Science

Class VI

Department of School Education
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Advisors

Sangay Zam, Secretary, Ministry of Education, Thimphu
Tshewang Tandin, Director General, Department of Adult and Higher Education, Ministry of Education, Thimphu
Kesang C Dorji, Director, Department of Curriculum and Research Division, Ministry of Education, Paro
Kinga Dakpa, Director General, Royal Education Council, Paro
Wangpo Tenzin, Curriculum Specialist, Royal Education Council, Paro

Coordination

Wangchuk, Royal Education Council, Paro

Proof Reading

Gopilal Acharya, Free Lance Editor, Thimphu
Amber Kumar Rai, Curriculum Officer, Royal Education Council, Paro
Sharda Rai, Subject Specialist, Bhutan Council for School Examination and Assessment, Thimphu

Art Work and Layout

Surjay Lepcha, Curriculum Officer, Royal Education Council, Paro
Sangay Tshering, Teacher, Drugyel HSS, Paro.

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Foreword

Today, science is an indispensable discipline of learning that shapes the lives of humankind and their wellbeing. The enduring engagement of people in the scientific world of exploration, inquiry and investigation has culminated in the addition of an ever-growing repository of scientific knowledge and milestones. Through the time, how science works and affects the world has been influencing the way we view and deal with the subject.

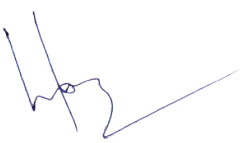
Unfortunately, many a times, the subject is seen as very complex and difficult, hard to comprehend and demanding to learn, thereby posing challenges in our effort in instilling scientific beliefs and attitudes in young learners. Such generalisation has influenced the learners to shy away from the experiential learning and the scientific endeavour in favour of a discipline that is perceived to be easier. Therefore, it is time that concerted efforts are pursued in making learning of science a way of igniting the fire of curiosity and investigation in the minds of learners.

Towards making education meaningful and relevant for students, it is imperative to link the scientific concepts to the real world through rigorous engagement of learners in the scientific processes of observation, inquiry, investigation, experimentation and generalisation. The timely revision of science textbooks is an attempt to align learning outcomes with the emerging global view of science and educational philosophies, accentuate the development of scientific skills of doing science, and foster the scientific temper and literacy in young minds. However, the endeavour in science education in our context emanates from the national, social, cultural and religious belief system imperative to nurturing nationally rooted and globally competent citizens who can productively contribute to the nation building initiatives and development of a dynamic global society.

Therefore, it is our sincere hope that the science curriculum provides a limitless avenue for every learner as a young scientist to explore continuously and engage in doing science. The meaningful participation is crucial in the development of transversal competencies of critical thinking, creativity, communication and collaboration along with other essential life skills fundamental to succeed and excel in the 21st century world as productive and socially responsible individuals.

I would like to wish all our teachers and students, a fulfilling social and academic engagement and experiential experiences through enduring and enterprising learning and doing science as part of every learner's life.

Tashi Delek



Kinga Dakpa
Director General

Contents

INTRODUCTION

Science is the study of everything around us, including our body. It includes studies about plants, water, soil, stones, wind, air, and how they work and influence us. We also study about our body, how each part of our body works, and how we can lead a healthy life. We develop a good understanding of our world, ourselves by observing the characteristics of things around us and their patterns by actively engaging in the processes of doing science. This is fundamental to assimilate indispensable scientific knowledge and skills that not only for the well-being of people, natural and social environment but also treasuring and conserving them for the future generations.

Science is the body of knowledge developed through the human activities. The volume of scientific knowledge with which we live and make meaning of this world can be attributed to the hard work of many people whom we call scientists. The contribution of science in the field of medicine and technology has always been a boon for the entire living organism on this Earth. Machines, simple or complicated, help people to work easily. Further, the scientific knowledge and skills developed through the learning of science are vital; making people as critical thinkers whose actions on the environment and society are based on sound scientific ideas and knowledge. This makes people to take good care of the environment and create a peaceful and prosperous society. On the contrary, the accelerated pace of development in the fields of science and technology also brings drastic changes on the Earth in the form of climate changes and human conflicts.

The learning of science, therefore, should equip young minds with the scientific knowledge and skill to make educated decisions in their everyday life. In this context, the study of primary science for class IV to VI is critical in laying a sound foundation. With this in mind, the science textbooks for these classes contain a variety of learning activities, embedded with the basic scientific concepts and ideas instrumental in helping learners to make good sense of the world around them. The basics that the learners acquire in these classes serve as stepping stones to pursue higher studies in the field of science.

The constructivist theory of learning informs the varieties of learning experiences in science for these classes. It ensures the active engagement of learners in the scientific processes and share responsibility in their learning. Rather than learning as a complacent listener waiting for their teachers, learners experience experiential learning through active engagement in the scientific processes.

Scientific Process

The scientific process is an inquiry approach that involves a systematic understanding of the natural and physical world. It forms the basis of experimentation for scientific knowledge. It entails asking relevant questions related to observation, testing ideas

and communicating the findings. Learners in sciences practice the following scientific process:

1. **Observation:** It is the fundamental skill that enables learners to view the world objectively and systematically by using the senses. It consists of gathering information, evidence and ideas about different phenomena. This facilitates learners to compare, contrast and generalise ideas about the world around. These experiences foster inquisitiveness in them.
2. **Questioning:** Reflective and enquiry approach develops the competency to link the known with the unknown ideas. It enhances the ability of the learners to put their observations in the form of a question that is clear, concise, and testable.
3. **Hypothesis:** It is an educated guess and possible explanation about the observation and question. Based on the limited evidence as a starting point, learners carry out further investigation. Therefore, hypothesis is a specific and testable prediction about what may happen in a study.
4. **Design:** It is an experimental set-up that allows investigation of the relationship between variables. This allows learners to manipulate the variables and test whether their prediction is accurate.
5. **Data collection:** It is the systematic observation, measurement and recording of information of various phenomena happening in the experimental set-up. It allows learners to gather evidence to answer stated research questions, test hypotheses, and evaluate outcomes.
6. **Analysis:** It is an interpretation of data through the use of analytical and logical reasoning to determine pattern, relationship and trends. The learner makes sense out of information recorded to establish a relationship between variables, based on which results and conclusions are drawn.
7. **Conclusion:** It is the step where the learner makes generalisation of the information based on the data analysis and interpretation. The generalisation may or may not support the hypothesis. This facilitates learners to develop the skills of articulating diverse information to draw a comprehensive conclusion about the phenomena.
8. **Sharing:** This is the final step wherein the learner presents their findings in the form of a final report, display or presentation as asked by the subject teacher. The learners explore and learn to use different forms of communication such as graphic, audio, visual, etc. to share their ideas or findings.

Based on the premise that, no book, by itself, can make learner gain knowledge and skills unless the learner meaningfully engages himself or herself with its contents, each topic has several activities that learners are required to do in fulfilling the learning objectives outlined in the syllabus. Therefore, this textbook is developed based on the

following learning experiences and plans.

Textbook content

The elements of textbook are arranged in the following sequence.

1. **Test Yourself:** This is to check what learners already know about the topic to be taught. This helps the teacher to understand the diverse experiences and knowledge of learners on the topic.
2. **You already know:** Set of questions provided to recapitulate the earlier ideas and scientific concepts learnt or known on the topic from the earlier lessons. This is to ensure that the teacher takes into consideration of the prior knowledge and experiences of learners in planning the teaching.
3. **You will learn:** This lists the expected learning objectives to be achieved in the lesson. At the end of the lesson, one can use this list to evaluate the learning.
4. **Learning activities:** This describes how the learning activities are carried out, either individually or in groups, and things needed for each activity in making generalisation of the scientific phenomena.
5. **Check your progress:** The questions determine the progressive learning of learners on the topic. The results help learners and teachers determine interventions needed in learning.
6. **Think again:** This part is to check the understanding and learning of learners on the chapter. It has different type of questions to test learning in terms of scientific knowledge, skills, and values and attitude towards science and the society.
7. **Do you know:** Wherever relevant, there is additional information provided as "Do you know" to add to your general knowledge in science. This is not for testing.
8. **Community involvement:** To vary the teaching process, wherever relevant, local community is invited to take science classes to share the local knowledge on various topics. This is to help learners keep abreast of the local knowledge vital in conserving the local knowledge and practices which, if not preserved, can disappear from the society.
9. **Model Question:** The model question paper with the sample answers is provided at the end of the textbook to help learners to understand the type of questions that are expected in the summative assessment. This also provides the cue of the range of cognitive levels of learning, skills, and the values and attitudes that the science curriculum are expected to achieve.

The science as a body of knowledge and as one of the essential learning areas in school education stimulates learners to wonder and explore extensively in the field of science

and technology. Through the active engagement in scientific processes, learners develop the 21st century education skills of critical thinking, creativity, collaboration and communication. These skills are inter-disciplinary and transferable into other learning areas and influence the intellectual development and overall performance of learners in school education.

In spite of the noble intention of every textbook, it has the limitation of fostering inspirational and experiential science learning. Cognizant of meaningful doing of science transcends beyond the science classroom and textbooks, it is imperative that both teachers and learners explore to use diverse resources and strategies of teaching and learning science through all grades and lessons.

STEM Unit

Royal Education Council

CHAPTER 1

Elements, Acids and Alkalis

1.1. What is an element made of?

Test Yourself

1. What is an element?
2. Give three examples of elements.
3. What is a pure substance?
4. Name the tiny particles that an element is made up of.
5. Can an element change into another substance?

You already know:

- element is composed of a single type of particles.

You will learn:

- elements are made of atoms.
- atoms combine to form molecules.

A. All matters are made up of tiny particles. An element is made up of one kind of particles called **atom**. An atom is the smallest particle of any material. A tiny portion of any material will have millions of atoms. Atoms are so small that thousands of them can fit on the tip of a pencil.

Define atom in your own words.

B. An atom is the smallest particle which may or may not have free existence.

Molecule can be made of one atom, two atoms or more than two atoms.

Figure 1.1 shows the formation of molecules from an atom or atoms.

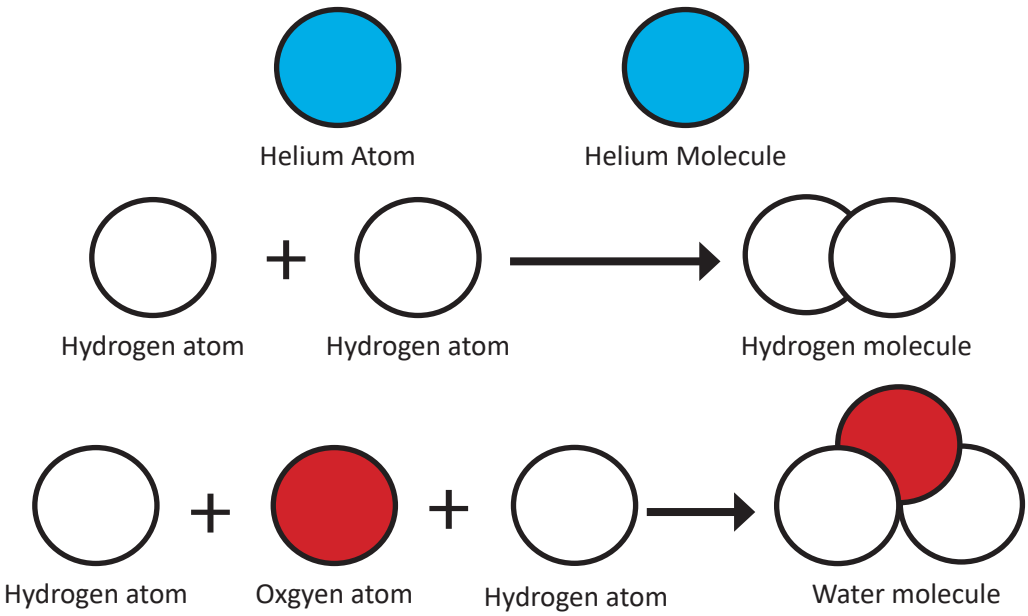


Figure 1.1. Formation of molecules from an atom or atoms.

A molecule is an atom or atoms which can exist independently.

Check Your Progress

i. Differentiate between atoms and molecules.

ii. What are elements made of?

Jacob Berzelius (1779-1848)

Do You Know?

Chemist Jacob Berzelius developed the modern system of symbols and formulae in chemistry.

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1.2. Elements and their Symbols

Test Yourself

1. Give three examples of solid elements.
2. What is an atom?
3. What is a molecule?
4. The short form of millilitre is mL. Why do we use short form?

You already know:

- element is made of atoms.
- atoms combine to form molecules.

You will learn:

- representing elements using symbols.

A. Elements are represented by one or two letters called **symbols**. We use symbols for elements because it requires less time and space to write. Scientists all over the world communicate with the same symbol for a particular element.

Elements are arranged in a special chart called **periodic table**.

In the periodic table, each element is represented by a symbol.

Figure 1.2 shows a part of the periodic table with some elements.

H Hydrogen							He Helium
			C Carbon	N Nitrogen	O Oxygen		
Na Sodium	Mg Magnesium	Al Aluminium				Cl Chlorine	

Figure 1.2. Part of the periodic table.

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Copy and complete Table 1.1.

Table 1.1 *Elements with One Letter Symbol*

Name of the Element	Symbol
Carbon	
Oxygen	
Hydrogen	
Nitrogen	

Each symbol begins with a capital letter (upper case). Symbols of some elements are represented by the first letter of their names.

B. Sometimes we need to use two letters to write symbols.

The first letter of a symbol is always represented by a capital letter (upper case) and the second letter of a symbol is represented by a small letter (lower case).

For example, the symbol for Helium is He.

Copy and complete Table 1.2 by using Figure 1.2.

Table 1.2 *Elements with Two Letter Symbol*

Name of the Element	Symbol
Magnesium	
Aluminium	
Chlorine	

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C. You may need:

Interactive Periodic Table from the link https://www.funbrain.com/games/periodic-table-game

The symbols of some elements are derived from Greek or Latin names. For example the symbol for gold is 'Au' and not 'G' or 'Go'. This is because in Latin, gold is called Aurum.

Copy and complete Table 1.3 by using the periodic table.

Table 1.3 *Elements with Symbol derived from Latin and Greek Names*

Name of the Element	Symbol
Iron	
Mercury	
Silver	

Check Your Progress

i. Match the items of column A with the items of column B.

Name of the Element	Symbol
Mercury	Au
Hydrogen	Fe
Gold	C
Iron	H
Carbon	Hg

ii. Why is the symbol of gold 'Au' and not 'Go'?

Do You Know?

Mercury is used in thermometer. It is a heavy metal and toxic.

http://www.chem4kids.com/files/atom_intro.html
http://www.sciencekids.co.nz/quizzes/elementsymbols.html

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1.3. Acid and Alkali

Test Yourself

1. What is a symbol?
2. Why are elements represented by symbols?
3. What are the symbols of oxygen, iron and gold?
4. What is the taste of lemon?
5. Why are wet soaps slippery?

You already know:

- examples of elements.
- symbols of elements.

You will learn:

- acid and alkali.

A. List three food items that taste sour and three food items that taste bitter.

Foods which taste sour contain acid.

Foods which are bitter and slippery to touch contain alkali. Acids and alkalis are also present in our body. Hydrochloric acid is produced in our stomach which helps in the digestion of food. The saliva is alkaline in nature. It also helps in digestion.

Antacids contain alkali and vitamin C contains acid.

Name two alkalis used in day-to-day life.

B. Work in groups

You may need:

- concentrated sulphuric acid
- dropper
- watch glass
- piece of paper

PRECAUTION

Acids are corrosive, handle with care. Dispose acid properly after use.

Place a piece of paper on a watch glass.

With the help of a dropper, add a few drops of concentrated sulphuric acid on the paper.

Observe for a few minutes.

Write down your observation.

What will happen if you drop the acid on green grass?

Do You Know?

Acids should be disposed off carefully. It has to be diluted with enough water before disposing..

Check Your Progress

i. In what ways are acids useful to us?

ii. Differentiate between an acid and an alkali.

WEBLINK

http://www.chem4kids.com/files/react_acidbase.html
http://www.kids-science-experiments.com/acids-alkalis.html

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1.4. Indicators for Acid and Alkali

Test Yourself

1. What is a symbol?
2. Why are elements represented by symbols?
3. What are the symbols of oxygen, iron and gold?
4. What is the taste of lemon?
5. Why are wet soaps slippery?

You already know:

- examples of elements.
- symbols of elements.

You will learn:

- acid and alkali.

A. An **indicator** is a substance which changes colour when brought in contact with acids or alkalis.

The most common indicator is **litmus**.

Work in groups

You may need:

- watch glass
- red litmus paper
- blue litmus paper
- vinegar
- lemon juice
- raw tomato juice
- ash solution

- forceps
- saliva

Take a few drops of vinegar in a watch glass.

Dip red and blue litmus paper into it one by one with the help of forceps.

Observe the litmus paper and record your observation in Table 1.4.

Clean the watch glass and repeat your investigation with other solutions.

