are further divided into three groups. They are thallophytes, bryophytes and pteridophytes.

## **Thallophytes**

Those plants whose body cannot be divided into roots, stems and leaves (thallus body) are known as thallophytes. It includes simple green plants, i.e. algae and non-green plants, i.e. fungi.

#### Green thallophytes (algae)

Green plants whose body cannot be divided into roots, stems and leaves are called algae. They are mostly found in aquatic environment. Algae have chlorophyll in them so they prepare their food by themselves. Examples of algae are spirogyra, hydrilla, chlamydomonas, ulothrix, etc.





Spirogyra

Hydrilla

### Non-green thallophytes (fungi)

Non-green plants whose body cannot be divided into roots, stems and leaves are called fungi. They are found in moist habitat. They lack chlorophyll. Therefore, they take their food from dead and decayed matter. Examples of fungi are yeast, mucor, mushroom, etc.





Mucor

Mushroom

## Activity

Observe the slides of mucor and spirogyra with the help of your teacher and note down the following features.

Features	Mucor	Spirogyra
Colour		
Body shape		
Size		
Can you identify an individual		

## **Bryophytes**

Plants with flat, green and leafy body without distinct roots, stems and leaves are called bryophytes. Mosses and marchanita are examples of bryophytes. Hair-like structures called rhizoids help them to stand erect on the ground. They are simple form of terrestrial plants found in damp places.





## **Pteridophytes**

Non-flowering plants with distinct roots, stems and leaves are called pteridophytes. Ferns, horsetails, and lycophytes are the examples of pteridophytes. They are the advanced form of non-flowering plants. Their plant body is erect and rigid. They are terrestrial plants found in damp and shady areas. They have developed system for transporting water and food in their body.





Fern

## **Activity**

Have you seen fern? Have you heard or eaten *Niguro* and *Daude* as vegetables? If not, note that the young shoots of fern are also eaten as vegetable. Based on your observation or experience, share its features with your friends.

## Flowering Plants (Phanerogams)

Plants that bear flowers in them are known as flowering plants or phanerogams.

Some plants produce flowers regularly while some only once in their life cycle. They are also called seed-bearing plants as they produce seeds. These seeds develop into new plants on favourable environmental conditions. There are two groups of phanerogams. They are **angiosperms** and **gymnosperms**.

#### Activity

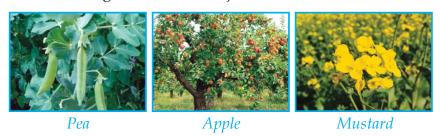
List the names of some flowering plants found around your school or home. Discuss how they are similar and different from each other.

## **Angiosperms**

Flowering plants with closed seed are called angiosperms. Coconut, mango, rose, maize, pea, gram, etc. are examples of angiosperms. Some angiosperms have one cotyledon (seed leaf) while some have two cotyledons in their seed. Plants that have only one cotyledon in their seed are known as monocotyledonous plants. Some examples of such plants are maize, paddy, wheat, bamboo, garlic, ginger, etc. They have long and narrow leaves with parallel veins in them. Most of them have fibrous root.



Plants having two cotyledons in their seed are called dicotyledonous plants. Pea, gram, mustard, apple, mango, rose, etc. are its examples. Leaves of such plants are flat and short having branched veins joined in a central vein.



## Activity

Visit a garden or field having both monocotyledonous and dicotyledonous plants. Observe the outer features of those plants based on the following table. Discuss it with your teacher.

Features	Any Monocot Plant	Any Dicot Plant
Leaves	Long and narrow	Short and flat
Root		

Stem	
Veins in leaves	
Number of petals in flower (if flower is present at the time)	

## **Gymnosperms**

Plants having naked or open seeds are called gymnosperms. Pine, fir, cycas, etc. are its examples. They do not bear true fruits but cones in them. They have long and needle-shaped leaves. They are usually found in cold climate.







Pine

Cycas

Fir

## 3 Step Exercise



#### 1. Write True for the correct and False for the incorrect statements.

- a. Algae and fungi are examples of thallophytes.
- b. Fern is the simplest form of non-flowering plant.
- c. Bamboo is an example of dicotyledonous plants.
- d. Plants with a single seed leaf in them are monocots.
- e. Pine bears cones instead of flowers.

## 2. Fill in the blanks with appropriate words.

- a. ..... is an example of algae.
- b. Non-green plants are also called .....
- c. Fern is found in ..... and ..... places.
- d. ..... plants have long and narrow leaves with parallel veins.
- e. Angiosperms have their ..... covered in seed case.

#### 3. Match the following.

Column B Column A Green thallophyta Cycas Bryophyta Fern Pterdophyta Rose Angiosperms Spirogyra Mosses **Gymnosperms** 

#### 4. Select the best alternatives.

- a. It is a green aquatic plant without distinct parts of plant.
- i. Yeast ii. Spirogyra

iii. Pea

ii. Bamboo

iv. Fern

iv. Pine

- b. It depends on dead or decayed organic matter for its food. ii. Lycopodium
- c. It is an example of monocotyledonous plants.

  - i. Bamboo ii. Garlic iv. Gram iii. Barley
- d. It is an example of dicots.
  - i. Pea ii. Ginger iii. Grass iv. Onion
- e. It bears cones.

i. Mushroom

ii. Banana iii. Pine iv. Bamboo i. Fern

## 5. Give a single word answer to the following.

- a. What is another name for non-flowering plants?
- b. Phanerogams are also known as this.
- c. Monocotyledonous and dicotyledonous plants are its divisions.
- d. Highly developed non-flowering plants fall in this group.
- e. Which division of non-flowering plants has least developed thalloid plants?

## 6. Write two differences between the following.

- a. Cryptogams and phanerogams
- b. Algae and fungi
- c. Spirogyra and fern

- d. Maize and pea
- e. Angiosperm and gymnosperm

#### 7. Give reasons.

- a. Fern falls under cryptogams.
- b. Maize is known as monocotyledonous plant.
- c. Algae are green thallophytes.
- d. Mustard is a dicotyledonous plant.
- e. Pines are known as angiosperms.

## 8. Name the following plants and list one important feature of each.









## Step

#### Define the following terms with two features and two examples of each.

- a. Cryptogams
- Phanerogams
- c. Thallophytes
- d. Bryophytes
- e. Pteridophyts
- f. Angiosperms
- g. Gymnosperms

## 10. Answer the following questions.

- a. List two contrasting features each of monocotyledonous and dicotyledonous plants with examples.
- b. Where can you find algae and fungi around your surroundings?
- c. Draw a figure of the following and write the name of the division they fall in.
  - a. Mushroom
- b. Fern
- c. Mustard



## Biodiversity and Environment

4.1 Environment and its balance

4.2 Ecosystem

Earth is the common home of all living beings. There are numerous types of plants and animals on the earth. They are different in their structure, size, shape, colour, habit and habitat. This difference in organisms makes biodiversity. In other words, the variety and variability of all living beings, their communities and their habitats is known as biodiversity. Apart from living beings, we have other natural features like land, rocks, air, water, sunlight, etc. around us. Similarly, we have social and cultural features like community, schools, hospitals, temples, arts and artifacts, etc. These entire living and non-living things together make an environment. In other words, environment is a combination of all living, non-living, natural, artificial, social, and cultural objects found in our surroundings.

4.1

Estimated Teaching Periods:		
Theory	Practical	
5	2	

## **Environment and its balance**

## Area and Sequence of Curriculum Issued by CDC

- 1. Introduction to environment and its balance
- 2. Environment conservation
- 3. Environment friendly behaviour (3R)

## **Learning outcomes**

#### At the end of this unit, students will be able to:

- 1. introduce environment.
- 2. adapt to environment-friendly behaviour.

## **Key terms and terminologies of the unit**

Biodiversity: Variety and variability of all living beings,

their communities and their habitats is known

as biodiversity.

**Environment:** Environment is a combination of all living,

> non-living, natural, artificial, social, and cultural objects found in our surroundings.

Environment conservation: Environment conservation is the process of

using natural resources wisely with little or

reduced effects on the natural resources.

Environment-friendly behavior: Environment-friendly behaviour is the set of

habits that encourage environment

conservation.

Reduce: Reduce means to decrease the use of products

that degrade the environment.

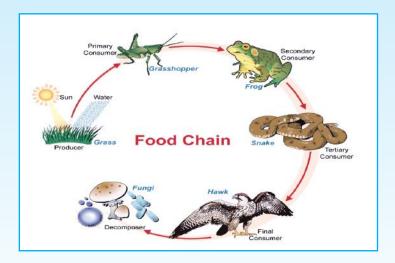
Reuse: Reuse means using the same things again and

again for similar or different purposes.

Recycle: Recycle means converting the unusable

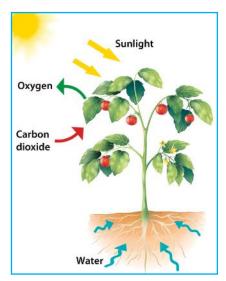
products into new or similar products.

Naturally, the environment is composed of non-living and living components. Non-living components include air, water, sunlight, land, rocks, etc. Living components include all plants and animals including humans. These non-living and living components interact in the nature to create a natural environment.



In a natural environment, plants take water and minerals from land and air from atmosphere to prepare food. Animals like rabbits eat plants as food. In the same way, leopards eat rabbits as food. Leopard gets decayed after its death. Microorganisms like bacteria and fungi decompose them and dissolve all minerals in the soil. The same process continues and natural environment is balanced. However, excessive development activities by humans have polluted air, water and land. Similarly, the habitats of animals and plants are destroyed. This alters the natural balance and creates imbalance in the environment. Such imbalance finally results in natural disasters like diseases, floods, landslides, fires, etc. Ultimately, natural disasters harm people more than other living beings. So, human activities must be sensible not to disturb natural environment.

## **Natural Components of Environment**

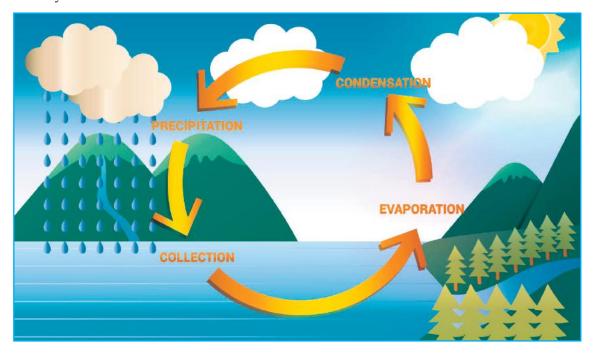


#### Air

The earth is surrounded by the layer of air. Air is one of the most important components of environment. It is composed of mixture of gases like nitrogen, oxygen, carbon dioxide, water vapours, etc. All living organisms need oxygen to respire. Oxygen breaks the food materials and releases energy and carbon dioxide during respiration. Plants absorb that carbon dioxide from air to conduct photosynthesis. Photosynthesis produces starch and oxygen. Oxygen gets released in the air through stomata. This balances the amount of oxygen and carbon dioxide in atmosphere.

#### Water

Water is another important and most abundant substance on the earth surface. About two-thirds of the earth surface is covered with water. Out of this, only about 3% of water is fresh water while the rest is salt water. Snowy mountains, springs, streams, ponds and rivers are the sources of fresh water. Seas and oceans are the sources of salt water. All living beings need water for their survival. Water on the land finally reaches seas and oceans through the rivers. Heat energy of sun evaporates water from lakes, seas and oceans. Water vapours rise up in the sky. During cooling, vapours cling to each other to form large clouds. Clouds become heavy as they hold much water and finally water drops as rainfall. Clouds also cause rain if they abruptly cool down due to barriers like hills and mountains. This cycle of water transfers water and minerals from land to ocean.



#### Land

Land is another important natural component of the earth. It comprises of about one-third of total earth surface. Land surface is formed by soil and rocks. Land contains all the minerals needed by plants and animals for their development. Plants grow on land. Animals conduct their activities on land.



Humans also grow food on land. After the death of plants and animals, microorganisms break complex parts of plants and animals and release minerals in the soil. In this way, minerals transfer from land to plants to animals and finally to land. It takes millions of years for soil. Rock disintegrates and forms soil while soil lumps together form rocks.

#### Sunlight

Sunlight provides both light and heat energy. Plants, in the presence of sunlight, conduct photosynthesis. Sunlight gets converted into food energy. This food energy is transferred from herbivores to carnivores. When animals and plants die and get decayed, they release that energy to land in the form of organic matter. Dead and dried parts of plants on burning



release heat energy. Similarly, plants and animals buried below the earth surface under high pressure get converted into fossil fuels in thousands of years. These fuels when burnt release heat energy. The heat of the sun evaporates water from ocean and makes water cycle. This water cycle causes rainfall, rivers to flow and springs to sprout. Heat of sun provides energy for air to flow. All of these statements show that sun is the ultimate source of energy on the earth.

#### **Plants**

Plants include all unicellular to multicellular organisms that prepare their food by themselves. Fungi are the only plants that take food from the organic matter. All animals directly or indirectly depend on plants for their food. After providing food, plants have many functions environment. They absorb carbon dioxide



and produce oxygen. They provide habitat for many animals. They anchor soil and control floods and landslides. They maintain fertility of soil. In this way, they are important for maintaining a balance in environment. Figure jungle

#### **Animals**

Animals include all unicellular to multicellular living organisms that depend on other organisms for their food. Herbivores eat plants and carnivores eat herbivores. All animals after their death get decayed and release minerals into the soil. Plants absorb the same minerals from soil and grow. Humans on the other hand consume both plants and animals. This interrelation between plants and animals balances the environment.

## **Environment Conservation and Environment Friendly Behaviour**

All the things obtained from nature that are used for the benefit of human beings are known as natural resources. Examples of natural resources are air, water, land, sunlight, plants, animals, minerals, rocks, etc. In the present context, humans are rapidly using natural resources. Rocks and minerals are used for construction. Fossil fuels like coal, petrol, natural gas, etc. are used for domestic and industrial activities. Rare plants and animals are killed to produce different cosmetic goods. Excessive fishing is done in rivers and seas. Huge amount of waste is generated and dumped in open areas and water bodies. Forests are cleared for timber and firewood. All these activities degrade the environment. Finally, it not only affects the home of plants and animals but also of human beings.







Environment conservation is the process of using natural resources wisely with little or reduced effects on the natural resources. Human beings are fully dependent on environmental resources for their livelihood and all other development activities. Therefore, environment conservation not only protects plants and animals but also humans and their resources. It also safeguards resources for future generations.

#### Activity

What happens to your community if all trees of your community are cut down by a timber company? Discuss and make a report.

Environment-friendly behaviour is the set of habits that encourage environment conservation. Such habits result in less or reduced effect on the natural environment. Nowadays, the term environment-friendly is replaced by ecofriendly. This term is also used by business firms for advertising their products. We should make the habit of choosing eco-friendly products to promote environment conservation.

## **3R Principle of Environment Conservation**

All the materials used by humans do not affect the environment. However, not managing the byproducts of our activities pollutes the environment. For an example, fossil fuels are great sources of energy. But we are unable to manage smoke and dust coming out after burning them. We cannot manage all environmental problems by ourselves. However, we can adopt environment-friendly habits in our daily life. The easiest habit for environment conservation is applying 3R principle in our daily life. 3R principle means **reduce**, **reuse** and **recycle** in our daily life.



#### Reduce

Reduce means to decrease the use of products that degrade the environment. For an example, we can prefer walking or cycling short distance to using vehicles. In our home garden, we can practice using fewer chemicals on our crops. Similarly, we can turn off the tap while brushing. We should use more paper products than plastics. Paper decomposes easily while plastic does not. We can avoid large and multiple packaging for common products. This causes factories to reduce unnecessary packaging.

#### Reuse





Reuse means using the same things again and again for similar or different purposes. Empty mineral water bottles can be used again to fill water at home. Same plastic bags or jute bags can be used again and again while buying different things. An old bucket can be used to grow indoor plants. Paper box can be used to hold our pen, pencil, ruler, etc. In this way, our habit of using things again and again in longer term reduces its production. It finally helps in environment conservation.

## Recycle







Recycle means converting the unusable products into new or similar products. Recycling may not be done at our home as it may need a lot of energy. A blacksmith can sharpen your old knife and you do not need to buy a new one. Similarly, you can use waste papers to make an envelope. Old utensils and metal pieces are

melted to produce new utensils. Old torn clothes can be recycled to make bedding materials. Have you seen scavengers collecting metal, paper, plastic and glass? They sell such things to industries, and the industries recycle them into same or different products.

## 3 Step Exercise

#### Step



#### 1. Write True for the correct statements and False for the incorrect ones.

- a. Biodiversity refers to variation among animals and their habitats.
- b. Schools, temples, hospitals, roads, etc. are the components of natural environment.
- c. Our social and cultural components are also the parts of our environment.
- d. Conservation of environment stops the development of mankind.
- e. Recycle means changing the materials into their original form or other similar forms.

#### 2. Fill in the blanks.

- a. ..... is the most important substance for living beings.
- b. About 97% of total water on the earth surface is ...... water.
- c. Environment-friendly behaviour is now replaced by ...... behaviour.
- d. ..... means to decrease the amount of substance we use.
- e. Using a plastic bottle again and again is an example of .....

## 3. Match the following:

- a. Natural environment i. Mixture of gases
- b. Social environment ii. Minerals
- c. Land iii. School
- d. Water iv. Plants and animals
- e. Air v. Fresh and salty



#### Write a one or two-word answer for the following.

- a. What is the set of things surrounding us is known as?
- b. Give an example of social environment.
- c. What is an example of the component of natural environment?
- d. What are the resources given by the nature itself called?
- e. Reusing things again and again is known as?

## 5. Write any two differences between the following:

- a. Air and water
- b. Reuse and recycle

#### 6. Give reasons.

- All water found on the earth cannot be used for drinking.
- b. Sun is the ultimate source of energy.
- c. Give an example each of the following.
  - i. Reuse
- ii. Reduce
- iii. Recycle

## Step

## 7. Define the following terms:

- a. Biodiversity
- b. Environment
- c. Natural resources
- d. Environment conservation
- e. Environment-friendly behaviour

## 8. Answer the following questions.

- a. Without plants, no animals will survive. Explain the statement.
- b. Plants are important for balancing oxygen and carbon dioxide in air. Explain.
- c. You have an old cracked bucket. Explain different environment-friendly options for its management.
- d. In your view, list some four ways of conserving the environment.

## 4.2

## Estimated Teaching Periods: Theory Practical 6 2

## **Ecosystem**

## Area and Sequence of Curriculum Issued by CDC

- 1. Introduction to ecosystem
- 2. Components of ecosystem
- 3. Relation among producers, consumers and decomposers
- 4. Types of ecosystems (forest ecosystem)

## **Learning outcomes**

At the end of this unit, students will be able to:

- 1. introduce ecosystem.
- 2. describe forest ecosystem along with its components.

## Key terms and terminologies of the unit

Ecosystem: The continuous and complex relationship between living

beings themselves and with their non-living environment

is called an ecosystem.

Abiotic components: All non-living components of the ecosystem that interact

with living beings are abiotic components.

Biotic components: All the living components of an ecosystem including

microorganisms, plants and animals are biotic components.

Producers: Those living beings that are capable of producing their

food by themselves are called producers (Autotrophs).

Consumers: Those living organisms that are not capable of producing

their foods by themselves are called consumers

(heterotrophs).

Primary consumers: Animals that eat plants as their food are called primary

consumers.

Secondary consumers: Animals that depend upon primary consumers are called

secondary consumers.

Tertiary consumers: Animals that directly depend on primary or secondary

consumers for their food are called tertiary consumers.

Decomposers: Organisms that take food by degrading dead plants,

animals or their parts are called decomposers.

An ecosystem that operates in water bodies is called Aquatic ecosystem:

aquatic ecosystem.

Pond ecosystem: A fresh water ecosystem that operates in a small body of

standing water is called pond ecosystem.

Terrestrial ecosystem: An ecosystem that operates on land is called terrestrial

ecosystem.

Grassland ecosystem: An ecosystem that operates in open area covered with

grasses is called grassland ecosystem.

The ecosystem that operates in woodland is called forest Forest ecosystem:

ecosystem.

Natural environment is composed of various living beings and non-living things. Non-living things include air, water, soil, rocks, temperature, etc. Living beings include microorganisms, plants, animals and humans. What if there are no plants? Of course, there will be no any animals including humans. Similarly, what if there is no air? There will be only some viruses and bacteria but no plants and animals. Where does the waste food disappear after some weeks? It is digested by microorganisms. The continuous and complex relationship between living beings themselves and with their non-living environment is called an ecosystem. Ecosystem is an activity and interaction of two major components. They are abiotic components and biotic components.

## **Abiotic Components**

All non-living components of the ecosystem that interact with living beings are abiotic components. Examples of abiotic components are sunlight, air, water, land and temperature. Sun provides heat and light energy to the living beings. Plants use sunlight for photosynthesis. Plants intake carbon dioxide and release oxygen during photosynthesis. All living beings intake oxygen for respiration. Respiration breaks down large molecules to release energy for living beings. Plants and animals conduct all their activities in soil. Microorganisms degrade plants and animals and release minerals into soil. Plants absorb water and minerals from soil. All living beings need favourable temperature for survival. In such a way, biotic and abiotic components of the ecosystem interact with each other.

## **Biotic Components**

All the living components of an ecosystem including microorganisms, plants and animals are biotic components. On the basis of mode of their nutrition, biotic components are classified into three groups. They are producers, consumers, and decomposers.

## **Producers (Autotrophs)**

Those living beings that are capable of producing their food by themselves are called producers (Autotrophs). Examples include all green plants that perform photosynthesis. All producers have chlorophyll (green pigment) in them. Chlorophyll in presence of water and minerals forms food (starch). Starch is stored in the body of plants as food. Plants like algae, moss, fern, grass, food crops, vegetables, fruits, etc. are producers. An ecosystem has a large number of producers.



## **Consumers (Heterotrophs)**

Those living organisms that are not capable of producing their foods by themselves are called consumers (heterotrophs). All consumers directly or indirectly depend on producers for their foods. All animals are consumers. Examples of consumers are grasshoppers, frogs, snakes, rabbits, deer, goats, buffaloes, foxes, leopards, tigers, etc. All consumers can be divided into three different levels. They are primary consumers, secondary consumers and tertiary consumers.

## **Primary Consumers**

Animals that eat plants as their food are called primary consumers. They are also known as herbivores. Some examples are grasshoppers, rabbits, deer, giraffes, horses, cows, etc. They are the foods of secondary consumers. An ecosystem has a large number of primary consumers.









Grasshopper

Rabbit

Giraffe

Elephant

#### **Secondary Consumers**

Animals that depend upon primary consumers are called secondary consumers.

Most of them are carnivores, but few are omnivores also. Some examples are frogs, snakes, crows, wolves, foxes, dogs, cats, seals, etc. They can be carnivores or omnivores. They are usually the food of tertiary consumers or top consumers or top carnivores. Secondary consumers are fewer in number than primary consumers.









Frog

Crow

Fox

Dog

#### **Activity**

List out some of the major producers and their consumers found in your surrounding environment.

## **Tertiary Consumers**

Animals that directly depend on primary or secondary consumers for their food are called tertiary consumers. Examples are eagles, pythons, sharks, tigers, lions, etc. The highest level of consumers that do not have their predators are top consumers. They are not eaten by other animals. They have the least number in an ecosystem among the consumers.









Shark

Snake

Eagle

Lion

The rank of the consumers depends upon the type of ecosystem they are present in. For an example in a forest ecosystem, deer eats grass and tiger eats deer. Therefore, deer is a primary consumer while tiger is a secondary consumer. There may not be any tertiary consumer. While in grassland ecosystem, a grasshopper is a primary consumer, frog is a secondary consumer, snake is a tertiary consumer and eagle is a top consumer as eagle eats the snake.

#### **Decomposers**

Organisms that take food by degrading dead plants, animals or their parts are called decomposers. Bacteria and fungi are the examples of decomposers. They grow rapidly through multiplication until the matter is available. They digest complex organic matter and release simpler substances. Along with simpler substances, decomposers disappear themselves in the soil. Producers use these minerals and water from soil to form food. Producers transfer that food energy to primary consumers and primary consumers to secondary consumers. Secondary consumers transfer that energy to tertiary consumers. All producers and consumers after their death transfer food energy to decomposers in the form of minerals. In this way, food energy is transferred in ecosystem.

## **Types of Ecosystem**

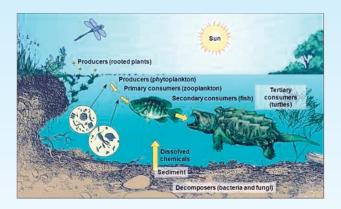
Broadly, ecosystems can be divided into two groups. They are aquatic ecosystem and terrestrial ecosystem.

## **Aquatic Ecosystem**

An ecosystem that operates in water bodies is called aquatic ecosystem. There are different types of aquatic ecosystems based on various factors like water current, salinity, temperature, pH, etc. Pond ecosystem, river ecosystem, estuaries ecosystem, bog ecosystem, etc. are few examples.

## **Pond Ecosystem**

A fresh water ecosystem that operates in a small body of standing water is called pond ecosystem. Biotic components of pond interact within themselves and with abiotic components to sustain the ecosystem.



Abiotic components in the pond ecosystem are dissolved oxygen, water, sunlight, soil, minerals, etc. Similarly, algae, submerged plants, floating plants and emerging plants are producers. Producers use sunlight, minerals, and oxygen to produce food energy. These foods are eaten by primary consumers like zooplanktons, beetles, cyclops, daphnia, small fish, etc. Secondary consumers like insects, frogs, crabs, fish, etc. eat primary consumers. Top consumers or tertiary consumers like large fish, water snakes, water birds, etc. eat secondary consumers. Similarly, bacteria and fungi degrade dead plants and animals after their death. Bacteria and fungi release the nutrients into soil and water. Rooted plants absorb nutrients from soil while floating plants absorb nutrients from water. In this way, pond ecosystem continues.

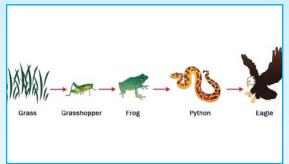
## **Terrestrial Ecosystem**

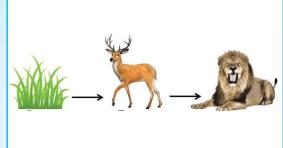
An ecosystem that operates on land is called terrestrial ecosystem. Grassland ecosystem, forest ecosystem, desert ecosystem, tundra ecosystem, etc. are its examples. Terrestrial ecosystem differs from each other based on the factors affecting living environment like hotness, coldness, air current, producers, consumers, etc.

## **Grassland Ecosystem**

An ecosystem that operates in open area covered with grasses is called grassland ecosystem. Plants and animals interact within themselves and with their abiotic components to sustain the ecosystem.

Soil, minerals, air, water, humidity, temperature are the abiotic components that affect the life of biotic components. Algae, grasses, shrubs, etc. are the major producers of the grassland. They produce food with the help of soil minerals, soil water, and carbon dioxide in the presence of sunlight.



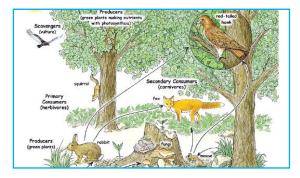


Grasshoppers, bees, rabbits, deer, zebras, etc. are the primary consumers that eat producers or their parts. This transfers food energy from producers to primary consumers. Secondary consumers like frogs, foxes, wild dogs, snakes, etc. intake food energy from primary consumers. Tertiary consumers like hawks, eagles, rattle snakes, lions, tigers, etc. eat secondary consumers. This transfers food energy from secondary consumers to tertiary consumers.

Organisms like beetles, vultures, etc. eat dead animals. Dead animals, plants and their parts are decayed by decomposers like bacteria and fungi. They release food energy into the soil in the form of nutrients. In such a way, a grassland ecosystem continues.

## **Forest Ecosystem**

The ecosystem that operates in woodland is called forest ecosystem. Forest ecosystems differ from each other based on the types of forests.

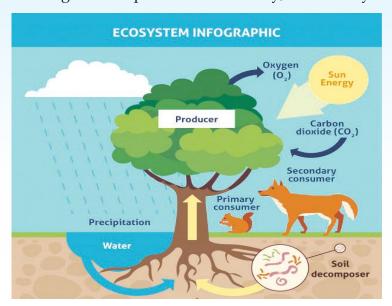


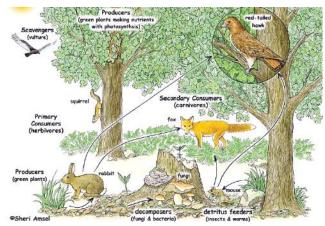
Both abiotic and biotic components are similar in almost all ecosystems. However, they are affected by various abiotic factors like humidity, air, heat, light, minerals, pH, etc. In a forest ecosystem, different trees and climbers are producers. Producers transfer their food energy to primary consumers.

Primary consumers like insects, squirrels, porcupines, deer, monkeys, etc. eat producers or their products. The food energy is transferred from primary

consumers to secondary consumers when animals like toads, wolves, snakes, and bears eat primary consumers. The tertiary or top consumers of the forest are leopards, owls, etc. From secondary consumers, food energy passes to tertiary consumers or top consumers.

Dead plants and animals or their parts are eaten by bug, beetles, etc. Remaining matter is digested by decomposers like bacteria and fungi. Decomposers break those organic matters into simpler substances like minerals. These minerals make the soil fertile for the growth of plants. In such a way, forest ecosystem continues.





#### Do You Know?

Half the world's species live in tropical rainforests.

#### **Project Work**

What type of ecosystem is found in your surrounding environment? Name its type and list the names of these producers: primary consumers, secondary consumers and tertiary consumers.

## **Importance of Ecosystem**

- a. Ecosystem provides habitat for wild plants and animals.
- b. It provides food to living beings.
- c. It provides air, water and minerals for regulating life processes.
- d. It recycles nutrients between biotic and abiotic components.
- e. Humans obtain all goods and services from the ecosystem.
- f. Healthy ecosystem is the source for development of mankind.

## 3 Step Exercise



<ol> <li>Fill in the blanks with appropriate v</li> </ol>	ords.
-----------------------------------------------------------	-------

- a. ..... break large molecules to release energy for living beings.
- b. All producers have green pigment called ...... in them.
- c. Consumers are also known as .....
- d. Tertiary consumers are sometimes also known as ...... carnivores.
- e. ..... and ..... are the examples of decomposers.

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

- a. Ecosystem is the result of interaction of living and non-living things.
- b. All autotrophs cannot make their own food.
- c. Tiger can be secondary consumer, tertiary consumer or top carnivore.
- d. Grass, rabbit, fox and lion are examples of forest ecosystem.
- e. Zooplanktons are the tiny primary consumers of forest ecosystem.

#### 3. Tick the correct alternatives.

- a. It is an abiotic component of ecosystem. (air, water, sunlight, all of them)
- b. These biotic components clean the environment. (producers, consumers, decomposers, all of them)
- c. Large fish in a pond ecosystem is an example of (producer, primary consumer, secondary consumer, tertiary consumer).
- d. The quantity of these biotic components is very high in grassland ecosystem (producers, primary consumers, secondary consumers, top carnivores).
- e. Tree leaves, monkey and leopard are the components of (pond, forest, grassland, all of them) ecosystem.

#### 4. Match the following with their best pairs.

- a. Grass I. Primary consumer
- b. Grasshopper II. Secondary consumer
- c. Frog III. Decomposer
- d. Snake IV. Producer
- e. Eagle V. Top carnivore
- . Fungi VI. Tertiary consumer

## Step

## 5. Give one word answer to the following.

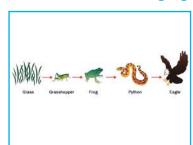
- a. An area where living beings interact with themselves and with the environment they live in to sustain their life.
- b. Which component of the ecosystem do microorganisms belong to?
- c. From where does the energy for the ecosystem come?
- d. What types of components are air, water, soil, sunlight, etc.?
- e. What is the major thing you observe that is transferred from producers to consumers in an ecosystem?
- f. Which group is responsible for recycling of nutrients into ecosystem?

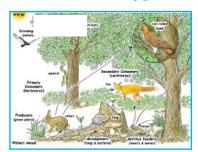
### 6. Write two differences between the following:

- a. Biotic and abiotic components
- b. Producers and consumers
- c. Primary consumer and secondary consumer
- d. Grassland and pond ecosystem
- e. Forest and grassland ecosystem

#### 7. Give reasons.

- a. Sunlight is the ultimate source of energy in the ecosystem.
- b. Microorganisms are called the cleaners of the ecosystem.
- c. There would be no ecosystem without producers.
- d. What if there are no primary consumers in the ecosystem?
- e. Why do you think the number of tertiary consumers is less in an ecosystem?
- 8. Look at the following figures and name the type of ecosystem.







# 9. Define the following terms with two examples of each.

a. Ecosystem

b. Producers

c. Consumers

d. Decomposers

e. Forest ecosystem

## 10. Complete the following matrix.

Features	Grassland Ecosystem	Pond Ecosystem	Forest Ecosystem
Characteristics	Found in Grassland		
Two contrasting abiotic components	Humidity, Soil nutrients	Water, Dissolved oxygen	Temperature, Crown cover
Producers		Algae, Submerged plants, Floating plants	
Primary consumers			Insects, Squirrel, Monkey
Secondary consumers			Leopard
Tertiary consumers			Leopard

# 11. Answer the following questions.

- a. What are the types of consumers? Describe their features with two examples of each.
- b. How is food energy recycled in an ecosystem? Explain on the basis of forest ecosystem.
- c. What is the role of decomposers in an ecosystem? Explain.
- d. Explain the situation of a forest ecosystem if all frogs are killed.
- e. List any four importance of ecosystem for humans.
- f. Draw a neat diagram of a forest ecosystem showing producers, consumers and decomposers.



# Life Processes

Estimated Teaching Periods:		
Theory	Practical	
8	2	

# Area and Sequence of Curriculum Issued by CDC

- 1. Introduction to mode of nutrition
- 2. Types of nutrition
- 3. Autotrophic mode of nutrition
- 4. Heterotrophic mode of nutrition (holozoic, parasitic and saprophytic)
- 5. Introduction, process and importance of photosynthesis
- 6. Introduction to digestion
- 7. Human digestive system and process of digestion

# **Learning outcomes**

At the end of this unit, students will be able to:

- 1. explain mode of nutrition.
- 2. explain photosynthesis with its importance.
- 3. explain human digestive system along with process of digestion.

# Key terms and terminologies of the unit

Life processes: All the systematic activities that are performed by a

living body are known as life processes.

Nutrients: Nutrients are those substances that are required by the

body of living organisms for their proper growth and

development

Nutrition: The process by which living beings obtain food and

utilize nutrients present in it is called nutrition.

Autotrophic nutrition: The mode of nutrition which is shown by autotrophs

or producers is called autotrophic nutrition.

Saprophytes: Those organisms which depend upon dead and

decaying organic matters for their food are called

saprophytes.

Holozoic nutrition: The mode of nutrition in which animals intake complex

organic food as a whole which is present in solid or

liquid form is called holozoic nutrition.

Ingestion: The process of intake of food is called ingestion.

Digestion: The process of breaking down of complex food

substances into simple and absorbable molecules is

called digestion.

Absorption: The process of absorption of digested food is called

absorption.

Assimilation: The process of utilization of digested food for energy

and for growth and repair is called assimilation.

Egestion: The process of removing undigested food from the

body is called egestion.

Photosynthesis: Photosynthesis is the process of making food by green

plants using water and carbon dioxide in the presence

of sunlight.

Chlorophylls: Chlorophylls are the green coloured pigments found

in plants.

Digestion: Digestion is a process of breaking down of complex

food materials into simpler forms that can be absorbed

by the body.

Digestive tract: The path from where the food enters the body to where

it is excreted as waste is called alimentary canal

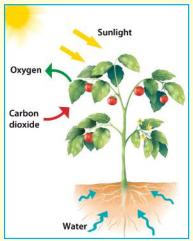
(digestive tract).

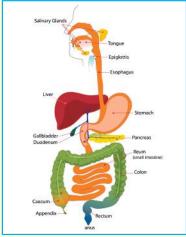
Digestive Glands: The groups of specific cells that secrete enzymes for

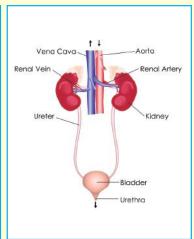
the digestion of food are called digestive glands.

### Look and discuss

What happens in each figure? Ask your friends, elders, teachers, etc. and discuss in the class.







Photosynthesis

Digestive System

Excretory System

What happens if an animal does not eat food and breathe air? No doubt, it dies. To be alive, all living bodies must take food, breathe air, digest food, throw waste out of the body, etc. All the systematic activities that are performed by a living body are known as life processes. Photosynthesis, respiration, digestion, excretion, reproduction, circulation, etc. are examples of life processes.

# Activity

Complete the following matrix based on your observation and experience regarding some animals and their food. The first one is done for you.

S.N.	Living beings	Types of foods they take
1	Frog	Insects
2	Fungi	
3	Earthworm	
4	Pigeon (Granivore)	
5	Squirrel (Frugivore)	
6	Lizard (Insectivore)	
7	Vulture (Detrivore)	

### Nutrition

Both plants and animals need food to survive. Food contains necessary nutrients which are required for living beings. These nutrients provide energy for their growth and to perform various activities. Thus, nutrients are those substances that are required by the body of living organisms for their proper growth and development. Broadly, nutrients are divided into carbohydrates, proteins, fats, vitamins and minerals. The process by which living beings obtain food and utilize nutrients present in it is called nutrition.

### **Modes of Nutrition**

Plants and animals have different modes of nutrition. Plants show autotrophic nutrition and animals show heterotrophic nutrition.

### a) Autotrophic Nutrition

Green plants prepare their food themselves. This process is called photosynthesis. Thus, photosynthesis is a process of making food by green plants using carbon dioxide and water in the presence of sunlight. This is a reason why green plants are known as autotrophs or producers. The mode of nutrition which is shown by autotrophs or producers is called autotrophic nutrition.



# Memory Tip

Living organisms that prepare their own food by using inorganic substances are called autotrophs or producers.

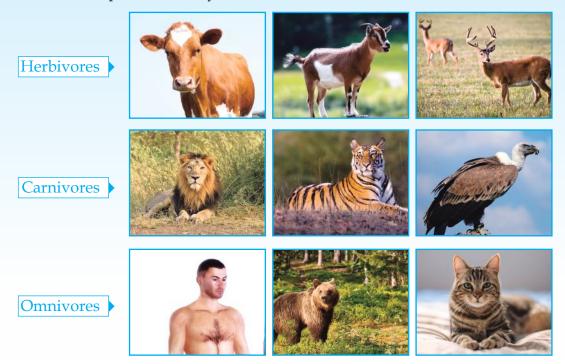
# b) Heterotrophic Nutrition

Animals and non-green plants do not have chlorophyll. They cannot prepare their own food. They depend directly or indirectly on plants for their food. They are called heterotrophs or consumers. Thus, those living organisms that depend on others for their food are called heterotrophs or consumers. Similarly, the mode of nutrition which is shown by heterotrophs is called heterotrophic nutrition. The following are the types of heterotrophic nutrition:

- i. Herbivores, Carnivores and Omnivores
- ii. Saprophytes and Parasites

# (i) Herbivores, Carnivores and Omnivores

Some animals like cows, goats, buffaloes, deer, monkeys, pigeons, etc. feed only on plants or parts of plants. So, they are called herbivores. Animals like lions, tigers, leopards, snakes, vultures, etc. feed on flesh of other animals. So, they are called <u>carnivores</u>. Similarly, humans, bears, foxes, dogs, cats, etc. feed on both animals and plants. So, they are called <u>omnivores</u>.



# (ii) Saprophytes and Parasites

Those organisms which depend upon dead and decaying organic matters for their food are called saprophytes. For example, non-green plants like mushroom, mucor, yeast, etc. Some animals like mosquitos, round worms, tapeworms, leeches, bed bugs, etc. depend on host for their food. They are called parasites.



Nova Science and Technology -6

All organisms like herbivores, carnivores, omnivores, saprophytes and parasites are called heterotrophs. They directly or indirectly depend on plants for their food.



### Memory Tip

Animals which depend on dead and decayed organic matter for their food are called saprotrophs such as vulture.

## **Holozoic Nutrition**

The mode of nutrition in which animals intake complex organic food as a whole which is present in solid or liquid form is called holozoic nutrition. The holozoic nutrition has following five steps.

**Ingestion:** The process of intake of food is called ingestion. **Digestion**: The

process of breaking down of complex food substances into simple and absorbable molecules is called digestion. Simple molecules

thus obtained can be absorbed by the body.

Absorption: The process of absorption of digested food is called absorption.

**Assimilation:** The process of utilization of digested food for energy and for

growth and repair is called assimilation.

**Egestion:** The process of removing undigested food from the body is called

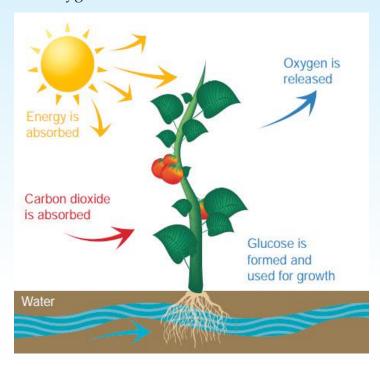
egestion.

# **Photosynthesis**

Photosynthesis is the process of making food by green plants using water and carbon dioxide in the presence of sunlight. Through this process all green plants prepare their food by themselves. This is the most essential process for the existence of plants and animals. Without this process no living organisms would survive on the earth. This process transforms the solar energy into food energy and releases oxygen for respiration.

Photosynthesis basically occurs in the green leaves of plants. However, it also occurs in green stem and branches. During this process, roots of plants absorb water from the soil and transport to the leaves through the stem.

The stomata of the leaves absorb carbon dioxide from the air. Chlorophyll absorbs light energy from sunlight. The chemical reaction of carbon dioxide and water in the presence of sunlight trapped by chlorophyll forms glucose (starch) and oxygen. Glucose is the food material that is transported from leaves to different parts of plants. Excess glucose is stored in roots, stem and fruits for future use. Stomata release the oxygen into the air.



Chlorophyll
Carbon dioxide + Water 
$$\rightarrow$$
 Glucose + Oxygen
Sunlight

Chlorophyll

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

# **Requirements for Photosynthesis**

# Chlorophyll

Chlorophylls are the green coloured pigments found in plants. These pigments make the plant leaves and parts look green. They are capable of absorbing sunlight in them.

# Sunlight

Sunlight provides energy for photosynthesis. Chlorophyll traps this light energy and converts it into food energy.

### Carbon dioxide

Carbon dioxide is one of the major raw materials for photosynthesis. Green leaves have small pores on their surface called stomata. Stomata absorb carbon dioxide from the air.

#### Water

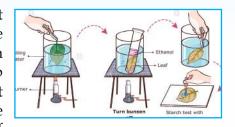
Water is another raw material for photosynthesis. Root hairs of roots absorb water from the soil and transport it to leaves through the stem.

### **Activity**

Objective: To observe that a leaf contains starch (food) in it

Materials Required: A fresh green leaf, alcohol, iodine solution, petri dish, test tube, beaker and a burner

Procedures: Dip a fresh leaf completely in a test tube containing 90% alcohol. Place that test tube in a beaker containing water. Light the burner on and heat the beaker with test tube in it. Stop heating the beaker if the alcohol inside the test tube dissolves chlorophyll. Leaf turns pale if the chlorophyll dissolves in the alcohol. Take the leaf



out of alcohol and wash it with clean water. Place the pale leaf in a petri dish containing iodine.

Observation: The pale leaf converts into blue black or dark blue in colour.

Result: The colour of starch in iodine is blue black or dark blue. Therefore, the leaf contains starch in it.

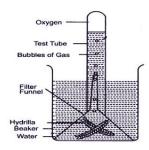
Conclusion: In such a way, we can observe that the leaf contains starch in it.

# **Activity**

Objective: To show that oxygen gas is produced during photosynthesis

Requirement: Twigs of hydrilla, large test tube, beaker, glass funnel, water, sodium bicarbonate, matchbox, etc.

Method: Put twigs of hydrilla in a beaker and cover them inside an inverted funnel. Fill the beaker with water and add a pinch of sodium bicarbonate as a source of carbon dioxide. Fill the



test tube with water and invert it gently over the funnel stem as shown in the figure. Air should not enter inside the test tube while inverting it over the stem of the funnel. Keep the apparatus in the sunlight for a few hours.

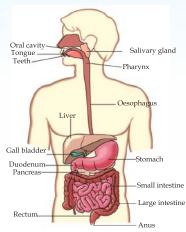
Observation: After few hours, gas bubbles are seen in the test tube. Gas starts to displace the water downward in the test tube.

Test of gas: After collection of enough gas, we lift up the test tube and insert a burning matchstick inside the inverted test tube with gas immediately. Matchstick burns more brightly inside the test tube than in ordinary air.

Conclusion: This experiment shows that oxygen gas is produced during photosynthesis.

### **Human Digestive System**

We need energy to conduct life processes and daily activities. Food gives us that energy. But all the food we eat does not convert into energy. The food materials needed by our body are absorbed while waste materials are excreted through the process called digestion. Digestion is a process of breaking down of complex food materials into simpler forms that can be absorbed by the body. It is necessary for human life, and therefore, it is one of the important life processes. The human digestive system is composed of alimentary canal (digestive tract) and digestive glands.



Digestive system

# **Alimentary Canal (Digestive Tract)**

The path from where the food enters the body to where it is excreted as waste is called alimentary canal (digestive tract). It starts from the mouth and ends at the anus. It is composed of organs like mouth, pharynx, oesophagus (food pipe), stomach, small intestine, large intestine, rectum and anus.



### **Memory Tip**

The total surface area of human intestine is about 2700 square feet which is more than the half of standard-size basketball court.

# **Digestive Glands**

The groups of specific cells that secrete enzymes for the digestion of food are called digestive glands. Enzymes are nothing but the chemical substances that

aid breaking down of the food. Examples of digestive glands are salivary gland, gastric gland, liver, pancreas and intestinal glands, etc.

# **Process of Digestion of Food**

When we eat food, teeth in the mouth break the food into small pieces. In the mouth, salivary gland secretes saliva that makes the food soft and slippery. Saliva contains an enzyme called amylase that digests starch and converts it into maltose. The slippery food then passes to the pharynx for swallowing. After swallowing, it passes to stomach through oesophagus (food pipe).

Stomach is an elastic bag that stores food. The wall of stomach has gastric glands which produce gastric juice and hydrochloric acid. Rhythmic contraction of stomach crushes the food and mixes with gastric juice and hydrochloric acid. Gastric juice contains two enzymes, i.e. pepsin and renin. Pepsin digests proteins from the food while renin digests milk protein. Hydrochloric acid kills most of the harmful microorganisms present in the food. Now the digested food passes to the small intestine.

The upper part of small intestine is duodenum. In duodenum, the bile juice mixes into the food which digests fat. Similarly, pancreatic juice secreted by pancreas mixes into the food. Pancreatic juice contains enzymes called trypsin, amylase and lipase. Trypsin digests proteins; amylase digests starch and lipase digests fats. The food then passes from duodenum to ileum. In ileum, intestinal glands secrete intestinal juice. Intestinal juice contains enzymes that convert food into simpler forms like amino acids, glucose, galactose, fructose, lactose, etc. In this way, complex food materials like starch, proteins and fats get digested into simpler soluble substances in the small intestine.

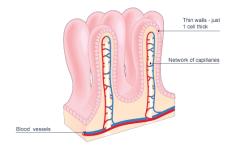
S.N.	Organ	Gland	Juice	Enzyme	Function
1	Mouth	Salivary	Saliva	Amylase	Digest starch
2	Stomach	Gastric	Gastric	Pepsin and Renin	Digest food protein and milk protein respectively
			Hydrochloric acid		Kills microorganisms

3	Small Intestine	Liver	Bile		Digest fat globules
		Pancreas	Pancreatic	Trypsin, Amylase and Lipase	Digest protein, starch and fats respectively
		Intestinal	Intestinal	Erepsin, Maltase, Lactase and Sucrase	Digest peptides, maltose, lactose and sucrose respectively

The digested simpler substances are absorbed by villi. Villi are the densely folded small projections on the wall of small intestine. Villi are connected with the blood vessels. The simpler food substances are then transported all over the body through these blood vessels.

From the end of small intestine, undigested food passes to large intestine. Large intestine absorbs water and passes the semisolid waste to the rectum. The undigested food stored in the rectum is excreted out of the body through anus. This process continues every time we eat food. In this way, digestion takes place in the human body.

Digestion process is completed now, but do you know how we get energy from the food? The digested foods are transported to each and every part of our body through blood circulation. When we breathe oxygen in, all these simpler food substances burn inside the body releasing energy. Do not worry, the burning is not real, it is just a chemical reaction to release energy. We use that energy for our day-to-day life and our body uses it for other life processes.



# 3 Step Exercise

# Step

### Write True for the correct statements and False for the incorrect ones.

- a. Food is a source of energy.
- b. Green plants convert solar energy into food energy.
- c. Stomata are the green pigments found in the leaf.
- d. Hydrochloric acid digests proteins in the food.
- e. Glands are the groups of specialized cells that secrete enzymes.

### Fill in the blanks with correct words.

- a. The green colour pigment found in leaves of green plants is called
- b. Green plants use ...... and ..... as the raw materials for photosynthesis.
- c. Starch when immersed in ...... shows dark blue or blue black colour.
- d. The alimentary canal of human body starts from ...... and ends at .....
- e. ..... are the small projections on the wall of small intestine that absorb digested food materials.

### 3. Select the best alternatives.

- a. Chlorophyll is able to trap...... (carbon dioxide, oxygen, sunlight, water).
- b. .....is the end product of photosynthesis. (Glucose, Carbon dioxide, Water, Food)
- c. All green plants need......(carbon dioxide, oxygen, nitrogen, water) gas for photosynthesis.
- d. Saliva can digest..... (protein, starch, peptides, fat).
- e. Trypisn is the enzyme secreted by..... (pancreas, liver, stomach, intestine).
- f. Gastric juice is found in...... (mouth, stomach, small intestine, large intestine).

## 4. Match the following with their pair.

- a. Mouth
- b. Stomach
- c. Liver
- d. Pancreas
- e. Small intestine
- f. Large intestine

- I. Absorbs water
- II. Bile juice
- III. Pancreatic juice
- IV. Intestinal juice
  - V. Hydrochloric acid
- VI. Salivary juice



## 5. Answer the following questions in one word:

- a. In which part of the plant does photosynthesis occur?
- b. Which gas is released as a result of photosynthesis?
- c. Name the substance in which starch becomes dark blue in colour.
- d. What is the secretion of salivary gland?
- e. Which juice digests food protein and milk protein?
- f. These are finger-like projections in the wall of small intestine.

# 6. Write down at least two major differences between the following:

- a. Photosynthesis and digestion
- b. Chlorophyll and stomata
- c. Stomach and liver
- d. Pancreatic juice and bile juice

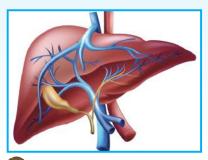
### 7. Give reasons.

- a. Photosynthesis does not occur during nighttime.
- b. Non-green plants cannot prepare food by themselves.
- c. How can you assure that leaves contain starch in them?
- d. Digestion is one of the important life processes in human beings.

## 8. Identify the following figures and list one important function of each.









# Step

# Define the following terms:

- a. Life processes
- b. Photosynthesis
- c. Digestion
- d. Holozoic nutrition

# 10. Define the following terms with two examples of each.

- a. Herbivores
- b. Carnivores
- c. Omnivores
- d. Saprophytes
- e. Parasites

## 11. List the function of the following.

- a. Gastric juice
- b. Hydrochloric acid
- c. Bile juice
- d. Pancreatic juice
- e. Intestinal juice
- f. Villi

## 12 Answer the following questions.

- a. Explain in short about the substances that are required for photosynthesis.
- b. Explain the process of photosynthesis in plants.
- c. Describe the procedures to show that leaf contains starch in it.
- d. List the organs of human digestive system.
- e. Briefly describe the process of digestion in human body.
- f. Draw a labelled diagram of alimentary canal of the human body.



# Force and Motion

Estimated Tea	ching Periods:
Theory	Practical
8	2

# Area and Sequence of Curriculum Issued by CDC

- 1. Definition of rest and motion
- 2. Transformation of force
- 3. Types of motion (linear motion and curvilinear motion)
- 4. Definition of force and its measurement
- 5. Effects of force (change in shape, size and motion)
- 6. Definition and examples of simple machines

# **Learning outcomes**

At the end of this unit, students will be able to:

- 1. Define rest and motion.
- 2. Differentiate linear motion and curvilinear motion.
- 3. Define force and measure force using spring balance.
- 4. State and demonstrate effects of force.
- 5. Give simple examples of transformation of force.
- 6. Define simple machines and give examples of simple machines which are used in our daily life.

# Key terms and terminologies of the unit

Force: Force is a factor which changes or tries to change the

state of rest or state of motion of an object

Transformation of force: Transformation of force refers to the application of

force at one point of the tool to do work at another place

with the tool.

Rest: A body is said to be at rest if it does not change its

position with respect to the surrounding objects.

Motion: A body is said to be in motion if it changes its position

with respect to the surrounding objects.

Linear motion: The motion of a body in a straight line is called linear

motion.

Curvilinear motion: The motion of a body in a curved path in which its

direction changes continuously is called curvilinear

motion.

Circular motion: The curvilinear motion of a body in a curved or a

circular path is called circular motion.

Rotatory motion: The type of curvilinear motion in which a body moves

about a fixed point or an axis without changing its

position is called rotatory motion.

Oscillatory motion: The type of motion in which an object moves to-and-fro

about the mean position is called oscillatory motion.

Random motion: The motion of a body in which it changes its path as

well as direction frequently is called a random motion.

Simple machine: A simple machine is a simple tool which makes our

work easier, faster and more convenient.

6.1

# **Introduction to Force**

We perform different works in our daily life such as pulling, pushing, sliding, lifting, loading, unloading, squeezing, stretching, twisting, etc. To do such activities, we need a factor called force. Without applying force, we cannot change the shape, size and position of objects. For example, a door does not open itself unless we apply force on it, a football remains on the ground unless a player kicks it and a spring does not become long unless we pull it from its ends. The above examples prove that objects change their states when they are pulled or

pushed. In physics, this pulling and pushing factor is called force. Thus, force is a factor which changes or tries to change the state of rest or state of motion of an object.







A horse pulling cart

A man pushing a car

Stretching a spring

Figure: Force used for different types of work

### Activity

Open and close the door. Similarly, pull and push the trolley. What is required to open and close the door? And, what is required to pull and push the trolley? Obviously, we need a factor to do these works called force. Thus, force is a factor which changes or tries to change the state of rest or state of motion of an object.





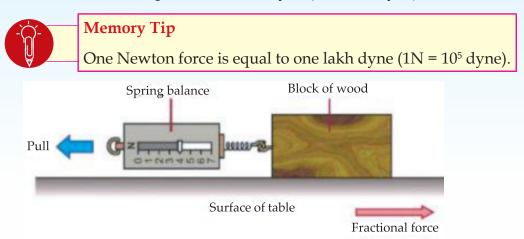
# Differences between pulling force and pushing force

S.N.	Pulling force	S.N.	Pushing force
1.	The force which pulls an object is pulling force.	1.	The force which pushes an object is pushing force.
2.	The direction of motion of the object is towards us. For example, pulling a cart, withdrawing water from a well, etc.	2.	The direction of motion of the object is away from us. For example, pushing a box, pushing a door, etc.

### Measurement of force and its units

Large amount of force is required to do heavy works like digging, running, lifting, loading, unloading, etc. On the other hand, a small amount of force is enough to do light works like eating, writing, walking, waving hands, etc.

Spring balance is the simplest instrument to measure the magnitude of force. In SI units, force is measured in Newton (N) and in CGS system, it is measured in dyne. One Newton force is equal to one lakh dyne (1N = 10<sup>5</sup> dyne).



### **Effects of force**

Force causes various effects on different objects. It is the only factor which changes shape, size, position, speed, direction of motion, etc. of the objects. Some of the major effects of force are described below:

# (a) Force can change the position of a body at rest

When a player kicks a football, it changes its position; when you throw a stone, it goes to another place. Similarly, while carrying a bag from your home to school, loading and unloading of the goods on a truck, lifting of loads, etc. there is change in position of objects as we apply force. Thus, force can change the position of the body at rest.



# Memory Tip

It is not necessary that a force always sets a body at rest into motion. For example, if we push a heavy truck, it does not move.







Carrying a load

Loading goods on a vehicle

Shifting a table

## (b) Force can change the speed of a moving body

What do we do to speed up a bicycle? Obviously, we apply force to its pedals. Similarly, a driver applies force on the brakes to slow down a moving bus. These activities show that force can increase or decrease the motion of a moving body. Thus, force is the factor which can change the speed of a moving body.



Speed of a football increases on kicking



Pulling a bicycle decreases speed



A speeding bicycle due to increase in force

# (c) Force can change the direction of a moving body

While playing cricket, a batsman changes the direction of the cricket ball by hitting it with a bat; a football player changes the direction of the moving football after kicking or heading; we can open or close a door on pulling or pushing its handle, etc. So, force can change the direction of a moving body.



A player hitting a ball with bat



A Player heading football



A man opening window

# (d) Force can change the shape and size of a body

Take an inflated balloon and press it. Observe the change that has occurred in its shape. Obviously, the balloon gets squeezed. Similarly, take a rubber band or a

spring and stretch it. Now, its size increases. In above activities, we observe that the shape and size of the objects change as we apply force on them. So, force can change the shape and size of a body.







Squeezing paste

Squeezing balloon

Stretching spring

### Transformation of force

### Activity

Observe different activities which are done in our surroundings, such as chopping the wood, digging the field, filling air in the bicycle, lifting water from the well, cutting grass, flying kite, cycling, etc. In these activities, we use required tools. Observe these activities carefully - where do these tools work? Similarly, where do we apply force upon these tools?



Chopping the wood



Digging the field



Filling air in bicycle



Lifting water from well



**Cutting Grass** 

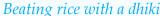


Flying kite

We need force to do work. To do work we use certain tools and machines. For example, we use axe for chopping the wood; we use spade for digging the field; we use pump for filling air in the bicycle; we use pulley for lifting water from the well; we use sickle for cutting grass; we use wheel and axle (lattai) for flying kite; we use knife for cutting vegetables, etc. While doing these works, we apply force

in a certain part of the tool. This force is transformed to do work in another part of the tool. For example, we apply force on the paddle of the bicycle and the bicycle moves on the road; we apply force on the handle of the axe and the axe chops the wood; we apply force on the knife and the knife cuts the vegetables, etc. Therefore, application of force at one point of the tool to do work at another place with the tool is called transformation of force. All kinds of simple machines like axe, spade, spoon, broom, sickle, crowbar, wheel and barrow, etc. transform force from one place to another.







Cutting wire with pliers



Chopping vegetables

# 6.2 Rest and Motion

In our surroundings we see various things. Among these things, some are in motion and some are at rest. Tree, house, electric pole, temple, bridge, bag on the table, etc. are at rest. This is because they do not change their position with respect to the surrounding objects. These objects do not change their position unless we do not apply force. Thus, a body is said to be at rest if it does not change its position with respect to the surrounding objects.



Bridge



Tree

We see animals, birds, fish, vehicles, players playing football, etc. moving from one place to another. They change their position with respect to the surrounding

House

objects. These bodies are said to be in motion. Thus, a body is said to be in motion if it changes its position with respect to the surrounding objects.







A bird flying in sky

Players playing football

A running horse

### **Activity**

Make a list of any ten objects in motion and any ten objects at rest.

### Rest and motion are relative terms

The same object may be at rest with respect to an object but in motion with respect to another object. For example, if you are sitting on a seat inside the moving bus then you and other passengers are in motion with respect to the trees, electric poles, buildings, etc. on the road side. But you and other passengers are at rest with respect to each other.



#### **Fact with Reason**

## Rest and motion are called relative terms, why?

An object can be at rest with respect to one set of objects while it can be in motion at the same time with respect to another set of objects. Hence, rest and motion are not absolute but relative terms.

# **Activity**

### To show that rest and motion are relative terms

Make a pair of two students and move from one corner to another corner of the ground. You are in motion with respect to the corners of the ground but at rest with respect to each other.

# **Types of Motion**

We can see various moving objects in our surroundings. They move in different ways. Some of them move in a straight line, some move in a circle, some in a spiral line and some move to and fro from a fixed point, etc. All these motions can be categorized into two main types. They are:

#### a) Linear motion b) Curvilinear motion

### (a) Linear motion

### **Activity**

Take a small piece of stone and tie it with a thread. Release the stone from a certain height. Observe the motion of the stone along with its thread.

Figure: releasing the piece of stone along with thread

In our surroundings, we can see motion of different objects. For example, a bullet fired from a gun, a boy sliding down a slope, the motion of a stone released from a catapult, an apple falling from a tree, etc. They move in a straight line, hence called linear motion. Thus, the motion of a body in a straight line is called linear motion.







A fired bullet

A falling apple

Sliding down a slope

### b) Curvilinear motion

# **Activity**

Take a piece of stone and a piece of paper. Release them from a certain height. Observe their motion. The piece of stone moves in a straight line but the piece of paper moves in the path other than the straight line.

Most of the bodies move in the path other than the straight line. For example, a javelin thrown by an athlete, a bus moving on a curved road, the motion of a spinning top, the motion of a ferris wheel, rote ping, wheel of a sewing machine, a potter's wheel, the blades of a fan, a child on a swing, the pendulum of a clock, etc. These motions are called curvilinear motion. Thus, the motion of a body in a curved path in which its direction changes continuously is called curvilinear motion. Curvilinear motions are of different types. They are circular motion, oscillatory motion, rotatory motion, random motion, etc.

### (i) Circular motion

The curvilinear motion of a body in a curved or a circular path is called circular motion. For example, a javelin thrown by an athlete, a bus moving on a curved road, etc.







A moving car on the curved road

### (ii) Rotatory motion

The type of curvilinear motion in which a body moves about a fixed point or an axis without changing its position is called rotatory motion. For example, the motion of a spinning top, the motion of a ferris wheel, rote ping, wheel of a sewing machine, a potter's wheel, the blades of a fan, etc.



A rotating fan



A rote ping (round swing)



A spinning top



### **Memory Tip**

The type of motion which has both linear and rotatory motion is called a spiral motion. For example, moving down in a winding staircase.

# **Activity**

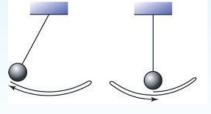
# To observe the rotatory motion

Bring a spinning top and spin on the ground. Observe its motion. It spins about its own axis for some time. This type of motion is called rotatory motion.

### (iii) Oscillatory motion

Have you observed the motion of the pendulum in a pendulum clock? In this clock, the pendulum moves forward and backward about the mean position continuously. This type of motion is called oscillatory motion. Thus, the type of motion in which an object moves to-and-fro about the mean position is called oscillatory motion. During oscillatory motion, the oscillating body cannot go beyond a certain distance. For example, a child on a swing, the pendulum of a clock, etc.







A child swinging

Oscillating pendulum

Pendulum clock



### Memory Tip

The very fast oscillatory motion is called vibratory motion. For example, a plucked string of a guitar and a sitar.

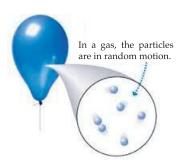
# **Activity**

# To show oscillatory motion

Take a small piece of a stone and tie it with a long thread. Suspend the stone to a fixed point so that it can move freely. Push the stone gently and observe its motion. The stone moves forward and backward about the fixed mean point. This type of motion is called an oscillatory motion.

# (iv) Random motion

The motion of a body in which it changes its path as well as direction frequently is called a random motion. For example, motion of gas molecules, motion of dust particles in air, motion of paper piece falling thorough air, etc.



# **Introduction to Simple Machine**

We do different types of work in our daily life. To do these works we use different types of tools and machines. Use of these tools and machines makes our work easier and faster. Such types of simple tools are called simple machines.

### **Activity**

Observe around your home. Identify different tools which are used over there. Name the tools and mention their function as in the given table.

S.N.	Name of tool	Use of the tool
1.	Pair of scissors	To cut clothes, paper, rubber, etc.
2.		
3.		