Table 1.4 *Observation for Litmus Paper*

Material	Observation		Acid or Alkali
	Red Litmus Paper	Blue Litmus Paper	
Vinegar			
Lemon juice			
Raw tomato juice			
Saliva			
Ash solution			

Draw a conclusion from the observation.

What would happen if a red litmus paper is dipped separately in a soap solution and apple juice?

B. You can also test how acidic or alkaline a solution is by using a pH indicator called **universal indicator**.

The colour indicates a number.

The number tells you how acidic or alkaline the solutions are.

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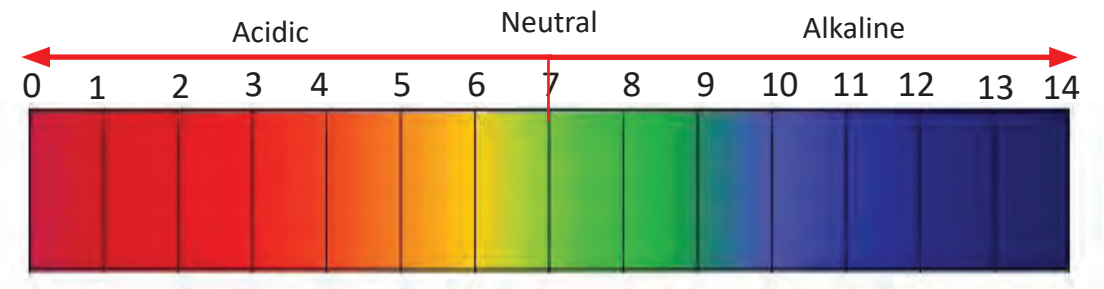

Figure 1.3. Chart showing different colours for different pH values.

Work in groups

You may need:

- detergent solution
- vinegar
- sodium hydroxide
- water
- pH paper
- watch glass
- dropper
- forceps

Do You Know?

Human blood is alkaline in nature. It's pH is about 7.4.

Take a few drops of detergent solution in a watch glass.

Dip the pH paper in the detergent solution.

Note the colour change.

Match the colour change with the chart in Figure 1.3 to find the pH values.

Record your findings in Table 1.5.

Repeat the above procedure using other solutions to find their pH values.

PRECAUTION

Sodium hydroxide is corrosive. Handle with care

Table 1.5 *Measuring pH*

Name of the Liquid	Colour	pH
Water	Green	7
Vinegar		3
Detergent solution		
Sodium hydroxide solution		

What is the pH of sodium hydroxide solution?

Is detergent solution acidic or alkaline? Why?

What would be the nature of solution having pH 7?

Check Your Progress

i. The pH of a solution is zero. Is it acidic or alkaline?

ii. Name any two indicators.

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1.5. Make Your Own Indicator

Test Yourself

1. What is an indicator?
2. What is the change in the colour of blue litmus paper when it is dipped in acid?
3. Why is pH indicator a good indicator?
4. What materials will you choose if you are to make your own indicator?
5. Why do we use indicator?

You already know:

- pH indicator.
- acid turns blue litmus red.
- alkali turns red litmus blue.

You will learn:

- making indicator from locally available materials.

A. Acidity and alkalinity can also be tested by making your own indicators.

Let us make an indicator paper using flower petals. For example, hibiscus, (italic) lilies, Aster, (italic) Rhododendron, (italic) red rose, Iris, (italic) etc.

Bright coloured petal gives better result.

Work in groups

You may need:

- warm water
- flower petals of one kind
- mortar and pestle
- strips of filter paper
- beaker
- forceps

Crush the flower petals using mortar and pestle.

Mix the crushed petals with warm water in a beaker to make a thick solution. Soak the strips of filter paper for ten to fifteen minutes in the mixture. Always use forceps to transfer the filter paper strips.

Leave the paper to dry.

Save it for next activity.

What is the colour of the indicator paper that you have made?

B. Similarly, make a turmeric indicator.

Write:

what you needed.

what you did.

Use the indicators that you have made to test the following solutions.

Lime water, detergent solution, vinegar, toothpaste solution, and lemon juice.

Copy and record the change in indicator paper in Table 1.6.

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Table 1.6 *Testing your own Indicators*

Solution	Colour Change	
	Petal Indicator	Turmeric Indicator
Vinegar		
Detergent solution		
Lime water		
Lemon juice		
Toothpaste solution		

What did you observe when turmeric indicator is used with vinegar?

How is it different from petal indicator?

Which indicator shows better result? What could be the reasons?

Check Your Progress

i. Name some locally available substances which can be used for making local indicators.

ii. Why are flower petals crushed while making an indicator?

http://chemistry.about.com/od/acidsbase1/a/red-cabbage-ph-indicator.htm

Think Again

1. Choose the correct answer.

   i. Which of the following is an element?

   A Water.
   B Salt.
   C Sugar.
   D Gold.

   ii. The symbol of silver is

   A S.
   B Si.
   C Au.
   D Ag.

   iii. The taste of an acid is

   A bitter.
   B sweet.
   C sour.
   D salty.

   iv. The pH of pure water is

   A 0.
   B 6.
   C 7.
   D 14.

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v. The colour change of turmeric indicator in alkaline solution is

A blue.
B red.
C pink.
D yellow.

2. Why should we handle acids and alkalis carefully?

3. What is the importance of pH value?

4. If you are provided with an onion, how will you prepare a local indicator?

5. 'X' and 'Y' are two mystery solutions. Using a strip of blue litmus paper, how will you identify which of the mystery solution is acidic?

6. Universal indicator is mostly preferred over litmus indicator. Why?

CHAPTER 2

Chemical Change

2.1. Chemical Change

Test Yourself

1. Is freezing of water a permanent change?
2. Is there a formation of any new substance when water is heated?
3. Give two examples of physical change.
4. When wood is burnt, it changes into _____.
5. What happens to a paper when it is burnt?

You already know:

- physical change.

You will learn:

- chemical change.

A. You have learnt that melting, boiling, dissolving and evaporation are physical changes which are reversible.

In this topic, you will learn about another type of change.

Work in groups

You may need:

- test tube

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- spirit lamp
- test tube holder
- matchbox
- sugar

PRECAUTION

Handle flame carefully.

Take a pinch of sugar in a dry test tube.

Heat it for 2-3 minutes.

What do you observe?

Has any new substance been formed during the change?

Is the identity of the sugar lost during the change?

Now, cool the test tube.

Is it possible to get back the original sugar on cooling?

Is the change reversible or irreversible?

Is the change temporary or permanent?

B. Work in groups

You may need:

- copper sulphate solution
- beaker
- sodium hydroxide solution
- glass rod
- test tube
- dropper

PRECAUTION

Sodium hydroxide can burn skin. Copper sulphate can cause eye irritation. Handle them carefully.

Take 6-7 drops of copper sulphate solution in a clean dry test tube.

Add 2 drops of sodium hydroxide solution slowly from the side of the test tube.

Do You Know?

Bases should be disposed off carefully. It has to be diluted with enough water before disposing

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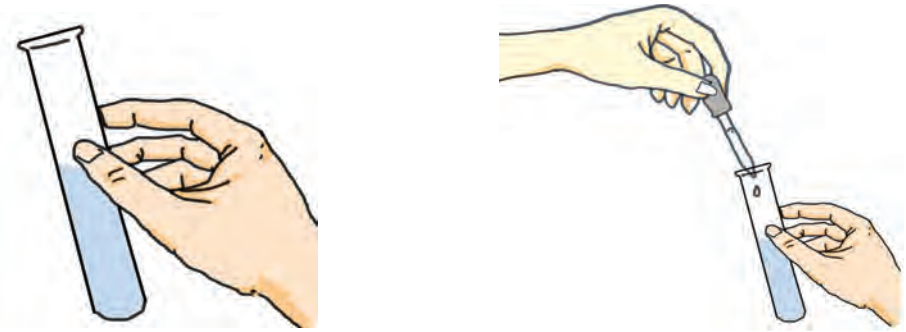

Figure 2.1. Adding sodium hydroxide solution.

What do you observe?

Has any new substance been formed when sodium hydroxide solution is added to copper sulphate solution?

Has the identity of the copper sulphate solution changed?

Is the change reversible or irreversible?

Is the change temporary or permanent?

The change in which new substances are formed and the identity of the original substance is lost is called **chemical change**.

C. Look at the set of pictures in Figure 2.2.

In which set of pictures has the match stick undergone a chemical change? Explain.

Figure 2.2. Match sticks.

Check Your Progress

i. Define chemical change.

ii. Classify the following examples into physical and chemical change. (Burning of paper, blowing balloon, growth of a tree, melting of butter, making curd, and combing hair.)

http://www.chem4kids.com/files/react_intro.html
http://www.kidsbiology.com/biology_basics/characteristics_life/characteristics_of_life_livining_things_4.php

2.2. Chemical Change in Living Things

Test Yourself

1. Define chemical change.
2. Write two examples of a chemical change.
3. What do living things need to stay alive?
4. Is ripening of an apple a permanent change?
5. Give two examples of permanent change in living things.

You already know:

- chemical change.

You will learn:

- chemical changes in living things.

A. There are a number of chemical changes that take place around us.

Many chemical changes occur in living things. Example, an unripe mango is sour, but on ripening, it becomes sweet.

Write some more examples of a chemical change that takes place in living things.

Look at Figure 2.3.

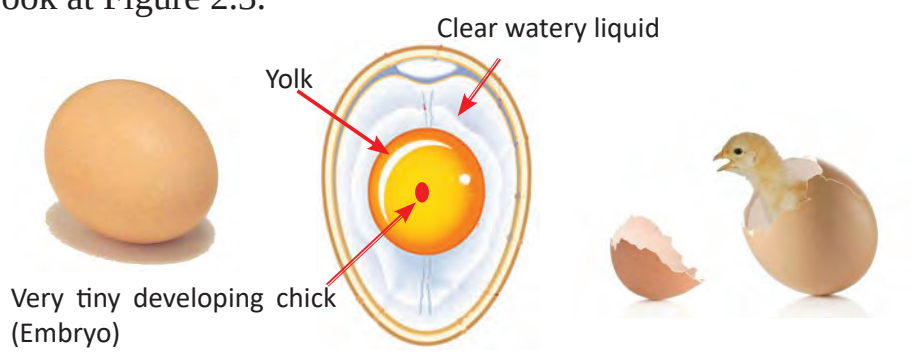

Figure 2.3. Hatching of an egg.

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For an egg to hatch into a chick, it undergoes many chemical changes.

Which part of an egg forms a chick?

Can the chick change back to an egg?

What type of change takes place during the development of a chick from an egg? Explain.

B. Read the passage given below.

Work in pairs

Plants are called autotrophs as they can prepare their own food by the process of photosynthesis.

$$\text{Carbon dioxide + Water} \xrightarrow[\text{Chlorophyll (Green pigment)}]{\text{Sunlight}} \text{Glucose + Oxygen}$$

The glucose produced is converted into starch and used for their growth. Plants are eaten by animals. The food animals eat are broken down into absorbable particles by the process of digestion. The absorbed food combines with oxygen to produce energy and carbon dioxide through the process of respiration. This energy helps animals to carry out life activities.

Discuss and identify the three important chemical changes given in the passage.

Why do you think that they are chemical changes?

Check Your Progress

i. Give five examples of a chemical change that takes place in living things.

ii. What would happen if chemical changes do not take place in living things?

2.3. Hard Water and Soft Water

Test Yourself

1. Write three uses of water.
2. Where does the water that we drink come from?
3. Is water a solute or a solvent?
4. Name three solids that dissolve in water.
5. Water which forms more lather with soap is called _____.

You already know:

- water is used for drinking and cooking.

You will learn:

- hard water.
- soft water.

A. Water is one of the most important natural resources. It supports all forms of life. Three-fourth of the Earth's surface is covered with water.

You might have noticed that the water from some places form lather easily with soap whereas that of other places do not form lather easily.

Find the meaning of the word 'lather' in the dictionary.

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Work in groups

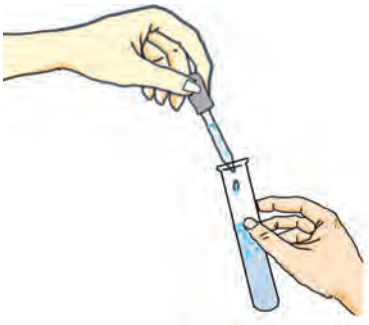


Figure 2.4. Adding soap solution.

You may need:

- test tube
- measuring cylinder
- dropper
- ruler
- stopwatch
- beaker
- soap solution
- water samples (rain water, tap water, boiled water, and mineral water)

Take 5 mL of tap water in a clean test tube.

Add 5 drops of soap solution into it.

Shake the test tube vigorously for 30 seconds.

Use a ruler to measure the height of the lather formed and record it in Table 2.1.

Repeat the same procedure for other samples of water.

Table 2.1 *Testing Water Sample*

Water Sample	Height of Lather in cm
Tap water	
River water	
…..	
……	

Use information from Table 2.1 and plot a graph in spreadsheet.

Which water sample forms the most lather?

Which water sample forms the least lather?

The water which does not form lather easily with soap is called **hard water**.

The water which forms lather easily with soap is called **soft water**.

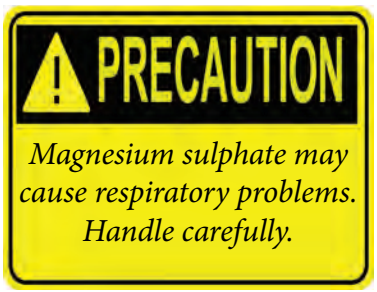
Identify the independent, dependent and controlled variables in the experiment.

How did you make this experiment a fair test?

B. The presence of soluble salts of calcium and magnesium in water makes it hard.

Carry out an experiment to show that hardness in water is due to the presence of magnesium salt.

Work in groups



You may need:

- tap water
- soap solution
- test tube
- dropper
- magnesium sulphate
- ruler
- measuring cylinder

Take two clean test tubes.

Label them A and B.

Add 5 mL of tap water in each test tube.

Add a small amount of magnesium sulphate using spatula to test tube A and shake it.

What do you observe?

Now add 5 drops of soap solution into each test tube.

Shake the test tubes vigorously for 30 seconds.

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Measure the height of lather formed in each test tube with a ruler.

Record it in Table 2.2.

Table 2.2 *Measuring the Height of Lather*

Test Tube	Height of Lather in cm
Test tube A	
Test tube B	

In which test tube, water forms more lather?

Adding magnesium sulphate to test tube A makes water hard. Is this a physical or a chemical change?

Identify the independent, dependent and controlled variables in the experiment.

How did you make your experiment a fair test?

Check Your Progress

i. What is hard water and soft water?

ii. Is rain water hard water or soft water? Explain.

http://chemistry.about.com/cs/howthingswork/a/aa082403a.htm
http://www.sciencefairadventure.com/Hard_vs_Soft_Water.aspx

2.4. Removal of Hardness of Water

Test Yourself

1. What type of water is good for washing clothes?
2. Why do we need to make water soft?
3. Will the boiled water form more lather with soap than tap water?
4. Does the taste of water remain same after boiling?
5. Which water tastes good, boiled or unboiled?

You already know:

- hard water.
- soft water.

You will learn:

- methods to remove hardness of water.

A. Work in groups

You may need:

- test tube
- test tube holder
- test tube rack
- spirit lamp
- matchbox
- ruler
- soap solution
- hard water

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Take two test tubes and label them A and B.

Take 5 mL of hard water in each test tube.

Boil the water in test tube A.

Let it cool for some time.

Add 5 drops of soap solution in both the test tubes.

Shake them vigorously.

Measure the height of lather in each test tube with a ruler.

Which test tube produces more lather?

Boiling hard water makes it soft. Explain whether it is a chemical or physical change.

Which is the control set-up used in the experiment?

B. Hardness of water can also be removed by distillation.

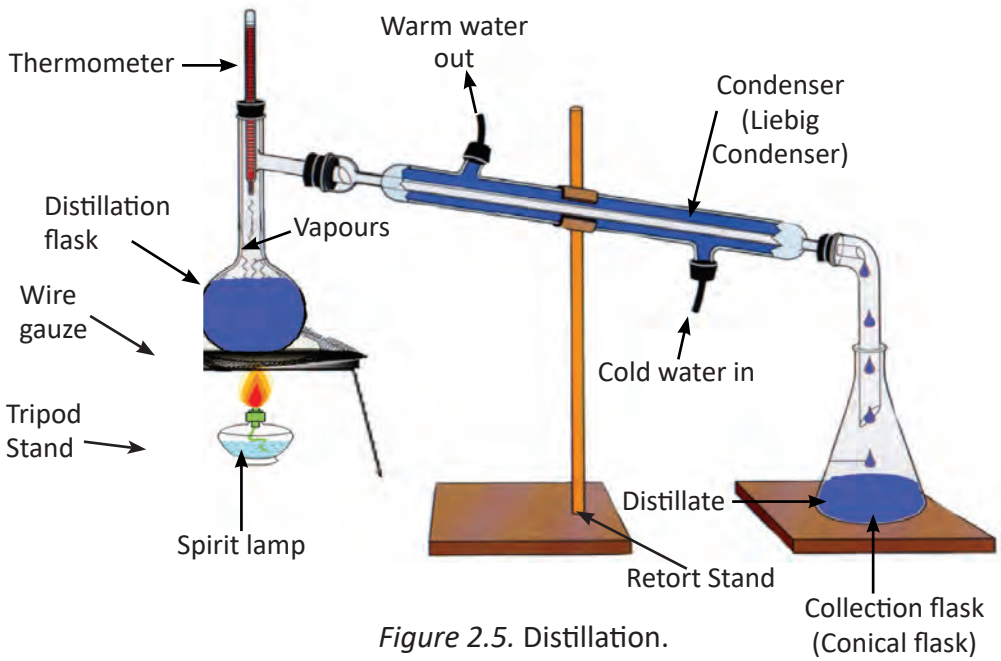

Figure 2.5. Distillation.