As mentioned in the activity, we use different tools to do different works in our daily life. For example, we use a knife to cut vegetables, a spoon to eat food, a pair of scissors to cut papers, an axe to chop wood, a pulley to draw water from a well, a screwdriver to open a jammed nut and so on. These tools have a very simple structure. We need very little force to do our work with the help of these tools. Use of these tools also makes our work faster and more convenient. Thus, a simple machine is a simple tool which makes our work easier, faster and more convenient. Some examples of simple machines are scissors, bottle opener, knife, screwdriver, pulley, axe, wheelbarrow, nail cutter, pliers, etc. These tools are frequently used in our daily life.







Bottle opener

Knife

Nail cutter









Pulley

Screwdriver

Wheelbarrow

scissors



### Fact with Reason

### Why is it easier to do work by using simple machines?

It is easier to do work by using simple machines because they can multiply force, transfer force or increase the rate of doing work.

# Differences between a simple machine and complex machine

S.N.	Simple machine	S.N.	Complex machine
1.	A simple machine is a simple tool which makes our work easier, faster and convenient.		A complex machine is the combination of many simple machines.
2.	A simple machine has very simple body structure and is easy to operate.		A complex machine has complex structure and is difficulty to operate.

# **Use of Simple Machines**

Simple machines make our work easier, faster and more convenient. So, we use different simple machines to complete our daily works. Screwdriver, pulley, bottle opener, tongs, etc. are some of the simple machines used in everyday life. Sometimes many simple machines are combined together to do a particular type of work. For example, a sewing machine is a complex machine but it is made up of different types of simple machines. A bicycle, motorcycle, car, bus, etc. are some examples of complex machines which are made from many simple machines. Complex machines are difficult to operate and many of them require fuel too. Some simple machines and their uses are listed below.

S.N.	Simple machine	Uses
1.	Scissors	It is used to cut clothes, paper, etc.
2.	Crowbar	It is used to lift a heavy load like a stone.
3.	Knife	It is used to cut vegetables, fruits, etc.
4.	Bottle opener	It is used to open the lid of a bottle like coca-cola.
5.	Wheelbarrow	It is used to carry loads like stones, bricks, etc.

Simple machines make our work easier, faster and more convenient in the following ways:

## (a) Simple machines can magnify the force applied

It is almost impossible to move a heavy stone by the strongest man. But a clever person can move such stone with the use of a crowbar. He also applies less effort to move the stone. This activity shows that use of simple machine magnifies the applied force. Thus, simple machines make our work easier, faster and convenient by multiplying the force applied.

### **Fact with Reason**



# How does an axe help to split wood?

An axe is a simple machine with a sharp end which produces high pressure. So it helps to split the wood.



Lifting a stone by using pulley



Lifting a stone using crowbar



### Fact with Reason

### Winding roads are made on hills, why?

Winding roads are inclined planes. These are made on hills, so that we can easily climb up the hill with less effort.

### (b) Simple machines can change the direction of force

It is difficult to pull a bucket full of water directly from a well. But it becomes easy to do the same work by using a pulley. With the help of a pulley, we pull the rope downwards but the bucket of water moves upwards. Here, pulley changes the direction of effort. Similarly, it is difficult to open the lid of a cold drink bottle without using the bottle opener. These activities show that the simple machines like pulley, bottle opener, crowbar, etc. change the direction of the effort applied. Thus, simple machines make our work easier, faster and convenient by changing the direction of the force applied.

### Fact with Reason



It is easy to pull the bucket of water with the help of a pulley. Why?

In a pulley we feel easier to apply an effort in the downward direction than in the upward direction since we can use our own weight to apply force.



*Lifting a stone with the help of a crowbar* 



Opening lid of a bottle



Drawing water from a well

# (c) Simple machines increase the speed of doing work

We use a broom for faster sweeping. Similarly, a dhiki is used to beat rice faster. In these activities simple machines increase the speed of doing work. So, simple machines make work easier, faster and convenient by increasing the speed of doing work.



Beating rice with a dhiki



Carrying load by a wheelbarrow

### **Fact with Reason**



Wheel and axle is a simple machine. Give reason.

Wheel and axle is a simple machine because it has a simple body structure and it can make our work easier, faster and more convenient.

### (d) Simple machines help to apply force at an exact point

We use scissors to cut clothes, pliers to cut wires, nutcracker to cut nuts, knife to cut vegetables and fruits, and screwdriver to drive a screw in or out. In these activities, simple machines help to apply force at an exact point. Thus, simple machines make our work easier, faster and more convenient by applying force at an exact point.



Cutting wire with pliers



Chopping vegetables



Tightening nut with a wrench

# Answer Writing Skill

# 1. The energy obtained from food is directly related with force and work done. Justify the statement.

We eat different kinds of foods. After digestion this food provides us energy. The energy in our body produces force through our muscle to do work. So, the energy obtained from food is directly related with force and work done.

### Why do we use pulley to pull water from the deep well?

Pulley is a simple machine. It changes direction of force. To pull down the rope, our body weight also performs as force. It helps pulling of water from the well. So, we use pulley to pull water from the deep well.

### 3. It would be difficult to do work if there were no simple machines. Why?

Knowingly and unknowingly, we use different kinds of simple machines in our daily life. Simple machines make our work easier, faster and more convenient. So, it would be difficult to do work if there were no simple machines.

### 4. How does an axe transfer force while chopping the wood?

An axe is a simple machine. It has a long handle and a double-inclined heavy head. We apply force form the handle. This force gets transferred to the particular point of the wood for its chopping.

## 5. How can we measure force using spring balance?

Weight of an object is also called force. To measure force of an object it is tied with spring balance and suspend freely. Now, the weight (force) of the object is shown in the reading of spring balance.

## Why is pushing and pulling called force?

Pulling and pushing is called force because pulling and pushing changes or tends to change the state of motion or rest of a body.

## 7. Even if we are sitting on a seat, we are at motion while travelling in a bus. Explain.

Even if we are sitting on a seat, we are at motion while travelling in a bus because we are changing place with respect to road, houses, poles and trees.

# 3 Steps exercise



# Fill in the blanks with appropriate words.

- a) We need to apply ..... to do any work.
- b) The unit of force in SI unit is .......
- c) Simple machines help to do our work ......

- d) A pencil sharpener is a .....machine.
- e) A pulley helps to ......direction of the force applied.

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

- a) A man sitting on a seat inside a bus is at rest as seen by the driver.
- b) We should apply force to change state of motion and state of rest of a body.
- c) A simple machine makes our work difficult.
- d) A pulley can be used to change the direction of the force applied.
- e) The sloping roads on mountains are example of inclined planes.
- 3. Select the best answer from the given alternatives.
  - a) Which is the SI unit of force?
    - i. Newton
      - ii. Dyne
- iii. Pascal
- iv. Joule
- b) How many dynes make 1N?
  - i. 10
- ii. 100
- iii.  $10^5$
- iv.  $10^6$
- c) Which of the following is not the effect of force?
  - i. Change direction of a moving body
  - ii. Change speed of a moving body
  - iii. Change shape and size of the moving body
  - iv. Change colour of an object
- d) Which one is not a linear motion?
  - i. Falling of apple

- ii. Boy sliding down the slide
- ii. Bullet fired from gun
- iv. A child playing swing
- e) Which one of the following cannot be done by a simple machine?
  - i. Magnify the applied force
  - ii. Increase the speed of doing work
  - iii. Transfer force from one point to another.
  - iv. All of them

### 4. Match the following:

i. measure force Force

Spring balance ii. Simple machine

Wheel of sewing machine iii. oscillatory motion

To and fro motion iv. curvilinear motion

Dhiki and crow bar v. pull and push



### 5. Answer the following questions in one word.

- a) Name the factor which is used for pulling or pushing the body.
- b) What can change the shape and size of an object?
- c) What kinds of terms the rest and motion are?
- d) What does combination of simple machines make?
- e) What are SI and CGS units of force?

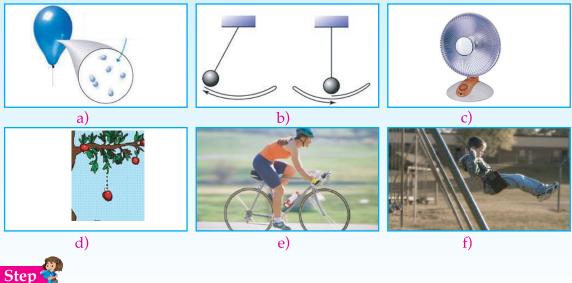
### 6. Give reasons.

- a) Rest and motion are relative terms.
- b) It is easier to do work by using simple machines.
- c) An axe helps to split wood.
- d) Winding roads are made on hills.
- e) It is easy to pull a bucket of water with the help of a pulley.

### 7. Differentiate between:

- a) Pulling force and pushing force
- b) Linear motion and curvilinear motion
- c) Simple machine and complex machine

#### 8. Write down the type of motion shown in the figures below:



- Answer the following questions.
  - a) What is force? Write its SI and CGS unit.
  - b) Describe any three effects of force.
  - c) Explain with examples about transformation of force.
  - c) What are rest and motion? Explain with example.
  - d) Describe linear and curvilinear motion with examples.
  - e) What are simple machines? How do simple machines help to do our work?
  - f) What are the functions of simple machines?

## **Project Work**

- 1. Make a list of different kinds of simple machines which are used at your home. Also mention their uses.
- 2. Make a list of examples present in your surroundings that show linear and curvilinear motion.



# **Energy in Our Daily Life**

7.1 Energy	7.2 Heat
7.3 Light	7.4 Sound

7.1

Estimated Teaching Periods: Practical Theory

## **Energy**

## Area and Sequence of Curriculum Issued by CDC

- 1. Definition of potential energy along with its examples
- 2. Factors affecting potential energy
- 2. Definition of kinetic energy along with its examples
- 3. Relation of kinetic energy with its mass and velocity
- 4. Examples of energy transformation

## **Learning outcomes**

#### At the end of this unit, students will be able to:

- 1. Define potential energy along with its examples.
- 2. Define kinetic energy along with its examples.
- 3. Demonstrate that object with more mass and velocity has more kinetic energy.
- 4. Provide examples of transformation of potential energy into kinetic energy.

## Key terms and terminologies of the unit

Energy: The capacity of a body to do work is called energy.

Mechanical energy: The energy of an object due to its motion or position is

called mechanical energy.

Potential energy: The energy possessed by a body due to its position or

deformation is called potential energy.

Kinetic energy: The energy possessed by a body in motion is called

kinetic energy.

Energy transformation: The process of change of energy from one form to

another is called energy transformation.

Conservation of energy: Energy can neither be created nor be destroyed but it

can be changed from one form to another. This is called

the law of conservation of energy.

Survival of living beings is impossible without energy. We have the capacity to walk or to do work due to the energy in our body. This energy comes from the food we eat. In a machine, there is fuel, which supplies energy for its working. No work can be done without energy. Thus, the capacity of a body to do work is called energy.

## **Units of energy**

The SI unit of energy is joule (J) and its CGS unit is erg.



#### Fact with Reason

The unit of energy is same as that of work, i.e. joule (J). Why?

Energy is the capacity to do work. It is equal to the amount of work done by the body. For example, 1J of energy is the capacity to do 1J work.

## Forms of energy

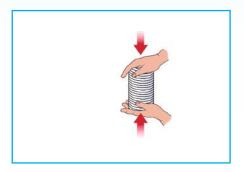
We do different types of works in our daily life. According to nature of work, we need different forms of energy. For example, mechanical energy, heat energy, sound energy, magnetic energy, light energy, electric energy, chemical energy, nuclear energy, etc. In this unit, we will study about mechanical energy.

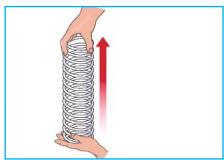
## Mechanical energy

Objects may be in motion or in different position of rest. Due to their motion or position, they have energy. This energy is called mechanical energy. Thus, the energy of an object due to its motion or position is called mechanical energy. For example, a bird flying at a certain height, water in a tank, moving vehicles, etc. have mechanical energy. There are two types of mechanical energy. They are kinetic energy and potential energy.

#### a) Potential energy

A stretched catapult can throw a stone at a certain distance. This is because a stretched catapult stores a form of energy called potential energy. Thus, the energy possessed by a body due to its position or deformation is called potential energy. Potential energy is stored energy. It is stored due to the position or deformation of the body. For example, a compressed spring, a stretched spring, a stretched catapult, a leg lifted to kick football, water in a dam, etc.





When a body of mass 'm' is raised to a height 'h' the potential energy contained by the body (PE) is calculated by the following formula.

Potential energy (P.E.) = mgh

Where, 'g' is acceleration due to gravity and its value is 9.8m/s<sup>2</sup>.

## **Activity**

Take a catapult and a stone. With the help of the catapult, throw the stone in the open area. Which energy is used to throw the stone? From where has this energy been derived?



#### Let's think

- 1. Which energy is used by the football player to kick the football?
- 2. Which energy is stored in the stretched and compressed spring?

#### Solved numerical: 1

A body of mass 10kg is lifted to a height of 5m from the ground. Calculate its potential energy if the value of acceleration due to gravity is 9.8m/s<sup>2</sup>.

#### Solution:

Mass of the body (m) = 10kg

Height from the ground (h) = 5m

Acceleration due to gravity (g) =  $9.8 \text{m/s}^2$ 

Potential energy (PE) = ?

Now, potential energy (PE) = mgh

 $= 10 \times 5 \times 9.8$ 

= 490I

Therefore, potential energy of the body is 490J.

### b) Kinetic energy

All kinds of moving bodies can do work. For example, blowing air can rotate the blades of a windmill, flowing water can rotate the turbines, etc. Thus, the energy possessed by a body in motion is called kinetic energy. For example, a rolling football, a falling apple, a running athlete, a moving vehicle, etc. possess the kinetic energy. The formula to calculate kinetic energy is:

Kinetic energy (K.E.) = 
$$1/2 \text{ mv}^2$$

Where, 'm' is mass of the body and 'v' is velocity of the body.

## Fact with Reason



A body at rest has zero kinetic energy. Why?

According to the formula K.E. = 1/2mv<sup>2</sup>, the value of kinetic energy depends upon mass of the body and its kinetic energy. A body at rest has mass but no velocity. So, its kinetic energy is zero.

#### Solved numerical: 2

A bullet having mass 15kg is shot with a velocity of 60m/s. Calculate the kinetic energy of the bullet.

#### Solution:

Mass of the bullet (m) = 15kg

Velocity (v) = 60 m/s

Kinetic energy (K.E.) =?

Now, kinetic energy of the bullet is given by K.E. =  $1/2 \text{ mv}^2$ 

or, K.E. =  $1/2 \times 15 \times (60)^2 = 1/2 \times 15 \times 3600 = 2700$  [ = 1.7k]

Therefore, kinetic energy of the bullet is 1.7kJ.

## Factors affecting kinetic energy

#### **Activity**

Take a cricket ball and a tennis ball. Go to the open space with your friend. Throw the balls slowly one by one and let your friend catch them. Again, throw the balls one by one at high speed and let your friend catch them.

- 1. What difference did you find while catching the cricket ball and tennis ball if thrown at the same speed?
- 2. What difference did you find while catching the fast moving cricket ball and slow moving cricket ball?



In the above activity, it is easy to catch the tennis ball in comparison to the cricket ball if they have the same speed. This is because the cricket ball has more mass and tennis ball has less mass. Similarly, it is easy to catch the cricket ball being thrown at slow speed compared to the cricket ball being thrown at high speed. Thus, kinetic energy depends upon the mass of the body and its velocity.

#### i) Mass

If a truck and a taxi are moving with the same velocity, then the kinetic energy of the truck is more than the taxi. This is because the mass of the truck is more than the mass of the taxi. Thus, kinetic energy of a body is directly proportional to its mass.

### i.e., K.E.a m (when 'v' remains constant)



#### **Memory Tip**

If the mass of a body is doubled, its kinetic energy also gets doubled and if the mass of the body is halved, its kinetic energy also gets halved.



#### Fact with Reason

Kinetic energy of a moving object increases if the mass of the body is increased. Why?

Kinetic energy of a moving object increases if the mass of the body is increased because kinetic energy of a body is directly proportional to the mass of the body.

#### ii) Velocity

A fast moving taxi has more kinetic energy than the taxi with slow velocity. This is because the kinetic energy of a body is directly proportional to the square of its velocity.

i.e.,  $K.E.\propto v^2$  (when 'm' remains constant)



## **Memory Tip**

If the velocity of a body is doubled, its kinetic energy becomes four times and if the velocity of a body is halved, then the kinetic energy gets reduced to one-fourth.



#### **Fact with Reason**

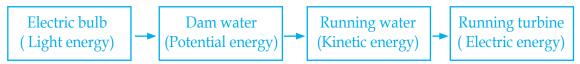
Kinetic energy of a moving object increases if the velocity is increased. Why?

Kinetic energy of a moving object increases if the velocity increases because the kinetic energy of a body is directly proportional to the square of its velocity.

S.N.	Kinetic energy	S.N.	Potential energy
1.	The energy possessed by a body by virtue of its motion is called kinetic energy.	1.	The energy possessed by a body by virtue of its position or configuration is called potential energy.
2.	Kinetic energy depends upon mass and velocity of the body.	2.	Potential energy depends upon mass, acceleration due to gravity and height of the body.
3.	The formula of the kinetic energy is  K.E. = $1/2 \text{ mv}^2$	3.	The formula of the potential energy is P.E. = mgh.

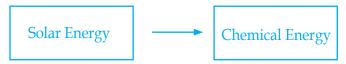
## **Transformation of energy**

Water stored in a dam has potential energy. If this stored water is allowed to flow, it runs turbine because the running water has kinetic energy. From the running turbine we get electrical energy. This electric energy is converted into light energy with help of electric bulb. In this process, one form of energy is converted into another form using different methods and devices. This process is called transformation of energy. Thus, the process of change of energy from one form to another is called energy transformation. Under suitable conditions, energy can be transformed from one form to another. For example:



## **Examples of energy transformation**

a) In photosynthesis, plants convert solar energy into chemical energy.



b) When a torch light is switched on, the chemical energy of the cells is converted into electrical energy. Now, the bulb converts electrical energy into light energy.

c) In an automobile engine, fuel is burnt to change chemical energy into heat energy and finally into mechanical energy.

Chemical Energy — Mechanical Energy

d) Generation of electricity in a thermal power station:

Coal is used as a fuel in the thermal power plant. When the coal is burnt, its stored chemical energy is converted into heat energy. This heat energy converts water into steam. Now, steam runs the turbines connected with generators to generate electricity. This electrical energy is converted into light energy with the help of electric bulb.

Chemical Energy — Heat Energy — Mechanical Energy — Electrical Energy — Light Energy

## Law of conservation of energy

We have discussed that in suitable condition one form of energy can be converted into another form. In this process, one form of energy disappears and the same amount of energy appears in another form. Hence, energy can neither be created nor be destroyed but it can be changed from one form to another. This is called the law of conservation of energy. For example, in a torch light, the chemical energy stored in the dry cells gets transformed into electric energy in the wire. This electrical energy is transformed into heat energy and light energy in the filament bulb.



1. Energy is necessary to do work, but a person without doing any work also loses energy and gets tired. Why?

Energy is necessary to do work, but a person doing no work also loses energy and gets tired because energy is also used for life processes such as breathing, circulation, growth, healing, etc.

2. Stretched rubber has potential energy. Why?

Stretched rubber has potential energy because it is in deformed state. Deformation stores potential energy in an object.

3. If a r truck and a bicycle are moving at a same speed? Which one will have more kinetic energy? Why?

If a truck and a bicycle are moving at a same speed, the truck will have more kinetic energy because it has more mass. Kinetic energy is directly proportional to the mass of an object.

#### 4. Why is an accident more dangerous if a bike is at high speed?

An accident is more dangerous if a bike is at high speed because it will have more kinetic energy. Collision with higher kinetic energy will result serious damage to person.

#### 5. How does energy transform into a microphone?

Microphone transforms sound energy into electricity.

# 6. If energy can neither be created nor be destroyed, how does hydropower station produce electricity?

As we know, energy can neither be created nor be destroyed. So, hydropower station does not produce electricity, but it transforms kinetic energy of flowing water into electricity by the help of generator.

## 3 Step Exercise



#### 1. Write *True* for the correct and *False* for the incorrect statements.

- a) Potential energy is given by PE =  $\frac{1}{2}$  mv<sup>2</sup>.
- b) Kinetic energy is measured in J/s.
- c) The SI unit of energy is Joule.
- d) A flowing river possesses kinetic energy.
- e) Water stored at a height in a dam possesses potential energy.

## 2. Fill in the blanks with appropriate words.

(K.E. =  $1/2 \text{ mv}^2$ , energy transformation, joule, kinetic, potential)

- a) The SI unit of potential energy is .....
- b) Strong wind possesses ...... energy.
- c) A stretched rubber possesses ..... energy.
- d) The change of energy from one form to another is called......
- e) The formula of the kinetic energy is.....

### 3. Select the best answer from the given alternatives.

- a) Which is the SI unit of energy?
  - i. Newton
- ii. Dyne
- iii. Pascal
- iv. Joule
- b) Which of the following is used to calculate potential energy?
  - i. Fxd
- ii. w/t
- iii. mgh
- iv. all of them
- c) How is solar energy transformed to leaves?
  - i. Solar energy to chemical energy
- ii. Light to heat

iii. All of them

- iv. Chemical to electricity
- d) It is mathematical expression of kinetic energy?
  - i. mgh
- ii. Fxd
- iii. mv²
- iv. Both 'i' and 'ii'
- e) On which factor kinetic energy depends on?
  - i. Mass
- ii. Velocity
- iii. None
- iv. Both 'i' and 'ii'

### 4. Match the following:

**Battery** 

i. Potential energy

Water stored in dam

ii. Kinetic energy

Acceleration due to gravity

iii. Light energy

Rolling football

iv.  $9.8 \text{ m/s}^2$ 

Electric bulb

v. chemical energy to electricity



## 5. Answer the following questions in one word.

- a) Which form of energy is present in the dam water?
- b) Along with mass which quantity is required for kinetic energy?
- c) What is the SI unit of all kinds of energies?
- d) What is the term used for the energy produced due to the motion of a body?
- e) What is the term used for the statement 'Energy can neither be created nor be destroyed'?

#### 6. Give reason:

- a) The unit of energy is same as that of work, i.e. joule (J).
- b) A body at rest has zero kinetic energy.
- c) Kinetic energy of a moving object increases if the mass of the body is increased.
- d) Kinetic energy of a moving object increases if the velocity is increased.
- e) We cannot work for a long time without eating food.

#### 7. Differentiate between:

- a) Potential energy and kinetic energy
- b) Conservation of energy and transformation of energy

## 8. Observe the figures and tell what kind of energy is possessed by them.









### Answer the following questions.

- a) What is energy? Write down its SI unit and different forms.
- b) Define mechanical energy. Write its types with examples.
- c) Define kinetic energy and potential energy with three examples of each.
- d) What is transformation of energy? Explain with examples.
- e) What would happen if the transformation of energy does not occur in the world?
- f) Our food is the result of transformation of solar energy. Justify the statement.
- g) Energy can neither be created nor be destroyed. Explain the statement.
- h) A bicycle of 50kg is moving with the velocity of 10m/s. Calculate its kinetic energy. (Ans: 2500J)

i) A car of 450kg is being driven by a driver of 50kg with the velocity of 40m/s. Calculate its kinetic energy. (Ans: 400kJ)

### **Project Work**

Make a list of various electrical devices of your house. How do they transform energy? Discuss.

7.2

Estimated Teaching Periods:					
Theory	Practical				
4	1				

## Heat

## Area and Sequence of Curriculum Issued by CDC

- 1. Definition of heat energy
- 2. Factors affecting absorption of heat (surface area and colour)
- 3. Application of absorption of heat

## **Learning outcomes**

At the end of this unit, students will be able to:

- 1. Define heat energy.
- 2. Prove absorption of heat depends upon surface area of the body and its application in our daily life.
- 3. Prove absorption of heat depends upon colour of the body and its application in our daily life.

## Key terms and terminologies of the unit

Heat is a form of energy which gives a sensation of

warmth.

Sources of heat: The objects from which heat energy can be obtained are

called sources of heat

Transmission of heat: the process of transfer of heat from one place or body to

another is called transmission of heat.

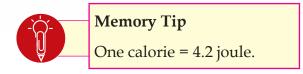
The transmission of heat into a body is called absorption Absorption of heat:

of heat.

When we sit near the fire, we feel warm. Similarly, when we touch an ice-cream we feel cold. In our daily life, we cook food and boil water using fire, gas stove or electricity. In these activities fire, gas stove or electricity provide a form of energy called heat energy. Thus, heat is a form of energy which gives a sensation of warmth. Heat is produced due to the vibration of atoms or molecules present in a body. More vibration produces more heat and less vibration produces less heat. Skin is a sense organ which gives sensation of warmth to us. When heat flows away from our body, we feel cold and similarly when heat flows into our body, we feel hot.

Heat is a very important source of energy in our daily life. It is used for various purposes like cooking, heating, lighting, drying clothes, running vehicles, boiling water, keeping out body warm, etc.

#### SI unit of heat



In SI system of units, heat is measured in joules (J) and in CGS system, it is measured in calorie (cal).



## Sources of heat

Heat energy is obtained from various sources. For example, the sun, fossil fuel, electricity, bio-fuel, etc. Thus, the objects from which heat energy can be obtained are called sources of heat.





Why is the sun considered as the main source of heat on the earth?

The sun is considered as the main source of heat energy on the earth because it gives a tremendous amount of heat energy to the earth which helps to keep the earth warm, support life, run water cycle, etc.

### **Effects of heat**

When an object is heated, various changes take place in the object.

#### 1. Heat changes state of matter

On heating, a substance changes its state from a solid to a liquid or from a liquid to a gas.

#### 2. Heat changes temperature of a body

On heating a substance, the average kinetic energy of its atoms or molecules increases. As a result, its temperature increases.

#### 3. Heat causes thermal expansion of a body.

Matters expand on heating and contract on cooling.

#### **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 making the metal hot.

## Transfer of heat

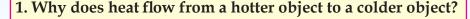
Have you ever put some ice on your palm? Also, what do you feel when your finger is dipped in very warm water even for one second? In such cases, our sense of touch estimates the degree of coldness and hotness of a body on the basis of the flow of heat. We feel cold if the heat flows out of our body. Similarly, we feel hot if the heat flows into our body. Thus, the process of transfer of heat from one place/body to another is called transmission of heat. Heat always flows from a body at higher temperature to a body at lower temperature.

#### **Activity**

To show heat flows from a body at a higher temperature to one at a lower temperature.

Take some hot water in a tumbler and dip a metal spoon for about 20 minutes. Do you feel the water cooling down? At the same time, 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 (water) to one at a lower temperature (spoon).

#### Fact with Reason





Heat flows from a hotter object to a colder object in order to balance the temperature between them. Heat continues flowing until both the objects have equal temperature.

2. Why do we feel cold when we put our legs in cold water?

We feel cold while putting our legs in cold water because our legs lose heat continuously.

## **Absorption of heat**

When we sit near the fire or heater, we feel hot. This is because the heat from fire enters into our body. At the same time, the heat from fire enters into our clothes, hair, wrist watch, belt, etc. As a result, all these substances become hot. This shows that all these substances absorb heat. Thus, the transfer of heat into a body is called absorption of heat. When a body absorbs heat, it becomes hot and when a body loses heat it becomes cold. Different substances have different capacity of heat absorption. It depends upon the surface area, colour and nature of the substances.

## **Activity**

Take two handkerchiefs of the same shape, size and colour. Keep one handkerchief in sunlight and another inside the room. After an hour, touch both handkerchiefs. Which one is hotter and why?

The handkerchief kept in sunlight is hotter because it absorbs heat from the sunlight.

## Factors affecting absorption of heat

All the bodies do not have the same capacity of absorption of heat. It mainly depends upon the surface area of the body and its colour.

#### 1. Surface area of the body

Take equal amount of water in a plate and in a bowl. Keep them in the sunlight for an equal time and observe. Now, the water in a plate becomes warmer than the water in a bowl. This is because the water in a plate covers more surface area and absorbs more heat. Thus, absorption of heat is directly proportional to the surface area of a body. It means that a body with more surface area absorbs more heat and the body with less surface area absorbs less heat. Considering the above fact, wet clothes are kept unfolded to dry, food grains are dispersed while drying in the sunlight, the surface of the solar heater is made wider, the base of the cooking utensils is made wider, etc.

#### **Fact with Reason**

#### 1. Why are wet clothes kept unfolded to dry?

Unfolded clothes cover more surface area and absorb more heat from the sunlight. Therefore, wet clothes are kept unfolded to dry them faster.

## 2. Why is food grains dispersed while drying in the sunlight?



Dispersed food grains cover more surface area and absorb more heat from the sunlight. Therefore, food grains are dispersed to dry them faster.

## 3. The surface of the solar heater is made wider. Why?

The surface of the solar heater is made wider because wider surface covers more area and absorbs more heat from the sunlight.

## 4. The base of the cooking utensils is made wider, why?

The base of the cooking utensils is made wider because wider base covers more area and absorbs more heat from the source of heat.

## 5. Why do we unfold fingers while sitting nearby the fire or heater in winter?

Unfolded fingers cover more surface area and absorb more heat from the fire or heater. So, to be warmer we unfold fingers while sitting nearby the fire or heater in winter.

### 2. Colour of the body

Take a black cloth and another white cloth of the same size. Keep them in the sunlight for an equal time and measure the temperature. We find more temperature in the black cloth and less temperature in the white cloth. From this activity, it becomes clear that black colour has more capacity to absorb heat. Thus, absorption of heat is higher in black colour and less in white colour. Considering the above fact, the surface of the cooking utensils, the surface of the solar heater, etc. are made black coloured.

#### Fact with Reason

#### 1. The base of the cooking utensils is made black. Why?

We know that absorption of heat is higher in black colour and less in white colour. Therefore, to cook faster as well as to save the fuel, the surface of the cooking utensils is made black coloured.



## 2. The surface of the solar heater is made black coloured. Why?

We know that absorption of heat is higher in black colour and less in white colour. Therefore, to heat water faster the surface of the solar heater is made black coloured.

## 3. We prefer wearing black dress in winter but white dress in summer. Why?

We know that absorption of heat is higher in black colour and less in white colour. Therefore, in winter black dress is preferred to keep our body warm. Similarly, in summer white dress is preferred to keep our body cool.



## 1. Ice melts on heating. Why?

Ice melts on heating because supply of heat energy increases the kinetic energy of the molecules. As molecules move away from each other, ice changes into liquid state.

# 2. Electric wires between two poles get longer and sag (drop) in summer season. Why?

Electric wires between two poles get longer and sag in summer season because they absorb more amount of heat in sunny days which causes their expansion.

#### 3. Does plant need heat?

Yes, plants need heat energy for germination of seeds.

# 4. Have you wondered it is warm if you curl while sleeping in winter nights? What might be the reason?

Yes, it is warm if we curl ourselves while sleeping in winter nights because curling decreases our surface area. As a result, we lose less heat.

## 5. Why are radish chopped into small pieces and dried before storing?

Radish is chopped into small pieces and dried before storing because cutting into small pieces increases its overall area. As a result, it absorbs more heat and dries faster.

### 6. Is it a good idea to dress up in a black dress during summer? Explain.

It is not a good idea to dress up in a black dress during summer because it absorbs large amount of heat. It causes sweating and bad smell.

#### **3 STEP EXERCISE**



## 1. Tick ( $\sqrt{ }$ ) the correct statement and cross (X) the incorrect one.

- 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) The SI unit of heat is joule (J).
- d) Absorption of heat increases when we increase the surface area.
- e) Object with white colour absorbs more heat energy.

riii iii tile blanks wi	ш арргоргіац	e words.						
(colour, low, high, joule, wider base, black, high, surface area)								
a) The SI unit of heat is								
b) Heat transmits fro temperature.	b) Heat transmits from a body attemperature to a body attemperature.							
c)coloured obj	ect has the hig	ghest capacity of abs	orption of heat.					
d) Usually, the botto	m of the cooki	ng utensils has	area.					
e) Absorption of hea	t mainly depe	nds upon	and					
Select the best answe	er from the gi	ven alternatives.						
a) It gives sensation	of warmth.							
i. Temperature	ii. Light	iii. Heat	iv. Sound					
b) Which of the follow	wing is CGS u	nit of heat?						
i. Joule	ii. Kelvin	iii. Calorie	iv. All of them					
c) Which one is not a	source of hea	at?						
i. Sun	ii. Fire	iii. Fossil fuel	iv. Torch light					
d) In which direction	does heat flo	w?						
i. Hotter object to	colder object	ii. Colder o	bject to hotter object					
iii. Random direct	ion	iv. Both 'i' a	nd 'ii'					
e) On which factor d	oes the absorp	otion of heat depend	?					
i. Colour ii. Su	ırface area	iii. Both of them	iv. None					
Match the following	•							
SI unit of heat								
Change in temperatu	re	ii. Thermal expansion						
More surface area		iii. Black colour						
Matter expands on he	Matter expands on heating iv. Joule							
Absorbs more heat		v. Higher rate of absorption						

**3.** 



#### 5. Answer the following questions in one word.

- a) What is CGS unit of heat?
- b) What is the term used for 'sum of kinetic energy of a body'?
- c) Write down the relation of joule and calorie.
- d) Which coloured body has the highest heat absorption capacity?
- e) Which coloured body has the lowest heat absorption capacity?

#### 6. Give reason:

- a) The sun is considered as the main source of heat on the earth.
- b) We feel cold when we put our legs in cold water.
- c) Wet clothes are kept unfolded to dry.
- d) The surface of the solar heater is made wider.
- e) The base of the cooking utensils is made wider.

### 7. Differentiate between absorption of heat and transformation of heat

## 8. Observe the diagram and discuss the reason behind it.



## 9. Answer the following questions.

- a) What is heat? Write down its SI and CGS units.
- b) What are the sources of heat? Write with examples.
- c) What is absorption of heat? List the factors which affect absorption of heat.

- d) What do you feel when your finger is in very warm water even for one second? Why does it happen so?
- e) Explain the relation of absorption of heat with colour of the object and its surface area.
- f) Why do we unfold fingers while sitting nearby the fire or heater in winter?
- g) The base of cooking utensils used at our home is wider with black colour. Write down the suitable reason.
- h) The surface of the solar heater is made wider with black colour. Why?
- i) We prefer wearing black dress in winter but white dress in summer. Why?

### **Project Work**

Stay in sunshine wearing a black dress for few minutes then change to white. In which dress you felt warmer? What might be the reason?

Estimated Teaching Periods:					
Theory	Practical				
4	1				

# Light

## Area and Sequence of Curriculum Issued by CDC

- 1. Demonstration of rectilinear propagation of light
- 2. Definition of ray and beam of light with their examples
- 3. Preparation and demonstration of pinhole camera
- 4. Formation of shadow
- 5. Introduction to sundial

## **Learning outcomes**

#### At the end of this unit, students will be able to:

- 1. show the rectilinear propagation of light with the help of experiment.
- 2. define ray and beam of light with a diagram.
- 3. make and demonstrate pinhole camera along with its working process.
- 4. explain and demonstrate formation of shadow.
- 5. show the change of length of shadow in the morning, day and evening.
- 6. explain the concept of sundial as well as its preparation.

## Key terms and terminologies of the unit

Light: light is a form of energy which causes a sensation

of vision in our eyes.

Sources of light: The objects which give out light are called

sources of light.

Natural sources of light: The bodies which give out light naturally are

called natural sources of light

Artificial sources of light: The man-made bodies which give out light are

called artificial sources of light.

Luminous objects: The objects which are able to emit light

themselves are called luminous objects.

Non-luminous objects: The objects which are unable to emit light

themselves are called non-luminous objects.

Transparent objects: The objects which allow the light to pass through

them are called transparent objects.

Translucent objects: The bodies which allow a part of light to pass

through them are called translucent objects

Opaque objects: The bodies which do not allow light to pass

through them are called opaque objects.

Propagation of light: the transmission of light when it comes out from

the source is called propagation of light

Rectilinear propagation of light: the propagation of light in a straight path

through a transparent homogeneous medium is

called rectilinear propagation of light.

Ray of light: A very narrow path of light is called a ray of

light

Beam of light: The collection of many rays of light is called a

beam of light.

Pinhole camera: The simple camera which has a small hole

without lens is called a pinhole camera.

Shadow: The dark spot formed behind an opaque object

when it is kept in the path of light is called the

shadow

Umbra shadow: When an opaque object comes in the path of

light and blocks the light completely, an umbra

shadow is formed.

Penumbra shadow: When an opaque object comes in the path of

light and blocks the light partially, a penumbra

shadow is formed.

Sundial: Sundial is a device that tells the time of the day

when there is sunlight by the apparent position

of the sun in the sky.

During the day, we see various things around us. But we cannot see same things in a dark room even though we keep our eyes open. It means only our eyes are not enough to see the things around us. But light also is equally important to see the things. Objects are invisible in a dark room at night even though we keep our eyes open because there is no light. There must be light to see things around us. Thus, light is a form of energy which causes a sensation of vision in our eyes. Light is necessary for humans and other animals to see things. Plants can prepare their own food in the presence of the sunlight.

## Sources of light

The objects which give out light are called sources of light. For example, the sun, glowing bulb, burning candle, lantern, torch light, firefly, etc. These sources emit light and make things visible. There are different sources of light. They are mainly divided into two categories. They are:

a) Natural sources of light b) Artificial sources of light

### a) Natural sources of light

The bodies which give out light naturally are called natural sources of light. For example: the sun, the moon, stars, firefly, etc.











## **Memory Tip**

In the sun there occurs thermonuclear fusion, so it produces heat and light continuously.

#### b) Artificial sources of light

The man-made bodies which give out light are called artificial sources of light. For example, lamps like kerosene lamp, CFL, LED bulb, burning candle, lantern, torch light, etc.











## Memory Tip

CFL = Compact Fluorescent Lamp, LED = Light Emitting Diode

## Activity

## Objective: To list different sources of light

Make a list of any 10 different sources of light which are present around you. What do they use to produce light? You can make a similar type of table to write them.

S.N.	Sources of light	What they use to produce light
1.	Bulb	Electricity

## **Luminous and Non-luminous Objects**

There are two types of objects. Some objects are able to emit light themselves like the sun, the stars, electric bulb, etc. Similarly, there are some other objects like stone, book, table, chair, glass, etc. which are unable to emit light themselves. So, on the basis of emission of light, there are two types of objects. They are:

- a) Luminous objects
- b) Non-luminous objects

### a) Luminous objects

The sun, the stars, lamp, electric bulb, fluorescent bulb, burning candle, etc. emit light themselves. So, they are called luminous objects. Luminous objects are bright and shiny. They make other things visible. Thus, the objects which are able to emit light themselves are called luminous objects.

### b) Non-luminous objects

The objects which are unable to emit light themselves are called non-luminous objects. For example, stone, soil, table, chair, glass, water, tracing paper, air, book, pen, pencil, moon, earth, planets, etc. They become visible only in the presence of other sources of light.

Non-luminous objects are of three types. They are transparent objects, translucent objects and opaque objects.

## i) Transparent objects

Some objects like glass, air, atmosphere, clean water, etc. allow the light to pass through them. They are called transparent objects. The objects which allow the light to pass through them are called transparent objects. Transparent objects absorb and reflect some portion of light which falls upon them and allow most of the light to pass through them.



#### **Fact with Reason**

The moon is a non-luminous object. Why?

The moon is a non-luminous object because it cannot emit light itself. It reflects the sunlight and becomes visible.



#### **Fact with Reason**

#### Glass cannot cast shadow, why?

Glass cannot cast shadow because it is a transparent object and does not block light at all.

#### ii) Translucent objects

The bodies which allow a part of light to pass through them are called translucent objects. Tracing paper, white paper immersed in oil, wax paper, ground glass, etc. are some examples of translucent objects. Translucent objects absorb and reflect most of the light which fall on them.



#### **Memory Tip**

Transparent objects do not form a shadow, translucent objects form a faint shadow and opaque objects form a dark shadow.

#### iii) Opaque objects

The bodies which do not allow light to pass through them are called opaque objects. Stone, book, pen, pencil, brick, chair, table, wall, etc. are some examples of the opaque objects. When opaque objects block the light, shadow falls behind them. The opaque objects either absorb or reflect light. But they do not allow light to pass through them.



#### Fact with Reason

## Why is brick called an opaque object?

Brick is called an opaque object because it does not allow the light to pass through it and blocks 100% light.



## Memory Tip

A white paper is an opaque body but it becomes translucent when it is immersed in oil.

#### **Activity**

Objective: To distinguish transparent, translucent and opaque objects.

Take a survey around you, your home and your school. Make a list of 20 objects which are available there. Then, divide them in groups of transparent, translucent and opaque objects. Make a similar type of table to fill them.

Transparent objects	Translucent objects	Opaque objects	

## **Propagation of Light**

Light travels from one place to another when it comes out from the source. Its speed is very high. It is about three lakh kilometre per second. So, the transmission of light when it comes out from the source is called propagation of light. For example, the sunlight comes out from the sun and reaches the earth due to its propagation.

## Rectilinear propagation of light

Take a plastic pipe and a burning candle. Observe the burning candle through a straight pipe. We can see the burning candle easily. Again, bend the pipe and observe the candle. We cannot see the burning candle. From this activity it becomes clear that light always propagates in a straight path. This is called rectilinear propagation of light. Thus, the propagation of light in a straight path through a transparent homogeneous medium is called rectilinear propagation of light. This process can be observed when the beam of a car head-light enters mist at night. It is also noticed that in one medium light does not travel in a straight path if the density of the medium goes on changing.



Light passing through a straight pipe



Light doesn't pass through a curved pipe

#### **Fact with Reason**



#### We cannot see beyond a wall, why?

Light always travels in a straight line and the opaque wall blocks it completely. So, we cannot see beyond the opaque wall.

### **Activity**

**Objective:** To demonstrate the rectilinear propagation of light

**Materials required :** Three cardboards of equal size, candle, matchbox, stand, etc.

**Method:** Take three equal-sized cardboards and make a hole in each of them. Stand the cardboards vertically so that all the holes lie in a straight line. Light a candle and put at one side and observe from the other side. Now, slightly change the position of the central cardboard and observe again. What do you observe?

**Observation:** When all the holes of cardboards are in a straight line, we can see the flame of the candle. After changing the position of the central cardboard the holes do not lie in a straight line. So, we cannot see the flame of the candle.

**Conclusion:** From the above activity, it is clear that light always propagates in a straight line.

## Ray and beam of light

A very narrow path of light is called a ray of light. It is a single wave of light. It is represented by a straight line with an arrowhead. An arrowhead drawn upon the ray of light indicates the direction of propagation of light. A ray of light is almost invisible to our eyes.

The collection of many rays of light is called a beam of light. A beam of light can be produced when light is passed through a pinhole. Actually what we see in the source of light is a beam, it is not a ray. The beam of light may be parallel, divergent or convergent.

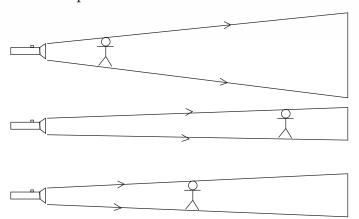


## Differences between ray of light and beam of light

S.N.	Ray of light	S.N.	Beam of light
1.	A very narrow path of light is called ray of light.	1.	Collection of many rays of light is called beam of light.
2.	A ray of light is represented by a straight line with an arrowhead.	2.	A beam of light is represented by two or more straight lines with arrow heads.

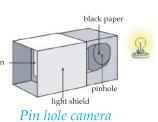
## Do we observe serpentine (bending) propagation of light in our daily life?

Sometimes we feel an illusion that light is propagating in a curved path. For example, light coming from the torchlight, burning candle, bulb, etc. Actually, light never propagates in a curved path. In above cases many rays of light emit from the surface of the source making a certain angle. Collection of these rays is called divergent beam of light. These divergent rays create an illusion that light propagates in the curved path.



## Pinhole camera

A pinhole camera is a very simple and basic type of camera. It does not have a lens. It works on the translucent screen principle that light always travels in a straight line. It has a light proof box with a small aperture. This aperture allows the light to pass inside. Light passes from this small aperture and makes an



inverted image of the object on the opposite side of the box. Thus, the simple camera which has a small hole without lens is called a pinhole camera.

## Memory Tip



Pinhole camera works on the principle of rectilinear propagation of light and forms a real and inverted image on the screen.

### **Activity**

Objective: To make a pinhole camera

**Requirement:** Two thick black papers, scissors, glue stick, cellophane tape, tracing paper, candle, matchbox, etc.

**Method:** Take two thick black papers and make two tubes of different diameters. One paper tube should hardly enter inside the other tube. Cover one end of the small tube by a tracing paper. Similarly, cover one end of the big tube by using a black paper which has a small hole in its centre. Insert the small tube in the big one. Place a burning candle on a table and observe with the help of this pinhole camera.

**Observation:** An inverted image of the candle is seen on the tracing paper.

**Conclusion:** A pinhole camera forms a real and inverted image of the objects.

#### **Shadow**

We know that light always travels in a straight line. When the path of the light is blocked by an opaque object, we can see the dark picture of the blocking object at its back. This dark space is called a shadow. Thus, the dark spot formed behind an opaque object when it is kept in the path of light is called the shadow. The size of shadow depends upon distance between



the source of light and object as well as the distance between object and screen or wall. If the distance between object and screen is more, the size of the shadow becomes big. Similarly, if the distance between the source of light and object is less, the size of the shadow also becomes big.



#### **Memory Tip**

The image which can be obtained on a screen is called a real image. An inverted image seems upside-down.

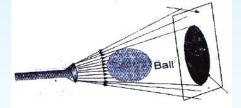
#### **Activity**

Make the room dark and put a burning candle on the table. With the help of your fingers and palm make different shapes of shadow on the wall. For example, head of a dog, flying bird, etc.



#### **Activity**

Take a small ball and keep on the table. Light a torchlight over it. Observe and identify the types of shadows behind the ball.



## Types of shadows

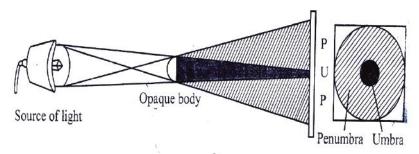
Two types of shadows are formed when an opaque object comes in the path of light. They are umbra shadow and penumbra shadow.

#### i) Umbra shadow

When an opaque object comes in the path of light and blocks the light completely, an umbra shadow is formed. In the above figure, the central dark patch is called umbra shadow. If we view the source of light from the umbra region, we just see the dark area on the source of the light.

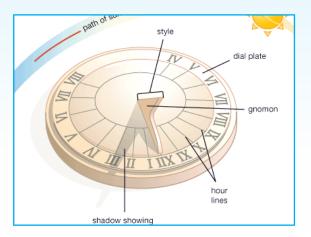
### ii) Penumbra shadow

When an opaque object comes in the path of light and blocks the light partially, a penumbra shadow is formed. In the above figure, the outer light dark area is called penumbra shadow. If we view the source of light from the penumbra region, we see the light dark area on the source of light.



#### **Sundial**

Before clocks were invented, people generally depended upon the position of the sun in the sky to tell time. According to the position of the sun in the sky, objects cast shadows of different length. On the basis of this fact, ancient people made an important device called sundial. Thus, sundial is a device that tells the time of the day when there is sunlight by the apparent position of the sun in the sky. It consists of a flat plate called dial and a long rod called gnomon. Gnomon casts a shadow onto the dial. With the help of the length of shadow people guess the time.



### **Activity**

During the school day, stand on the ground before the school prayer. Mark the length and position of your shadow. In the afternoon, stand on the same place and mark the length and position of the shadow. Similarly, in the evening stand on the same place and mark the length and position of the shadow. What difference did you observe in the length, position and direction of your shadow? Discuss in the class.



## **Activity**

Take a rod of about 20cm length and a cardboard. Early in the sunny day, erect the rod on the cardboard and put on the ground. Record the length and position of the shadow in each hour. What difference did you observe in the length, position and direction of the shadow? Discuss in the class.

Time	8 AM	9 AM	10 AM	11 AM	12 AM	1 PM	2 PM	3 PM	4 PM	5 PM
Length										



1. Sun is the ultimate source of light on the earth. Explain.

Sun is the ultimate source of light on the earth because it gives tremendous amount of light for vision and photosynthesis.

2. Moon is a non-luminous object even though it gives light. Give reason.

Moon is a non-luminous object even though it gives light because the light given by moon is not emitted by the moon itself. It is the reflection of sunlight only.

3. A white paper is an opaque body but it becomes translucent when it is immersed in oil. Why?

A white paper is an opaque body but it becomes translucent when it is immersed in oil because it makes paper surface smooth and reduces the reflection. More rays of light pass through the paper.

4. Even though water is transparent, sunlight cannot reach the bottom of ocean. Why?

Even though water is transparent, sunlight cannot reach the bottom of ocean because ocean is very deep. Light energy is completely absorbed in the midway.

5. What was used to tell the time before the clocks exist?

The position of stars, constellations and sun were used to tell the time before the clocks exist.

## 3 Step Exercise



- 1. Tick ( $\forall$ ) the correct statement and cross (X) the incorrect one.
  - a) Candle is a source of light.
  - b) Light also travels in a curved line.
  - c) Objects are visible due to the light reflected from them.
  - d) A very narrow path of light is called a ray of light.

	e) The collection of many rays of light is called a beam of light.								
2.	Fill in the blanks with appropriate words.								
	sun, light, luminous, lens, straight								
	a) Objects are not visible without								
	b) The main na	atural s	ource of light	is					
	c) Out of all the light sources available, some are while the others are non-luminous.								
	d) Light alway	s propa	ngates in a	line.					
	e) In a pinhole	camera	the tracing <sub>J</sub>	paper works a	.s				
3.	Select the bes	t answe	er from the g	iven alternati	ves.				
	a) It gives the	a) It gives the sense of vision?							
	i. Light	ii. He	eat	iii. Sound	iv. A	iv. All of them			
	b) It is natural source of light?								
	i. Sun	ii. To	rch light	iii. Bulb	iv.La	mp			
	c) It is an opaq	<sub>l</sub> ue obje	ct?						
	i. Clean water		ii. Glass	iii. Wood	iv. A	ir			
	d) It uses shad	ow to to	ell time?						
	i. Hour glas	3S	ii. Digital w	ii. Digital watch					
	iii. Sun dial iv. Botl			and 'ii'					
	e) It is the darkest shadow made by opaque object?								
	i. Eclipse		ii. Umbra	iii. Penumb	ora	iv. All of them	L		
4.	Match the following:								
	a. The sun		i. Tr	acing paper					
	b. Moon		ii. L	uminous obje	ct				
	c. Transparent		iii. I	iii. Book					
	d. Translucent			iv. Non-luminous object					
	e. Opaque			v. Glass					

### 4. Answer the following questions in one word.

- a) Give one example of an artificial source of light energy.
- b) What type of source of light is the sun?
- c) Is the moon a luminous object?
- d) What kind of objects cannot cast the shadow?
- e) What is the term used for a dark spot formed when the light is blocked?

## Step

## Answer the following questions in one word.

- a. What is the term used for man-made source of light?
- b. What is the term used for objects that can emit light themselves?
- c. What is an object called if it allows light to pass through?
- d. What is the term for propagation of light in a straight line?
- e. Which camera does not have a lens?

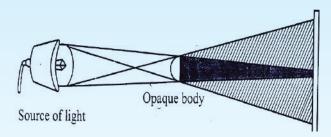
### 6. Write any two differences between:

- a) Transparent objects and translucent objects
- b) Transparent objects and opaque objects
- c) Ray of light and beam of light
- d) Artificial source of light and natural source of light
- e) Luminous object and non-luminous object

#### Give reasons.

- a) The sun is called the major natural source of light on the earth.
- b) A brick is called an opaque object.
- c) The moon is not a luminous object.
- d) Glass cannot cast a shadow.
- e) We cannot see beyond an opaque wall.

# 8. Observe the given diagram and answer the following questions.



- a) How many types of shadows are formed by an opaque object?
- b) Why is penumbra shadow faint?

#### Step



#### 9. Answer the following questions.

- a) Define light energy.
- b) What are the sources of light? Give any four examples.
- c) Define luminous objects and non-luminous objects with any two examples of each.
- d) What are ray and beam of light? Show in the diagram.
- e) Give any four examples each of the artificial sources of light and natural sources of light.
- f) How does a shadow form? Write in short.
- g) Define rectilinear propagation of light. Describe it with an activity.
- h) What are transparent, translucent and opaque objects? Give any two examples of each.
- i) Describe the structure and working of a pinhole camera.
- j) What is shadow? How does it form? Describe its types.
- k) What is sundial? Why is it made?

# **Project Work**

Work in a group to make a sundial.

	_
Theory	Practical
4	1

# Sound

# Area and Sequence of Curriculum Issued by CDC

- 1. Origin of sound wave
- 2. Propagation of sound wave in solid, liquid and gas medium
- 3. Application of propagation of sound wave in solid, liquid and gas medium

# Learning outcomes

#### At the end of this unit, students will be able to:

- 1. show sound is produced due to vibration of the body.
- 2. demonstrate that sound requires material medium for its propagation.
- 3. state application of sound wave propagation in solid, liquid and gas.

# Key terms and terminologies of the unit

Sound:	Sound	is	a	form	of	energy	which	produces	a

sensation of hearing in the ears.

Sources of sound: The vibrating bodies which produce sound are

called sources of sound.

Musical sound: The sound which has a pleasing effect on our ears

and mind is called a musical sound.

Noise: The sound which has an unpleasant effect on our

ears and mind is called noise.

Wave: A wave is a path of energy which is produced due

to the disturbance in a medium.

The transfer of wave in per unit time is called wave Wave motion:

motion.

The wave in which vibration of the medium Transverse wave:

> particles is perpendicular to the direction of the wave propagation is called transverse wave.

Longitudinal wave: The wave in which vibration of the medium

particles is parallel to the direction of the wave

propagation is called longitudinal wave.

Origin of sound: Sound is produced when there is vibration in the

body.

Propagation of sound waves: The transmission of sound waves from one place

to another place is called propagation of sound

waves.

#### Introduction

We hear different types of sounds every day. The blowing horn, the sound of school bell, lecture of teachers, speech of a leader, barking of a dog, chirping of birds, sound of vehicles, music on radio, TV, etc. are some common examples of sounds we hear every day. Sounds produce a sensation of hearing in our ears. So, sound is a form of energy which produces a sensation of hearing in the ears. All kinds of sounds are produced due to vibration of the substances. When we speak, our throat vibrates which produces a sound. We hear a sound by our ears.

#### Sources of sounds

The vibrating bodies which produce sound are called sources of sound. Musical instruments like sarangi, madal, guitar, drum set, the horn of a vehicle, whistle, barking dog, radio, cassette player, television, temple bell, etc. are some examples of sources of sound. In the sources of sound, the whole body or a part of the body vibrates to produce the sound. When you play a radio, its speaker vibrates to produce the sound. Similarly, the string in sarangi vibrates to produce the sound. Different sources of sound produce different kinds of sound. So, we can identify objects even by their sound. We can easily distinguish a dog's barking from the sound of the bird's chirping even without seeing them.









Sarangi

Madal

Guitar

Drum Set



Why do different people have different voices?

Different people have different-sized vocal cord. So, they produce different voices.



#### Memory Tip

We cannot hear all kinds of sounds. For example, infrasound and ultrasound.

#### **Activity**

Objective: To observe the vibration in a source of sound

Requirement: A madal, some wheat flour

Methods: Take a madal and keep it vertically upright as shown in the figure. Hit its upper surface and put some wheat flour over it immediately. You will see the flour vibrating until you hear the sound of the madal. The vibration of the flour will cease as soon as the sound stops.

Conclusion: This activity proves that the vibration in a body produces sound.

# Types of sound

We hear different types of sounds every day. Some of the sounds like song, music, etc. have a pleasant effect while the sound of quarrelling people is very disturbing to our mind. So, on the basis of the effect of the sound upon us, we can divide sounds into two groups. They are musical sound and noise.

#### a) Musical sound

We feel very comfortable and relaxed when we hear a melodious music. The sound which has a pleasing effect on our ears and mind is called a musical sound. It is harmonious and tolerable. For example, sound of songs, birds and sound of musical instruments like the guitar, piano, flute, madal, violin, etc.





Madal



Tuning fork



Whistle

# b) Noise

The blow of horn, barking of a dog, random shouting of people, thunderstorm, sound of industry and factory, etc. are very irritating. We do not want to hear these kinds of sounds. They are called noise. Thus, the sound which has an unpleasant effect on our ears and mind is called noise.

#### Wave

Take a piece of stone and throw it into a pond. It produces ripples on the water surface. Similarly, take a soft spring and compress it in between your hands vertically. Now, release the spring from the lower hand and observe the motion. The spring moves up and down continuously for some time. The ripples in the pond and up-down motion of the spring are called waves. Therefore, a wave is a path of energy which is produced due to the disturbance in a medium.





#### **Memory Tip**

The circular waves in water which move towards the edge are called ripples.

#### Wave motion

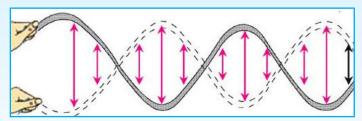
The transfer of wave in per unit time is called wave motion. In wave motion, the medium particles do not move from one place to another. They just vibrate up and down or to and fro. In this vibration, particles transfer energy to the nearby molecules. For example, when we drop a piece of stone into a pond, the water molecules near the stone get energy from the stone and start to vibrate up and down. These vibrating water molecules transfer the energy to the nearby water molecules. The process of transferring energy to the water molecules of the edge continues. Thus, in wave motion, there occurs transfer of energy but does not occur transfer of medium particles.

# Types of waves

On the basis of direction of wave motion, there are two types of waves. They are transverse waves and longitudinal waves.

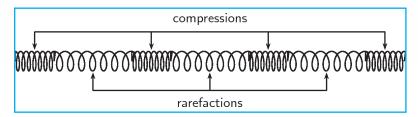
#### a) Transverse wave

The wave in which vibration of the medium particles is perpendicular to the direction of the wave propagation is called transverse wave. For example, waves in water, waves in string, etc. Transverse waves move by making crest and trough.



#### b) Longitudinal wave

The wave in which vibration of the medium particles is parallel to the direction of the wave propagation is called longitudinal wave. For example, sound waves, waves in a spring, etc. Longitudinal waves move by making compression and rarefaction.



# **Activity**

Visit a nearby pond and drop a piece of stone into the water. Observe the surface of the water. Do ripples produce on the surface of water? Let the water be calm and drop a big stone in the same place. Observe and compare the ripples produced before and now. Now, throw a piece of paper or a leaf on the surface of the water and observe its motion. Write down the conclusion of this activity in your exercise book.

# Origin of sound wave

Take a metal plate and hit it with a small rod. The plate vibrates and produces sound. This sound propagates through air and reaches our ears. So, sound is produced when there is vibration in the body. If there is more vibration in the body, it produces louder sound and if there is less vibration in the body, it produces fainter sound.



# Propagation of sound wave

Sound waves are the longitudinal waves. They move from one point to another by making compression and rarefaction of the medium particles. Thus, the transmission of sound waves from one place to another place is called propagation of sound waves. The sound waves produced by a vibrating body propagate in air and reach our ears. This causes a sensation of hearing in our ears.



#### **Fact with Reason**

# Why are sound waves called mechanical waves?

Sound waves are called mechanical waves because they need a material medium to propagate.

# Propagation of sound in different mediums

We have discussed that sound is a mechanical wave. It needs a material medium to propagate. Sound can propagate through solids, liquids and gases. But it cannot propagate through a vacuum.

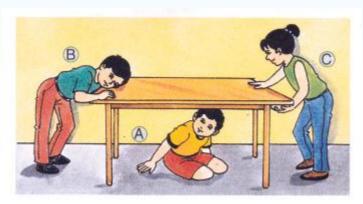
# Propagation of sound in solid medium

Sound easily propagates through a solid medium. In this medium, the molecules are tightly packed. It takes a very short time to transfer the sound wave from one molecule to another in the solid medium. Thus, the speed of sound in solid is more than in liquid and gas. It is about 5200m/s in steel.

#### **Activity**

**Objective:** To demonstrate that sound propagates through a solid medium

- 1. Keep your head on a table resting one ear on its side.
- 2. Ask your friend to scratch at the other end.
- 3. What do you feel? The sound is loud and heard very fast.
- 4. Now, remove your ear from the desk and again ask your friend to scratch on the table and listen to the sound.
- 5. Compare the sounds you heard before and now.
- 6. Share the result with your teacher and friends.



Propagation of sound in solid

#### Fact with Reason

# Sound moves faster in solid than in liquid and gas.



In solid medium, the molecules are tightly packed. It takes a very short time to transfer the sound wave from one molecule to another in solid medium. So, sound moves faster in solid than in liquid and gas.

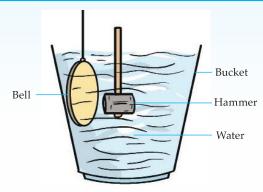
# Propagation of sound in liquid medium

Sound can also propagate through a liquid medium. In comparison to the solid, the liquid molecules are loosely packed. So in comparison to the solid medium, it takes more time to transfer the sound wave from one particle to another in liquid medium. The speed of sound in water is about 1498m/s.

#### **Activity**

Objective: To demonstrate that sound propagates through a liquid medium

- 1. Take a bucket full of water.
- 2. Take a bell and a hammer and dip them into the bucket.
- 3. Strike the bell inside the water in the bucket.
- 4. Do you hear the sound outside? Yes.
- 5. This activity proves that sound can propagate through a liquid medium.



Propagation of sound in liquid

# Propagation of sound in gas medium

We know that air is a mixture of various gases. So, sound can propagate through air. In comparison to the solid and liquid, the molecules in the gas medium are loosely packed. So, it takes more time for the sound wave to transfer from one particle to another. The speed of sound in air is about 332 m/s which is the least among solid, liquid and gas medium.



# Propagation of sound in vacuum

Sound is a mechanical wave. It needs material medium to propagate. In vacuum, there is no material medium to transfer the sound wave. So, the sound cannot propagate in a vacuum. For example, there is a vast gap in between the sun and the earth. In this gap, there is no material medium to transfer the sound. Therefore, we cannot hear the sound of big explosions that occur in the sun.



- 1. What is used as the source of sound in science lab?
  - Tuning fork is used as the source of sound in science lab.
- 2. Which organ is the source of sound in our body?
  - Vocal cord present at throat is the source of sound in our body.
- 3. We cannot hear the big explosions that occur in the sun. What might be reason?

We cannot hear the big explosions that occur in the sun because there is no matter between sun and earth. Since there is no material medium, sound cannot travel from the sun to the earth.

- 4. What type of wave is sound, why?
  - Sound is a longitudinal wave because medium particles in sound wave propagate parallel to the direction of wave propagation.
- 5. Which medium is the best for the propagation of sound and why?
  - Solid medium is the best for the propagation of sound because the particles of the solid are compactly arranged.
- 6. Sound cannot propagate on the moon surface. Why?
  - Sound cannot propagate on the moon surface because there is no air. This is a reason why astronauts use special electronic devices to communicate on the surface of the moon.

# **3 STEP EXERCISE**



- 1. Fill in the blanks with appropriate words.
  - Solid, vibration, noise, longitudinal, gas
  - a) Sound is due to ..... of the body.
  - b) Sound travels in a medium as a .....wave.

c) .....is a sound which has an unpleasant effect on our ears. d) The speed of sound is maximum in.....medium e) The speed of sound is minimum in.....medium. 2. Write True for the correct and False for the incorrect statements. a) Sound is produced due to the vibration of the body. b) Sound is a longitudinal wave. c) Speed of sound is more in gas than in water. d) Musical sound of a flute is noise. e) Different people produce different kinds of sound. 3. Select the best answer from the given alternatives. a) It gives the sense of hearing? i. Light ii. Heat iii. Sound iv. Electricity b) It is the source of sound? iv. All of them iii. Vocal cord i. Guitar ii. Drum set c) It is an unwanted sound. ii. Noise iv. Wave i. Music iii. Song d) This wave travels perpendicular to the direction of wave propagation. i. Longitudinal wave ii. Transverse wave iii. Both of them iv. None of them e) The transfer of sound wave from one point to another is called ....... i. Wave propagation ii. Sound propagation iii. Both of them iv. None of them 4. Match the following: Light i.  $332 \, \text{m/s}$ Speed of sound in air ii. longitudinal wave Wave in string iii. sensation of hearing iv. sensation of vision Wave in spring Sound v. transverse wave



#### Answer the following questions in one word.

- a) What is the term used for a sound that produces a pleasant effect on our ears?
- b) Which organ helps us to detect the sound?
- c) Where is the maximum velocity of sound among air, stone and water?
- d) Which type of wave is sound?
- e) Name the medium where there is least speed of sound.