Distillation involves the conversion of a liquid into vapour and then condensing the vapour back into liquid by cooling it.

Your teacher will demonstrate this process.

What materials did your teacher use?

Write the procedure for removing the hardness of water by distillation.

What did you observe during teacher's demonstration?

Is distillation a chemical or a physical change? Give reason.

Collect the distilled water and carry out an investigation to find out distilled water forms more lather than tap water.

Write:

what you needed.

what you did.

what you observed.

Check Your Progress

i. Give two methods to remove hardness of water.

ii. Which method is suitable to remove hardness of water at home?

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2.5. Advantages and Disadvantages of Hard Water

Test Yourself

1. Have you seen dark scales deposited on the wall of a water boiler?
2. Can filtration remove hardness of water?
3. What makes hard water good for drinking?
4. Mention two minerals present in hard water.
5. Which mineral is good for the formation of bones and teeth?

You already know:

- hard water and soft water.
- removal of hardness in water.

You will learn:

- advantages and disadvantages of hard water.

A. Hard water generally contains dissolved mineral salts, mostly calcium and magnesium.

These minerals are useful for our body.

The dissolved minerals help in proper growth of teeth and bones. It also helps in preventing diseases.

Hard water also has certain disadvantages.

It is not suitable for most domestic and industrial purposes, because:

- it does not form lather easily, so there is wastage of soap while washing.
- it is not suitable for bathing since minerals react with soap

and cause skin irritation.

- it forms deposits of insoluble salts on the walls of water pipes and water boilers.

Why is soft water preferred over hard water for washing clothes?

B. Hard water is usually found in places where limestone and gypsum are present.

During rainfall, these minerals dissolve in water as it flows through them, thus forming hard water.

Work in group

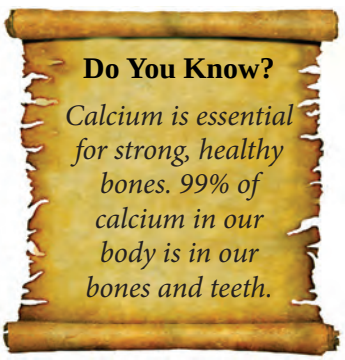
You may need:

- outline map of Bhutan

In the outline map of Bhutan, locate three places where hard water is found.

What are the difficulties faced by the people living in these areas while using hard water.

Share your findings to the class.



Check Your Progress

i. Write three advantages of hard water.

ii. Write three disadvantages of hard water.

http://www.absorblearning.com/chemistry/demo/units/LR1104.html#Theeffectsofhardwaterandhowitforms

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Think Again

1. Fill in the blanks.
   a. Dissolved _____ make water hard.
   b. During _____ change, new substances are formed.
   c. Distilled water is _____ water.
   d. Hardness of water can be removed by _____
   e. _____ water is good for the formation of bones and teeth.
2. What makes water hard?
3. Light brings many chemical changes. Can you think of any chemical change brought about by light?
4. Differentiate between physical change and chemical change.
5. Is cooking **emadatsi** a chemical change? Explain.
6. Places rich in limestone and gypsum have hard water. Why?

CHAPTER 3

Separating Mixture

3.1. Local Methods of Separation

Test Yourself

1. Name various methods of separation.
2. Name a solid-solid mixture that can be separated by sublimation.
3. What are the characteristics of the components in mixtures by which they are separated?
4. Name some methods of separation practised in your locality.
5. How is rice grain separated from its stalk?

You already know:

- hand-picking
- winnowing
- sieving

You will learn:

- local methods of separation .

A. You might have seen people separating different mixtures using different methods in your locality.

Example: Winnowing is a common method used for separating husk from grains.

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Figure 3.1 illustrates one of the local methods of separation called threshing.

Threshing is the process of beating the stalks to separate seeds or grains.

Give two examples of crops separated by threshing.

Figure 3.1. Threshing.

Look at the pictures in Figure 3.2.

(a) Pedal thresher

(b) Threshing with stick

(c) Threshing with a flail

Figure 3.2. Types of threshing.

Which type of threshing is commonly used in your locality?

B. Make a field trip to the nearest village from your school or ask your parents and neighbours to find out different methods of separation used by people.

Design and use a questionnaire to interview people.

Copy and complete Table 3.1.

Table 3.1 *Methods of Separation*

Method of Separation (in English)	Local Name of Separation	Things Separated

Present your report to the class and compare it with your friends.

Which method of separation is common in your locality?

Why should we practice the local methods of separation?

Check Your Progress

i. Name some of the local methods of separation which are not practised these days. Give reasons.

ii. What are the benefits of practicing local methods of separation?

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3.2. Mixture with Liquid

Test Yourself

1. What is solid-liquid mixture?
2. Name one solid-liquid mixture.
3. Name the methods to separate solid-solid mixture.
4. What will you observe when oil is poured in water?
5. What will happen to salt when it is added to water?

You already know:

- mixtures of solids and liquids.
- method to separate solid-solid mixtures.
- method to separate solid-liquid mixtures.

You will learn:

- solute, solvent and solution.
- miscible and immiscible liquid.

A. Some solids dissolve in liquids while others do not.

Solids which dissolve in liquids are called **solute**.

The liquid which dissolves the solute is called **solvent**.

The mixture of solute and solvent is called **solution**.

Work in groups

You may need:

- sugar
- water
- beaker
- spatula
- glass rod
- measuring cylinder

Add a spatula of sugar in 100 mL of water in a beaker.

Stir the mixture with a glass rod.

Name the solute used.

Name the solvent used.

What is this mixture called?

Why is water known as universal solvent?

B. The liquid that mixes completely with other liquids is called miscible liquid.

The liquid that does not mix completely with other liquids is called immiscible liquid.

Work in groups

You may need:

- beaker
- measuring cylinder
- coloured water
- mustard oil
- spirit

Take 20 mL of coloured water in a beaker.

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Pour the same amount of mustard oil in it.

Shake it well.

Keep it undisturbed for a few minutes and observe.

Do they mix completely?

What type of liquids are they?

Now, take 20 mL of coloured water in another beaker.

Pour the same amount of spirit on it.

Shake it well.

Keep it undisturbed for a few minutes and observe.

Do they mix completely?

What type of liquids are they?

Can spirit mix with mustard oil?

Prove it.

Check Your Progress

i. People do not use water to adulterate oil, while water is commonly used to adulterate milk. Give reasons.

ii. Differentiate between miscible and immiscible liquids.

3.3. Solids of Different Densities in Liquids

Test Yourself

1. Why does oil float in water?
2. Which of the following will float in water? Why?
   a. Wooden block.
   b. Stone.
   c. Iron nail.
3. In which liquid does an ice cube float, kerosene or water? Why?
4. Why does a piece of wood float more easily in salt solution than in water?

You already know:

- solids and liquids.
- particle arrangement in solids and liquids.

You will learn:

- floating and sinking of a solid in different liquids.

A. Solids and liquids are said to be dense if the particles inside them are closely packed.

Dense objects are usually heavy. Take a wooden block and a thermocol of the same size. Wooden block is heavier than thermocol though they are both solids. This is because in a wooden block, particles are closely packed than in the thermocol.

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Work in groups

You may need:

- wooden block
- stone
- water
- beaker

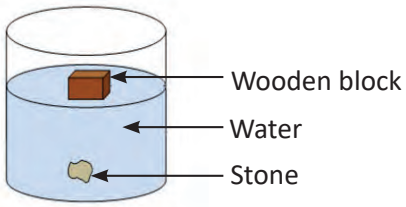

Figure 3.3. Floating and sinking.

Pour some water in a beaker.

Now, put the stone and the wooden block one by one in the water.

Observe and complete Table 3.2.

Table 3.2 *Observing Solids of Different Densities*

Object	Observation
Stone	
Wooden block	

Which is denser, the stone or the wooden block?

How can you make the wooden block sink in water?

Identify the dependent, independent and controlled variables in the experiment.

What conclusion can you draw from your experiment?

B. Like in solids, particles in some liquids are closely packed and in some, they are far apart.

Some objects float differently in different liquids depending on how dense the liquids are. Denser the liquid, more the objects float.

Work in groups

You may need:

- wooden block
- water
- kerosene
- alcohol
- salt solution
- beaker
- measuring cylinder

Design and carry out an experiment to find out whether the wooden block sinks or floats.

Write:

what you needed.

what you did.

what you observed.

what you concluded.

Identify the dependent, independent and controlled variables.

Check Your Progress

i. Solids are generally denser than liquids. Justify.

ii. Will mercury float in water? Why?

WEBLINK

http://web.lemoyne.edu/~giunta/chm151L/density.html

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3.4. Separating Soluble Solid

Test Yourself

1. What is a solution?
2. What is evaporation?
3. Give one example of solute and solvent.
4. Name one soluble solid.
5. How can you separate the soluble solids from a solution?

You already know:

- solute, solvent and solution.
- filtration.

You will learn:

- separating soluble solids by evaporation.

A. Sea water has salt dissolved in it.

To obtain salt, sea water is collected in shallow pits.

The heat of the Sun changes the water into vapours leaving behind the salt.

(a) Sea water.

(b) Sea water in shallow pits.

(c) Sun heat evaporates the water.

(d) Salt after purification.

Figure 3.4. Separating salt from sea water.

Name the process involved in obtaining salt from sea water.

Define the process that you have named.

B. You are provided with a mixture of salt and sand.

Design and carry out an experiment to separate salt from sand.

Write:

what you needed.

what you did.

what you observed.

Can we separate salt from salt solution by filtration? Give reason.

Check Your Progress

i. What would happen if evaporation does not take place in nature?

ii. Write two examples of mixture which can be separated by evaporation.

WEBLINK

http://www.nuffieldfoundation.org/practical-chemistry/separating-sand-and-salt

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3.5. Separating Immiscible Liquids

Test Yourself

1. What is miscible liquid?
2. What is immiscible liquid?
3. What is decantation?
4. How will you separate a mixture of oil and water?

You already know:

- separating soluble solids by evaporation.
- separating insoluble solids by filtration.

You will learn:

- separating immiscible liquids.

A. Work in groups

You may need:

- beaker
- measuring cylinder
- glass rod
- water
- oil

Pour 20 mL of water in a beaker.

Add 20 mL of oil into the water.

Allow it to stand for one minute.

What do you observe?

What kind of mixture is it?

Figure 3.5. Separating oil and water.

Now, observe the picture and try separating the mixture.

What is this process called?

B. Immiscible liquids are also separated by using a separating funnel.

Separating funnel is a glass apparatus which is fitted with a tap.

Work in groups

You may need:

- water
- oil
- separating funnel
- retort stand
- conical flask

Set up the apparatus as shown in Figure 3.6.

Make a mixture of oil and water.

Pour the mixture into the separating funnel and observe.

Which liquid forms the upper layer? Why?

Which liquid forms the lower layer? Why?

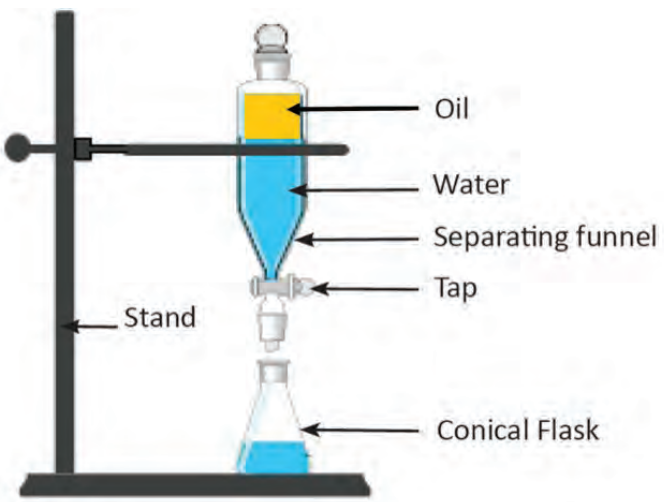

Figure 3.6. Separating immiscible liquids using separating funnel.

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Now, separate the oil from the water by opening the tap.

How do you separate the mixture of oil and water?

What precaution should you take while separating the mixture?

Check Your Progress

i. What type of mixtures can be separated by decantation?

ii. Why do we use a separating funnel instead of a filter funnel in separating immiscible liquids?

3.6. Separating Miscible Liquids

Test Yourself

1. What is condensation?
2. Name an apparatus used to separate immiscible liquids.
3. Name the process by which salt is obtained from sea water.
4. What will happen when you add water to milk?
5. How will you separate alcohol from water?

You already know:

- separating immiscible liquids.
- evaporation and condensation.

You will learn:

- separating miscible liquids.

A. Miscible liquids can be separated by the process of distillation. Distillation not only separates soluble solids mixed in a liquid but also separates miscible liquids of different boiling points. The boiling point of a liquid is the temperature at which it starts to boil. During distillation, the liquid with lower boiling point evaporates and condenses leaving behind the liquid with higher boiling point.

Distillation is the process used to obtain pure liquid from a mixture.

Your teacher will demonstrate the process of distillation.

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Draw a labelled diagram showing the process of distillation.

Explain the process of distillation.

Mention one use of distillation.

B. Observe Figure 3.7 and answer the questions that follow:

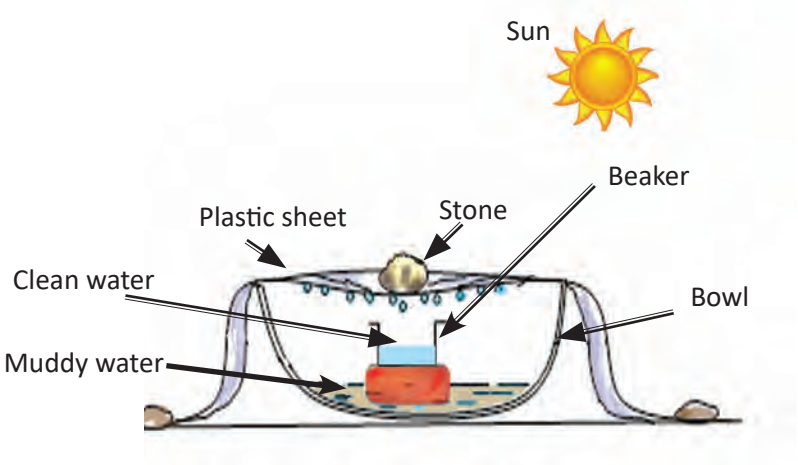

Figure 3.7. Purification of water.

What are the two processes that you observe in Figure 3.7?

What is collected in the beaker?

Which method of separation is indicated in the diagram?

Do You Know?

Distilled water is the purest form of water.

Check Your Progress

i. Describe the method to obtain clean water from muddy water.

ii. Is rain water distilled water? Justify.

WEBLINK

http://www.wiredchemist.com/chemistry/instructional/laboratory-tutorials/distillation

THINK AGAIN

1. Write TRUE or FALSE for the following statements.
   a. Alcohol and water can be separated by decantation.
   b. Common salt is obtained from the sea water by evaporation.
   c. A mixture of oil and water can be separated by using separating funnel.
   d. Threshing cannot be done with machine.
   e. Solution is a mixture of solute and solvent.
   f. Dense object floats in water.
2. You are provided with a mixture of water and sugar. Name an appropriate process which can be used to separate them without wasting any of them.
3. Why is it possible to separate mixture of two liquids with different boiling point by distillation?
4. Differentiate between a solute and a solvent. Give an example each.
5. Beaker A contains mixture of kerosene and water. Beaker B contains salt solution. What separation methods will you use to separate these mixtures?
   a. Kerosene and water
   b. Salt from water
6. Which is denser, 1 kg of water or 10 kg of water? Why?

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CHAPTER 4

Mass and Weight

4.1. Gravity

Test Yourself

1. What is force?
2. Give two examples of contact force.
3. Give two examples of non-contact force.
4. Why does a ball moving upward slow down and fall back?
5. What happens to the gravitational force, if mass of one of the bodies is larger?

You already know:

- contact and non-contact force.

You will learn:

- gravity.

A. The force with which the earth pulls everything towards its center is called earth's gravity.

Work in groups

You may need:

- stone
- eraser
- piece of paper
- textbook

Place a stone and an eraser on the edge of a textbook.

Lift it to a certain height.

Now, tilt the textbook to allow the stone and the eraser to fall.

Which object hits the ground first?

Repeat the process with a piece of paper and a stone.

Which object hits the ground first? Why?

The dense objects such as eraser, marble and stone dropped from the same height will hit the ground at the same time because the pull of the Earth is the same for all objects.

However, light objects like feathers or pieces of paper take longer time to reach the ground because they float in the air.

B. Work in groups

You may need:

- a pair of scissors
- ruler
- chart paper
- colour pens

Draw an outline of the ruler on a chart paper.

Divide it into six equal parts and colour each part differently.

Cut out the shape of the ruler.

Ask your friend to hold the paper strip hanging down just above your stretched hand as shown in Figure 4.1.

Choose a colour on the paper strip. Ask your friend to release the paper strip. Try to catch the

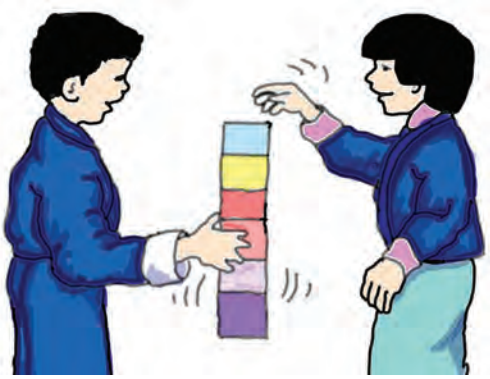

Figure 4.1. Catching the coloured paper strip.

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colour you have chosen on the paper strip. Try it a few times.

Can you catch the colour you have chosen every time?

Does the paper strip fall with same speed every time it is released?

What is pulling the paper strip?

C. Work in groups

You may need:

- ping pong ball
- flat stick

Hold the stick ready.

Ask a friend to drop the ball from a height.

Try to hit the ball before it hits the ground.

Try it a few more times.

Are you able to hit the ball each time?

Dis the ping pong ball fall with same speed every time it was released?

What was pulling the ping pong ball?

When an object is released (like the ping pong ball or a paper strip) from a height, it is difficult to catch or hit it due to the motion caused by the pull of the Earth on the objects. This pull of the Earth is called **gravitational force**.

Gravitational force holds the planets in its orbit around the Sun and also keeps the Moon in its orbit around the Earth.

Work in groups

You may need:

- computer
- internet connection

Play PhET simulation on gravity and orbit using the given URL and answer the questions.

https://www.google.com/url?q=https://phet.colorado.edu/sims/html/gravity-and-orbits/latest/gravity-and-orbitsenhtml&sa=D&ust=1579669023367000&usg=AFQjCNE1nu8aX_vHilgngIMdYWfYJdYcyg

What helps the heavenly bodies to stay in their orbit?

How does the mass of heavenly bodies affect the gravitational force?

What would happen to our earth without gravity?

Check Your Progress

i. Why do objects thrown in the air fall back to the ground?

ii. When a marble and a sharpener are dropped at the same time from the same height, which one will hit the ground first? Why?

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4.2. Relationship between Mass and Weight

Test Yourself

1. What helps the Earth to stay in its orbit?
2. Name the force that pulls objects towards the Earth.
3. Will your mass change if you move from one place to another which differs in altitude? Why?
4. Will our weight change if we move from one place to another which differs in altitude? Why?

You already know:

- gravitational force.

You will learn:

- relationship between mass and weight.

A. **Mass** is the quantity of substance contained in a body. It remains constant everywhere. It is measured by a beam balance. The standard unit of mass is kilogram (kg).

Weight is the gravitational force acting on mass of an object. The weight of an object is different at different altitudes. Weight of an object is slightly more at the sea level than at the mountain tops. Weight of the object is more when it is closer to the centre of the Earth. Weight is measured by a spring balance. Its unit is newton (N) or kilogram force (kgf). It is also measured in gram force (gf).

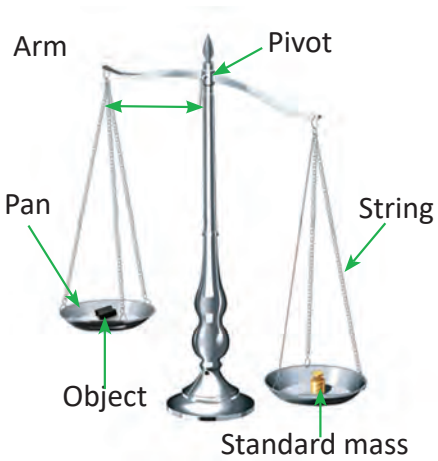

Figure 4.2 (a). Beam balance.

Figure 4.2 (b). Spring balance.

Work in pairs

Make your own beam balance.

Make sure your balance is fair.

Write about:

what you needed.

what you did.

how you made your balance fair.

Use your balance to measure the mass of an object using a standard mass.

Display your balance in the class.

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B. Work in groups

You may need:

- spring balance
- pebbles
- small paper bag

Hang a paper bag from a hook of a spring balance.

Put the pebbles in the paper bag and weigh it.

Copy Table 4.1 and record your observation.

Table 4.1 *Weighing Pebbles*

Number of pPebble	Predict Weight (in gf)	Actual Weight (in gf)
2		
4		
6		
8		
10		

Use spreadsheet to plot a graph with number of pebble versus actual weight from Table 4.1.

Identify the dependent, independent and controlled variables in the experiment.

What conclusion can you draw from the graph?

Draw a line graph using the information in Table 4.1.

Each pebble has its own mass. As the number of pebbles increases, the mass increases.

As mass increases with the number of pebbles, weight increases as well.

The relation between mass and weight of a body is given by:

Weight = Gravitational force

Weight = Mass × Acceleration due to gravity

Figure 4.3. Weighing using Spring balance.

Check Your Progress

i. What is mass?

ii. What is the relationship between mass and weight?

http://www.nyu.edu/pages/mathmol/textbook/weightvmass.html
http://sciencenetlinks.com/interactives/gravity.html

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4.3. Altitude and Gravity

Test Yourself

1. Which force pulls down the object thrown in the air?
2. Which has more weight:
   a. mass of 10 kg.
   b. mass of 20 kg.
3. What will happen to our weight if we travel from Phuentsholing to Gasa?

You already know:

- gravity is the pull of the Earth.
- altitude is the height of the place above the sea level.

You will learn:

- relationship between altitude and gravity.

A. The gravitational force differs from place to place of varying altitudes.

As we move higher from the sea level, the weight of a body decreases.

For example, your weight will be slightly less in Gasa than in Phuentsholing.

The gravitational force is more at the poles than at the equator. This is because the poles are nearer to the centre of the Earth due to oblate shape of the Earth.

Work in groups

Use the information from Table 4.2 to draw a bar graph between altitude and the value of acceleration due to gravity.

Table 4.2 *Change of Gravity with Altitude*

Place	Altitude (km)	Value of Gravity (m/s^2)
A	0	9.8
B	1000	7.3
C	2000	5.7
D	3000	4.5

What do you conclude from the graph?

The gravity of the Moon is less than the Earth's gravity. The gravitational force of the Earth is six times the gravitational force of the Moon, i.e.

Gravity of the Earth = 6 times the gravity of the Moon

Therefore, the weight of an object on the Moon will be $\frac{1}{6}$ times the weight of the object on the Earth. For example, an object which weighs 6 kgf on the Earth will weigh 1 kgf on the Moon.

Check Your Progress

i. The weight of a sack of potato in Gelephu is 50 kgf. Will the weight increase or decrease in Lingshi? Why?

ii. Why is the pull of gravity more at the poles than at the equator?

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Think Again

1. Write whether the following statements are true or false.
   a. The pull of the Earth is less than the pull of the Moon.
   b. Gravity increases with increase in altitude.
   c. The gravitational force acting on the mass of an object is called weight.
   d. Stone sinks in water as it is denser than water.
   e. The gravitational pull of the Earth is more at the equator than at the poles.
2. If you weigh 30 kgf on the Earth, how much will you weigh on the Moon?
3. Why does an object weigh more on the Earth than on the Moon?
4. The reading on a spring balance for same mass is not the same everywhere. Why?
5. The weight of a sack of potatoes is 100 kgf. What will be the mass of the sack of potatoes if gravitational force is 10 units.
6. What will happen if there is no gravitational pull of the Earth?

CHAPTER 5

Light and Sound

5.1. Reflection

Test Yourself

1. What is reflection?
2. Why do we use mirror?
3. In how many directions does light reflect from an even surface?
4. Your image seems to move backward as you move away from a mirror. Why?
5. Have you seen the word AMBULANCE written in reverse order? Why do you think it is written so?

You already know:

- reflection.

You will learn:

- formation of image.

A. When you stand in front of a mirror, you see yourself in the mirror. This is your image. The image that you see in the mirror is the reflection of yourself.

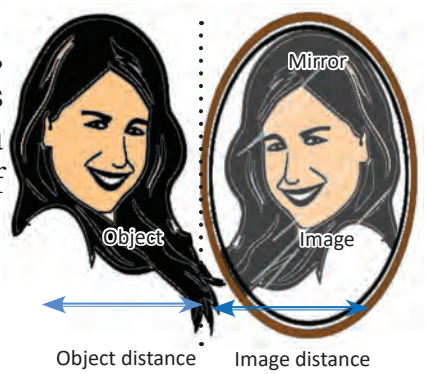

Figure 5.1. Formation of image.

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Work in pairs

You may need:

- mirror
- paper
- pen

Write your name on a sheet of paper.

Hold it in front of a mirror.

Write what you see in the mirror.

Copy the following words on the paper:

REFLECTION, BHUTAN, SCHOOL, WOW, POP

Predict and write the images of these words that you think you will see in the mirror.

Now, hold the paper in front of the mirror.

Compare the image you see with what you have predicted. Are they same?

Stand in front of the mirror.

Now, wave your right hand.

You will notice that your image waves its left hand.

In a mirror, the image formed is such that left hand side of the object is seen as the right hand side. This appearance of left side of an object as right side in the image is called **lateral inversion**.

B. Work in groups

You may need:

- grid paper
- pencil
- ruler
- mirror

Draw a horizontal line in the middle of a grid paper.

Place the mirror on the line.

Place your pencil four squares in front of the mirror.

Where is the image of the formed pencil in the mirror?

Next, place the pencil in another position on the grid and check the location of the image again.

Repeat the above steps changing the position of the pencil on the grid.

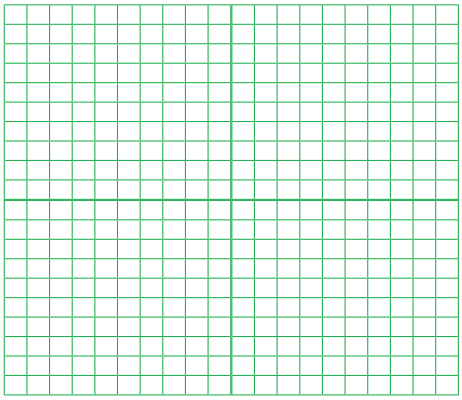

Figure 5.2. Grid paper.

Find the relationship between the object distance and the image distance.

Check Your Progress

i. A tree, a candle, and a toy car were kept in front of a mirror. Dema looked at them and drew the diagram as shown in Figure 5.3. What is wrong with the diagram? Draw the correct diagram.

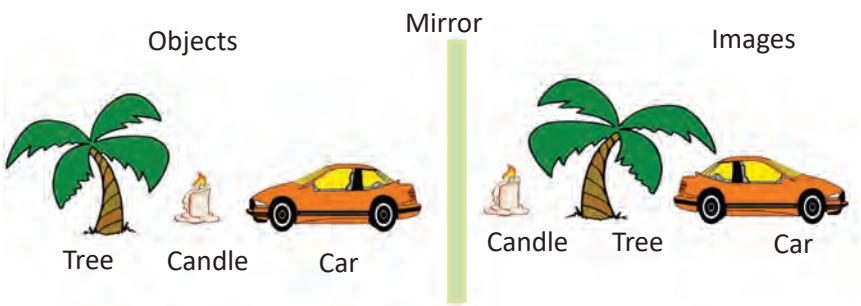

Figure 5.3

ii. What is lateral inversion?

iii. State three characteristics of the image of an object formed by the plane mirror.

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5.2. Light through Different Media

Test Yourself

1. What is lateral inversion?
2. How is an image formed in a mirror?
3. Does light pass through a glass of water? Why?
4. We cannot see through the classroom wall. Why?

You already know:

- reflection of light.

You will learn:

- light travel through different media.

A. Why do you think window panes are made of glass?

What would happen if the wind shield of a car is made of wood?

Work in groups

You may need:

- beaker
- water
- milk
- torch
- book

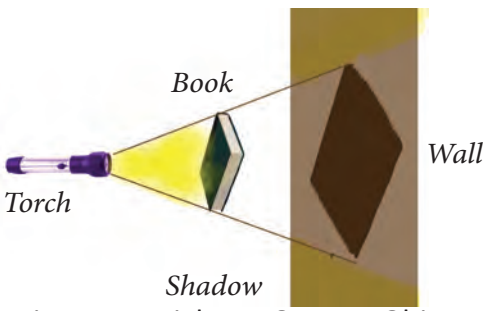

Figure 5.4. Light on Opaque Object.

Switch on the torch.

Hold the book in the path of the light. Ask your friend to observe from the other side.

Can your friend see the light from the other side of the book?

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Place a beaker of water in the path of the light as shown in Figure 5.5.

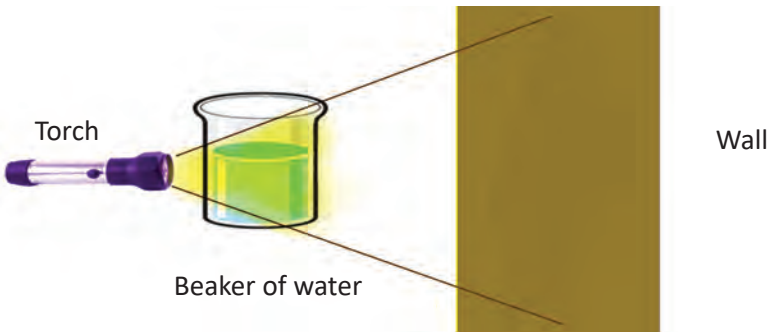

Figure 5.5. Light through a transparent object.

Can you see the light from the other side of the beaker with water?

An object which does not allow light to pass through is called **opaque object.**

Behind an opaque object, a shadow is formed.

Give an example of an opaque object.

An object which allows most of the light to pass through is called **transparent object**.

Give an example of a transparent object.

Next, add some milk in the beaker of water.

Ask your friend to observe from the other side of the beaker containing mixture of water and milk.

Can your friend see the light from the other side?

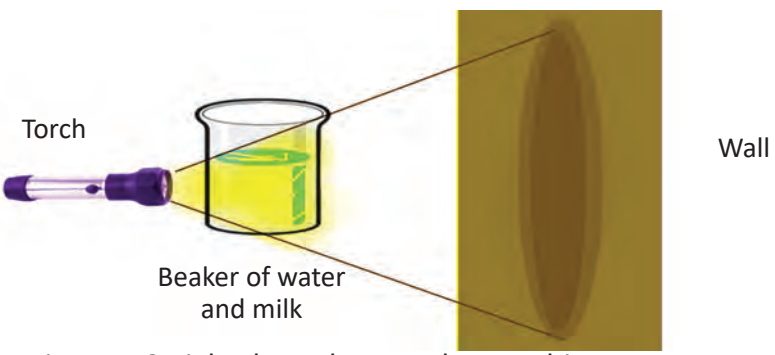

Figure 5.6. Light through a translucent object.

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Is there a difference in the brightness of the light after the addition of the milk?

An object which allows some light to pass through it is called a **translucent object**.

Give an example of a translucent object.

The object through which light travels is called medium. A medium can be transparent or translucent. Air, glass, and water are examples of media.

B. Look in and around your house. Identify ten different materials and categorise them in Table 5.1.

Table 5.1 *Categorisation of Objects*

Transparent Object	Translucent Object	Opaque Object

Share your work in your class.

Write one characteristic of an opaque object.

Write one characteristic of a transparent object.

Write one characteristic of a translucent object.

One aspect of green building design is to save energy. How do you think the use of transparent CGI sheet will help to save energy?

Check Your Progress

i. Why are window panes in toilet usually made of frosted glass?

ii. If you have to build a greenhouse, which material would you use? Why?

5.3. Bending of Light

Test Yourself

1. What is an opaque object?
2. Give two examples of transparent materials.
3. Name two translucent materials.
4. How does your leg look like in water?
5. Name some media through which light travels.

You already know:

- light travels through different media.

You will learn:

- refraction of light.

A. Light can pass from one transparent medium to another. When light passes from one transparent medium to another, it changes its direction slightly or bends. These bends of light is called **refraction.** For example, when light passes from air to water, there is refraction of light.

Work in groups

You may need:

- beaker
- pencil
- water
- coin
- cup

Take a beaker of water.

Slant a pencil in the beaker of water.

Figure 5.7. Pencil in water.

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Observe the pencil from the sides and also from the top of the beaker.

Draw and show how the pencil looks from these positions.

Now, place a coin in an empty cup.

Move back until you do not see the coin.

Ask your friend to pour water slowly into the cup.