#### 6. Write any two differences between:

- a) Music and noise
- b) Transverse wave and longitudinal wave

#### 7. Give reasons.

- a) Different men have different voices.
- b) Sound cannot be heard in space.
- c) Sound waves are called mechanical waves.
- d) We have to use an electronic device to hear the sound on the moon.
- e) Sound moves faster in solid than in liquid and gas.



# 8. Answer the following questions

- a) Define sound energy.
- b) What is wave motion? Which type of wave is sound?
- c) Define musical sound and noise.
- d) What are the sources of sound? Give two examples.
- e) Define propagation of sound. Describe propagation of sound wave in solid, liquid and gas medium.
- f) What is the speed of sound in solid, liquid and gas?

# 9. Project Work

Take a bucket of water. Take metal rod in each of your hand. Hit one rod with another inside the water. Do you hear the sound? What does it prove?



# Electricity and Magnetism

**Unit 8.1 Magnetism** 

**Unit 8.2 Electricity** 

8.1

Estimated Teaching Periods:					
Theory	Practical				
5	2				

# Magnetism

# Areas and Sequence of Curriculum Issued by CDC

- 1. Magnetic field of a bar magnet
- 2. Drawing the magnetic field of a bar magnet
- 3. To make a magnet using rubbing method and electricity
- 4. Method to increase magnetism of an electromagnet
- 5. Application of an electromagnet

# **Learning outcomes**

# At the end of this unit, students will be able to:

- 1. explain magnetic field.
- 2. identify magnetic field of a bar magnet with the help of iron dust.
- 3. draw the magnetic field of a bar magnet.
- 4. make a magnet using rubbing method and electricity.
- 5. demonstrate the method to increase magnetism of an electromagnet.
- 6. state application of an electromagnet.

# Key terms and terminologies of the unit

The substance which can attract substances like iron, Magnet:

> cobalt, nickel and always rests in the north-south direction when suspended freely is called a magnet.

The substances which are attracted by a magnet are Magnetic substances:

called magnetic substances.

The substances which are not attracted by a magnet Natural magnets:

are called non-magnetic substances.

Natural magnets: The magnets which are found in nature are called

natural magnets.

Artificial magnets: The magnets which are made by human beings are

called artificial magnets

North Pole of the magnet: The edge of a magnet which rests towards the North

Pole of the earth when suspended freely is called

North Pole of the magnet

South Pole of the magnet: The edge of a magnet which rests towards the South

Pole of the earth when suspended freely is called

South Pole of the magnet

Effective magnetic length: The total distance between two actual poles of a

magnet is called effective magnetic length.

Magnetic field: The space around a magnet where the magnet can

show its effect is called magnetic field.

Magnetization: The process of making magnets from the soft iron

materials is called magnetization.

Single-touch method: Magnetization done by rubbing a pole of a permanent

magnet several times on an iron bar in one direction

is called a single-touch method.

Double-touch method: The magnetization done by rubbing opposite poles

of two permanent magnets in outward directions from the middle of an iron bar at the same time is

called double-touch method.

Electromagnet: A temporary magnet made by passing electric

current around a magnetic substance through an

insulated wire is called an electromagnet.

#### Introduction

In Magnesia, Greeks discovered a wonderful black coloured stone around 2,000 years ago. This stone had the capacity to attract pieces of iron. Thus, the substance which can attract substances like iron, cobalt, nickel and always rests in the north-south direction when suspended freely is called a magnet. The natural magnet is also known as lodestone or magnetite. Now, magnets can be prepared in a laboratory by using electricity. It is called an electromagnet. Ancient Chinese were the first men to use magnetic compass in navigation. At present, magnet is used in a large variety of applications. It is a part of electronics and electricity. It is used to make dynamo, generator, magnetic compass, electric bell, motor, speaker, etc. It is also used in the treatment of different diseases.



#### **Memory Tip**

Naturally occurring magnet is a magnetite. It is an ore of iron. Magnetite is a Chinese word. Its meaning is leading stone.

#### **Fact with Reason**

#### Why is magnet used in navigation?



Magnet is used in navigation because a freely suspended magnet always rests in the N-S direction.

# A bar magnet cannot attract gold and aluminium, why?

A bar magnet cannot attract gold and aluminium because under normal conditions gold and aluminium are non-magnetic substances.



Lodestone



Bar magnet



Horseshoe magnet

# Magnetic and Non-magnetic Substances

There are different types of substances in our surroundings. Some substances like iron, nickel, cobalt, etc. are attracted by a magnet. They are called magnetic substances. Thus, the substances which are attracted by a magnet are called magnetic substances. However, the substances like tin, copper, wood, plastic,

water, etc. are not attracted by a magnet. They are called non-magnetic substances. Thus, the substances which are not attracted by a magnet are called non-magnetic substances.

# Differences between magnetic substances and non-magnetic substances:

S.N.	Magnetic substances	S.N.	Non-magnetic substances
1.	The substances which are attracted by a magnet are called magnetic substances.	1.	The substances which are not attracted by a magnet are called non-magnetic substances.
2.	Magnetic substances behave like a magnet when a magnet is brought near them. Example: iron	2.	Non-magnetic substances never behave like magnet. Example: wood

#### **Activity**

To identify magnetic and non-magnetic substances

- 1. Collect different types of substances like iron pins, a coin, a piece of copper, a piece of glass, a shaving blade, a piece of rubber band, pencil, etc. which are present in your surroundings.
- 2. With the help of a bar magnet, identify whether they are magnetic substances or non-magnetic substances.
- 3. Make a table similar to the given one and write down magnetic and nonmagnetic substances separately.

S.N.	Name of substance	Magnetic substance or non-magnetic substance
1.	Iron	Magnetic substance

# **Natural and Artificial Magnets**

The magnets which are found in nature are called natural magnets. Lodestone is an example of natural magnet. The shape and size of natural magnets is not fixed. They are irregular in shape and have less force of attraction. Due to this reason, natural magnets have limited use.

The magnets which are made by human beings are called artificial magnets. In comparison to the natural magnets, the force of attraction of the artificial magnets is much higher. The shape of artificial magnets can be designed according to our use. Bar magnet, U-shaped magnet, horseshoe magnet, etc. are some examples of artificial magnets. Iron or steel is used to make artificial magnets. Similarly, aluminium, nickel or cobalt can also be used to make an artificial magnet.

#### **Memory Tip**



Alnico is an alloy of iron. In addition to iron, it is composed of aluminium (Al), nickel (Ni), cobalt (Co). This also includes copper (Cu) or titanium (Ti). It is used to make a strong permanent magnet.

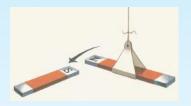
#### Fact with Reason

#### Why do people use artificial magnets in different instruments?

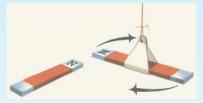
Artificial magnets are used in different instruments instead of a natural magnet because artificial magnets are more powerful and can be shaped into any size according to our need.

# **Magnetic Poles**

Have you ever played with a magnet? If yes, you might have noticed that two magnets sometimes attract each other and sometimes repel. It means that a magnet has two opposite regions in it. These opposite regions of a magnet are called poles of the magnet. A magnet has two opposite poles. They are the North Pole (N) and South Pole (S). The edge of a magnet which rests towards the North Pole of the earth when suspended freely is called North Pole of the magnet. It is represented by the symbol (N). Similarly, the edge of a magnet which rests towards the South Pole of the earth when suspended freely is called South Pole of the magnet. It is represented by the symbol (S). The like poles of the magnets (N-N poles or S-S poles) repel each other while the unlike poles of the magnet (N-S poles or S-N poles) attract each other.





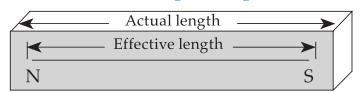


Repulsion between magnetic poles

# Differences between North Pole and South Pole of a magnet

S.N.	North pole	S.N.	South pole
1.	North pole of a freely suspended magnet faces the north of the earth.	1.	South pole of a freely suspended magnet faces the south of the earth.
2.	Magnetic lines of force come out from the north pole of the magnet.		Magnetic lines of force enter into the magnet through the south pole.

There is a strong force of attrition at the poles of a magnet. But, it is noticed that the actual poles of a magnet are not located at the extreme ends. They are present just inside the ends of a magnet. Thus, the total distance between two actual poles of a magnet is called effective magnetic length.





#### **Fact with Reason**

Poles of a magnet collect more iron dust than the middle part, why?

More iron dust is collected at the poles of a magnet. This is because magnetic force is more at poles than in the middle part.



#### **Memory Tip**

In a magnet, the effective magnetic length or magnetic length is always less than the actual magnetic length or length of a magnet.

# Properties of the magnetic poles

- i) A magnet has two poles.
- ii) Magnetic poles never get separated from one another.
- iii) Magnetic power is more at the poles.
- iv) Magnetic poles do not lie exactly at the ends. They are a bit inside from both the ends of a magnet.

#### **Activity**

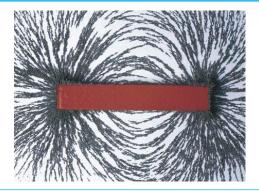
**Objective:** To prove that poles of a magnet have more magnetic power

Requirement: Iron dust, bar magnet

**Procedure:** A bar magnet is moved over the iron dust.

**Observation:** We see that more amount of iron dust is collected at the ends and less amount of iron dust is collected in the middle.

**Conclusion:** This activity proves that magnetic power is more at the ends of a magnet.



# **Activity**

**Objective:** To find the actual position of the magnetic poles

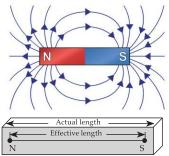
**Requirement:** A bar magnet, a magnetic compass, a pencil, white paper, thumb pins, a cardboard, etc.

**Procedure:** Fix a white paper on a cardboard and keep a bar magnet at its centre. Draw the outline of the bar magnet with a pencil. Keep a magnetic compass at different position around the ends of the bar magnet and mark the ends x, y, and z shown by the needle of the compass. Magnetic compass and

bar magnet are replaced from the paper and the points on the paper are joined with the straight lines.

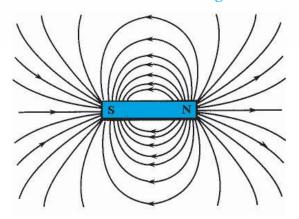
**Observation:** The two intersecting points inside the border line of the bar magnet represent actual poles of the magnet. The distance between two actual poles of a bar magnet is shorter than its actual length.

**Conclusion:** The above activity proves that the poles of a bar magnet exist a bit inside from both ends.



# **Magnetic Field**

When you place an iron nail near a magnet it gets attracted strongly. As you take the nail far away from the magnet, it is very difficult to get attracted by the magnet. This is because the force of attraction of the magnet can be experienced only in certain part. It means that a magnet has a limited region around it where it shows its effect to the magnetic materials. Thus, the space around a magnet where the magnet can show its effect is called magnetic field.



Magnetic field



#### **Fact with Reason**

Why does an iron nail in contact with a magnet attract other nails?

Iron nail in contact with a magnet attracts other nails because the nail in contact with a magnet also becomes a magnet by magnetic induction.

#### Activity

Take a bar magnet, iron dust and white paper. Put the bar magnet under the white paper. Sprinkle the iron dust over the white paper and observe. Magnet attracts iron dust upto the limited area. The space around a magnet where the magnet can attract iron dust is called magnetic field.

# **Magnetization**

#### The process of making magnets from the soft iron materials is called magnetization.

Artificial magnets can be made by using different methods such as single-touch method, double-touch method, induction method, electrical method, etc. In this unit, we will discuss single-touch method, double-touch method and electrical method.



#### **Memory Tip**

The process of losing the magnetic property of a magnet is called demagnetization.

#### (a) By rubbing method

This method uses a strong bar magnet to rub the magnetic material. The rubbing action aligns the molecular magnets in one direction. It can be done by two methods.

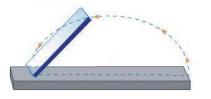
# (i) Single-touch method

In single-touch method, one pole of a strong bar magnet is rubbed over a magnetic substance in one direction only. While rubbing the magnet, we should use the same pole every time. With the help of this method, iron bar, blade, iron clips, etc. can be magnetized.

# Activity

# To make magnet by using single touch method

Bring an iron bar and keep it horizontally on the table. Place one of the poles of a bar magnet (for example, the North Pole) over one end of the iron bar and start to rub. On reaching another



end of the iron bar, lift the bar magnet and bring it at the starting point. This process is repeated several times to develop magnetic properties in the iron bar.

Thus, magnetization done by rubbing a pole of a permanent magnet several times on an iron bar in one direction is called a single-touch method.

# Poles of magnet made by single-touch method

In the single-touch method, a pole opposite to the removed pole of the bar magnet develops at that end. In the given figure, end A becomes the North Pole and end B becomes the South Pole.



#### **Fact with Reason**

How does rubbing method change a magnetic substance into magnet?

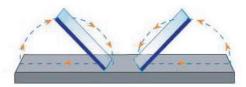
Rubbing method changes a metal into magnet by rearranging the molecular magnets in a straight line.

#### (ii) Double (or divided) touch method

In double-touch method, two opposite poles of equally strong bar magnets are rubbed many times in opposite directions from the middle of a magnetic substance.

# **Activity**

To make magnet by using double-touch method



Bring an iron bar and keep it horizontally on the table. Place the opposite ends of the two magnets at the centre of this iron bar. Rub the poles of these two magnets towards the ends of the iron bar. This process is repeated several times to develop magnetic properties in the iron bar.

The magnetization done by rubbing opposite poles of two permanent magnets in outward directions from the middle of an iron bar at the same time is called double-touch method.

# Poles of magnet made by divided-touch method

In the double-touch method, a pole opposite to the removed pole of the bar magnet develops at the end of the iron bar. In the given figure, end A becomes the north pole and end B becomes the south pole.



#### **Memory Tip**

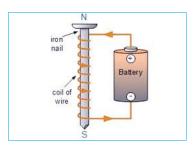
The double-touch method is more efficient than the single-touch method.

#### (b) By using electricity

We can prepare magnet by using electricity. In this method, a magnetic substance is kept inside a coil of insulated wire. Both the ends of insulated wire are connected with a source of electricity. As we supply electricity, the magnetic substance becomes a magnet called electromagnet. Thus, a temporary magnet made by passing electric current around a magnetic substance through an insulated wire is called an electromagnet.

#### **Activity**

#### To make an electromagnet



Take a long coil of insulated copper wire and wind it around an iron rod. Connect both ends of the coil to a battery. Supply current and bring some pieces of iron nail close to the iron rod. Do they stick to the iron rod? What happens to the iron nails when we cut off the electric supply? Do they fall down from the iron rod?



#### Fact with Reason

Electromagnet is called a temporary magnet. Why?

Electromagnet is called a temporary magnet because it loses its magnetic property as soon as electric current through the coil stops.

# Things to remember in making an electromagnet

- We should wrap the insulated wire around the magnetic substance in one direction.
- ii. We should use insulated wire in wrapping the magnetic substance.

# Characteristics of an electromagnet

- The strength of an electromagnet can be changed according to the requirement.
- ii. It can be made in different shapes and sizes.
- iii. An electromagnet is a temporary magnet.



#### Fact with Reason

#### Why are electromagnets widely used?

An electromagnet is a temporary magnet. It can be made as required. Its strength can be changed according to our requirement. So, electromagnets are widely used.

# Factors affecting the strength of an electromagnet

- **1. Number of turns:** The strength of the electromagnet can be increased by increasing the number of turns.
- **2. Current:** The greater the current flowing in the wire, the more is the magnetic field strength.
- **3. Soft iron core:** Magnetic lines of force get concentrated in a soft iron core. It increases the strength of the magnetic field.

# Applications of an electromagnet

- Electromagnets are used to make electrical appliances, such as electric bell, electric fan, electric motor, etc.
- ii. Electromagnets are used in electric generators to produce a strong magnetic field.
- iii. They are used in magnetic separation of iron ores from the earthy substances.
- iv. Strong permanent magnets are made with the help of an electromagnet.

#### **Fact with Reason**

An insulated wire is wrapped around the magnetic substance to make electromagnet. Why?



The insulated wire wrapped around the magnetic substance does not let the electric current pass through the magnetic substance. If the current passes through the magnetic substance, then it does not get magnetized. It also makes a short circuit and the wire gets heated.

We should wrap the wire around the magnetic substance in one direction only. Why?

Random wrapping of an electric wire around the magnetic substance cancels the magnetic field. It also reduces the strength of the electromagnet.

# Answer Writing Skill

1. Lodestone is not used as much as permanent magnet. Why?

Lodestone is not used as much as permanent magnet because lodestone is a weak magnet. It has inappropriate shape.

2. Iron is used to make permanent magnet. Why?

Iron is sued to male permanent magnet because its molecular magnet rearranges in a single direction for a very long time.

3. A freely suspended magnet always rests in north - south direction. Why?

A freely suspended magnet always rests in north-south direction because it is pulled by magnetic poles of the earth.

4. Rubbing a magnet against a steel bar multiple times produces magnetism in it. Explain.

Rubbing a magnet against a steel bar multiple times produces magnetism in it because the magnetic strength of magnet rearranges molecular magnet of steel bar in a single direction on a straight line.

5. Soft iron core is used to make temporary electromagnet. Why?

Soft iron core is used to make temporary electromagnet because its molecular magnets arrange and disarrange faster.

#### 6. Why is a horse shoe magnet more powerful than a U shape magnet?

A horse shoe magnet is more powerful than a U shaped magnet because North Pole and South Pole of a horse shoe magnet are closer to each other than that of U shaped magnet.

#### **3 STEP EXERCISE**



	1.	Fill	in	the	b	lanks	with	ap	pro	priate	words	s.
--	----	------	----	-----	---	-------	------	----	-----	--------	-------	----

two, natural, north, single, magnetic

- a) Lodestone is a .....magnet.
- b) ...... pole of a magnet points towards geographical north direction.
- c) A magnet has ...... poles.
- d) Magnet attracts .....substances.
- e) ...... pole of a magnet does not exist separately.

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

- a) Magnet has two poles.
- b) A freely suspended magnet remains vertically up.
- c) North and south poles of a magnet can be separated from each other and carried away.
- d) Polythene bag is attracted by a magnet.
- e) Like poles of a magnet repel and opposite poles attract.

# Select the best answer from the given alternatives.

- a) It is a magnetic substance?
  - - ii. Plastic iii Silk
- iv. Water
- b) It is a non-magnetic substance?
  - i. Iron

i. Iron

- ii. Nickel
- iii. Cobalt
- iv. Silk

- c) It is a natural magnet?
  - i. Bar magnet
- ii. U-shaped magnet
- iii. Lodestone
- iv. Horse shoe magnet
- d) North Pole of magnet faces ...... Pole of earth.
  - i. East
- ii. West
- iii. North
- iv. South
- e) Which one of the following is not a method of magnetization?
  - i. Single touch method
  - ii. Double touch method
  - iii. Using electricity
  - iv. Heating

# 4. Match the following:

Electromagnet

i. magnetic substance

Lode stone

ii. non-magnetic substance

Iron

iii. temporary magnet

Wood and rubber

iv. natural magnet

# Step



# 5. Answer the following questions in one word.

- a) Which magnet is prepared using electricity?
- b) Which type of substances can be changed into magnet?
- c) Which alloy is used to make a permanent magnet?
- d) Can we separate the magnetic poles?
- e) What is the direction of magnetic lines of force outside a magnet?

# 6. Write any two differences between:

- a) Magnetic substance and non-magnetic substance
- b) Natural magnet and artificial magnet

#### 7. Give reasons.

- a) Magnet is used in navigation.
- b) Iron nail in contact with a magnet attracts other nails.
- c) Artificial magnets are used in instruments instead of a natural magnet.
- d) A bar magnet cannot attract gold and aluminium.
- e) Iron dust collects more at poles of a magnet than in the middle part.
- f) Electromagnet is called a temporary magnet. Why?
- g) Electromagnets are widely used.
- h) An insulated wire is wrapped around the magnetic substance to make electromagnet.
- i) We should wrap the wire around the magnetic substance in one direction only.

#### 8. Draw the diagrams of the following:

- a. Bar magnet
- b. U shaped magnet
- c. Magnetic compass



# 9. Answer the following questions.

- a) What is a magnet? Define natural magnet and artificial magnet.
- b) What do you mean by the poles of a magnet?
- c) Make a list of the property of magnets.
- d) Define magnetic lines of force and magnetic field.
- e) What are the properties of the poles of a magnet?
- f) Define electromagnet. How can we increase the strength of an electromagnet?
- g) State application of an electromagnet.

# 10. Project Work

Take a bar magnet. Rub it against a needle. Put it on the soil and observe the result.

8.2

Estimated Teaching Periods:					
Theory	Practical				
6	2				

# **Electricity**

# Areas and Sequence of Curriculum Issued by CDC

- 1. Simple cell
- 2. Symbols used in electricity and to draw electric circuit
- 3. Simple method to produce heat using electricity
- 4. General introduction to fuse and MCB

# **Learning outcomes**

At the end of this unit, students will be able to:

- 1. introduce simple cell and its preparation with the help of sour thing, copper and zinc plates.
- 2. draw the electric circuit using conducting wire, switch, cell and resistance.
- 3. produce heat with the help of dry cell, nichrome or constant wire.
- 4. explain the function of fuse wire and MCB.

# Key terms and terminologies of the unit

Electricity:	Electricity	is	a	form	of	energy	which	is

produced due to the flow of electrons or

charges from one place to another.

Sources of electricity: The devices which produce electricity are

called sources of electricity.

Cells: Cells are the sources of electricity which

convert chemical energy into electrical

energy

Simple cell: A simple cell is a source of electricity which

consists copper and zinc plates dipped into

dilute sulphuric acid.

Dry cell: The source of electricity which contains a

paste of ammonium chloride instead of

liquid acid is called a dry cell.

Electric circuit: The conducting path made by connecting a

cell, a switch and a bulb is called an electric

circuit.

The circuit in which switch is off and no Open circuit:

current is flowing is called an open circuit.

Closed circuit: The circuit in which switch is on and current

is flowing through the circuit is called a

closed circuit.

Heating effect of electric current: When electric current is passed through a

high resistance wire, it becomes very hot and produces heat. This is called heating effect of

electric current.

Heater: Heater is an electrical appliance that converts

electrical energy into heat energy. It consists

of coil of nichrome.

Fuse: A fuse is a thin wire made of tin and lead

having a low melting point and high

resistance.

MCB: MCB is a circuit breaker which is used in

place of a fuse to protect overflow of current

automatically.

# **Introduction to electricity**

Electricity is the most common and useful form of energy. It can be converted into other forms of energy easily. The various kinds of electric devices are used to convert electric energy into other forms of energy. For example, electric lamp, fluorescent lamp, CFL, LED, etc. convert electric energy into light energy. Similarly, electric heater converts electric energy into heat energy; electric motor converts electric energy into mechanical energy; radio, speaker, mobile, etc. convert electric energy into sound energy, etc.

Electricity is a form of energy which is produced due to the flow of electrons or charges from one place to another. It can flow only through conductors. In this unit, we will discuss about different sources of electricity, electric circuit, effect of electricity, fuse, etc.



#### **Memory Tip**

The full form of CFL is Compact Fluorescent Lamp and LED is Light Emitting Diode

# Sources of electricity

Electricity is the most common and useful source of energy to run our modern lifestyle. We use various electric devices in our daily life. For example, computer, calculator, radio, television, electric fan, electric bulb, heater, etc. To operate these devices, we need electricity. To get electricity we use various devices like simple cell, dry cell, photo cell, dynamo, generator, etc. These devices are called sources of electricity. Thus, the devices which produce electricity are called sources of electricity.









Dry Cell

Solar Pannel

Dynamo

Generator

#### a) Cells

Cells are the sources of electricity which convert chemical energy into electrical energy. They are the most common sources of current. They are used to produce a small scale of electricity. There are two types of cells. They are primary cells and secondary cells. Primary cells are also of two types. They are simple cell and dry cell.

# (i) Simple cell

As the name suggests, the simple cell is very simple in construction. It contains two metal plates. They are copper plate and zinc plate. These metal plates are dipped into dilute sulphuric acid (H<sub>2</sub>SO<sub>4</sub>). Thus, a simple cell is a source of electricity which consists copper and zinc plates dipped into dilute sulphuric acid. With the help of conducting wire, when these metal plates are connected to the bulb, the bulb glows. A simple cell produces very small amount of current.

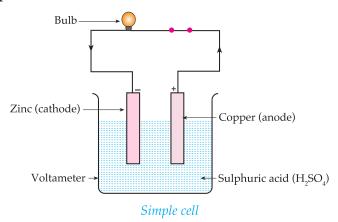


# **Memory Tip**

Simple cell contains sulphuric acid. Hence, it is dangerous to transport. So simple cell is very rarely used.

#### **Activity**

To make a simple cell

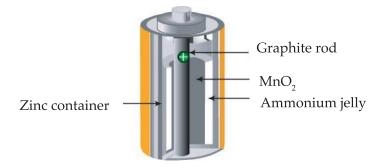


Bring a beaker with dilute sulphuric acid. Dip a copper plate and a zinc plate in it. Connect these plates with a LED bulb using conducting wire. Now, observe the bulb.

# Dry cell

A dry cell is a small and portable source of electricity. It contains a paste of ammonium chloride instead of dilute sulphuric acid. Thus, the source of electricity which contains a paste of ammonium chloride instead of liquid acid is called a dry cell. At the centre of a dry cell there is a carbon rod covered by a muslin bag. The muslin bag contains a mixture of manganese dioxide and carbon powder. The carbon rod contains a brass cap at its top.

The carbon rod, muslin bag and dry chemicals are kept inside the leak-proof zinc container. Dry cells are most commonly used in watch, calculator, torch light, radio, cassette player, etc.

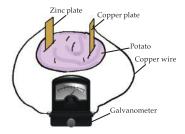


#### **Activity**

**Objective:** To produce electricity from the potato

**Requirement:** A big potato, a zinc plate, a copper plate, copper wires, galvanometer, etc.

**Methods:** Take a potato and keep it in a salt solution for about half an hour. Take out the potato and insert one zinc plate and one copper plate in it. Remember that these plates should not touch each other. Join the plates and galvanometer as shown in the figure and observe the deflection in the galvanometer. Galvanometer shows the deflection indicating that current is produced in the circuit. Try the same experiment with lemon, orange, apple, etc.



#### Fact with Reason



# Dry cell is better than a simple cell, why?

Dry cell is better than a simple cell because a dry cell is portable, produces more current and is easier to use than a simple cell.



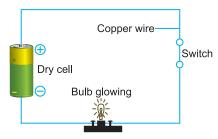
#### **Memory Tip**

A dry cell contains a paste of ammonium chloride instead of dilute sulphuric acid. So, it is called a dry cell.

# **Electric Circuit**

Electric circuit is a continuous path through which electricity flows smoothly. In an electric circuit current flows from source to the electric device. Thus, the conducting path made by connecting a cell, a switch and a bulb is called an electric circuit.

The main components of an electric circuit are given below:



Electric circuit

# Components of an electric circuit

#### (a) Source

Electricity is obtained from the various sources like dry cell, dynamo, generator, solar panel, etc.

#### (b) Conducting wires

These are the medium which carry current from the source to the electric devices. They are made using the conducting wires like copper, aluminium, etc.

#### c) Electric load

The electric devices which convert electric energy into other forms of energy like heat, light, sound, etc. are called electric loads. For example, electric bulb, motor, rice cooker, computer, etc.

#### d) Switch

The current flows in a circuit when a load is connected to the source using connecting wire. To break the flow of current, there is a device in a circuit called switch. Thus, a device which is used to open or close an electric circuit is called a switch.

#### **Activity**

**Objective:** To make electric circuit

Take a LED bulb, a holder, a dry cell, a switch, conducting wires, etc.

Connect the two terminals of the cell with the bulb and switch using conducting wire.

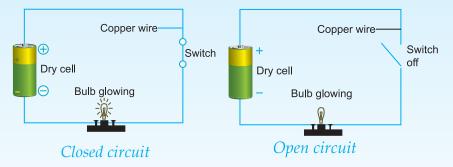
# Does the bulb glow when we switch on?

The circuit becomes closed when the switch is on. At switch on condition, current flows in the circuit and the bulb glows. Similarly, the circuit becomes open when the switch is off. At switch off condition, current does not flow in the circuit and the bulb does not glow.

# Open circuit and closed circuit

The circuit in which switch is off and no current is flowing is called an open circuit. In open circuit current cannot flow. So, the devices which are connected in an open circuit do not work.

The circuit in which switch is on and current is flowing through the circuit is called a closed circuit. In the closed circuit current can flow smoothly. So, the devices connected in a closed circuit can work properly.





#### **Fact with Reason**

# Bulb does not glow in an open circuit, why?

Bulb does not glow in an open circuit because current cannot flow in an open circuit.

S.N.	Open circuit	S.N.	Closed circuit
1.	The circuit in which switch is off and no current is flowing is called an open circuit.		The circuit in which switch is on and current is flowing through the circuit is called a closed circuit.
2.	In an open circuit, current cannot flow.	2.	In a closed circuit, current can flow smoothly.

# Symbols used for the components in electric circuit

It is difficult to indicate different electric components by drawing their figures in an electric circuit. In order to draw a circuit diagram, various electric components are represented by suitable symbols. Some of the most common circuit symbols are given below.

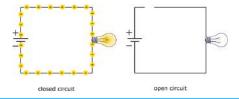
Electrical Components	Symbol	Function
Connecting wire		To connect components in an electric circuit
Jointed wire	+	To conduct electricity

Wire crossing	<del></del>	Overlap of wires without joint
One cell	⊣⊢	Source of electricity
Two cells	<b>⊣</b> ı ⊢	Source of electricity
Many cells	<del></del>	Source of electricity
Bulb		To produce light from electricity
Resistor	-ww <u>-</u>	To convert electrical energy into other forms of energy
Open switch	/	To make a circuit open
Closed switch		To make a circuit close
Ammeter	———(A)——	To measure electric current in a circuit
Voltmeter		To measure voltage in a circuit
Fuse		To protect a circuit from excessive heating

# **Activity**

Objective: To draw symbolic electric circuit

Using the symbols of dry cell  $(\neg \vdash)$ , conducting wire  $(\neg)$ , bulb  $(\neg \circlearrowleft)$  and switch (\_\_\_\_\_) draw a closed circuit and an open circuit in your project work exercise book.



# **Effect of current electricity**

Electricity is a form of energy. With the help of different devices, it can be converted into other forms of energy. For example, electrical energy can be converted into light energy, heat energy, magnetic energy, etc. These are called effects of current electricity. In this unit, we will discuss about heating effect of current electricity.

#### Heating effect of current electricity

When electric current is passed through a high resistance wire, it becomes very hot and produces heat. This is called heating effect of electric current. Most of the heating devices use nichrome wire to convert electric energy into heat energy. Nichrome, constantan, etc. are the heating elements which convert electrical energy into heat energy. Thus, the wire which is used to produce heat by passing current through it is called heating element.

#### **Activity**

Objective: To observe heating effect of current electricity

Take a dry cell, a switch, a wax candle, copper wire, nichrome wire, etc. Connect these components as shown in the given figure. Switch on the circuit. After some time, touch the nichrome wire with the help of wax candle. Does the wax candle melt?



#### **Electric heater**

Heater is an electrical appliance that converts electrical energy into heat energy. It consists of a heating element called nichrome. Nichrome has high melting point and high resistance. Heaters are used for different purposes like cooking food, making the room warm, ironing clothes, heating water, etc.



#### **Fuse**

Fuse is a safety device. It avoids the flow of unwanted current in the circuit. Thus, a fuse is a thin wire made of tin and lead having a low melting point and high resistance.

Fuse limits the current that can pass through a circuit. For example, a fuse melts and breaks the circuit if the current greater than 5A flows through it. If any fault arises in a circuit, its fuse wire melts without affecting the other circuit. It protects the circuit from fire and avoids fire hazards.





#### **Fact with Reason**

A fuse wire has high resistance and low melting point, why?

Fuse is a safety device of the circuit. During excessive heating of an electric circuit, the fuse wire melts and opens the circuit. As a result, it protects other components of the circuit.

#### Miniature circuit breaker (MCB)

MCB is a circuit breaker which is used in place of a fuse to protect overflow of current automatically. It is an advanced form of a fuse. It is used to protect the household wiring from overloading or short circuiting.