Can you see the coin?

In the above experiments, the pencil looks bent and the coin appears to rise up due to the refraction of light.

Check Your Progress

i. Define refraction.

ii. A clear river looks shallower than its actual depth. Give reason.

http://www.neok12.com/php/watch.php?v=zX0a6a7b01014b4e727a7f7b&t=Light-Optics
http://riddles.com/all-kinds-of-riddles/riddles/lateral-inversion-000000009961/
http://learningideasgradesk-8.blogspot.com/2011/02/transparent-translucent-and-opaque.html

5.4. How Sound Travel

Test Yourself

1. How is sound produced?
2. What produces sound in a guitar?
3. What produces sound in a flute?
4. How does the sound travel when your teacher speaks in the class?
5. Can sound travel through water?

You already know:

- vibration produces sound.

You will learn:

- sound travels through different media.

A. Sound needs a medium to travel. It cannot travel through vacuum. Vacuum is an empty space. Vacuum does not contain any medium. Even air is not present in vacuum.

Work in pairs

Place your ear on one end of the table.

Ask your partner to tap gently at the other end.

Change roles and repeat the above steps.

Can you hear the sound?

How did sound reach your ear?

In this experiment, sound is travelling

Figure 5.8. Sound through solid.

Reprint 2024

through the table, which is a solid.

B. Work in groups

You may need:

- bucket of water
- rubber pipe
- metal spoon
- funnel

PRECAUTION

Tapping the table hard may damage your ears.

Take a bucket of water.

Fit the funnels at both ends of a rubber pipe. (This set-up can be reused to conduct activity B.)

Immerse one end of the rubber pipe in the water.

Hold two spoons in the water as shown in Figure 5.9 and clink them together.

Take turns and listen carefully at the other end of the rubber pipe.

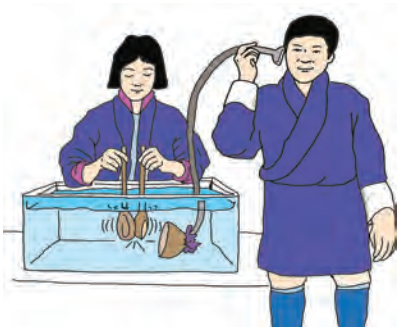

Figure 5.9. Sound through liquid.

Can you hear the sound?

How does sound travel in this experiment?

In this experiment, the sound is travelling through water which is a liquid.

C. Use the same pipe with the funnel from activity B.

Place one funnel over your ear.

Ask your friend to whisper through the other funnel.

Take turns and listen carefully from the other end.

Can you hear the sound?

PRECAUTION

Shouting or screaming close to ears, may damage your ears.

Reprint 2024

How does the sound travel in this experiment?

In this experiment, sound is travelling through the air.

Work in pairs

Design and make a telephone.

Write:

what you needed.

what you did.

Go outside and use your telephone.

Take turns to talk on ‘sound travelling through different media’.

How does sound travel in your telephone?

How can you make your telephone sound clearer?

Check Your Progress

i. Name various media through which sound travels.

ii. Write one difference between the way light and sound travel.

http://www.knowitall.org/nasa/flash/sound/how_sound_travels.swf

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5.5. Pitch and Volume

Test Yourself

1. What is a vacuum?
2. Does every object make same kind of sound?
3. Give an example of sound travelling through air.
4. Why do we use speakers during the school function?
5. When a cat meows and a dog barks, are the sounds same?

You already know:

- different sound notes.

You will learn:

- pitch and volume.

A. We live in a world filled with sounds.

The sound of a whistle is different from the sound of a drum. A whistle produces a shrill sound compared to the sound produced by a drum. The shrillness of the sound is called **pitch**.

We hear sound from different sources with low or high pitch.

Work in pairs

Using the list below, discuss and complete Table 5.2.

- Child whispering
- Dog growling
- Breathing

- Whistling
- Footsteps
- Baby crying
- Birds chirping
- Starting of a vehicle engine
- Cock crowing
- Bell ringing
- Pig grunting

Table 5.2 *Categorisation of Sound*

High Pitch Sound	Low Pitch Sound

B. Radios and televisions have a volume button that lets you control and play the sounds loudly or softly. A police siren makes a loud sound. Whispering makes a soft sound. Whether a sound is loud or soft, it depends on the force or power of the sound. Powerful sound travels farther than a weak sound. To talk to a friend across the street, you have to shout and send out a powerful sound. Your friend may not hear if you whisper.

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Work in groups

You may need:

- containers of different size
- stick

Place three containers upside down on a table.

Hit each container with the stick.

Which container produces the loudest sound?

Which container produces the faintest sound?

Which container would you prefer to use during a march-past? Give a reason.

C. Work in pairs

You may need:

- rubber cord
- nail

Your teacher will provide you a short piece of rubber cord. Design an experiment to demonstrate the production of high-pitched sound and low-pitched sound.

Write:

what you did.

what you observed.

Draw the diagram of your experiment.

Check Your Progress

i. Nima is whispering to her friend and Dawa is singing. Which sound is louder?

ii. Tshewang is talking to her friend and Dema is screaming at her dog. Which sound has higher pitch?

THINK AGAIN

1. Write the correct word from the jumbled letters given in the bracket.
   a. An object that does not allow light to pass through it. [Q U E P A O] _____
   b. Bending of light. [T R F E I N C O R A] _____
   c. An object which allows only a part of light to pass through it. [R N L C T E A S U N T] _____
   d. Sound cannot travel through. [M U C A U V] _____
   e. What you see in the mirror. [M G I E A] _____
2. In which medium, is sound heard louder? Why?
3. Giant explosions often occur on the Sun's surface. Why can't we hear any of any of those explosions?
4. Do all the strings in guitar produce the same sound? Give reason.
5. Are all transparent objects made from the same material? Give examples.
6. Transparent objects do not cast shadow. Why?

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CHAPTER 6

Electricity and Magnetism

6.1. Connection in Parallel

Test Yourself

1. What is a switch?
2. What is a series circuit?
3. Calculate the voltage supply if three cells of 1.5 V each are connected in series.
4. Have you seen two switches for one bulb?

You already know:

- series circuit.

You will learn:

- parallel circuit.

A. **Parallel circuit** is an electric circuit where there is a source of electricity, connecting wires and more than one electrical appliance such as bulb. In this circuit, the bulbs are connected parallel to each other.

Work in groups

You may need:

- dry cell
- torch bulbs
- wire

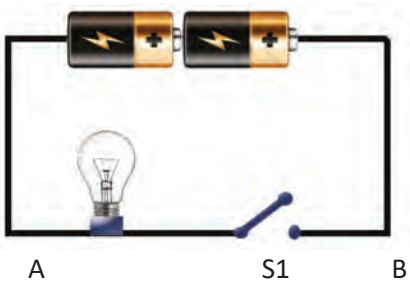

Figure 6.1. Electric circuit.

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- switch
- battery box
- bulb holder

Make a circuit as shown in Figure 6.1.

Turn on the switch S1.

Observe the brightness of the bulb.

Now, turn off the switch S1.

Break the circuit at point A and B.

Add one more bulb and switch S2 as shown in Figure 6.2.

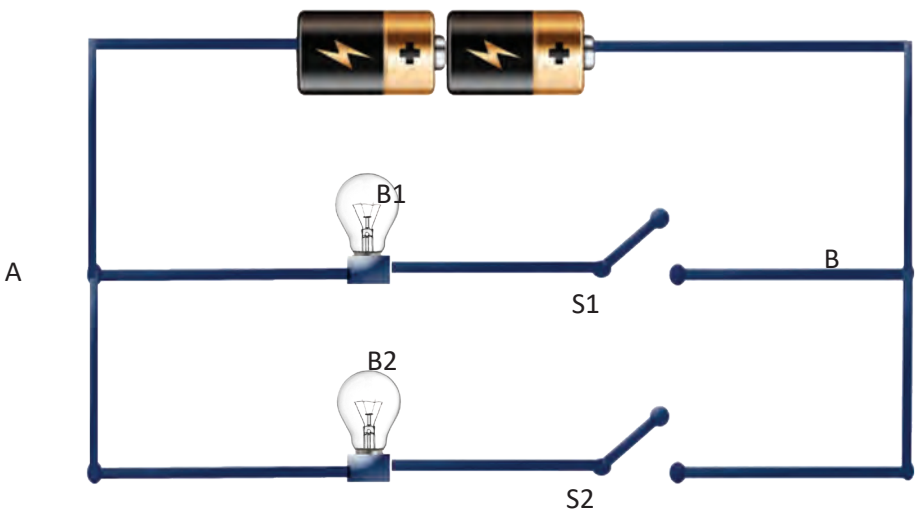

Figure 6.2. Parallel circuit.

Turn on the switches S1 and S2.

Observe the brightness of both the bulbs.

What difference do you observe in the brightness?

What happens to the brightness of the bulb B2 when you turn off switch S1?

What happens to the brightness of the bulb B2 when you turn off switch S2?

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A parallel circuit is the circuit in which, the current after leaving one end of the battery has an option to take two or more paths to flow in and eventually return to the other end of the battery. In parallel circuit, bulbs receive equal voltage from the battery. Therefore, bulbs glow with equal brightness. Other electrical appliances can also be connected in parallel.

Add one more bulb and switch in parallel to previous bulbs and switches.

Observe the brightness of all the three bulbs.

Do all the bulbs glow with the equal brightness? Give a reason.

What happens if one of the bulbs is removed from the circuit? Why?

Draw all the three circuit diagrams in your notebook.

B. Work individually.

Name the circuits given in Figure 6.3 (a) and (b).

(a) (b)

Figure 6.3. Identifying circuits.

Complete Table 6.1 by comparing the circuits in Figure 6.3 (a) and (b).

Table 6.1 *Identifying Circuits*

Statement	Series/ Parallel
Bulbs glow with equal brightness.	
Bulbs glow with unequal brightness.	
Bulbs receive equal electrical voltage.	
Bulbs receive unequal electrical voltage.	
In the absence of one bulb, the other bulb glows.	
In the absence of one bulb, the other bulb does not glow.	

Check Your Progress

i. What is the difference between a parallel connection and a series connection?

ii. Which circuit will be useful for your classroom? Why?

http://www.physicsclassroom.com/class/circuits/u9l4b.cfm
http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc

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6.2. Circuit at Home

Test Yourself

1. What is a parallel circuit?
2. Why do bulbs glow with equal brightness in a parallel connection?
3. What kind of circuit connection does a house normally have?
4. Why is it dangerous to play with electrical circuit at home?

You already know:

- series circuit and parallel circuit.
- voltage.

You will learn:

- circuit at home.

A. Electrical appliances can be turned on or turned off using switches.

Usually a single switch turns on and off all the electrical appliances connected in series. Each appliance in parallel circuit is provided with an individual switch. The circuit at home is the combination of series circuits and parallel circuits.

At home, look at the electrical circuits under adult supervision.

Select any two switches in your home.

Turn on and turn off the switches.

What kind of circuit is it? Why?

Appliances such as water boiler, room heater, and rice cooker that require more voltage are always connected in parallel. Too many electrical appliances should not be connected to a single electrical point. Many electrical appliances connected to a single point may heat and melt the wire and cause fire hazard.

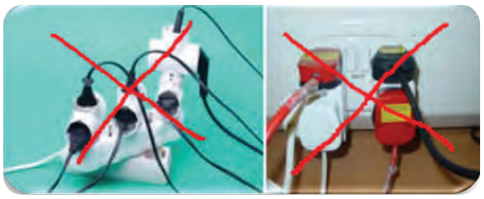

Figure 6.4. Improper use of electrical power point.

Figure 6.5. Proper use of electrical power point.

How can you make the connection safe?

B. Work in groups

You may need:

- chart paper
- coloured pens
- metre ruler

Draw a diagram of electrical connection of a room at home showing the light, sockets, and switches.

Display your work in your classroom.

Check Your Progress

i. Sometimes you observe that light bulb at home glows very dim. Why do you think it happens?

ii. Which type of circuit do you prefer to have in your house? Give reasons.

WEBLINK

http://www.physicsclassroom.com/class/circuits/u9l4b.cfm
http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc

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6.3. Types of Magnet

Test Yourself

1. What is the shape of a bar magnet?
2. What are like poles and unlike poles of the magnets?
3. What types of magnet have you seen?

You already know:

- shape of a bar magnet is rectangular.

You will learn:

- temporary and permanent magnets.
- different shapes of magnet.
- magnets are used in various appliances.

A. There are two types of magnets that we use. They are permanent and temporary magnets.

Permanent magnets are those magnets which keep their magnetic strength for long time. Strength of these magnets cannot be increased further.

It can lose its magnetic power if we handle it roughly or heat it.

Most of the magnets we use in experiments are permanent magnets. A bar magnet is an example of permanent magnet.

Temporary magnets are those magnets whose magnetic strength is temporary.

An example of a temporary magnet is an electromagnet. Electromagnet is made by passing current through a coil wound round the magnetic materials. A magnetic substance is easily attracted by a magnet or can be easily magnetised. Iron and steel

are the examples of a magnetic materials.

Work in groups

You may need:

- insulated copper wire
- nail
- dry cells
- pins

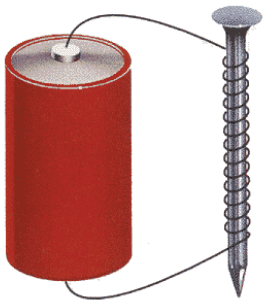


Figure 6.6. Making an electromagnet.

Take a wire and wind it round a nail.

Connect the two ends of the wire to the battery as shown in Figure 6.6.

Keep the set-up for about 30 seconds.

Take the nail closer to the pins.

What do you observe?

Does the current flow? Why?

Why are the pins attracted to the nail?

Break the circuit and take the nail closer to the pins.

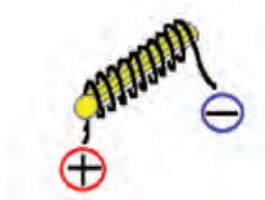
What do you observe?

Does the current flow? Why?

Why are the pins not attracted to the nail?

Why is this type of magnet known as electromagnet?

B. Magnets are of different shapes. Figure 6.7 shows magnets of different shapes. They are used according to the shapes and sizes required in appliances.



(a) Electro cylindrical magnet

(b) Bar magnet

(c) Horseshoe magnet

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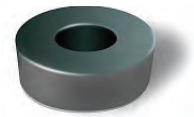
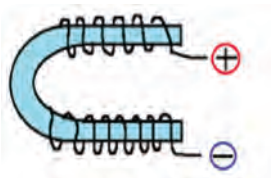
(d) Ball ended magnet



(e) Ring magnet

(f) Cylindrical magnet

(g) Magnetic needle



(h) Horseshoe electromagnet

(i) Spherical magnet

Figure 6.7. Magnets of different shapes.

Which magnets have you used in your experiments so far?

Where do we use an electromagnet?

Check Your Progress

i. What are the two types of magnet?

ii. Why are magnets designed in different shapes and sizes?

6.4. Strength of Magnet

Test Yourself

1. What is a permanent magnet?
2. What is a temporary magnet?
3. What is an electromagnet?
4. How can you make a magnet stronger?
5. How can we test the strength of a magnet?

You already know:

- different types of magnet.

You will learn:

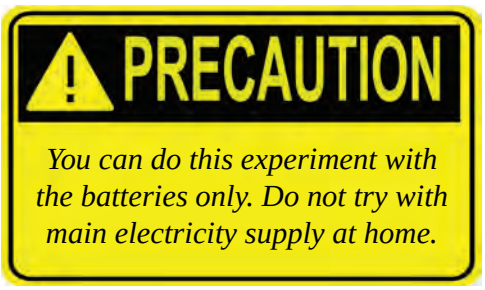
- strength of magnet.

A. The stronger magnet has the greater power of attraction.

Work in groups

You may need:

- long wire
- nail
- dry cell
- pins



Make an electromagnet.

Increase the number of cells.

Record the number of pins attracted by the nail each time in Table 6.2.

Keep the number of turns of the coil same throughout the experiment.

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Table 6.2 *Number of Cells and strength of Electromagnet*

Number of Cell	Number of Pins Attracted
1	
2	
3	

What happens to the number of pins attracted while the number of cells is increasing? Why?

What happens to the voltage in the circuit when the number of cells increases?

Keep the number of cells same.

Increase the number of turns on the nail.

Record the number of pins attracted by the nail each time in Table 6.3.

Table 6.3 *Number of Turns and Strength of Electromagnet*

Number of Turns in Wire	Number of Pins Attracted by the Magnet
20	
30	
40	

What happens to the number of the pins attracted while increasing the number of turns? Why?

How do you increase the strength of an electromagnet?

B. Work in groups

You may need:

- bar magnets of different shape
- sheets of paper
- paper pin

Label the magnets A, B, and C.

Put the paper pin beneath a sheet of paper.

Try to pick up the pin with the magnet A.

Repeat with magnets B and C.

Increase the number of sheets.

Now, pick up the pin with magnet A, B and C in turns.

Repeat the steps.

Copy and complete Table 6.4.

Table 6.4 *Number of Sheet of Paper and Strength of Magnet*

Number of Paper Sheet	Pin Attracted by		
	Magnet A [yes/ no]	Magnet B [yes/ no]	Magnet C [yes/ no]
2			
4			
6			
8			

Which magnet is the weakest? Why?

Which magnet is the strongest? Why?

Are there any magnets of equal strength? Why?

Check Your Progress

i. What happens to the strength of an electromagnet if the number of turns decreases?

ii. How is the strength of an electromagnet different from a permanent magnet?

http://www.kidsgen.com/school_projects/magnets.htm

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6.5. Magnetic Lines of Force

Test Yourself

1. How many poles does a magnet have?
2. Name the poles of a magnet.
3. Which pole of the magnet points towards the geographical North of the Earth when suspended?
4. Which parts of a magnet will attract the maximum number of pins?

You already know:

- poles of a magnet.

You will learn:

- magnetic lines of force.

A. The region where the magnetic effects can be felt is called **magnetic field**. Although we cannot see this field, we can represent it by a set of lines called **magnetic lines of force**. Magnetic lines of force always run from North Pole to South Pole.

Work in groups

You may need:

- bar magnet
- iron filings
- rubber gloves

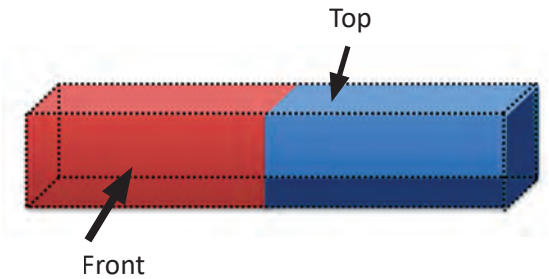

Figure 6.8. Magnet.

Label the four faces of a bar magnet as A, B, C, and D.

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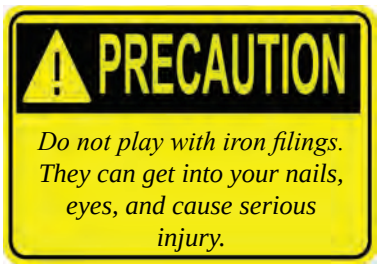
Place the magnet on the table with face A facing up.

Place a sheet of paper on top of face A.

Use the rubber gloves to sprinkle iron filings on the paper.

Tap gently on the paper to get a clear observation as shown in Figure 6.9.

Figure 6.9. Magnetic lines of force.



What happens to the iron filings?

Draw the representation of the magnetic lines of force from your observation.

Repeat the process for the other three faces (B, C and D) and draw the magnetic lines of force for each case.

What can you say about the magnetic lines of force?

They are all similar because magnetic lines of force run over all the faces of a magnet.

Check Your Progress

i. What is the direction of magnetic lines of force in a bar magnet?

ii. What is a magnetic field?

iii. Why should you use rubber gloves to sprinkle iron filings?

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THINK AGAIN

1. Write True or False against each sentence.
    i. We can see the magnetic lines of force.
    ii. The brightness of a bulb will decrease in parallel circuit.
    iii. The strength of an electromagnet increases with increasing voltage.
    iv. Electromagnets are permanent magnets.
    v. Magnetic lines of force always run from South Pole to North Pole.
2. State the advantages of permanent magnet.
3. Look at Figure 6.10 and answer the questions.

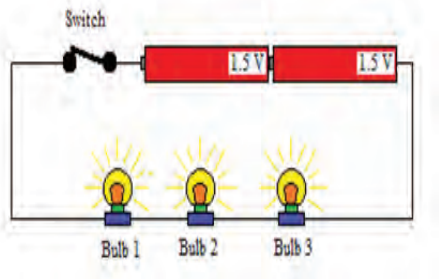

Figure 6.10.

    i. Which bulb will glow the brightest? Why?
    ii. What will happen to the other bulbs if bulb 1 is not working?
4. What is the total voltage flowing in the above circuit?
5. Draw the magnetic lines of a horseshoe magnet.
6. Which part of a bar magnet has closer lines of force? Why?

7. Redraw the circuit in Figure 6.11 by connecting two more bulbs in parallel to the given bulb in the diagram.

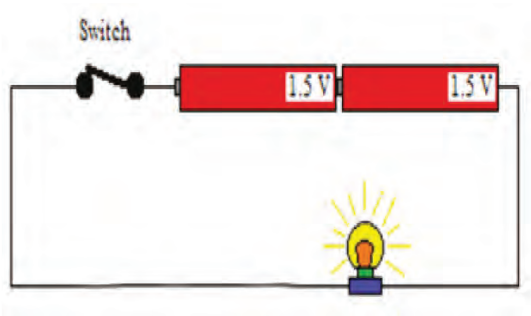

Figure 6.11.

8. Observe Figure 6.12 and answer the questions

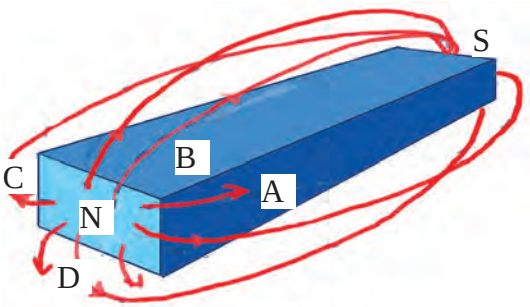

Figure 6.12.

a. What is the direction of magnetic lines of force?
b. Magnetic lines of force are more concentrated at the poles. Why?

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CHAPTER 7

Living Things and their Environment

7.1. Humans and Animals Affect the Habitat

Test Yourself

1. Does a farmer working in a field destroy habitats? How?
2. Name the animals whose habitats are destroyed by farmers.
3. How can we protect habitats?
4. What are the different ways in which humans destroy habitats?

You already know:

- threats to habitat.
- protecting habitat.

You will learn:

- humans and animals affect habitat.

A. Land, forest, river, and rock are some of the habitats of organisms. People extract a lot of resources from these habitats for various purposes.

Work in groups

Carry out a survey and find out how people in your locality make

use of the natural resources from the habitats as listed in Table 7.1.

Table 7.1 *Habitats used by Human*

Habitat	Use
Land	
Sand	
Rock or stone	
Forest	
River	
Pond	

Which habitat is mostly used in your locality?

What will happen to the habitat if the resources are overused?

B. Habitats can also be affected by both domestic and wild animals. Study the effect of waste in Figure 7.1.

Figure 7.1. Effects of waste on habitat.

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What are the types of waste found at your home?

How do you manage them?

What would happen if waste is not properly managed in your community?

C. Overgrazing by cattle can cause destruction of young plants and branches of trees which affect the habitat of other animals and plants.

Choose one domestic animal and one wild animal. Explain how these animals affect habitats.

Suggest ways to minimise the habitat destruction by the animals.

D. Changes brought by humans and animals to the habitats are at times beneficial. Following are some of the changes brought about by humans that have positive impact on habitats.

Figure 7.2. Beneficial changes brought by human on habitat.

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Check Your Progress

i. How do afforestation and reforestation help plants and animals?

ii. Suggest ways to reduce overgrazing in the forest.

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7.2. How Plant Adapt to Specific Habitat

Test Yourself

1. As a student, how can you protect habitat?
2. How is food chain affected when you destroy habitat?
3. Name the activities which will change habitat.
4. Can you grow a rose plant in water? Why?
5. Trees found in southern region of our country normally have broad leaves. Give reasons.

You already know:

- humans and other animals affect habitat.

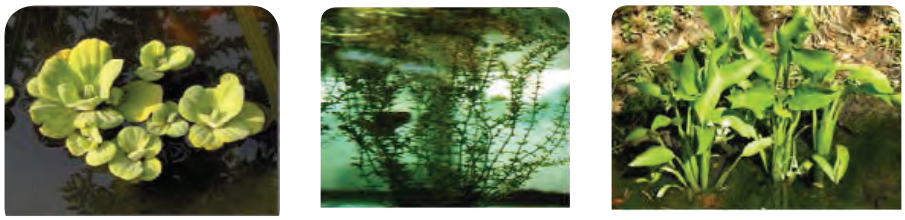
You will learn:

- specific plant habitat.

A. The following are different types of plant.

Mesophytes: They are plants which are adapted to grow in average supply of water. They usually have broad flattened leaves. Example, rose, ferns, apple, oak, mango, etc.

Hydrophytes: They are plants which are adapted to grow in water body. These plants are found floating or submerged in water. They have flat leaves with air space for floatation. They are also called aquatic plants.



(a) *Pistia* (floating) (b) *Hydrilla* (floating) (c) *Sagittaria* (Partially submerged)

Figure 7.3. Hydrophytes.

Xerophytes: They are plants which are adapted to grow in dry conditions. They have smaller leaves and fewer branches. In some xerophytes, like cactus, the leaves are modified into spines to reduce the loss of water.

(a) *Acacia* (b) *Prosopis* (c) *Solanum* (d) Cactus

Figure 7.4. Xerophytes.

Epiphytes: They are plants that grow on another plant but do not depend on it for their nutrition. Since epiphytes lack normal root structure, they have developed other special features for their nutrition. Some have aerial roots to absorb moisture and nutrients while others absorb water and nutrients from the base of their overlapping leaves. Epiphytes get access to light since they grow on other plants. Example, orchids, lichens, liverworts, etc.

Lithophytes: They are plants growing on rocks. Their roots grow in between the cracks of rocks for support, in search of moisture, and food. Example, mosses, algae, ferns.

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Work in groups

Copy Table 7.2. Identify plants under different groups in your school campus with the help of your teacher.

Table 7.2 *Classifying Plants*

Name of the plant	Plant Group					Adaptive Characteristics
	Mesophyte	Hydrophyte	Xerophyte	Epiphyte	Lithophyte	

Which group of plant is most common in your school?

What are the special characteristics of each plant group?

B. Making herbarium.

Work in groups.

You may need:

- duplicating paper
- wooden planks
- mesophyte
- hydrophyte
- xerophyte
- lithophyte
- epiphyte

Collect small plants with stem, leaves and flowers belonging to all five groups.

Note down the name, plant group, adaptive characteristics, date and place of collection of each plant.

Spread each plant on a duplicating paper. Make sure the parts do not overlap.

Cover the plant with another duplicating paper.

Press it between the wooden planks (plant press).

Change the paper every day till the plant becomes dry.

Paste the dry plant on a chart paper with glue.

Make a herbarium label as shown in Figure 7.5.

Display them in the class room.

Why should we press plants between duplicating paper while making a herbarium?

What is the importance of maintaining a herbarium?

Name:

Date of collection:

Place of collection:

Plant group:

Adaptive characteristics:

Figure 7.5. Herbarium.

C. Carry out a class project.

Collect some hydrophytes, mesophytes, epiphytes, lithophytes and xerophytes. Grow them in your school campus and nurture them.

Check Your Progress

i. Some xerophytes have spines instead of leaves. Why do you think so?

ii. Why is the stem of hydrophytes spongy?

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7.3. How Animal Adapt to Specific Habitat

Test Yourself

1. How do plants growing in water survive?
2. What do you mean by special characteristic of an organism?
3. How can you protect plants growing in your school campus?
4. Describe the places where takin and elephant live.
5. Can an elephant live in cold places? Why?

You already know:

- adaptation in plant.

You will learn:

- specific animal habitat.
- adaptive characteristic of animal.

A. Animals live in various habitats. Animals live on land, in water or on trees. Some live in cold places while others live in hot places.

Work in groups

Name the animals based on their habitat and write their adaptive characteristics in Table 7.3.

Table 7.3 *Animal Habitat and Adaptation*

Animal	Habitat	Adaptive Characteristic
	Cold place	
	Hot place	
	Water	
	Tree	

How are adaptive characteristic helpful for animals?

Why are buffaloes not found in Bumthang?

Frogs live both on land and in water. Why?

B. There are animals which live in deserts. Animals that live in deserts need to conserve water in their body, survive on less food and water. They also need to protect themselves from the heat and cold and should be able to walk on sand.

(a) Camel

(b) Desert squirrel

Figure 7.6. Desert animals.

Camels live in desert. They have thick skin which protect them from heat and cold. They have padded feet, long eyelashes and hair inside the ears. Their nostrils can open and close, and their

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humps store fat to give energy.
Why do camels have padded feet?

Why do camels have long eyelashes and hair inside their ears?

Animals also live in the polar regions. Polar regions are covered with snow throughout the year. Food is also scarce. Animals living in the polar regions need to protect themselves from the cold and store food in their body.

(a) Polar bears

(b) Penguins

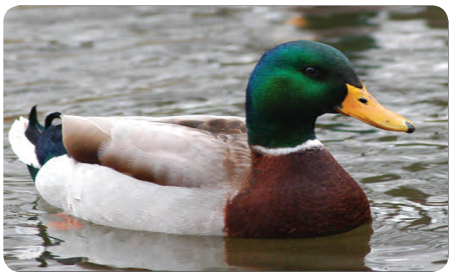
Figure 7.7. Animals in polar region.

Polar bears and penguins are found in the polar regions. Polar bears have white fur and they have thick layer of fat under their skin to avoid heat loss. Penguins stay close in groups to share body heat.

Why does polar bear have fur that appears white?

Why do penguins stay close in groups?

C. Animals that live in water are called **aquatic animals**.
Aquatic animals swim, find food in water and may reproduce in water.



(a) Duck

(b) Fish

Figure 7.8. Aquatic animals.

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Fish and ducks are examples of aquatic animals.

Suggest some special features that enable them to live in water.

Name two aquatic animals other than fish and duck.

How are they adapted to live in water?

Check Your Progress

i. Why do people prefer camel over horses in deserts?

ii. Write the adaptive characteristics of animals living in polar regions.

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7.4. Food Chain Pyramid

Test Yourself

1. What is a food chain?
2. In a food chain, name the producer.
3. How does a producer help to maintain habitat?
4. What is food chain pyramid?
5. What will happen if the number of consumers becomes more than the producer in a food chain?

You already know:

- specific animal habitat.
- adaptive characteristics of animal.

You will learn:

- food chain pyramid.

A. A **food chain pyramid** is the diagrammatic representation of organisms in each level of a food chain in the form of pyramid.

Pyramid of number represents the number of organisms in each level of a food chain.

In a pyramid of numbers, the number of organism decreases as we go higher so that the food becomes sufficient for organisms in each level.

Figure 7.9 shows a pyramid of number. The decrease in size of the box represents the decrease in number of animals in each level.

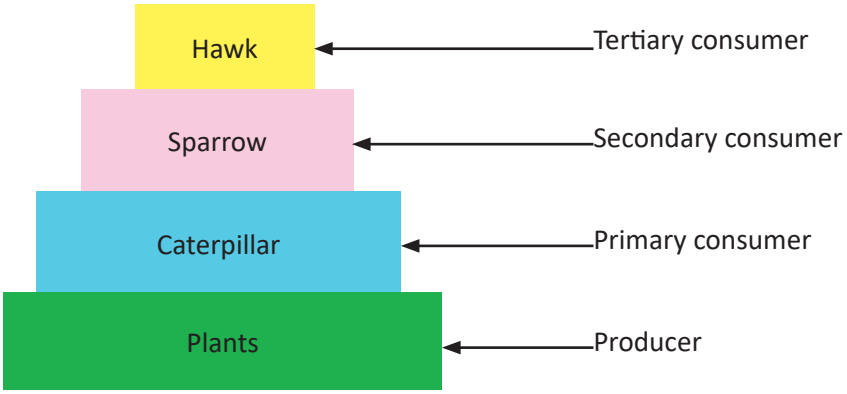

Figure 7.9. Pyramid of number.

Do you think the pyramid is stable?

B. Work in groups

You may need:

- erasers

Stack the erasers as shown in Figure 7.10.

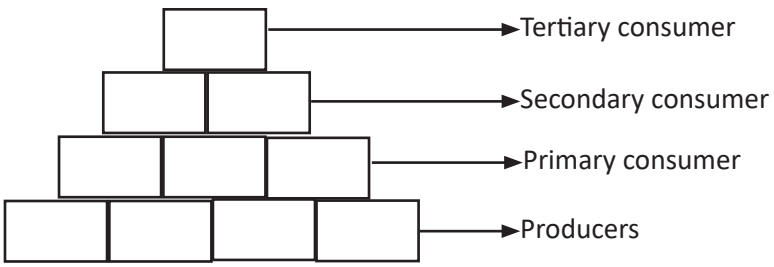

Figure 7.10. Pyramid of number.

Is your pyramid stable? Why?

What does the base of your pyramid represent?

Which consumer is the least in number?

Now try to stack the erasers as shown in Figure 7.11.

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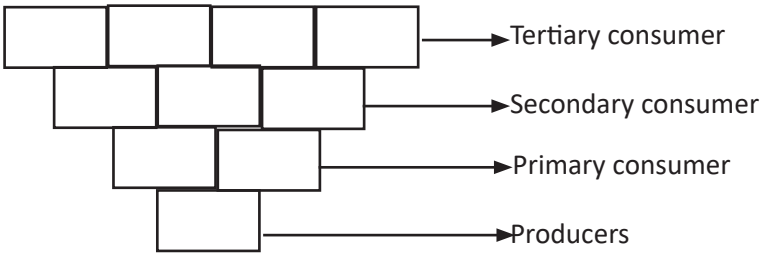


Figure 7.11. Inverted pyramid of number.