Advantage of an MCB over fuse: A fuse melts during overloading. It must be replaced to use the circuit again. But an MCB can be reset after the fault has been corrected.



#### Why do we prefer MCB in place of fuse?

A fuse melts during overloading or short circuiting. It must be replaced to use the circuit again. But MCB trips when there is a fault in the circuit and current exceeds the safe limit. It can be reset after the fault has been corrected. MCBs are safer, easier and offer more protection. So, we prefer MCB in place of fuse.

# Answer Writing Skill

#### 1. Nichrome is used in an electric heater, why?

Nichrome is used in an electric heater because it has very high resistance to produce heat without breaking.

#### 2. Fuse should be connected to live wire, why?

Fuse should be connected to live wire because current comes into device through live wire.

#### 3. Electricity is very popular than other forms of energy, why?

Electricity is very popular than other forms of energy because it can operate electrical devices and change into any other forms of energy easily. It is cheaper and easily stored too.

#### 4. What is the property of wire due to which electricity can change into heat?

The property of wire due to which electricity can change into heat is resistance.

#### 5. Define electrical conductors.

The substances that allow current to flow through them are called electrical conductors.

#### 6. What is the function of Ammeter and Voltmeter?

The function of Ammeter is to measure amount of current flowing in closed circuit.

The function of Voltmeter is to measure the voltage between any two points of electric circuit.

#### 3 Step Exercise

<ol> <li>Fill in the b</li> </ol>	lanks with ap	propriate words.
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safety, energy, two, doesn't glow, source

- a) Electricity is a form of .....
- b) Charges are of .....types.
- c) In an open circuit bulb ..........
- d) Fuse is a ..... device.
- e) Dynamo is a ..... of electricity.

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

- a) Electricity is a form of energy.
- b) Concentrated sulphuric acid is used in simple cell.
- c) Generator is a source of electricity.
- d) Current flows in an open circuit.
- e) Pure water is a good conductor of electricity.

#### 3. Select the best answer from the given alternatives.

- a) It is term for energy produced by flow of electron?
  - i. Sound
- ii. Light
- iii. Heat
- iv.Electricity

- b. It is source of electricity?
  - i. Cell
- ii. Photocell
- iii. Dry cell
- iv. All of them
- c) It contains copper plate and zinc plate dipped inside sulphuric acid?
  - i. Dry cell
- ii. Simple cell
- iii. Photocell
- iv. Generator
- d) It produces electricity by the ionization of ammonium chloride?
  - i. Dry cell
- ii. Simple cell
- iii. Photocell
- iv. Generator

e) Which one of the following is conducting path of current?

i. Electric heater ii. Electric circuit

iii. Electric bus iv. All of them

#### 4. Match the following:

Electric bulb i. Simple cell

Electric source ii. Load does not work

iii. Load works Sulphuric acid

Open circuit iv. Generator

Close circuit v. Load

## Step



#### 5. Answer the following questions in one word.

- a Which device is used on bicycle for lighting purpose?
- b) In which type of cell there is use of a liquid chemical substance?
- c) What is the name of a device which is used to make an electric circuit close and open?
- d) What is the full form of MCB?
- e) Name the wire which converts electric energy into heat energy.

#### 6. Write any two differences between:

- a) Simple cell and dry cell
- b) Open circuit and close circuit
- c) Fuse and MCB

#### 7. Give reasons.

- a) Dry cell is better than a simple cell.
- b) Light does not glow in an open circuit.
- c) Nichrome is a heating device.

- d) Simple cell is dangerous to transport.
- e) MCB is better than fuse.
- 8. Draw the diagrams of a simple cell.



#### 9. Answer the following questions.

- a) What is electricity? How does it produce?
- b) What is cell? Write in short about simple cell with diagram.
- c) What are the advantages of a dry cell over simple cell?
- d) Define sources of electricity with examples.
- e) What is an electric circuit? Write in short about components of electric circuit.
- f) What are open and closed circuits? Show with diagram.
- g) What is fuse? Write the full form of MCB, CFL and LED.

#### 10. Project Work

Use a dry cell, conducting wires and a LED bulb to make an open circuit. Use coin, eraser and paper as key. When does or does not the bulb glow?



## Matter

Estimated Tea	ching Periods:
Theory	Practical
12	3

#### Area and Sequence of Curriculum Issued by CDC

- 1. Introduction to mixture and its types
- 2. Homogeneous and heterogeneous mixture
- 3. Solution, colloid and suspension
- 4. Importance of solution
- 5. Methods of separation of mixture (evaporation, distillation, paper chromatography and centrifuging)

#### **Learning outcomes**

#### At the end of this unit, students will be able to:

- 1. define mixture and explain its types.
- 2. prepare solutions from the substances used in our daily life and find their uses.
- 3. state the methods used to separate mixture.
- 4. show and explain evaporation.
- 5. show and explain distillation.
- 6. separate colour components using paper chromatography along with its reason.
- 7. show separation of mixing components using centrifuge.

#### Terms and terminologies of the unit

Matter: Matter is anything that has mass and occupies space.

Mixture: A mixture is the mass which is obtained by mixing two or more substances in any proportion by their weight.

Homogeneous mixture: The mixture in which the mixing components are

distributed uniformly and they cannot be identified by

naked eyes is called homogeneous mixture.

Heterogeneous mixture: A mixture in which the components of mixture are not

distributed uniformly and they can be identified by

naked eyes is called a heterogeneous mixture.

Solution: The homogeneous mixture of two or more substances

is called a solution.

Solute: Solute is a substance that gets dissolved into another

substance.

Solvent: Solvent is the substance that dissolves the solute.

Colloids: The heterogeneous mixtures which look like

> homogeneous with the size of solute particles in between 10<sup>-7</sup> to 10<sup>-5</sup> cm in diameter are called colloids.

Suspension: The heterogeneous mixture in which the solute particles

do not dissolve but remain suspended throughout the

medium is called suspension.

Separation of mixture: The process by which we get pure substances from the

mixture is called separation of mixture.

Evaporation: Evaporation is the process of changing liquid into

vapour (gas) by heating.

Distillation: The method of separation of mixture in which we

separate liquids from solids or from other liquids through vaporization (evaporation) followed by

condensation is called distillation.

Simple distillation: The distillation process which is used to separate a

pure substance from its mixture that dissolves another

substance in it is called simple distillation.

Chromatography: Chromatography is a process of separation of mixture

in which the mixture is passed through a medium

which adsorbs the components at different rates.

Paper chromatography: Paper chromatography is a process of separating the

> coloured components of a mixture with the help of a paper which can adsorb different substances at different

rates.

Centrifugation: Centrifugation is the method of separating heavy or

suspended particles from their mixture by rotating the

mixture at a high speed.

Centrifuge: A centrifuge is a device that contains a rotator and

holder, which rotates at a high speed to separate the

components of a mixture.

We need different types of things to survive on the earth. For example, we need clothes to wear; food to eat; home to live; medicine to cure diseases; books to read; soil to grow plants and many more. All these things like water, air, food, medicine, book, pen, etc. are called matter. Different matters have different shape, size, colour, odour, taste and other features. In spite of these differences, all the matters have two common properties. They are:

i. All matters have mass. ii. All matters occupy space.



#### **Fact with Reason**

Sound, heat, light, shadow, etc. are not considered as matter. Why?

Sound, heat, light, shadow, etc. are not considered as matter. This is because they do not have mass and do not occupy space.

So, matter is anything that has mass and occupies space. Matter is made of atoms or molecules. It may be pure or impure. Pure matter is the substance which is made of only one kind of atoms or molecules. It includes elements and compounds. Impure matter is the substance which is made of two or more kinds of atoms or molecules. Impure matter is also called mixture.

## 9.1

## **Mixture**

In our surroundings, there are many substances which are mixed with each other. In the atmosphere, different types of gases and dust particles are mixed together. We prepare sugar solution by putting sugar into water. Many similar types of solutions are used in our daily life, such as tea, medicine, drinks, etc. Not only solutions but also different types of mixtures are familiar to us. For example, rice husks in rice, sand in rice, sand in lime, dust particles in air, etc. So, a mixture is the mass which is obtained by mixing two or more substances in any proportion by their weight.

### Types of mixture

Depending on the nature, there are two types of mixtures. They are:

a) Homogeneous mixture

b) Heterogeneous mixture

#### a) Homogeneous mixture

Take some amount of sugar and mix in water. After some time, sugar gets disappeared in water. Here, water and sugar are two different components. But after some time, we cannot see sugar in water. In a sugar solution, sugar particles are distributed uniformly throughout the water. Similarly, in a salt solution, salt is uniformly distributed in water. Such kinds of mixture are called homogeneous mixtures. The mixture in



which the mixing components are distributed uniformly and they cannot be identified by naked eyes is called homogeneous mixture. For example: sugar solution, salt solution, atmosphere, etc.

#### b) Heterogeneous mixture

Observe sandy water and muddy water. We can identify sand mixed in water and mud in muddy water. Such kind of mixture is called heterogeneous mixture. A mixture in which the components of mixture are not distributed uniformly and they can be identified by naked eyes is called a heterogeneous mixture. Rice husks in rice, sand in rice, muddy water, etc. are some examples of heterogeneous mixtures.



## Differences between homogeneous mixture and heterogeneous mixture

S.N.	Homogeneous mixture	S.N.	Heterogeneous mixture
1.	In homogeneous mixture, the components of mixture are distributed uniformly.	1.	In heterogeneous mixture, the components of mixture are not distributed uniformly.
2.	We cannot identify all the components of homogeneous mixture. For example, salt solution, brass, etc.	2.	We can identify all the components of heterogeneous mixture. For example, muddy water, pieces of stones in rice, etc.

#### **Solution**

Solution is a type of homogeneous mixture. It is also called true solution. For example, sugar solution, salt solution, solution of copper sulphate, soft drinks, alcohol, etc. In solution, the mixing components are mixed uniformly. Thus, the homogeneous mixture of two or more substances is called a solution. In solution, there are two components. They are solute and solvent.

#### Solution = Solute + Solvent



Solute is a substance that gets dissolved into another substance. Normally, solutes are solids. The amount of solutes is less than that of solvent. Solvent is the substance that dissolves the solute. For example, in a sugar solution, sugar is a solute and water is a solvent. Similarly, in copper sulphate solution, copper sulphate is a solute and water is a solvent. In coca cola, carbon dioxide gas and sugar are solutes whereas water is a solvent.



#### **Memory Tip**

Water is called a universal solvent because it can dissolve most of the organic substances in it.

#### Differences between solute and solvent

S.N.	Solute	S.N.	Solvent
1.	Solute is a substance that gets dissolved into another substance.	1.	Solvent is a substance that dissolves the solute.
2.	Relatively solute is less in amount than the solvent. Example: sugar in sugar solution.	2.	Relatively solvent is more in amount than the solute. Example: water is a solvent in sugar solution.

#### Uses of solution

- (i) Roots of plants absorb water and minerals in the form of solution.
- (ii) Most cold drinks are the solution containing water, sugar, gases or any soluble additives.
- (iii) Digestion and absorption of food occurs in the form of a solution.
- (iv) Solutions are used in food industries, metal industries, medical and pharmaceutical industries, cosmetics and other industries.
- (v) Saline solution for patients is widely used to maintain ion concentration and body fluids in patients.

#### Colloid

We know that sugar, salt, copper sulphate, etc. in water make true solution. In solution, the size of solute particles is very small (10<sup>-7</sup> cm or less in diameter). These particles are invisible to the naked eyes or even in a microscope. On the other hand, there are some mixtures like milk, blood, gum, fog, cloud, muddy water, milk of magnesia, etc. which seem to be homogeneous but actually they are heterogeneous. The size of solute particles in colloidal solution is in between 10<sup>-7</sup> cm to 10<sup>-5</sup> cm in diameter. Thus, the heterogeneous mixtures which look like homogeneous with the size of solute particles in between 10<sup>-7</sup> to 10<sup>-5</sup> cm in diameter are called colloids.

Since the colloidal solutions are heterogeneous in nature, the term 'sol' is used in place of solution in order to distinguish them from a true solution. The solute particles of the colloidal solution are called colloidal particles.

#### Characteristics of colloids

- (i) Colloid is a type of heterogeneous mixture but looks like homogenous.
- (ii) The size of colloidal particles is in between 10<sup>-7</sup> to 10<sup>-5</sup> cm in diameter.
- (iii) Colloidal particles cannot be separated by filtration method as they pass through ordinary filter paper.
- (iv) Colloidal solution is quite stable because colloidal particles do not settle down when left undisturbed.
- (v) Colloidal particles are invisible to the naked eyes. However, in some cases, they are visible under an ultra-microscope.



#### **Memory Tip**

The colloidal solution of liquid in liquid is called emulsion.

### Suspension

Take some insoluble substances like chalk powder, wheat flour, lime, bleaching powder, etc. Add these substances to water and stir the mixture. Now, we get a heterogeneous mixture called suspension. Thus, the heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the medium is called suspension.

In suspension, the solute particles are bigger in size and heavier in weight. So, they settle down easily when left undisturbed for sometimes. The diameter of the solute particles in suspension is  $10^{-5}$  cm or bigger than this. Due to their larger size, they can be filtered easily by filter paper.

#### Characteristics of a suspension

- (i) Suspension is a heterogeneous mixture.
- (ii) The size of solute particles in suspension is 10<sup>-5</sup> or more in diameter.
- (iii) The solid particles in suspension settle down easily when left undisturbed for some time.
- (iv) The solid particles of suspension can be filtered by filtration method.

(v) Suspensions are either opaque or translucent.

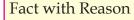
#### Separation of mixture

The substances which are mixed to form a mixture are called components of the mixture. The components of a mixture can be separated to get pure substances. Various methods are applied to separate the components of a mixture. For example, filtration, sedimentation, decantation, winnowing, sieving, evaporation, distillation, chromatography, centrifuging, churning, etc.

Thus, the process by which we get pure substances from the mixture is called separation of mixture.

#### 1. Evaporation

Evaporation is the process of changing liquid into vapour (gas) by heating. It is one of the easy processes to separate solid-liquid homogeneous mixtures. This method is applied when liquids have lower vaporizing temperature than that of solid. Mixtures of salt and water, water and sugar, water and alum, etc. can be separated by this method. When we evaporate the liquid of such mixtures, gas escapes out and the solid remains as a residue. Evaporation is used for removing salt from sea water. For this purpose, salt water is brought to shallow ponds and left to vaporize. The heat of the sun gradually evaporates water from the mixture and salt is left behind. Figure of evaporation

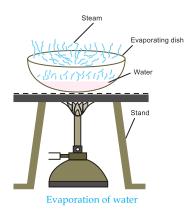




Evaporation is used to separate salt from water, why?

Water has lower vaporizing temperature than that of common salt. This makes it possible to remove water in the form of vapour leaving salt behind. So, evaporation is used to separate salt from water.

#### **Activity**



To separate salt from salt solution (mixture)

**Requirement:** Porcelain basin or evaporating dish, tripod stand, burner, wire gauze, salt, water, glass rod, etc.

**Procedure:** Take some distilled water in a porcelain basin. Add some salt in it and stir with the help of glass rod. Place the basin above the wire gauze on the burner as shown in the figure. Heat the solution till a little amount of water remains in the basin. Turn off the burner and observe after a few minutes.

**Observation:** The remaining little water also evaporates from the porcelain basin and salt remains there.

**Conclusion:** Water is evaporated and salt is left behind as a residue. In this way, we can separate water and salt solution by means of evaporation.

#### Activity

Under the strict guidance and supervision of your teacher, separate copper sulphate from the solution of copper sulphate and water.

#### 2. Distillation

Distillation is the most popular process of separating two or more components present in a homogenous mixture. However, the components of the mixture to be separated by distillation process should have different boiling points. Distillation method can be used to separate solution of solid and liquid or two or more miscible liquids having different boiling points. Mixtures like solution of salt and water, iodine and alcohol, alcohol and water, potassium chloride and water, crude oil, etc. can be separated by using the distillation process. Thus, the method of separation of mixture in which we separate liquids from solids or from other liquids through vaporization (evaporation) followed by condensation is called distillation. The pure liquid that is formed by the condensation of vapour is called distillate. The set of apparatus used in distillation process is called still. The still consists of a Round Bottom Flask (boiler), Liebig's condenser and a collecting vessel or receiver (beaker).



#### Fact with Reason

Distillation is the best method to purify a substance from a mixture, why?

Distillation is carried out by heating a mixture at a certain temperature so that only particular matter will evaporate and be collected in another vessel. So, distillation is the best method to purify a substance from a mixture.

#### Types of distillation

There are two types of distillations. They are:

a) Simple distillation

b) Fractional distillation

#### Simple distillation

The distillation process which is used to separate a pure substance from its mixture that dissolves another substance in it is called simple distillation. The simple distillation is more appropriate for separating the components of solutions having large or significant differences in their boiling points. Sea water contains high amount of salt in it. When the sea water is distilled, pure water vaporizes and is collected in the receiver. At the same time, the salt remains behind in the flask separating salt from the water.



#### Memory Tip

The distillation process which is used to separate a mixture of two miscible liquids having a wide range of boiling point is called simple distillation.



#### Drinking water in Arabian countries is more costly, why?

People of Arabian countries and sea-shore countries use distillation process to get pure water from the sea water. So, drinking water in such areas is more costly than other areas.

#### Activity

To separate pure water from salt solution

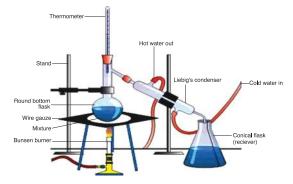
**Requirement:** Round bottom flask, stand, Liebig's condenser, collecting vessel, clamp, burner, thermometer, wire gauze, tripod stand and salt solution

**Procedure:** Take a RB flask of about 500ml and pour about 200ml salt solution in the flask. Clamp the flask to the stand and place wire gauze at its base. Clamp the condenser with delivery tube in another stand. Place one end of the delivery tube inside the flask through the rubber cork and another end to the collecting vessel. Put a thermometer in another hole in the cork to maintain the temperature. Turn on the burner. Gradually, flow cold water through one hole of the condenser after the solution is heated.

**Observation:** Vapour from the heated solution gets raised and passes to the condenser through the delivery tube. Continuous inflow of cold water through the condenser cools the vapour inside it. After cooling, the vapour changes into water droplets and is collected into the vessel. After complete vaporization, the salt is left in the bottom of the flask.

**Result:** Pure water and salt are separated from the mixture by using the simple distillation process.

**Conclusion:** Therefore, distillation process can be used to separate components of mixture having different boiling points.





The mixture of the substances having almost same boiling points cannot be separated by distillation, why?

Distillation is carried out by heating the mixture at a certain temperature so that only a particular matter will be evaporated and be collected in the receiver at a particular temperature. If both components have the same boiling point both of them will evaporate together and cannot be separated.

#### Use of distillation as a local technology

In some parts of Nepal, people make alcohol at their home. They use simple distillation process. This process is also called local technology for making alcohol. To make alcohol, they use fermented food and water. The mixture of fermented food and water is heated in a special heating device. After some time vapour of alcohol and water comes out from the mixture. This vapour is converted into a liquid called alcohol (raksi).



#### 3. Chromatography

Chromatography is a modern technique for separating components of a mixture. This technique is based on the principle of selective adsorption of the components of the mixture. The mixture used in this process is normally in a liquid or gaseous state. This mixture is allowed to move over the surface of a solid or a liquid medium. The moving substance is called the mobile phase and the medium is called the stationary phase. As the mobile phase moves, it separates out into its components on the stationary phase. Then, we can identify them one by one. Different substances have different speed in different media. So, the components of a mixture can be separated by using various mobile phases and stationary media in chromatography. Therefore, chromatography is a process of separation of mixture in which the mixture is passed through a medium which adsorbs the components at different rates.



Chromatography cannot separate a mixture if the two components have the same speed through an adsorbing medium, why?

Chromatography separates a mixture on the principle that different substances have different speed through an adsorbing medium. So, if two components of a mixture have the same speed through an adsorbing medium, the mixture cannot be separated by chromatography.

#### **Types of Chromatography**

There are different types of chromatography. They are:

a) Paper chromatography b) Column chromatography c) Gas chromatography In this unit, we will discuss about paper chromatography.

#### **Memory Tip**



The word chromatography has been derived from two Greek words kroma and graphy. Here, kroma means colours and graphy means process of writing or recording. So, different colours can be separated by using chromatography technique.

#### Paper chromatography

Paper chromatography is a process of separating the coloured components of a mixture with the help of a paper which can adsorb different substances at different rates. Different coloured mixtures like red, blue, black, etc. can be separated by using this technique. Filter paper is used as a medium to separate colours in paper chromatography.

#### **Fact with Reason**



Simple filter paper can be used to demonstrate paper chromatography, why?

Simple filter paper can be used to demonstrate paper chromatography. This is because filter paper has porous and fibrous structure. Through such filter paper the components of a mixture travel with different speed and get separated.

#### **Activity**

To separate coloured components of a black marker ink



**Requirement:** Filter paper, black marker, plate, distilled water in a dropper

**Procedure:** Take a circular filter paper or a white tissue paper. Mark a dark point at the centre of the paper using a black marker. Put the paper in a plate. Pour some drops of distilled water on the black spot at the centre of the filter paper using a dropper and wait.

Observation: After about 30 minutes, you will see different coloured rings on the filter paper.

Result: Black colour ink of the marker is a mixture of various colourful components.

**Conclusion:** Different coloured components of a mixture have different speed on the filter paper. So, different coloured rings can be observed on the filter paper.

#### **Activity**

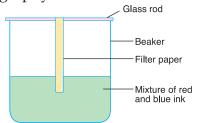
**Objective:** To separate mixtures of different coloured inks using a filter paper Requirement: Filter paper, mixture of red and blue ink, glass rod, beaker, distilled water

**Procedure:** Take a beaker of volume 250ml and pour about 50ml of water in it. Add about 3 drops of red ink and 3 drops of blue ink in the beaker. Cut a rectangular piece of filter paper that should have breadth of less than half of the diameter of the beaker. Place a delivery tube or glass rod horizontal on the surface of the beaker. Clip or attach the piece of filter paper to the rod or delivery tube so that a little portion of the filter paper should be under distilled water. Leave the experiment for about 30 minutes.

**Observation:** We can see a band of blue ink and red ink on the filter paper.

**Result:** Red and blue colours get separated from their mixture.

**Conclusion:** Therefore, the coloured components of a mixture having different speed through an adsorbing medium can be separated on the same filter paper by using paper chromatography.



#### Application of chromatography

Chromatography is used to separate the components of a mixture for different purposes. Following are some common applications of chromatography:

- (i) Chromatography is used for detecting the presence of drugs in urine, blood, soil, etc.
- (ii) It is used to separate colours from various natural and artificial dyes.
- (iii) It is used for studying the complex mixtures of food, perfumes, petrochemical and pharmaceutical productions.
- (iv) It is used in forensic science to identify the samples taken from the criminal acts.
- (v) It is used in pollution monitoring for identifying small concentrations of unknown pollutants present in the sample of air and water.

#### 4. Centrifugation

Heavier and lighter components of the mixture can be separated by using centrifugation method. In this method, mixture is rotated at high speed. Thus, centrifugation is the method of separating heavy or suspended particles from their mixture by rotating the mixture at a high speed. Examples of such mixtures are: milk, chalk powder in water, muddy water, blood, etc. This process is used in dairy industries to separate cream from the milk. In medical laboratories, blood cells and plasma are separated by this method.



#### Centrifuge

A centrifuge is a device that contains a rotator and holder, which rotates at a high speed to separate the components of a mixture. Holder holds the test tubes or vessels in which the mixture is kept. When centrifuge is turned on, the rotator rotates at a high speed. The force of rotation acts very high in heavier particles. Due to the combined effect of rotational force and gravity, heavier particles settle down at the bottom of the test tube and lighter particles settle over them. The lighter particles are usually separated by decantation.



#### **Memory Tip**

Plasma, which is one of the important constituent of human blood, is separated from the blood by using centrifugation.



#### Fact with Reason

#### Why is milk centrifuged?

Milk is centrifuged to separate fat from it. Fat has a different density from other components of the milk.

#### **Activity**

**Objective:** To separate the mixture of chalk powder and water

**Requirement:** Centrifuge, test tubes, beaker, chalk powder and water

**Procedure:** Prepare a mixture of chalk powder and water in a beaker. Transfer the mixture into some test tubes. Place the test tubes in test tube holder in the centrifuge. Switch on the centrifuge. Turn it off after a couple of minutes.

**Observation:** The chalk powder settles down at the bottom of the test tube when rotated at a very high speed in the centrifuge. Water remains above the chalk powder.

**Conclusion:** Upon centrifugation, the heavier substance like the chalk powder settles at the bottom and lighter substance like water remains at the top. In this way, we can separate chalk powder and water from their mixture by centrifugation.

#### Use of centrifuge as a local technology (churning)

Have you seen churning the curd to take out cream? It is a local technology to take out cream from the milk. It works on the principle of centrifugation. In this method, we collect curd in a wooden pot (theki). This curd is agitated with the help of madani. After some time, cream comes out form the curd and floats on the surface of the mixture. Figure churning (mahipareko)



#### 1. Salt solution cannot be separated by filtration. Give reason.

Salt solution cannot be separated by filtration because the solute particles are smaller in diameter than the size of pores in filter paper. So, both solute and solvent come down in the filtrate.

#### 2. Identify the solute in the given cases. Give reason.

20 ml of milk is mixed in 30 ml of water.

20 ml of milk is solute in this solution because it is lesser in volume.

30 ml of milk is mixed in 20 ml of water.

20 ml of water is solute in this solution because it is lesser in volume.

#### 3. How is salt extracted from seawater?

Seawater is collected in a pond. Heat energy from the sun evaporates water from the pond. After some days, only salt remains in the pod. It is collected and crushed into powder. Iodine is mixed and packed.

#### 4. Watering the plants helps in better grow of plants. Why?

Watering the plants helps in better growth of plants because water dissolves the minerals present in the soil. Plants easily absorb this solution and use for its growth and development.

#### 5. How is plasma separated from blood?

Blood sample is put in a centrifuge and rotate at very high speed. Since blood cells are heavier, they get collected at the bottom of the container. Plasma is lighter than blood cells so it remains at top. Plasma is then poured into another container.

#### 6. Petroleum cannot be separated by simple distillation. Why?

Petroleum is a mixture of petrol, diesel, kerosene and others. These products have almost same boiling point. Simple distillation separates the mixture if components have significant difference in boiling point. Therefore, petroleum cannot be separated by simple distillation.

#### 3 Step Exercise

#### 1. Fill in the blanks with appropriate words.

- a) Matter occupies space and has ......
- b) A ..... is a mass which is obtained by mixing two or more substances in any proportion by their weight.
- c) A mixture in which the components of the mixture are not distributed uniformly and they can be identified by naked eyes is called a ......
- d) ..... is a substance that gets dissolved into another substance.
- e) The size of colloidal particles is in between ...... cm in diameter.

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

- a) The suspension is a heterogeneous mixture.
- b) A mixture in which the components of the mixture are not distributed uniformly and they can be identified by naked eyes is called a homogeneous mixture.
- c) The solvent is a substance that gets dissolved into another substance.
- d) Evaporation is used to separate salt from water.
- e) Distillation method can be used to separate the solution of solid and solid.

#### 3. Select the best answer from the given alternatives.

- a) This process is used to separate water and salt form salt solution.
  - i. Centrifugation

ii. Filtration

iii. Simple distillation

iv. Chromatography

- b) This process is used to separate a mixture of colours.
  - i. Centrifugation ii. Filtration iii. Paper chromatography iv. Evaporation
- c) It is a solute in sugar solution.
  - i. Water
- ii. Sugar
- iii. None of them
- iv. Both of them

d) It is a homogenous mixture.

i. Salt solution ii. Sugar solution iii. Brass iv. All of them

e) It is a colloid.

i. Salt solution ii. Blood iii. Lime in water iv. All of them

#### 4. Match the following.

Evaporation Miscible liquids with a different boiling point

Distillation Paper chromatography

Filter paper Centrifugation

Centrifuge Madani and theki

Local device to separate cream from milk Separate salt from sea water

#### Step



#### 5. Answer the following questions in one word.

- a) What kind of mixture is chalk in the water?
- b) Which method of separation of mixture is useful to separate salt and water from salt solution?
- c) What is the size of particles in solution?
- d) Which one is solute if 20 gram of water is added to 40 gram of ethyl alcohol?
- e) Write the name of the device which is used for centrifugation.

#### 6. Write any two differences between:

- a) Homogeneous mixture and heterogeneous mixture
- b) Solution and suspension
- c) Solute and solvent

#### 7. Give reasons.

- a) Blood is a colloid.
- b) A mixture of liquids having almost the same boiling point cannot be separated by simple distillation.

- c) Why is the chromatography process not able to separate components of solution which have same speed?
- d) Filter paper can be used to demonstrate chromatography.
- e) Observe the given diagram and answer the following questions.
- f) The figure of simple distillation separating alcohol from water
- f) Which method of separation of mixture is shown in the diagram?
- 8. What is the reason for the separation of alcohol from water in the abovedescribed process?



- 9. Answer the following questions.
  - a) What is mixture? Write down any two examples.
  - b) Write down any three characteristics of colloid and suspension.
  - c) What are the major uses of the solution?
  - d) Describe the process of evaporation with the help of an example.
  - e) What is distillation? Write the names of mixtures that can be separated by this process.
  - f) Define chromatography. Enlist types of chromatography. Describe paper chromatography with its application.
  - g) What is centrifugation? Mention its application.



# Materials Used in Daily Life

Estimated Tea	ching Periods:
Theory	Practical
8	2

### Area and Sequence of Curriculum Issued by CDC

- 1. Chemicals used in daily life
- i. Food materials (ghee, oil, salt, sugar and baking soda)
- ii. Cleansing materials (soap, shampoo, detergents, phenol and stain remover)
- 2. Chemical pollution
- 3. Metals and non-metals
- i. Physical properties of metals and non-metals (sonority, ductility, lustre, malleability, conductivity of heat and electricity and density)

#### **Learning outcomes**

#### At the end of this unit, students will be able to:

- 1. state examples of chemicals used in daily life.
- 2. differentiate between metals and non-metals based on physical properties.
- 3. identify effects of chemical pollution due to use of chemicals in daily life.

#### Terms and terminologies of the unit

Kitchen chemicals: Different types of chemicals which are used in our kitchen

are called kitchen chemicals. For example, sugar, common

salt, lemon juice, vinegar, etc.

Baking soda: Chemical name of baking soda is sodium bicarbonate. It is

made from minerals.

Common salt: The chemical name of common salt is sodium chloride. It is

also called table salt, edible salt, etc. It is a mineral.

Sugar: The chemical name of sugar is sucrose. It is made from

sugarcane juice and beetroot.

Ghee: Ghee is a type of fat obtained from the milk.

Vegetable oil: Vegetable oil is a liquid substance obtained by crushing parts

of a plant (usually seeds).

Disinfectants: Disinfectants are the chemicals used for killing germs.

Phenol: Phenol is a type of alcohol that is used as a disinfectant.

Dettol: Dettol is a multi-purpose chemical made from phenol.

Soap is a cleaning agent made from oil or fat. Soap:

Detergent is a synthetic powder or liquid chemical that is Detergent:

used as a cleansing agent.

Stain remover is a chemical used to clean stains. Stain remover:

Shampoo: Shampoo is a viscous liquid chemical substance that is used

for cleaning hair.

Chemical pollution: The pollution due to different types of unwanted chemcials

is called chemical pollution.

#### Introduction

We use a variety of materials in our daily life such as salt, sugar, oil, spices, soap, detergent, shampoo, toothpaste, stain remover, medicine, insecticides, pesticides, etc. We use sugar, salt, oil, spices, etc. in our kitchen. They are also called kitchen chemicals. Similarly, we use soap, shampoo, detergent, toothpaste, etc. in our bathroom. They are also called cleansing chemicals. In this unit, basically we will discuss about kitchen chemicals as well as cleansing chemicals.

## 10.1

## Some Useful Chemicals

#### Activity

Identify and name the given materials. Classify these materials as food materials, cleansing materials, medicines, agricultural materials, etc. Write down the name of such other materials too.



A variety of chemicals are used in our daily life. Among them, some are derived from natural resources and some are man-made. For example, mustard oil, lemon juice, etc. are obtained from plants. Soap, toothpaste, chemical fertilizers, etc. are man-made chemicals. In our daily life, these chemicals are used in food items, cleansing actions, cosmetics, agriculture, medicine, etc.

#### 1. Chemicals used in foods

We use different chemicals in our kitchen. They are called kitchen chemicals. For example, use of sugar for sweet taste, common salt for salty taste, lemon juice and vinegar for sour flavour, etc. Similarly, we use vegetable oil and ghee to cook food, spices to make food tasty, baking powder to make bread, alcohol to preserve foods, colour additives to make food attractive, etc.

#### 1. Baking soda

#### Activity

Take different ingredients to make 'sel roti'. With the help of your teacher or parents make a 'sel roti' without adding baking soda. Next time repeat the same procedure to make 'sel roti' using backing soda. Observe the action of backing soda in 'sel roti'. The 'sel roti' made by using baking soda is puffy and the 'sel *roti* made without using baking soda is non-puffy.

Chemical name of baking soda is *sodium bicarbonate*. It is made from minerals. The use of baking soda helps to inflate food items. For example, bread, cookies, biscuits, etc. are bloated with the use of baking soda. Baking soda is also used to make soft drinks. It is used as a medicine to overcome 'hyperacidity in our stomach'. When using baking soda, we need to pay attention to its amount. Overuse of backing soda in food items can cause a feeling of being full, gas and bloating, stomach cramps, vomiting, diarrhea, etc.

#### 2. Common salt

The chemical name of common salt is sodium chloride. It is also called table salt, edible salt, etc. Common salt is a mineral. It is obtained naturally from sea water and rock salt is obtained from underground deposits.



Common salt gets dissolved in water. It is added to foods for salty taste. Common salt added in food is one

of the major sources of sodium required in our body. Although sodium chloride is essential for our body, it is harmful when used in excessive amount. An increase in sodium level in blood can cause high blood pressure and mental stress. This condition can lead to serious diseases such as heart disease, kidney disease, etc. Common salt is also used as a food preservative to preserve fish, meat and pickles. It is used to manufacture soap, paper, etc.

#### **Memory Tip**



Iodine is added to common salt to make iodized salt. Iodine deficiency in children causes goitre and they become physically and mentally weak. Children need adequate amount of iodine in their body to be active and to avoid goitre.



#### 3. Sugar

The chemical name of sugar is sucrose. Sugar is made from sugarcane juice and beetroot. Fruits like banana, mango, pineapple, etc. also contain some amount of sugar. Human blood has a small amount of sugar in the form of glucose. Sugar crystals dissolve easily in water. So, it is used to make various beverages like soft drinks.

#### 4. Ghee

Ghee is a type of fat obtained from the milk. It remains solid in winter and liquid in summer due to variation in room temperature. Ghee is used to make a variety of sweets and delicious food items. Ghee is also used as a moisturizer to prevent dry skin. Ghee is a source to get fat required by our



body. But if there is excess consumption of ghee, then fatty substances accumulate in body tissues.

#### 5. Vegetable Oil



Vegetable oil is a liquid substance obtained by crushing parts of a plant (usually seeds). Mustard oil, soybean oil, sunflower oil, flaxseeds oil, olive oil, etc. are common examples of oil used by people. Oil can also be extracted from parts other than seeds of plants. For example, olive oil is extracted from fruits. Oil is used to cook food items. It is also used to manufacture soap, vanaspati ghee (dalda), etc.

#### 2. Chemicals that are used as disinfectants

#### **Activity**

Take a bucket filled one fourth of it with water. Add few capfuls of phenol in it. Pay attention about body contact with disinfectants. Wipe the floor. Repeat the same process with Dettol too. At last, if there is phenol solution in bucket then do not dispose it near sources of water. Do you observe difference in smell of phenol and Dettol? Can you distinguish one from another?

Disinfectants are the chemicals used for killing germs. Phenolic disinfectants are effective against bacteria and enveloped viruses.



#### Phenol

Phenol is a type of alcohol that is used as a disinfectant. It is widely used as a bactericide. It is highly toxic. The eyes should be protected from exposure to phenol. Phenol also burns the skin. When using phenol, gloves should be worn on the hands. Phenol dissolves easily in water. It is also used for disinfection of the floor. It also repels insects like ant, housefly, cockroach, etc.

#### **Dettol**

Dettol is a multi-purpose chemical made from phenol. It can be used for cleaning and disinfection of skin during surgical procedures. Dettol is used for first-aid in wounds. Bathing children with Dettol soap protects their soft skin from the attack of bacteria. Even when washing children's clothes, they are cleaned by adding few capfuls of Dettol in water.

#### Fact with Reason



Why is Dettol called a multi-purpose germ-killing household cleaner?

Diluted Dettol can be used as an antiseptic to clean and sterilize cuts. Few capfuls of Dettol are added to kill germs while washing clothes. Dettol without adding water can be used to clean sinks or toilets. It can be used as antiseptic, disinfectant and cleaner. So, Dettol is a multi-purpose germ-killing house cleaner.

### 3. Chemicals that are used as cleansing agents

#### **Activity**

Collect data from your class to draw a simple conclusion on the available cleansing agents in your locality. You can use a table for data collection in the given format:

Toilet soaps	Bathing bars	Washing soaps	Detergents	Stain removers	Shampoos
		•••••	•••••	•••••	

#### Soap and detergent







#### Do you know?

Soap nuts contain chemical substances that produce a soapy lather. These can be used as cleaning agent.



Soap is a cleaning agent made from oil or fat. A variety of soaps are made by adding different scented substances. Toilet soap, bathing bar and laundry soap are common types of soaps in use. Soaps do not form lather in all kids of water. It has been largely replaced by detergent for cleaning clothes. Detergent is a synthetic powder or liquid chemical that is used as a cleansing agent. It is more soluble in water than soap. Clothes cleaned with detergent look cleaner than those cleaned with soap.

#### Stain remover

Sometimes when our clothes, bedding, carpets, etc. get dark stains then a normal detergent wash cannot remove such stains. Such stains can be easily removed with the use of stain remover. Stain remover is a chemical used to clean stains. Stain removers are available in both powder and liquid forms.





#### Shampoo

Shampoo is a viscous liquid chemical substance that is used **for cleaning hair.** When shampoo is mixed with some water then it spreads evenly throughout our scalp and forms an ample amount of foam. Shampoo includes a detergent ingredient that makes it easier to trap oil and grease present in our hair thoroughly. Thus, shampoo cleans our hair better than soap.



#### Chemical pollution

#### **Activity**

Follow the steps in 'scientific method' to conduct a simple investigation on impact of detergents or disinfectants in seed germination and growth of plants.

We need to keep knowledge about management of chemicals used in daily life. Chemicals used as disinfectants and strong cleansing agents are industrially man-made products. It is important to study the effects of these chemicals on human health and the environment before their use.

- Phenols are not biodegradable and toxic to many organisms. They remain in soil for long. If we discharge them near sources of water, then they get back into drinking water. So, improper use of phenolic disinfectants leads to soil and water contamination.
- Soaps and detergents are common cleansing agents. Chemicals used in soap are biodegradable. But some detergents are non-biodegradable. Detergent solution when discharged into soil deteriorates the quality of soil. It directly affects soil microbes and plants. The chemicals accumulated in the soil affect the aquatic organisms when they reach the water resources.
- Excessive use of chemical fertilizers in soil also has a negative impact on environment. Thus, knowledge of chemical contents plays a crucial role in proper use of chemicals in daily life.

#### Causes of chemical pollution

The main causes of chemical pollution are listed below:

- 1. Excessive use of insecticides and fertilizers
- Random use of household wastes and plastics

- 3. Smoke emission from vehicles and factories
- 4. Use of colouring materials in foodstuff
- 5. Use of different kinds of soaps, dyes and detergents
- 6. Improper throwing of metallic particles

#### Control measures of chemical pollution

#### The main control measures of chemical pollution are listed below:

- 1. We should use insecticides and fertilizers wisely.
- 2. We should apply 3R principle to manage household wastes, metallic particles and plastics.
- 3. Smokeless vehicles or electric vehicles should be promoted in place of old vehicles.
- 4. Use of colouring materials in foodstuff should be reduced.
- 5. We should use biodegradable soaps, detergents and dyes.



1. Give two examples of chemicals that are used to make lemon tea.

Two chemicals that are used in kitchen to make lemon tea are sugar and acid from lemon.

2. What are common purposes of using chemicals in food items?

Chemicals are used for different purposes in food items such as to add nutritional value, taste, preservation, colouring, etc.

3. Write two differences between sanitizer and soap.

Sanitizer	Soap
1. It is a disinfectant. It removes germs from our body.	1. It is a cleansing agent. It removes dirt, microbes, etc. from our body.

- 2. It is mainly made up of alcohol.
- 2. It is mainly made from fat or vegetable oil and caustic soda.

#### 4. Why should we be cautious while using phenol?

Phenol is highly toxic. It is carcinogenic that is it can cause cancer. Phenol when discharged in soil causes soil and water pollution. So, we should be cautious while using phenol.

5. Detergents have more cleansing property than soaps, yet we have to limit the use of detergents. Justify.

Soaps are less soluble in water than detergents. Soap components when mixed in soil get decomposed into harmless components by soil microbes. Soap does not pollute soil and water for a long time. Detergents are not ecofriendly. They are non-biodegradable. When detergent-mixed water is discharged into soil then it causes soil pollution. It directly affects soil microbes and plants. The detergent components do not decompose in soil and reach sources of water. Detergents are harmful to our skin too. Thus, we need to limit the use of detergents despite their better cleansing property than soaps.

#### 3 Step Exercise



1. Fill in the blanks with appropriate words.

(bactericide, soap, sodium bicarbonate, ghee, biodegradable, toxic)

- a) Chemical name of baking soda is ......
- b) Vegetable oil and ..... are chemicals used as a source of fat.
- c) Phenol is widely used as a.....
- d) Phenols are not...... and ..... to many organisms.
- e) Chemicals used in .....are biodegradable.

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

- a) Rock salt is obtained from saline water.
- b) The use of diluted Dettol prevents bacterial growth at cuts.
- c) Detergents are more soluble in water than soap.

- d) We need to know about the chemical content before using chemicals in daily life.
- e) Excessive use of chemical fertilizers has negative impact on environment.
- 3. Select the best answer from the given alternatives.
  - a) Chemical name of common salt is

i. Sodium bicarbonate ii. Sodium chloride

iii. Sucrose iv. Sodium carbonate

b) What is the chemical that is used as a food preservative and obtained from underground deposits?

i. Common salt ii. Sugar

iii. Baking soda iv. Rock salt

c) Chemical substance to bloat food items

i. Sugar ii. Baking soda

iii. Common salt iv. Ghee

d) Which is a perfect set of chemicals used in daily life?

i. Phenol, Dettol, sanitizer, detergent, soap

ii. Soap, shampoo, detergent, stain remover

iii. Ghee, vegetable oil, Dettol, sugar

iv. Toilet soap, shampoo, rock salt, detergent

e) Which set of chemicals can cause negative impact on environment?

i. Phenol, common salt, detergent ii. Oil, Dettol, stain remover

iii. Phenol, smoke, detergent iv. Soap, ghee, stain remover

## 4. Match the following:

synthetic powder i. shampoo

phenolic disinfectant ii. soap

viscous liquid iii. Dettol

cleaning stain iv. detergent

solid cleansing agent v. stain remover



## Answer the following questions in one word.

- a) What is the chemical name of sugar?
- b) Which viscous chemical is used mainly for hair cleaning?
- c) In which physical state does shampoo occur?
- d) Give the name of the component mixed with common salt in iodized salt.
- e) Which household chemical can be used as a skin moisturizer in absence of glycerin?

### 6. Write down a main difference between:

- a) Cleansing agents and disinfectants
- b) Soap and detergent
- c) Edible salt and edible soda

### 7. Give reasons.

- a) Baking soda is used in making bread, cookies, biscuits, etc.
- b) Dettol is a multi-purpose germ-killing household cleaner.
- c) We have to limit the use of detergents with non-biodegradable components.

## 8. Answer the following questions on the basis of given figure.



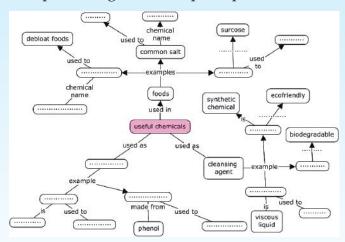






- a. Write two uses of each of them.
- b What are the effects on human health when they are consumed in excess amount?

## b) Copy and complete the given concept map.



## Step



## 9. Answer the following questions.

- a) Write name of four chemicals that are used in foods along with two uses of each.
- b) What are disinfectants? Write in short about domestic use of phenolic disinfectants.
- c) Make a list of chemicals that are used as cleansing agents. Also write their uses.
- d) You have both soap and detergent at your home. Which one will you use more often to wash your clothes? Support your answer with reasons.
- e) What could be the solution for your friend who got a stain of ball pen ink on his shirt?
- f) There is a newly-born baby in your surroundings. Which chemicals will you suggest to the parents to protect the baby skin from infection? Note down the points that you will tell about applications of the chemical that you intend to suggest.
- g) What is chemical pollution? Write down its causes and control measures.

## 10. Project Work

- a) Write an essay on 'Management of chemicals used in daily life'.
- b) Prepare a speech on the topic 'Increasing use of chemicals in daily life and its impact'.

## **Metals and Non-metals**

## Terms and terminologies of the unit

Metals: Metals are those elements which are good conductors of heat and

electricity, malleable and ductile in nature.

Malleability: Malleability is the property of metals to be converted into thin sheets.

Metals can also be drawn into wires after heating. This property of Ductility:

metals is called ductility.

Non-metals: Non-metals are those elements which are bad conductors of heat

and electricity, non-malleable and non-ductile in nature.

Metalloids: Those elements which show the properties of both metals and non-

metals are called metalloids.

### Activity

Observe the different utensils present in your surroundings. Discuss about their hardness, nature of conduction of heat and electricity, etc.

In kitchen	In transportation	To use electricity	In construction	Others
Knife,	Buses,	Switch,	Iron rod, pipes,	•••••

We can see a variety of substances in our surroundings. These substances may be pure or impure, elements or compounds. Pure substances include elements and compounds. About 118 elements have been discovered till today. Some of the elements are soft, some are hard, some are solid and others are liquid and gas. Some elements conduct electricity while some do not. Some elements can be converted into thin sheet after hammering while some break down into pieces when hammered. On the basis of these properties, all these elements are divided into three groups. They are metals, non-metals and metalloids. Out of 118 elements, more than eighty percent are metals while others are non-metals and metalloids. In this unit, we will discuss the physical characteristics of metals and non-metals.

### **Metals**

## **Activity**

- 1. Take a piece of aluminium foil, a steel knife and a wooden piece in your classroom. Take them out of your classroom and keep in the sun. Look at their surface. Do they all look shiny?
- 2. Take a steel spoon and a piece of wooden rod. Drop them on a concrete floor from a certain height. Observe the sound produced on striking the floor. Which one produces a ringing sharp sound?
- 3. Take a piece of iron rod, wooden stick, and a burning candle. Heat the ends of iron rod and wooden stick with a burning candle. After a while, the heat transfers from one end to another end in the iron rod. There is no such transmission of heat through wood.
- 4. Take a piece of iron rod and a piece of stone. Hit them with a hammer. Which one breaks into pieces?

From the given activity, it is clear that some materials like aluminium, steel, iron, etc. are shiny, good conductor of heat, brittle and produce a sharp sound. They are called metals. Thus, metals are those elements which are good conductors of heat and electricity, malleable and ductile in nature. For example: silver, gold, platinum, iron, copper, aluminium, sodium, potassium, calcium, magnesium, etc. The common characteristics of metals are given below:

## i) Metals are good conductors of electricity

Metals like copper, aluminium, etc. are used to make electric wires. This is because they conduct electricity from one place to another. Not only copper and aluminium all other metals also conduct electricity. So, metals are called good conductors of electricity.

## **Activity**

To show that metals are good conductor of electricity

**Requirement:** Dry cells, bulb, copper wire, metal piece, a piece of paper, a piece of wood, iron nail, rubber and a piece of a blade

Metal piece Wooden piece

A B A B

Battery Battery

(a) (b)

**Procedure:** Assemble the electrical circuit as shown in the figure. Place a coin in between A and B of the circuit. What do you observe? Does the bulb glow? Take out the coin and place a wooden piece, a piece of paper, an iron nail, a rubber and a piece of blade one by one.

## ii) Metals are good conductors of heat

We should not touch the pressure cooker, kettle and other cooking utensils while they are heated. Do you know the reason? This is because they are good conductors of heat. They conduct heat when they come in contact with a source of heat.

## **Activity**

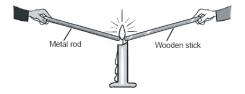
**Objective:** To show that metals are good conductors of heat

**Requirement:** Wooden stick, metal rod, candle, match box

**Procedure:** Bring a metal rod and a wooden stick of equal shape and size. Light a candle. Heat both metal rod and wooden stick by using the candle. Catch the opposite ends of the wooden stick and metal rod. Observe the hotness of the wooden stick and metal rod by touching their outer ends.

**Observation:** The metal rod is felt hot but the wooden stick is not.

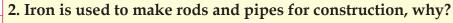
**Conclusion:** From this activity, it can be concluded that metals are good conductors of heat while non-metals are bad conductors.



### Fact with Reason

1. Iron and copper are used for making cooking utensils, why?

Iron and copper are used for making cooking utensils because they are malleable and good conductors of heat.



Iron is used to make rods and pipes for construction because iron is malleable, ductile and hard.

3. Copper is used for making wires, why?

Copper is used for making wires because it is ductile and a good conductor of electricity.

4. Gold and silver are used for making ornaments, why?

Gold and silver are used for making ornaments because these metals are very less reactive as well as highly malleable and shiny.



## iii) Metals are usually hard

Most of the metals are hard and strong. However, a few metals are soft and weak. Iron, copper, aluminium, silver, etc. are hard whereas lithium, sodium, potassium, etc. are soft.

## **Activity**

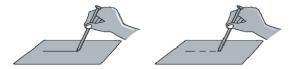
**Objective:** To show that metals are harder than non-metals

Requirement: Iron nail, brick, a steel plate

**Procedure:** Scratch a brick, wooden board and a steel plate turn by turn using an iron nail. What do you observe?

**Observation:** We can see a deep scratch in the brick and wooden board but the scratch is faint in the steel plate.

**Conclusion:** From this activity, it can be concluded that metal plate is harder than the brick and wood.



## iv) Metals have metallic lustre

Metals reflect light and shine brightly. This property of metal is called metallic lustre. Freshly cut metals or corrosionless metals shine more brightly than others.

## **Activity**

**Objective:** To show that metals have metallic lustre

Requirement: Steel plate, brick, wooden board

**Procedure:** Keep a steel plate, a wooden board and a brick in the sunlight. Try to reflect the sunlight by using each of them.

**Observation:** Steel plate reflects the maximum amount of light and shines brighter while the brick and wooden board do not shine.

**Conclusion:** From this activity, it can be concluded that metals have metallic lustre.

## v) Metals produce tinkling sound

When we hit metals and metallic instruments with hard substances, they produce a tinkling sound. However, non-metals do not produce tinkling sound on hitting.

### **Activity**

**Objective:** To show that metals produce tinkling sound

**Requirement:** Steel plate, stick, brick

**Procedure:** Hit a steel plate with a stick and listen to the sound. Again, hit the brick with the same stick and listen to the sound. What difference do you notice in the sound produced by steel plate and brick?

**Observation:** When we hit the steel plate with a stick, it produces a sharp sound but the brick does not produce a sharp sound.

**Conclusion:** From this activity, we can conclude that metals produce a tinkling sound but the non-metals don't.



## vi) Metals are malleable and ductile in nature

Metals are malleable and ductile in nature. Malleability is the property of metals to be converted into thin sheets. They can also be drawn into wires after heating. This property of metals is called ductility. On the other hand, solid non-metals break down into pieces when hammered.

## **Activity**

**Objective:** To show that metals are malleable in nature

**Requirement:** Iron rod, brick, hammer



**Procedure:** Hit a brick with a hammer and observe the change. Again, hit the iron rod with a hammer and observe. What difference do you notice?

**Observation:** Brick breaks down into pieces on hammering but iron rod does not break and becomes thinner if hammered for a long time.

**Conclusion:** This activity shows that metals cannot be broken down into pieces on hammering but non-metals can be broken down into pieces.

## **Memory Tip**

The common characteristics of metals are given below:

- i) Metals are good conductors of heat and electricity.
- ii) They are malleable. It means that they can be converted into a thin sheet after hammering.



- iii) They are ductile. It means that they can be drawn into a wire after heating.
- iv) They have metallic lustre. It means that they reflect light and show the shining nature.
- v) Most of the metals are solid at room temperature except mercury, caesium (or cesium) and gallium.
- vi) Most of the metals are hard except Li, Na, and K.
- vii) Metals produce a tinkling sound. It means they are sonorous in nature.
- viii) They have high melting and boiling point.

### **Uses of Metals**

The most common uses of metals are given below:

- i) Metals are used for making cooking utensils.
- ii) Metallic rod, nut, bolt, etc. are used in construction works.
- iii) Metals are used in industries for making engines, equipment, etc.
- iv) Some metals like gold, silver, etc. are used for making ornaments.
- v) Metals are used for manufacturing the parts and accessories of machines and vehicles.
- vi) They are used for making electric wires, coins, crowns, vases and other items for decoration.
- vii) Mercury is used in a thermometer.
- viii) Aluminium foils are used for making food wrappers and medicine wrappers.

### Fact with Reason



## Why is gold preferred for making jewellery?

Gold possesses an attractive lustre. It does not get rusted like iron. It is highly malleable and ductile. Gold can easily be drawn into wires. It can also be hammered into very thin sheets without any cracks. So, goldsmiths use gold to design attractive jewellery even from a small amount of gold.

### Non-metals

Non-metals are those elements which are bad conductors of heat and electricity, non-malleable and non-ductile in nature. Examples: Oxygen, nitrogen, sulphur, chlorine, iodine, etc. Some common properties of non-metals are given below:

- Non-metals are bad conductor of heat and electricity.
- ii) They are non-malleable and non-ductile in nature.
- iii) They do not have metallic lustre except graphite and iodine.
- iv) They are present in solid, liquid and gaseous states.
- v) They do not produce tinkling sound. It means they are non-sonorous in nature.



#### Fact with Reason

## Glass does not conduct electricity, why?

Glass does not conduct electricity because it is a non-metal.

## Uses of Non-metals

The most common uses of non-metals are given below:

- Non-metals are used to make insulators in electric wires and cooking utensils.
- ii) Hydrogen is used to fill in balloons.
- iii) Liquid hydrogen is used to fill in the rockets as a fuel.
- iv) Some non-metals like sulphur are used to make explosives.
- v) Non-metals like chlorine are used to make medicines.
- vi) Oxygen is used for breathing and burning of substances.

### Differences between metals and non-metals:

Metals	Non-metals
Metals are malleable in nature.	Non-metals are non-malleable in nature.
Metals are ductile in nature.	Non-metals are non-ductile in nature.
They are good conductor of heat and electricity.	Non-metals are bad conductor of heat and electricity except graphite.
Except mercury, metals are solid at room temperature.	Non-metals are found in all three states at room temperature.
They have metallic lustre except lithium.	They do not contain metallic lustre except iodine and graphite.
They are generally hard except soft metals like sodium and potassium.	They are generally soft except diamond.

## **Metalloids**

Those elements which show the properties of both metals and non-metals are called metalloids. Thus, metalloids fall in between metals and non-metals. Some properties of metalloids are similar to metals while others are similar to nonmetals. For example: arsenic, silicon, antimony, germanium, etc.



## 1. Which metal is present in human blood, chlorophyll and thermometer?

Ans: Iron is present is human blood, magnesium is present in chlorophyll and mercury is present in thermometer.

## 2. What is malleability? Write name of any three elements which are malleable.

Ans: The property of metals to be beaten into a thin sheet is called malleability. Examples: copper, gold, silver.

## 3. Differentiate between malleability and ductility.

Malleability	Ductility	
The property of metals to be beaten into a thin sheet is called malleability.		
Malleability refers to a compressive force on metals.	Ductility refers to a pulling force on metals.	

## 4. In winter season, when we touch an iron rod, it feels colder than wood, why?

Ans: Iron is a good conductor of heat. Wood is a bad conductor of heat. When we touch an iron rod then the heat from our hand transmits very fast through it. This is much slower when we touch a piece of wood. So, we feel colder when we touch an iron rod than when we touch a piece of wood.

5. You are given two materials that are unknown to you yet. If one of them is metal and the other is non-metal, then explain in short about your two ways to distinguish one from another.

Ans: Metals and non-metals can be distinguished on the basis of following two properties:

Property	Procedure		
Sonority	When the given two materials are struck with a rod, they produce a sound. One that producing tinkling sound is a metal.		
Lustre	When the given two materials are kept in bright light, one them shines. One that shines is metal.		

## 3 Step Exercise



## 1. Fill in the blanks with appropriate words.

- a) ...... have metallic lustre.
- b) Metals are good conductor of ..... and .......
- c) Malleability is the property of metals to be beaten in the form of a .........
- d) ..... is a non-metal that conducts heat and electricity.
- e) Metal produces ..... sound.

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

- a) Silver is the best conductor of electricity.
- b) Arsenic is an example of a metalloid.
- c) Graphite is a metal.
- d) Gold is the least reactive metal.
- e) Non-metals are malleable in nature.

## 3. Select the best answer from the given alternatives.

## a) Which of the following is a set of metals?

- i. Iron, gold, carbon, mercury iii. Silver, copper, graphite, aluminium
- ii. Iron, copper, potassium, gold iv. Silver, gold, lead, graphite

## b) Which of the following is not a property of metal?

- i. Conducts electricity iii. Conducts heat
- iii. Produces tinkling sound iv. Found in gas state

## c) Which one is a non-metal?

- i. Lithium iii. Copper
- ii. Sodium iv. Helium

## d) Which metal is mainly used to make steel?

- i. Gold iii. Iron
- ii. Copper iv. Carbon

## e) Identify the false one.

- i. Mercury occurs in liquid metal. iii. Bromine occurs in liquid state.
- ii. Phosphorous occurs in solid state. iv. Hydrogen occurs in solid state.

## 4. Match the following:

- i. Malleable i. Shiny appearance
- ii. Ductile ii. Can be cut with a knife
- iii. Lustre iii. Can be drawn into wire
- iv. Sonority iv. Can be hammered into a sheet
- v. Potassium v. Produces a special 'tinkling' sound when struck

## Step 2

## 5 Angway the following a

## 5. Answer the following questions in one word.

- a) Write the name of the hardest non-metal.
- b) Which metal is present in human blood?
- c) What is the term used for property of metals to be changed into thin wires?
- d) Name a metal which is liquid and is used in thermometer.
- e) Which metal is usually used to make food wrappers?

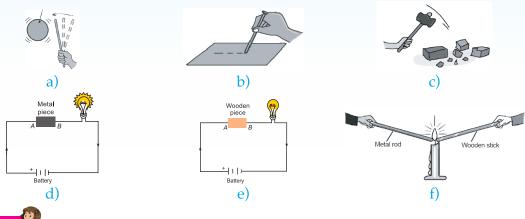
## 6. Write any two differences between:

- a) Metal and non-metal
- b) Malleability and ductility

### 7. Give reasons.

- a) Iron and copper are used for making cooking utensils.
- b) Copper is used for making wires.
- c) Gold and silver are used for making ornaments.
- d) Iron is used to make rods and pipes for construction.
- e) Glass cannot conduct electricity.

## 6. Write an objective of the activity corresponding to each of the given figures.



## 8. Answer the following questions.

- a) Define metal and non-metal with any three examples of each.
- b) What are metalloids? Write any three examples.
- c) Write any three uses of metals.
- d) Define malleability. Write name of any three elements which are malleable.
- e) Define ductility. Write name of any three elements which are ductile.
- f) Classify the following as metal, non-metal and metalloid: silicon, germanium, aluminium, silver, phosphorus, chlorine, nitrogen, sodium, iodine, platinum, gold.

## 9. Describe an activity to show:

- a) Metals are good conductor of heat.
- b) Metals are good conductor of electricity.



# Earth and Space

Estimated Tea	ching Periods:
Theory	Practical
8	2

11.1 Soil 11.2 Internal structure of the earth 11.3 Solar system

## Area and Sequence of Curriculum Issued by CDC

- 1. Soil
  - i. Introduction to soil
  - ii. Process of soil formation
  - iii. Soil erosion and deposition
  - iv. Conservation of soil
  - v. Soil profile
  - vi. Causes, effects and control measures of soil pollution
- 2. Internal structure of the earth
- 3. Four seasons and their effects on our daily life
- 4. Solar system
  - i. Introduction to the sun (shape, structure, temperature and source of temperature)
  - ii. Introduction to members of solar system (planets, satellites, comets, asteroids and meteors and meteorites)

## **Learning outcomes**

At the end of this unit, students will be able to:

- 1. introduce soil along with the steps of its formation and conservation.
- 2. prepare soil profile.
- 3. state causes of soil pollution, its effects and controlling measures.
- 4. explain the internal structure of the earth.
- 5. demonstrate the orbital revolution of the earth along with four seasons.
- 6. introduce sun and solar system along with the heavenly bodies which revolve the sun.

## Terms and terminology of the unit

Soil: Soil is a mixture of different kinds of organic and inorganic

substances like humus, minerals, water, sand, clay, dead

animals and plants, etc.

Soil erosion: The removal of top fertile soil by various agents like air,

water, wind, river, glaciers, hurricane, cyclone, etc. is called

soil erosion.

Soil deposition: Soil deposition is a process of accumulation of the eroded

soil away from the place of erosion.

Deforestation: The cutting down of trees on a large scale is called

deforestation.

Overgrazing: Grazing of pastures, grasslands and forests by livestock

beyond the capacity of renewal of vegetation is called

overgrazing.

Soil profile: The vertical arrangement of various layers of soil down from

the surface of the soil is called soil profile.

Soil pollution: The change in physical, chemical and biological composition

of soil that harms humans and other organisms is called soil

pollution.

Lithosphere: The hard and rigid outer layer of the earth is called lithosphere.

About 70% of the outer surface is covered with water, which

is called hydrosphere.

Crust: The crust is the outermost and thinnest layer of the earth. I

Mantle: Just below the crust, there is the thickest layer of the earth

called mantle.

Core: The innermost layer of the earth is called core.

Outer core: It is the second thickest layer of the earth, which is present in

between inner core and mantle.

Inner core: It is the innermost and central layer of the earth.

Axis: Axis of the earth is an imaginary straight line perpendicular

to its equatorial plane and passing through the centre.

Orbit: Orbit of the earth is an elliptical path on which it revolves

around the sun.

Rotation: Rotation refers to the anti-clockwise spinning of the earth on

its axis. It is also called diurnal motion.

**Revolution:** The orbiting of the earth around the sun is called revolution.

It is also called annual motion of the earth.

Solar system: The family of the sun which consists of eight planets and

their satellites, comets, asteroids, etc. is called the solar

system.

Satellite: A satellite is an object that revolves around the planet in a

fixed orbit.

Natural satellite: A satellite which is naturally formed and revolves

continuously around a planet is called a natural satellite.

Artificial satellites: The satellites which are made by humans and launched in

the space to revolve round a planet are called artificial

satellites.

Asteroids: The rocky and metallic objects which are present in between

the orbits of Mars and Jupiter that revolve around the sun

are called asteroids or minor planets.

Comet: A broom-shaped shining object with a bright head is called a

comet.

Meteors: The pieces of stone or metal which enter the earth's

atmosphere are called meteors.

Meteorite: The meteor that does not burn completely in the atmosphere

and reaches the earth surface is called a meteorite.

## 11.1

Soil is one of the most important components of an ecosystem because plants grow out of soil. They provide food for animals. Indirectly, carnivores also depend on soil because they eat herbivores, and herbivores eat plants. Soil is a mixture of different kinds of organic and inorganic substances like humus, minerals, water, sand, clay, dead animals and plants, etc. It is the topmost layer of the earth's crust. It contains life supporting substances and supports life on the earth. Soil contains various nutrients that support life. Different soil organisms like ants, earthworms, bacteria, fungi, insects, etc. are found in soil. Some vertebrates like rats, rabbits, snakes, porcupine, etc. live in burrows under the soil. Similarly, growth of plants is possible only in soil.



### Fact with Reason

## Soil is called life supporting medium, why?

Soil contains different kinds of life supporting components like humus, minerals, air, water, sand, clay, micro-organisms, etc. So, it is called life supporting medium.