Are you able to make a stable pyramid? Why?

What happens if there are more tertiary consumers than secondary consumers?

How can we make pyramid of numbers stable?

Check Your Progress

i. From the list of organisms given below:

grass, grasshopper, snake, hawk, frog

a. Make a food chain.

b. Represent the food chain in the form of a pyramid.

ii. Why is producer more in number than consumer?

7.5. Helpful and Harmful Micro-Organism

Test Yourself

1. What are micro-organisms?
2. Where can we find micro-organisms?
3. Name the micro-organisms that you know.
4. Why are some micro-organisms harmful?
5. How are micro-organisms helpful to humans?

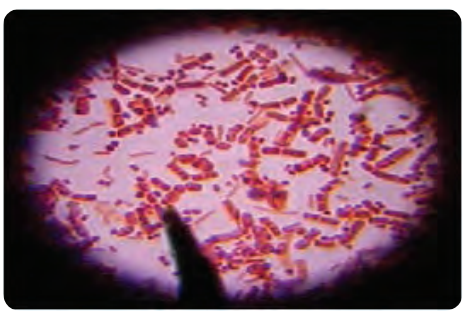
You already know:

- micro-organisms help in decay.

You will learn:

- helpful and harmful micro-organisms.
- transmission and prevention of STIs/STDs (including AIDS).

A. Micro-organisms are present in air, water, and soil. Some examples of micro-organisms are bacteria, virus and fungi. Some micro-organisms are helpful while others are harmful.



(a) *Bacillus* (bacteria)

(b) Bread mould (fungus)

Figure 7.12. Micro-organisms.

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Your teacher will show some micro-organisms under a microscope.

Why did your teacher use microscope to show the micro-organisms?

Draw what you have observed under the microscope.

B. Many micro-organisms cause diseases in humans.

Work in groups

Browse the internet or any other sources. Find out information on the following human diseases. Copy and complete Table 7.4.

Table 7.4 *Human Diseases*

Disease	Causative)rganism (Virus, Bacteria, Fungi)	Prevention
Common cold		
Tuberculosis		
Ringworm		
Cholera		
Athletes foot		
Red eyes (Conjunctivitis)		

Which diseases are common in your school?

How can you prevent these diseases?

Which one in the above list is a skin disease?

In your opinion, which one is the most serious disease? Why?

Work in groups

Visit the nearest health centre to find out more about the cause, mode of transmission and prevention of sexually transmitted infection (STI) and AIDS.

Interview the health official and fill in Table 7.5.

Table 7.5 *Sexually Transmitted Infection*

SlNo	Name of Sexually Transmitted Infection	Causative Organism	Mode of Transmission	Prevention

How do you support people living with STIs or AIDS?

C. There are also micro-organisms which are helpful. Certain bacteria and fungi are used by human beings for various purposes.

For example, some bacteria help in curdling of milk.

Yeast is a fungus. It is used in making bread and alcohol.

Some micro-organisms are used in making life saving medicines.

Name one useful micro-organism.

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Check Your Progress

i. How are micro-organisms helpful?

ii. In what ways are micro-organisms harmful?

http://www.vtaide.com/png/foodchains.htm
organisms_behaviour_health/disease/revise2.shtml

Think Again

1. State whether the following statements are true or false.
   a. Tuberculosis is caused by virus.
   b. Cacti are xerophytes.
   c. Camels have thick and padded feet.
   d. Garbage should be dumped in water bodies.
   e. Overgrazing leads to destruction of habitats.
2. Why do you think animals living in high altitude have thick fur?
3. What is the use of a microscope?
4. Describe two important ways to prevent common cold.
5. Why do you think wild animals encroach human settlements?
6. Design posters to inform people on the prevention of HIV/AIDS.
7. What would be the consequences if polar bears were black?
8. In your school garden, there are 50 cabbages where 30 caterpillars and one hawk often visit the garden.
   a. Construct a food chain and pyramid of numbers of the ecosystem.
   b. Is the ecosystem in your school garden stable? Why?

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CHAPTER 8

Green Plants

8.1. Food for Plants

Test Yourself

1. Why is water important for plants?
2. Why do plants bend towards light?
3. What are nutrients?
4. Why do you think the leaves are green?
5. Why do farmers use dung and dried leaves in their fields?

You already know:

- effect of light, air, temperature and water on the growth of plants.
- nutrients.

You will learn:

- three important nutrients that plants need for proper growth.
- manure and chemical fertilizers.

A. Plants need nutrients for their healthy growth. These nutrients are absorbed from the soil. The three most important nutrients that plants need are nitrogen (N), phosphorus (P), and potassium (K).

Table 8.1 *Nutrients and their Importance*

Nutrient	Roles	Deficiency Symptoms
Nitrogen (N)	Helps plants to grow. Gives green colour to plants.	Results in yellowing of leaves. 
Phosphorus (P)	Helps roots and green parts of plants to grow. Protects them from diseases.	Plants are small and weak. They may have red or purple stem and leaves. 
Potassium (K)	Protects plants from diseases, insects and cold. Helps in flowering and fruit formation.	Plants grow slowly. Fruits are small. 

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What are the primary nutrients?

Which nutrient will provide green colour to plants?

What will happen to plants if there is no potassium in the soil?

Visit your school garden and observe the plants that have nutrient deficiency symptoms.

Recall three important nutrients and complete Table 8.2.

Table 8.2 *Nutrient deficiency Symptoms*

Plant	Symptoms	Nutrient Deficiency
1. 2. 3. 4. 5.		

B. Plant nutrients can be added to the soil in the form of manure and chemical fertilizers. Manure is produced from natural sources, whereas chemical fertilizers are produced artificially. Examples of manure are compost, green manure, and farmyard manure.

Work in groups

Making a Compost

You may need:

- Fresh sample of organic material (kitchen waste)
- Stone
- Tree pruning or any available plants
- Choose a site with a gentle sloping ground and shady place with windbreaks.

Do You Know?

There are as many as sixteen essential nutrients required by plants for their normal growth and development.

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- Chop the organic materials and mix it thoroughly.
- Prepare the base with stones.
- Arrange a layer of tree prunings/ maize stalks/grasses over the stone base.
- Pile 10-15cm of chopped materials and add cow dung slurry over each layer.
- Once the heap has attained the height of your choice cover the heap with artemesia or gunny bags.

Figure 8.1. Compost.

- Turn the heap after every seven days until your compost looks dark crumbly soil mixed with small pieces of organic materials.

What is a compost?

Name other manures used by farmers in your locality.

Explore the advantages of using compost.

C. Some examples of chemical fertilizers are urea, ammonium sulphate, ammonium nitrate, superphosphate, and NPK (Nitrogen, Phosphorus, and Potassium).

Interview your school agriculture program (SAP) coordinator or agriculture extension officer and find out information on chemical fertilizers.

Write down the advantages and disadvantages of using chemical fertilizers.

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Check Your Progress

i. What symptoms would plants show if there is lack of phosphorus in the soil.

ii. Which fertiliser do you prefer, manure or chemical fertiliser? Why?

http://www.ncagr.gov/cyber/kidswrld/plant/nutrient.htm

8.2. Leaf-The Food Factory

Test Yourself

1. What will happen to plants if nitrogen is absent in the soil?
2. How does phosphorus help plants?
3. How do water and minerals reach different parts of a plant?
4. What is the source of food for all organisms?
5. Why are plants called producers?

You already know:

- some important nutrients of plants.

absorption of water and minerals by roots.

You will learn:

- chlorophyll.
- photosynthesis.

A. Plants prepare food in their leaves. Hence, leaves are called the 'food factories'.

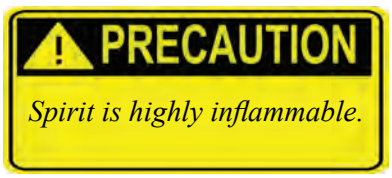
What makes leaves green?

Let us find out.

Work in groups

You may need:

- green leaf
- beaker



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- water
- spirit lamp
- spirit
- iodine solution
- petri dish
- dropper
- test tube
- test tube holder
- forceps
- tripod

Figure 8.2. Boiling the leaf.

Put a green leaf in the beaker containing 100 mL of water.

Boil it for three to five minutes.

Take out the leaf with the help of the forceps.

Put it in a test tube containing 10 mL of spirit.

With the help of the test tube holder, dip the test tube in the beaker containing hot water as shown in Figure 8.3.

Figure 8.3. Removing colour from the leaf.

Heat the water till the leaf becomes pale.

What colour is the spirit now?

Where does the colour come from?

Rinse the leaf in cold water.

(Note: Take care of the leaf. You will need it for the next activity.)

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The pigment that makes the leaf green is called **chlorophyll**. Therefore, green leaves can produce food.

Watch a video clip on photosynthesis. Your teacher will provide the link to the video. The process of preparing food by green plants in presence of light is called **photosynthesis.** It is represented as:

$$Water + Carbondioxide \xrightarrow[Chlorophyll]{Sunlight} Glucose + Oxygen$$

The term photosynthesis originated from the Greek words: 'photo' meaning 'light' and 'synthesis' meaning 'putting together'.

Plants use some of the glucose for various activities like growth, respiration, and reproduction. The remaining glucose is changed into a substance called starch which is stored in different parts of the plant such as leaves, roots, stem, seeds, and fruits.

B. To test the presence of starch in the leaf (Iodine test).

Work in groups

You may need:

- leaf from activity A
- dropper
- iodine solution
- petri dish

Place the leaf in a petri dish.

Put a few drops of iodine solution on it.

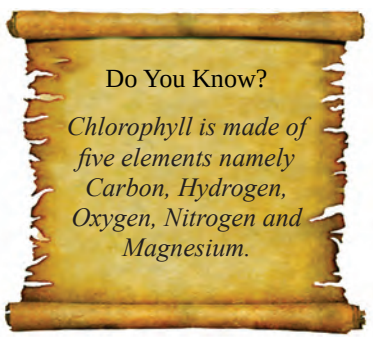

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Figure 8.4. Iodine test.

What is the colour of the leaf now?

What can you conclude?

Check Your Progress

i. What do plants need for photosynthesis?

ii. What is the role of chlorophyll in green plants?

WEBLINK

http://www.nuffieldfoundation.org/practical-biology/testing-leaves-starch-technique

8.3. Transfer of Pollen Grain

Test Yourself

1. Name the male part of a flower.
2. When you play with flowers, your hands collect yellow dust. What is it called?
3. What is chlorophyll?
4. Why do you think bees visit flowers?
5. Why are flowers colourful and have sweet scent?

You already know:

- parts and functions of flower.

You will learn:

- pollination.

A. Go around your school campus. Observe insects visiting the flowers.

Why do you think they visit the flowers?

What do you see on the bodies of the insects when they fly from flower to flower?

When insects move from flower to flower, they transfer pollen grains from anther to stigma. This is called **pollination**.

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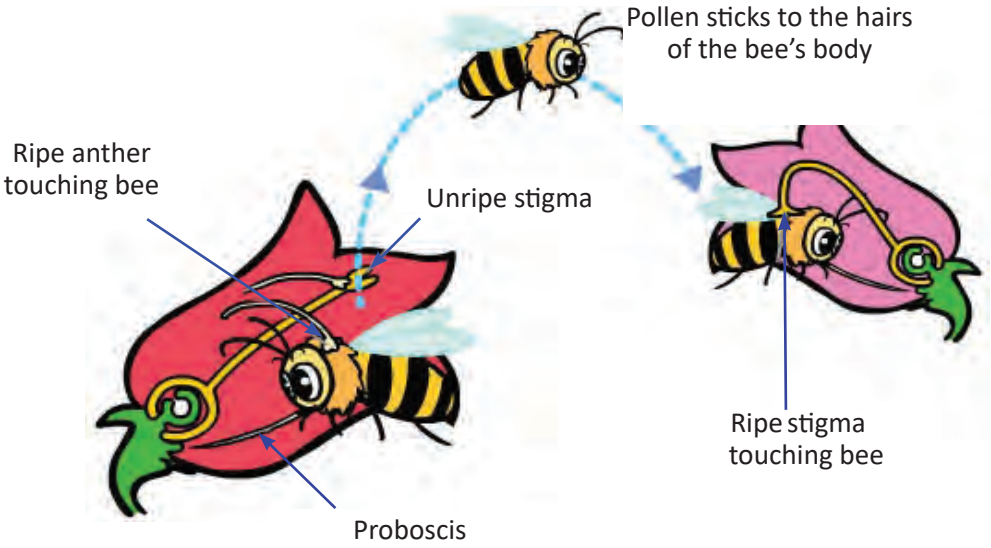

Figure 8.5. Pollination by insect.

Flowers pollinated by insects usually make sweet nectar to attract insects. Brightly coloured petals and scents also attract insects.

(a) Bee (b) Butterfly

Figure 8.6. Flowers pollinated by insects.

B. Wind can also help in pollination.

Flowers pollinated by wind have the following characteristics:

- lots of pollen
- long feathery stigma
- small and dull in colour
- no scent and nectar

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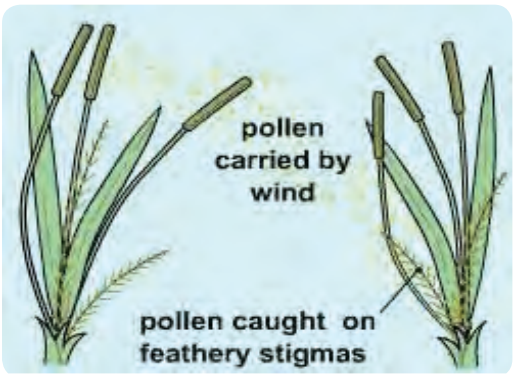

Figure 8.7. Pollination by wind.

Do You Know?

Jasmine flower is used to make perfume.

Go to a garden. Observe different types of flowers.

Name the flowers pollinated by wind.

Check Your Progress

i. Flowers pollinated at night have pleasant smell. Why?

ii. Write three differences between insect pollinated and wind pollinated flowers .

WEBLINK

http://www.mbgnet.net/bioplants/pollination.html

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8.4. How Seeds are Formed

Test Yourself

1. What is pollen?
2. What is pollination?
3. Name some agents of pollination.
4. Which part of the fruit germinates into a young shoot?

You already know:

- parts of flower.
- pollination.

You will learn:

- fertilisation, formation of seeds and arrangement of seeds inside fruits.

A. Work in groups

You may need:

- young flower
- blade
- hand lens
- watch glass

Take out an ovary from a flower.

Cut a thin circular section of the ovary.

Place it on a clean watch glass.

Observe the section using the hand lens.

Do you see some round like structures inside the section?

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These round like structures are called **ovules**. After pollination, pollen grains meet with the ovules and fuse together inside the ovary. This process is called **fertilization**.

The fertilized ovules develop into seeds, while the ovary develops into fruits.

The petals, stamens, style, and stigma dry and fall off.

B. Different flowers produce different kinds of seeds. They are arranged inside the fruits in different ways.

(a) Orange

(b) Apple

(c) Peas

Figure 8.8. Arrangement of seeds in fruit.

You are going to observe arrangement of seeds inside different kinds of fruits.

Work in groups

You may need:

- fruits
- knife
- tray

Cut the fruits into circular or longitudinal section.

Observe how seeds are arranged inside the fruits.

Draw the diagrams of the section showing the arrangement of seeds.

Which fruit has more seeds?

Which fruit has less seeds?

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Why do you think the fruit having more seeds has advantage over the one with less seeds?

Check Your Progress

i. What is fertilization?

ii. What is a fruit?

Do You Know?

The largest seed in the world is the coco de mer (palm tree). The single–seeded fruit weighs up to 20kg and can take about ten years to develop.

(a) Coco de mer plant

(b) Coco de mer seed

Figure 8.9. The largest seed.

8.5. Dispersal and Germination of Seeds

Test Yourself

1. Where are ovules found inside the fruit?
2. Which part of the flower develops into fruit?
3. Which part of the flower develops into seed?
4. Why do you think some seeds have hook on them?
5. What will happen to plants if they grow very close to each other?

You already know:

- formation of fruits and seeds.

You will learn:

- seed dispersal and germination.

A. When a fruit is ripened, it breaks away from the parent plant and its seeds are scattered. The scattering of seeds away from the parent plant is called **dispersal**.

What are some of the ways by which seeds get dispersed?

Seeds that are small and light are usually dispersed by wind. Cotton and *dandelion* seeds have fine, long hair around them. Some seeds like *oroxylum* (**Tsampaka**), pine, and maple have wings which help them to float in air.