## **Formation of Soil**

Soil is formed by the weathering of parent rocks by various methods. Sun, wind, water, glaciers, etc. are responsible for weathering of rocks into soil. Formation of soil is a very slow process. It takes millions of years for the formation of soil. Some common methods of weathering of rocks are briefly explained below:

- a) Water: Pores and cracks are present in the big rocks. Water enters into these pores and cracks. At low temperature, water freezes into ice. Ice has more volume than water. So, it exerts pressure on the rocks. Similarly, when the water melts, it releases pressure. This activity expands and contracts the rocks. As a result, rocks weather and form soil in a long time.
- b) Heat: Continuous heating and cooling causes expansion and contraction of rocks. Over a long period of time, the rocks break down into smaller fragments. These fragments finally form soil particles.
- **Humidity:** Many rocks swell in humid air and shrink in dry air. The swelling and shrinking activity breaks down the rocks into fragments. These fragments finally form soil particles.

- d) Tides of sea and ocean: Tides of sea and ocean grind the rocks from their bank. Similarly, the current of river water also carries small fragments of rocks along with it. In the course of their movement, these fragments hit each other and break down into smaller particles. Rivers finally deposit soil on their bank and channel.
- e) Plants: Plants like lichens grow on rocks. Their growth, death and decay releases organic acid. In the long run, these organic acids decay the rocks into soil. Similarly, roots of trees go deeper into the ground. Sometimes, they may enter into the cracks of the rocks and grow. When they grow, they exert pressure inside the rocks and break them down into fragments. Finally, these fragments form the soil.
- **f) Glaciers movement:** Glaciers movement through the Rocky Mountains weathers rocks into soil.



## **Memory Tip**

The weathering of rocks into soil by means of physical factors like air, water, heat, humidity, etc. is called physical weathering.

## **Erosion and Deposition**

Erosion is a process of carrying soil away. It can be done by air, water, wind, river, glaciers, hurricane, cyclone, etc. It is also caused by human beings. Thus, erosion is a process of carrying away of humus, soil particles, sediments, rock fragments, etc. from one place to another by the agents like air, water, storm, flood, landslide, hurricane, etc. After erosion, it is necessary to sediment (deposit) the eroded materials away from the site of erosion. It is called deposition. Erosion and deposition occur side by side. It means erosion is always followed by deposition. Thus, deposition is a process of accumulation of the eroded materials away from the place of erosion.

## **Soil Erosion**

The top layer of the soil can be carried away from its natural place due to different natural agents like air, water, wind, river, glaciers, hurricane, cyclone, etc. It is a serious problem in the agricultural land. Due to various human activities, the rate of soil erosion is increasing day by day. After soil erosion, the fertile land becomes less fertile or even unfertile. Thus, the removal of top fertile soil by various agents like air, water, wind, river, glaciers, hurricane, cyclone, etc. is called soil erosion. After soil erosion, it is necessary to sediment the eroded soil

away from the site of erosion. It is called soil deposition. Soil erosion and soil deposition occur side by side. It means soil erosion is always followed by soil deposition. Thus, soil deposition is a process of accumulation of the eroded soil away from the place of erosion. Soil erosion mainly occurs due to the natural process but these natural processes are induced by various human activities. Some of the major causes of soil erosion are given below:

## Causes of Soil Erosion

## a) Deforestation

When large trees are cut down and small plants are planted in their place, it is not called deforestation. But the cutting down of trees on a large scale is called deforestation. After deforestation, the forest is exposed to wind and rainfall. Absence of plants makes the soil loose and prone to erosion. Therefore, rainfall easily washes the top layer of the land that contains loose organic materials.



### **Fact with Reason**

## Deforestation is an important cause of soil erosion. How?

Deforestation results in dry land, irregular rainfall, extreme weather and wind. As a result, soil erosion is more likely after deforestation.

## b) Overgrazing

Grazing of pastures, grasslands and forests by livestock beyond the capacity of renewal of vegetation is called overgrazing. Absence of vegetation on land makes the soil dry and loose. Such soil is easily carried away by wind, floods and landslides.

## c) Improper farming

The traditional method of farming on hills and mountains makes soil weak and prone to erosion. Such practice exposes the soil to wind, water and sunlight. As a result, the fertile soil is easily carried away by wind and rainfall.

## **Effects of Soil Erosion and Deposition**

- i) After soil erosion, the soil becomes less fertile and hence production of crops decreases.
- ii) After soil erosion, the soil does not support vegetation for longer time.
- iii) Soil erosion causes landslides and floods.

- iv) Deposition of soil into reservoir decreases the life of the reservoir.
- v) Deposition of soil, silt, sand, etc. destroys crops and vegetation.
- vi) Deposition of soil, silt, sand, etc. changes the chemical composition of the soil.
- vii) Both erosion and deposition of soil change the structure of land.



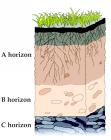
### **Fact with Reason**

The Terai region of Nepal is more fertile than the mountain region, why?

The fertile soil of mountains region is washed away every year by rain. This eroded soil is carried away by flood and deposited in the Terai region. Thus, the Terai region of Nepal is more fertile than the mountain region.

## Soil Profile

Soil profile is a physical and chemical description of soil, which is arranged in different layers (called horizons). It shows the layers from the surface to the depth where soil forming processes are no longer evident. Thus, the vertical arrangement of various layers of soil down from the surface of the soil is called soil profile. A soil profile contains various layers like top-soil, subsoil and bed rocks. A typical soil profile includes the following Chorizon horizons.



a) A horizon: The uppermost dark layer which is rich in humus is called top soil or A-horizon. It is also called an organic layer. It is light, soft and porous. It holds enough water. Various kinds of soil organisms like bacteria, fungi, earthworms, etc. are present in this layer. From this layer, roots of plants can absorb water and minerals. The amount of humus and minerals is not same in all top soil.



### **Fact with Reason**

The top layer of soil contains various nutrients in it, why?

The top layer of soil contains various nutrients in it because it receives these nutrients from the dead and decayed organic materials.

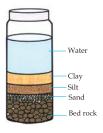
**b) B horizon:** This layer is present below the top soil. It is hard, compact and rich in soluble minerals. It does not contain more organic matter like the top soil. Roots of plants can reach down to this layer.

c) C horizon: It is a layer made up of large pieces of bed rocks such as granite, basalt, quartzite, sandstone, limestone, etc. Small cracks are partially or totally filled with soil materials and roots of big plants.

## **Activity**

## To observe different layers of soil

Take a transparent glass bottle or a jar. Collect some amount of soil from a garden or field and keep it in the bottle or jar. Add water in the bottle. Keep in mind that water should make solution easily. Stir the mixture for about two minutes and leave it without disturbing. Observe the solution after an hour. You can see that the soil is arranged in different visible layers like humus, clay, silt, sand and pebbles.



## Soil Conservation

We cannot live without food. Food comes from the plants that grow on soil. Formation of soil takes millions of years. Soil is a main natural resource. So, it is necessary to conserve soil. We can conserve the soil by following these conservation methods.

- (i) We should discourage deforestation and should encourage afforestation.
- (ii) We should practise terrace farming on the slopes.
- (iii) We should practise contour ploughing on the slopes.
- (iv) Waterproof surfaces should be reduced which decreases speed of water flow.
- (v) Overgrazing should be controlled.
- (vi) Plants which have strong roots like bamboo should be planted on the river banks.
- (vii) Rain barrel should be made to conserve water and soil.
- (viii) We should construct embankments on the rivers.

- (ix) Windbreaks should be planted which reduce wind erosion.
- (xi) Crop rotation should be practised to conserve the fertility of soil.

### **Soil Pollution**

The change in physical, chemical and biological composition of soil that harms humans and other organisms is called soil pollution.

Plastics, glasses, metal scraps, wires, pots, kitchen wastes, hospital wastes and many other types of solid wastes are produced in millions of tons every day in our locality. These solid wastes should be disposed properly. However, in developing countries such as Nepal, most of the cities are unplanned. Tons of solid wastes are dumped improperly every day. Due to this reason, the land looks ugly, smells bad and becomes infertile. The decrease in the quality and quantity of soil due to the mixing of harmful materials is called soil pollution.

### **Causes of Soil Pollution**

## The major causes of soil pollution are:

## i) Detergents

Synthetic cleaners such as detergents are non-biodegradable. Molecules of detergents block pores in the soil. Subsequently, soil absorbs less air and water. Microbes and earthworms die due to lack of oxygen. As a result, soil becomes infertile.

### ii. Insecticides and chemical fertilizers

Use of insecticides and chemical fertilizers in excess increases the acidity of soil and kills earthworms. As a result, soil loses its quality.

### iii. Acid rain

The rain whose pH value is less than 7 increases the acidity of soil.

## iv. Domestic wastes, municipal wastes and agricultural wastes

Parts of vegetables, broken tools, glasses, metal parts, papers and plastics are domestic wastes. Due to lack of dumping sites, means of transportations or political issues solid wastes are left on roads or parks.

## v. Hospital wastes

Syringes, bandages, bottles, waste foods and various solid wastes are produced from hospitals every day.

#### vi. Industrial wastes

Though industries are very important for economic development of countries, they are the major cause of environmental pollution. Lots of industrial wastes are dumped in the surroundings every day.

### Measures to Control Soil Pollution

Soil pollution is harmful to animals, plants and humans. It spreads germs, initiates water and air pollution, decreases agricultural production, kills underground life forms, and makes us unhealthy. Therefore, soil pollution must be controlled. Some of the activities that help to control soil pollution are:

Dispose agricultural waste properly.

Reduce, reuse and recycle wastes.

Reduce the use of synthetic cleaners, insecticides and chemical fertilizers.

Manage proper dumping sites.

## 11.2

## The Earth

The earth is a common habitat for all. It is the only one planet of the solar system where the life form exists. It is not a perfect sphere like a football. But it has a shape like that of an orange. It is depressed on its poles and elevated on the equator. Earth can be divided into three interconnected spheres, viz. lithosphere, hydrosphere and atmosphere. About 70 % of the earth's surface is covered with water and remaining 30% with land. So, it is also called a blue planet.



#### Fact with Reason

## The earth appears blue as seen from the moon, why?

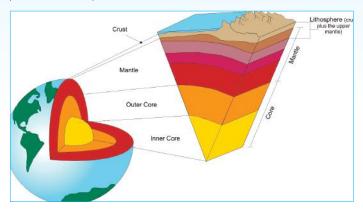
The earth appears blue as seen from the moon because 70% of the earth has been covered with water, which reflects the blue colour scattered in the atmosphere.

## **External Structure of the Earth**

The outer surface of the earth is hard and strong. The hard and rigid outer layer of the earth is called lithosphere. About 70% of the outer surface is covered with water, which is called hydrosphere. Due to the mass of the earth, it has a certain force of attraction. As a result, the earth is covered with a layer of air. The layer of air around the earth is called atmosphere.

### **Internal Structure of the Earth**

The internal structure of the earth is studied with the help of earthquake and volcano. The internal part of the earth is divided into three different layers. They are: a) Crust b) Mantle c) Core



## **Activity**

Take a boiled egg and cut it vertically with a knife. Compare the different parts of the egg with the structure of the earth.

- i) Egg's shell represents crust.
- ii) White part represents mantle.
- iii) Yolk represents core.





### a) Crust

The crust is the outermost and thinnest layer of the earth. It is just like the outer coat of an egg. Its average thickness ranges from 5 to 50 km from the surface of the earth. In the crust, the temperature ranges from 25°C to 750°C which increases with the increase in the depth. The important elements found in the crust are oxygen, sodium, silicon, calcium, iron, etc. The crust is generally found in solid state. Different types of plants and animals live on the crust. The crust consists of forests, crop fields, deserts, hills, mountains, plains, oceans, etc. Construction of homes, farms, towns, settlements, construction of roads, etc. are done on the crust.

## b) Mantle

Just below the crust, there is the thickest layer of the earth called mantle. Its thickness is about 2900 km. In the mantle, the temperature ranges from 750°C to 2500°C. It is 2-3 times heavier than the crust. The important elements found in this layer are magnesium, iron, silicon and oxygen. These substances are found in the molten state called magma. Magma comes out of the earth's surface during volcanic eruption. The average pressure in the mantle is 2-3 times more than that of the crust.



### Fact with Reason

## Why does magma erupt as volcano?

Magma erupts as a volcano to release the pressure built inside by the weight of crust.

## Differences between Crust and Mantle

S.N.	Crust	S.N.	Mantle
1.	The crust is a thin outer layer of the earth where we live.	1.	The layer of the earth below the crust is called the mantle.
2.	The crust varies from around 5 km thick (in the ocean floor) to around 50 km thick (on land).	2.	The mantle is much thicker than the crust. Its thickness is about 3000km.

## c) Core

The innermost layer of the earth is called core. It is divided into two parts, i.e. outer core and inner core.

### i) Outer Core

It is the second thickest layer of the earth, which is present in between inner core and mantle. Its thickness is about 2100 km. In the outer core, the temperature ranges from 2500°C to 3000°C. The materials found in this layer are in liquid state. The important elements present in this layer are iron, cobalt and nickel.

## ii) Inner Core

It is the innermost and central layer of the earth. Its thickness is about 1300 km and the temperature ranges from 3000°C to 5000°C. It has a very high pressure. Due to this high pressure, the substances are found in solid state. This layer consists of iron, cobalt and nickel.



### **Fact with Reason**

## Why is the inner core of the earth found in solid state?

Inner core of the earth is in solid state because of tremendous pressure from every side due to weight of other layers.

### **Project Work**

Make a comparative table of different layers of the earth in a chart paper and display in the classroom.

## Axis and Orbit of the Earth

Axis of the earth is an imaginary straight line perpendicular to its equatorial plane and passing through the centre. The earth's orbit around the sun is not completely circular, but it is oval or elliptical. Thus, the orbit of the earth is an elliptical path on which it revolves around the sun.

## Activity

With the help of a marker or a chalk, make an elliptical circle on the table. Keep a tennis ball at the centre of this elliptical circle. Take a marble and roll it throughout the circle. Is the distance between the tennis ball and marble same everywhere? Observe the maximum and minimum distance between them.

## **Rotation and Revolution**

Earth shows two types of motions. They are rotation and revolution. Earth rotates on its axis and revolves on its orbit. Rotation refers to the anti-clockwise spinning

of the earth on its axis. It is also called diurnal motion. One rotation takes about twenty-four hours and is called a mean solar day. The orbiting of the earth around the sun is called revolution. It is also called annual motion of the earth. One revolution of the earth takes 365.25 days. The orbital plane is a twodimensional flat surface on which the earth



revolves around the sun. The earth's axis is not perpendicular to the orbital plane of the earth. It makes an angle of 66.5° with the orbital plane of the earth. This tilting causes variation in intensity and duration of the sunlight reaching the earth. The most prominent effects of tilting of the earth are given below:

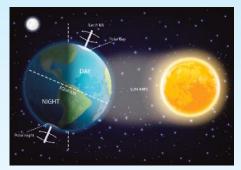
- a) The four seasons in a year are caused by the tilt of the earth's axis as it orbits the sun.
- b) Tilting of the earth causes different climates in the different places of the earth.
- c) Due to tilting of the earth, the duration of days and nights is not always equal except in the equatorial areas.
- d) Due to tilting of the earth, the point and time of the sunrise and sunset is different.
- e) Variation in the solar altitude (height of the sun from the earth at noon) is due to the tilting of the earth's axis.

S.N.	Orbital plane	S.N.	Axis
1	The orbital plane of the earth is a two-dimensional flat surface on which it revolves around the sun.		Axis of the earth is an imaginary line perpendicular to its equatorial plane and passing through the centre.
2	It is a thin, elliptical, disk shaped path.	2	It is a straight line.

## Differences between orbital plane of the earth and axis of the earth

## Day and night

The sun is a major source of light on the earth. As the earth spins continuously on its axis, at any time, half of the surface of the earth faces towards the sun and half of its surface faces away from the sun. The time duration during which the earth faces the sun while rotating on its axis is called day and the time duration during which the earth faces away from the sun is called night. As the earth takes 24 hours to complete a rotation, a complete day is of nearly 12 hours. Similarly, night is of 12 hours too. But, the days and nights are not equal due to tilting (slanting) of the earth. Thus, the continuous rotation of the earth on its axis is the cause of day and night on the earth.



### **Activity**

Take a globe and a burning candle. Draw an elliptical circle around the candle and make the room dark. Rotate the globe through the elliptical path around the candle. Assuming the globe as the earth and the candle as the sun, study the following things:

- 1. During rotation of the earth, which side is day and which side is night?
- 2. During revolution of the earth, which side is cold and which side is hot?





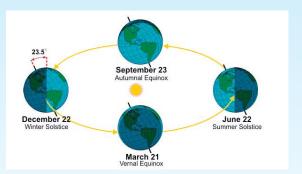
Why does variation occur in day time and night time throughout the year?

The earth's axis is not perpendicular to the orbital plane of the earth. It makes an angle of 66.5° with the orbital plane of the earth. This tilting causes variation in the duration of the light received by the earth. So, variation occurs in day time and night time throughout the year.

## **Change in Seasons**

Earth revolves around the sun on an elliptical orbit. While revolving, the earth reaches at different distances from the sun. The point on the earth's orbit nearest to the sun is called perihelion. At this point, the earth is about 147.3 million km away from the sun. It occurs on January 3. The point farthest from the sun is called aphelion. At this point, the earth is about 152.1 million km away from the sun. It occurs on July 4.

The elliptical orbit causes variation of the earth's distances from the sun. Yet, this phenomenon is not responsible for the seasons on the earth. The tilting of the earth's axis is the major cause of change in season. Seasons are of four major types. They are:



## 1. Spring Season

In the Northern Hemisphere, spring season comes after winter season. In Nepal, this season lasts from Falgun to Baishakh. As the spring starts, the days become longer and the nights become shorter. Around Chaitra 7 (March 21), the day and the night become equal. Spring is the season of flowers and greenery.

### 2. Autumn Season

In the Northern Hemisphere, autumn season comes after summer season. In Nepal, this season lasts from Bhadra to Kartik. During this period, the solar radiation falls equally on Northern and Southern hemisphere. Due to this reason, the days and nights are nearly equal in autumn season. Around Ashoj 7 (September 23), the day and night become equal.

### 3. Winter Season

In the Northern Hemisphere, winter season comes after autumn season. In Nepal, this season lasts from Mangsir to Magh. In winter season, the solar radiation decline in the Northern hemisphere. Therefore, the days are shorter and the nights are longer. Around Poush 7 (December 22), there is the shortest day and the longest night.

### 4. Summer Season

In the Northern Hemisphere, summer season comes after spring season. In Nepal, summer season lasts from Jesth to Shrawan. Around Ashad 7 (June 21), there is the longest day and the shortest night.

The seasons in the Southern Hemisphere are the opposite of those in the Northern Hemisphere. That is, when there is autumn season in the Northern Hemisphere there is spring season in the Southern Hemisphere. Similarly, when there is summer season in the Northern Hemisphere there is winter season in the Southern Hemisphere. The change in seasons in the Northern Hemisphere and the Southern Hemisphere is described below in solstice and equinox.



#### Fact with Reason

## Why do seasons change on the earth?

Change in seasons takes place on the earth due to its tilted axis as well as revolution around the sun.

## **Seasons in Nepal**

Generally, there are four seasons on the earth, but in the context of Nepal, there are six seasons. They are given below:

- 1. Spring season: It includes CHAITRA and BAISHAKH.
- 2. Summer season: It includes JESTHA and ASHAD.
- 3. Rainy season: It includes SHRAWAN and BHADRA.
- 4. Autumn season: It includes ASHOJ and KARTIK.
- 5. Pre-winter season: It includes MANGSIR and POUSH.
- 6. Winter season: It includes MAGH and FALGUN.

## **Project Work**

Bring a chart paper and write down the characteristics of seasons that are described in the context of Nepal.



## The Solar System

The family of the sun which consists of eight planets and their satellites, comets, asteroids, etc. is called the solar system. The sun is the main member of the solar system which remains at the centre. All the members of the solar system revolve around the sun in elliptical paths called orbits.

## The Sun

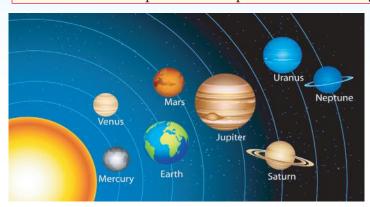
The sun is a medium-sized star closest to the earth. The size of the sun is about 110 times bigger than the size of the earth. We can compare the size of a mustard seed and the size of a basketball as the size of the earth and the sun respectively. The sun is a huge ball of burning gases. In presence of high temperature, high pressure and high amount of hydrogen, there occurs nuclear fusion of hydrogen

gases to give helium. In this process, tremendous amount of heat and light energy is released. Just imagine, what would happen if there was no sun? Have you ever wondered? All the plants and animals including human beings get heat and light energy from the sun. Green plants need sunlight for photosynthesis. All the animals depend on plants for their food. The heat of the sun maintains water cycle on the earth. The sun is the ultimate source of energy. Therefore, all plants and animals would die in the absence of the sun.

## **Memory Tip**



- 1. Diameter of the sun: About 14,00,000 km
- 2. The distance between the earth and the sun: 15,00,00,000 km
- 3. The surface temperature of the sun is about 5500°C while its inner core has temperature of up to 15.6 million degrees Celsius.



Solar System

### Fact with Reason



The sun looks almost same in size to the moon while looking at them from the earth, why?

The sun and the moon seem about same sized while looking from the earth because objects look smaller when they are observed from far. The sun is very big but it is very far from the earth. The moon is very small but comparatively very close to the earth.

### **Planets**

The heavenly bodies that revolve around the sun on their own elliptical orbits are called planets. There are eight planets in the solar system. They are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. There are also a number of small, dwarf planets in the solar system. Some of the dwarf planets are Pluto, Eris and Ceres. Planets revolve around the sun as well as rotate around their own axis. Planets do not emit their own light like stars but reflect the light of the sun. This makes the planets shine in the dim sky.

### **Fact with Reason**

1. Planets do not have their own light but they shine. Give reason.



Planets shine and become visible because they reflect the sunlight that falls on them.

2. Earth is a planet. Why?

Earth is a planet because it is a huge, round heavenly object revolving around the sun, a star.

## a) Mercury

Mercury is the smallest planet of the solar system. It is closest to the sun. The part of the Mercury that faces the sun is extremely hot and other part is extremely cold. Mercury has no atmosphere, hence life cannot exist there.





## **Memory Tip**

Mercury is made up of mostly rock and heavy metals.

## b) Venus

Venus is the brightest and hottest planet of the solar system. It is the closest planet to the earth. The atmosphere of the Venus mainly consists of carbon dioxide. Life cannot exist on the Venus.



### **Fact with Reason**

1. Venus is the hottest planet, why?



Venus is the hottest planet because it has the highest average temperature among all the planets due to the presence of lots of greenhouse gases like carbon dioxide.

2. Venus is called evening star. Why?

Venus is called evening star because it is seen in the western sky of the earth in the evening.

## **Activity**

- 1. Mercury can be seen just before the sunrise in the months of September and October. Similarly, it can be seen just after the sunset in March and April. Observe Mercury and show it to your family members too.
- 2. Venus can be seen just before the sunrise and just after the sunset. Observe Venus and show it to others also. Please note that Venus is the brightest heavenly body at night after the moon.

## c) Earth

Earth is the third nearest planet from the sun, on which we live. This planet has life supporting gases, i.e. oxygen and carbon dioxide, water and suitable temperature for living beings. Therefore, life exists on the earth's surface. The earth has one natural satellite, i.e. moon. Earth is the only planet which has all the conditions essential for the existence of life. The earth takes 365.25 days to complete one revolution



around the sun. It takes 24 hours to complete one rotation on its own axis. It causes day and night to occur on the earth.

### Differences between the sun and the earth

S.N.	Sun	S.N.	Earth
1.	The sun is a medium-sized star, which is the main member of the solar system.	1.	The earth is a planet, which revolves around the sun in an elliptical orbit.
2.	The sun is too hot and does not support life.	2.	The earth has suitable temperature and supports life.

### **Fact with Reason**

1. Earth is called a planet, why?



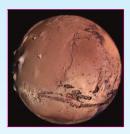
Earth is called a planet because it is a big, sphere-like heavenly body, which revolves around the sun.

2. 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.

## d) Mars

Mars is the fourth planet from the sun. It can be seen with our naked eyes. It looks like a bright orange-red star due to the presence of a red mineral called limonite. It is almost half the size of the earth. The atmosphere of the Mars mainly consists of nitrogen gas. Mars has two moons.



### Fact with Reason



1. First four planets are called inner planets or terrestrial planets. Why?

First four planets are called inner planets or terrestrial planets because they are made up of rocks and soil.

2. Mars is called a red planet. Why?

Mars is called a red planet because of its reddish appearance due to the limonite rocks.

## e) Jupiter

Jupiter is the largest planet of the solar system. It is the third brightest object at night after the moon and the Venus. The Jupiter looks like a bright star with our naked eyes. It consists of bands of clouds and a big red spot. This planet has four large moons and 67 small moons.





### **Memory Tip**

Jupiter is the fastest rotating planet in our solar system. Its days are only 10 hours long.

## f) Saturn

Saturn is the second largest planet and the third farthest planet of the solar system. This planet is surrounded by the rings of dust and rocks. It has 62 moons.





### **Fact with Reason**

Saturn is called a giant planet. Why?

Saturn is called a giant planet because it is massive like Jupiter.



## **Memory Tip**

As the fifth brightest object in our solar system, Saturn can be seen with the naked eyes and by using binoculars.

## g) Uranus

Uranus is the second farthest planet of the solar system. It is a very cold planet. Uranus too has rings around it. This planet has 27 moons.





## **Memory Tip**

Uranus is the first planet to be discovered by the use of a telescope.

## h) Neptune

Neptune is the farthest planet of the solar system. It cannot be seen with our naked eyes. It is the coldest planet. It has 14 moons.





### **Memory Tip**

Neptune is not visible with naked eyes.

## **Activity**

- Make a colourful chart of the solar system with the help of your textbook or your science teacher.
- 2. Name the eight planets of the solar system. Also, write important features of each planet in your exercise book.

## **Satellite**

A satellite is an object that revolves around the planet in a fixed orbit. There are two kinds of satellites. They are:

## i) Natural Satellite

A satellite which is naturally formed and revolves continuously around a planet is called a natural satellite. This satellite is primarily formed during the formation of the solar system. There are more than 173 natural satellites in the solar system. Some of them are the Moon of Earth, Ganymede of Jupiter, Titan of Saturn, Triton of Neptune, etc.

## ii) Artificial Satellite

The satellites which are made by humans and launched in the space to revolve round a planet are called artificial satellites. There are more than 8,000 artificial satellites in the solar system. For example, Geostationary satellite.

### **Asteroids**

The millions of rocky and metallic heavenly bodies that range from few kilometres to hundreds of kilometres in diameter are called asteroids. They lie in between Mars and Jupiter. Thus, the rocky and metallic objects which are present in between the orbits of Mars and Jupiter that revolve around the sun are called asteroids or minor planets. The asteroids have two kinds of shape: (i) nearly spherical which are now known as



minor or dwarf planets and (ii) irregular. Some of the irregular asteroids are Juno, Vesta, Pallas, Iris, Flora, Victoria, Eros, etc. On the basis of size, Pallas is the largest asteroid.

### **Comets**

Comets are tailed flying bodies that can be observed in the sky. They are small bodies in the solar system which are made up of ice, dust, rocks and trapped gases. Thus, a broom-shaped shining object with a bright head is called a comet. There are about 3,296 known comets. A person may not see a particular comet twice in his/her lifetime. This is because it has a highly elliptical orbit around the sun due to which it takes



many decades to revolve around the sun. A comet is generally a ball of ice, dust and gases. But, when it approaches the sun, a tail is produced. The tail of the comet increases on approaching the sun due to the solar radiation and solar wind.



## **Memory Tip**

Halley's Comet is one of the most clearly visible comets from the earth.

### Fact with Reason

**1. Why do comets produce a tail on approaching the sun?** When a comet approaches the sun, some of its frozen matter begins to evaporate into gases due to the heat of the sun. These gases rush out due to the effect of solar wind and high speed of the comet. In this way, a long tail is formed when a comet approaches the sun.



## 2. The tail of the comet becomes shorter on going farther from the sun, why?

The tail of the comet becomes shorter on going farther from the sun. It is because the heating effect of the sun increases on approaching the sun which causes more ice and gases to become vaporized. But, when the comet goes far away from the sun, the heating effect decreases and thus the tail of the comet becomes shorter.

**3.** Why do comets have a longer revolution period? Comets have a longer revolution period because their path around the sun is highly elliptical, due to which they take a long period of time to revolve once around the sun.

## **Meteors (falling stars or shooting stars)**

A meteor is a space rock ranging from the diameter of an atom to several metres. It floats freely inside the solar system. Scientists believe that they are the leftovers of the formation of the solar system. Thus, the pieces of stone or metal which enter the earth's atmosphere are called meteors. Meteors drag



themselves in the atmosphere and produce a bright light. So, they are also known as 'shooting stars', falling stars', or 'fireball'. The meteor that does not burn completely in the atmosphere and reaches the earth surface is called a meteorite.

## 3 Step Exercise



## 1. Fill in the blanks with appropriate words. (Why it begins with no. 10?)

- a) ..... is the topmost layer of the earth's crust.
- b) Sun, wind, water, glaciers, etc. are responsible for ..... of rocks into soil.
- c) ..... is a serious problem in the agricultural land.
- d) Grazing of pastures, grasslands and forests by livestock beyond the capacity of renewal of vegetation is called ......

e) ...... is a physical and chemical description of soil which is arranged in different layers.

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

- a) The uppermost dark layer which is rich in humus is called top soil or A-horizon.
- b) C-horizon is a layer made up of large pieces of bed rocks such as granite, basalt, quartzite, sandstone, limestone, etc.
- c) We should encourage deforestation and should discourage afforestation.
- d) About 30% of the earth's surface is covered with water and remaining 70% with land.
- e) The internal structure of the earth is studied with the help of earthquakes and volcanoes.

## 3. Select the best answer from the given alternatives.

- a) Thickness of crust is:
  - i. 5 to 50 km
- ii. 5 to 40 km
- iii. 40 to 50 km
- iv. 10 km
- b) The molten state of rock at the mantle is called:
- i. magma
- ii. lava
- iii. silicon
- iv. none of them

- c) The temperature of core is:
- i. 3000 to 5000°C
- ii. 2000 °C
- iii. 3000°C
- iv. 100°C
- d) Duration of revolution by earth around the sun.
- i. 365 days
- ii. 365.25 days
- iii. 366 days
- iv. None of them
- e) It is the reason for change in season on earth.
- i. Tilted axis of earth
- ii. Moon
- iii. None
- iv. Both i & ii

## 4. Match the following:

Day and night

December 22

The point on the earth's orbit nearest to the sun

Aphelion

Shortest day in the northern hemisphere

March 21 and September 23

The point on the earth's orbit farthest from sun

Perihelion

Days and nights have equal duration Rotation

## Step



## 5. Answer the following questions in one word.

- a) Write the name of the largest planet.
- b) Which planet is called the brightest planet?

- c) Which planet is called the blue planet?
- d) What is the value of thickness of the outer core?

## 6. Write any two differences between:

- a) Crust and mantle
- b) Outer core and inner core
- c) Rotation and revolution
- d) Planet and satellite
- e) Asteroid and comet

### 7. Give reasons.

- a) Deforestation causes soil erosion.
- b) The Terai region of Nepal is more fertile than Himalayan region.
- c) Earth is called the blue planet.
- d) There are different seasons on the earth.
- e) Mars is called the red planet.
- f) Tail of a comet changes its length while revolving around the sun.
- 8. Observe the given diagram and answer the following questions:



- a) What is shown in the diagram? Define the term.
- b) Which layer is better for agriculture?

## Step

## 9. Answer the following questions:

- a) What is soil? Write any three points of importance of soil.
- b) Describe the process of formation of soil in brief.
- c) Define soil erosion and soil deposition.
- d) Describe three causes of soil erosion in brief.
- e) Enlist the important methods for conservation of soil.
- f) What is soil pollution? Mention any two causes and two harmful effects of soil pollution.
- g) What would you do to reduce soil pollution in your locality?
- h) Describe internal structure of the earth with diagram.
- i) What is season? What is responsible to change the season? Describe different types of seasons.