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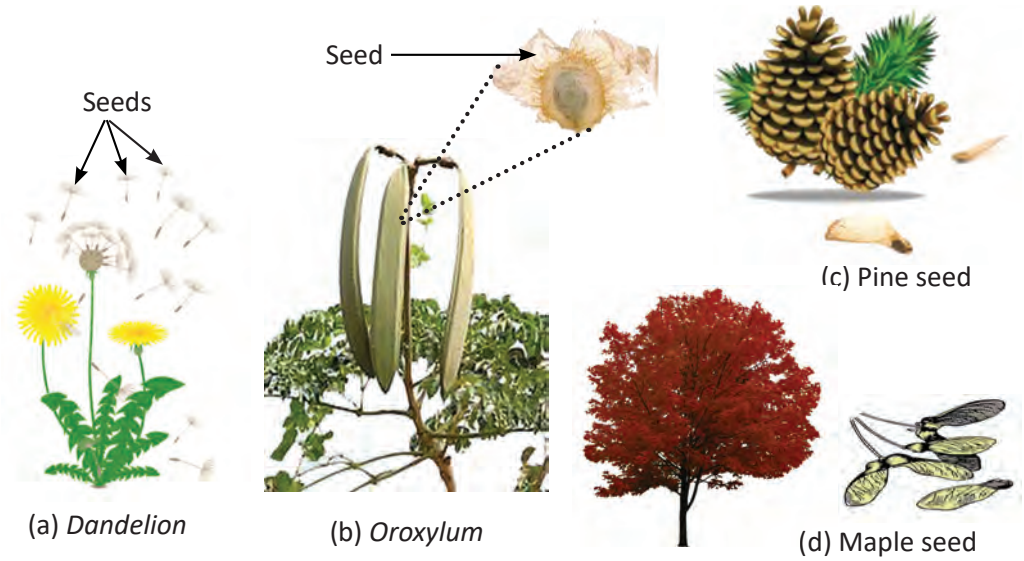

Figure 8.10. Seeds dispersed by wind.

The seeds of plants that grow in or near flowing water are generally dispersed by water. Coconuts, water lilly, and lotus are three examples.

Figure 8.11. Seeds dispersed by water.

When the pods of peas and beans are fully grown, they burst open and scatter their seeds away from their parent plant.

Seeds are also dispersed by animals.

Name five fruits whose seeds are dispersed by animals.

Figure 8.12. Peas.

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Collect different types of seeds. Observe and discuss how they are dispersed.

Copy and complete Table 8.3.

Table 8.3 *Identifying Agents of Seed Dispersal*

Seed	Agents of Seed Dispersal
Seed 1	
Seed 2	
Seed 3	
.....	

WEBLINK

http://www.vtaide.com/png/seed-dispersion.htm

Do You Know?

Seeds of some plants germinate while the seeds are still attached to the mother plant. This condition is called ***vivipary****.*

B. Let us observe the structure of seeds.

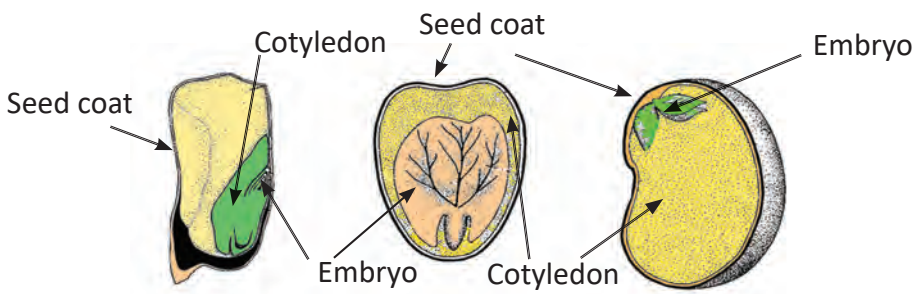

Figure 8.13. Structure of seed.

Work in groups

You may need:

- soaked bean seed
- forceps
- hand lens

Observe a bean seed.

Carefully remove the seed coat of soaked bean seed using the forceps.

The seed coat protects the seed.

Split open the seed and observe using the hand lens.

You will see a very small new plant. This is called **embryo**.

Around the embryo is the food store which is called **cotyledon**.

Draw a labelled diagram of the seed.

What is the function of cotyledon?

C. What happens to the seeds that are dispersed in different places?

When seeds fall in the soil containing water, suitable temperature and air, the embryo starts growing into a seedling. The formation of a seedling from the embryo is called **germination**.

Investigating the germination of seeds.

Work in groups

You may need:

- bean seeds
- jars
- paper
- water

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You are going to do one of these five experiments.
Your teacher will tell you which one to do.

1. Make a paper cylinder to fit inside a jar.

2. Fill the paper cylinder with soil.

3.Label the jars with your group name or number.

Figure 8.14. Jar.

SET 1

Put three beans in each jar.

Put them between the paper and the jar as shown in Figure 8.15(a).

Make the soil moist in both the jars.

Keep one jar in the dark and the other in the light.

(a) SET 1

SET 2

Put three beans in each jar.

Put them between the paper and the jar as shown in Figure 8.15(b).

Make the soil moist in one jar.

Leave the other one dry.

Keep both the jars in the light..

(b) SET 2

SET 3

Put three beans in each jar between the paper and the jar as shown in Figure 8.15(c).

Make the soil in both the jars moist.

Keep both the jars in the light.

(c) SET 3

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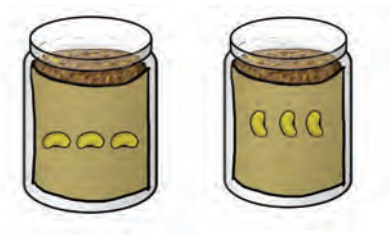
SET 4

Put three beans in each jar as shown in Figure 8.15(d).

Make the soil in both the jars moist.

Keep both the jars in the light.



(d) SET 4

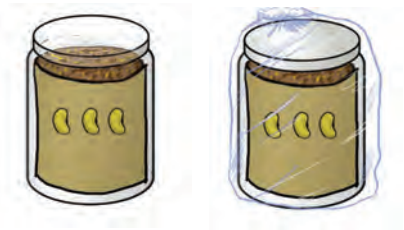
SET 5

Put three beans in each jar as shown in Figure 8.15(e).

Keep both the jars in the light.

Make the soil in both the jars moist.

Cover one jar with clear plastic.



(e) SET 5

Figure 8.15. Conditions necessary for germination.

Note: Keep the above jars in safe place.

What is similar about the two jars in Figure 8.15(a)?

What is different about the two jars in Figure 8.15(b)?

Observe the set-ups for two weeks and record your observation in Table 8.4.

Table 8.4 *Observing Seed Germination*

Day	Jar 1	Jar 2
Day 1		
Day 2		
Day 3		
.....		

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Present your finding to the class.

Based on the presentation, answer the following questions.

What are the conditions necessary for germination?

Is the position of the seed important for germination? Why?

Which comes out first from the seed, a root or a shoot?

What would happen to the bean seeds if you leave them for another month?

Check Your Progress

i. Write the functions of the following:
   a. seed coat
   b. cotyledon
   c. embryo

ii. What is germination? Name the conditions required for germination.

http://urbanext.illinois.edu/gpe/case3/c3facts3.html
http://www.youtube.com/watch?v=PKFQmj2brt4

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Think Again

1. Fill in the blanks.
   a. Early falling of leaves is caused by the lack of .....
   b. The scattering of seeds away from the parent plant is called .....
   c. A small structure that grows into seedling is called .....
   d. Leaves are green due to the presence of .....
   e. Matured anther releases .....
2. Thousands of seeds are scattered in different places, yet only a few of them germinate. Why?
3. What will happen if you keep a plant in the dark?
4. Why is soil important to plants?
5. It is important that seeds grow some distance away from their parent plant. Give reasons.
6. Students in their field trip to a farm observed that all the potato leaves have turned yellow. What advice will students give to the farmer?

CHAPTER 9

Classification of Animal

9.1. Reptiles

Test Yourself

1. Name any three animals.
2. How are animals useful to humans?
3. Where do animals live?
4. Does a snake lay egg or give birth?
5. Do you think that animals will survive if we change their habitats?

You already know:

- different animals live in different places.

You will learn:

- reptiles and their characteristics.

A. There are many animals that live on land. They breathe with the help of lungs.

They use sense organs to look for food and protect themselves from enemies.

Name five animals that live on land.

How do these animals breathe?

How do dogs use their sense organs to find food?

B. Bodies of animals are usually covered with fur, feathers, scales, etc. Scales are small plate like structures that form the external

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coverings of certain animals. Scales prevent the entry of water into the body of animals. They also retain moisture. Scales give protection to animals and also help in movement.

Here is a list of some animals: cow, lizard, cat, crocodile, dog, bear, monkey, donkey, snake, and humans.

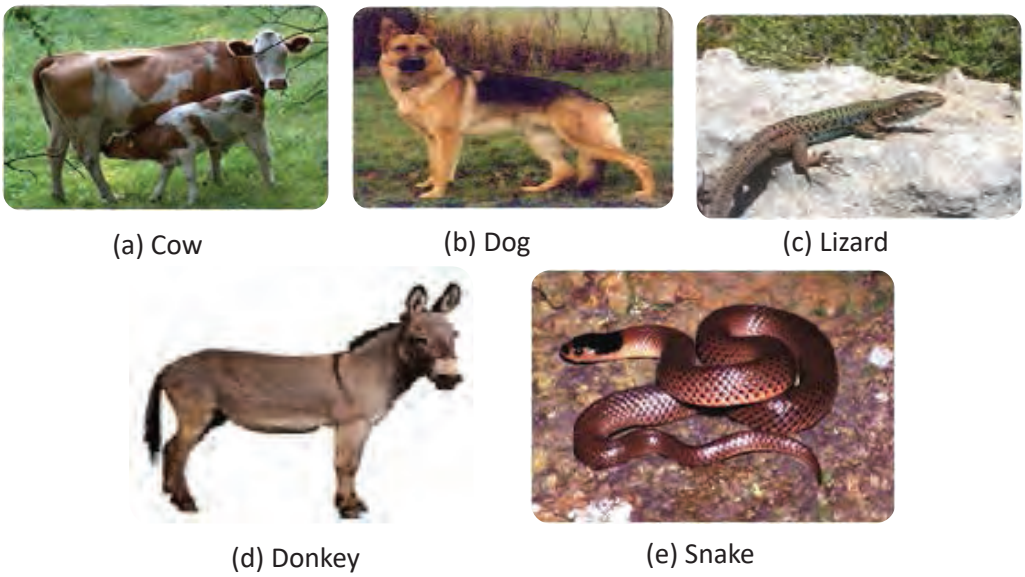


Figure 9.1. Types of animals.

From the above list, identify the animals whose bodies are covered with fur.

Identify the animals whose bodies are covered with dry scales.

Animals whose bodies are covered with dry scales are called **reptiles**. Reptiles are best suited to live on land. Some reptiles such as crocodile, tortoise, snakes, etc. live on land as well as in water. Reptiles lay eggs with thick hard shell. They breathe through lungs. They are cold-blooded animals. Cold-blooded animals do not have a constant body temperature. They change their body temperature according to the temperature of their surroundings.

C. Your teacher will provide a chart containing pictures of different reptiles.

Identify a few reptiles from the chart that are found in your locality.

Draw a neat diagram of a reptile.

Label the following parts:

head

eyes

scales

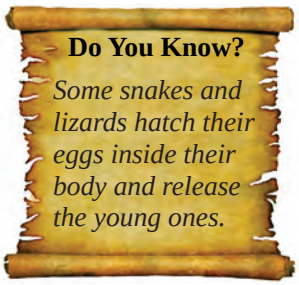
tail

Where does it live?

Does it lay eggs?

What type of food does it eat?

How does the body scales help it to live on land?



Check Your Progress

i. Write the characteristics of reptiles.

ii. Give three examples of reptiles.

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9.2. Fishes

Test Yourself

1. Name three reptiles.
2. Write three important characteristics of a reptile.
3. Name two animals that live in water.
4. What enables fishes to live in water?

You already know:

- reptiles.

You will learn:

- fish and its characteristics.

A. List some animals that live in water.

Name an animal that lives all the time in water.

Animals that live in water are called **aquatic animals**. Fish is one of the aquatic animals..

Fish has special structures such as gills, scales, fins and tail to live in the water. Gills help fish to breathe in water. The streamlined body, fins and tail help fish to swim. Fish is a cold-blooded animal. A cold-blooded animal has a body temperature that varies along with the temperature of the surrounding.

Work in groups

Observe the figure given below and answer the questions.

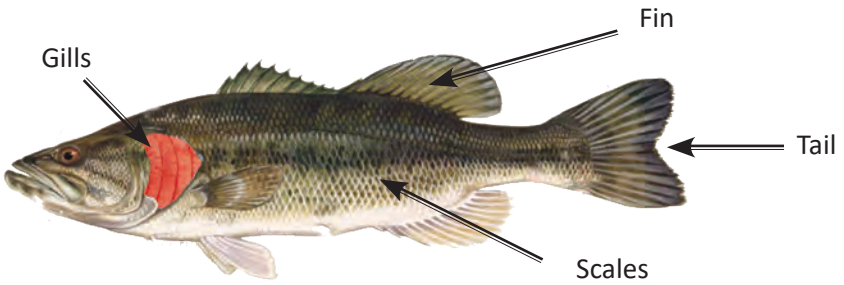

Figure 9.2. A fish.

What helps the fish to swim?

What helps it to breathe?

What does it eat?

How does a fish reproduce?

B. Browse the internet or any other sources for picture of different fishes. Draw any five fishes in your scrap book and label their common features

Check Your Progress

i. What are aquatic animals? Give three examples.

ii. Write down the characteristics of a fish.

WEBLINK

http://www.kidzone.ws/animals/animal_classes.htm

Do You Know?

Fishes live in both fresh and salt water and can be found all over the world, except in hot springs and the Dead Sea which is too salty.

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9.3. Amphibians

Test Yourself

1. Give one example of an aquatic animal.
2. How is fish adapted to live in water?
3. Do you think that fish can live on land? Why?
4. Name an animal that can live both on land and in water.
5. What enables this animal to live both on land and in water?

You already know:

- reptiles.
- fishes.

You will learn:

- amphibians and their characteristics.

A. Animals that spend a part of their time on land and the rest in water are called **amphibians**.

Amphibians are cold-blooded animals.

They have features that help them to live successfully both on land and in water.

Do You Know?

Amphibians were the first animals to venture on to land. They emerged from the oceans over 300 million years ago.

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When on land, amphibians breathe with their lungs. In water, their moist skin absorbs oxygen from the water for breathing. These animals also have folds of skin between the toes of their feet. These are called **webs**, which help them to swim. Amphibians lay eggs in water where young ones hatch out and live in water until they become adults. The young amphibians have tails and breathe through their gills.

Few examples of amphibians are frog, toad, newt, and salamander.

(a) Newt

(b) Salamander

Figure 9.3. Amphibians.

Have you seen a frog? Observe a frog in a nearby pond.

What does the skin of a frog look like?

How is the skin of a frog different from that of a fish?

How does a frog breathe in water?

What helps a frog to breathe on land?

What helps a frog to swim in water?

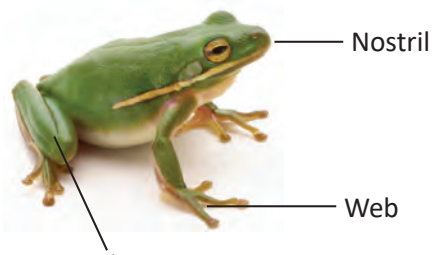

Figure 9.4. Frog.

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The Figure 9.5 shows the life cycle of a frog.

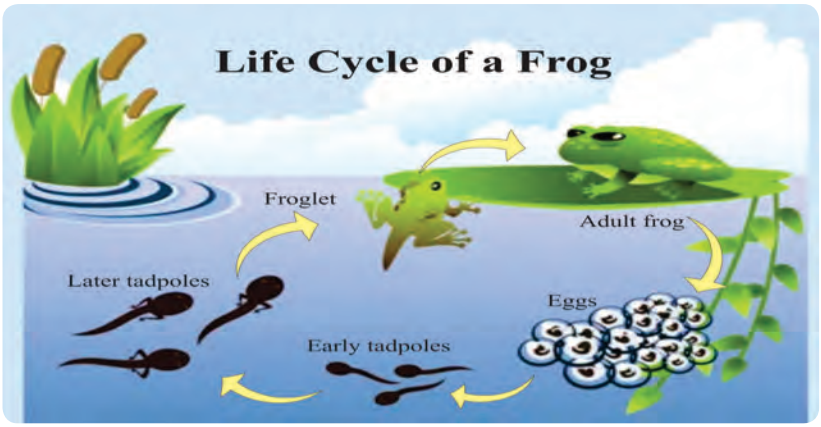

Figure 9.5. Life cycle of a frog.

Where do frogs lay its egg?

Which stage represent the completion of life cycle?

Where does the adult frog live?

Which group of animals does a frog belong to?

Check Your Progress

i. Name two amphibians.
ii. Write down the characteristics of an amphibians.

WEBLINK

http://www.kidzone.ws/animals/amphibian1.htm
http://kids.sandiegozoo.org/animals/amphibians
http://birding.about.com/od/Bird-Trivia/a/What-Is-A-Bird.htm
http://kids.sandiegozoo.org/animals/birds

9.4. Birds

Test Yourself

1. How is the skin of an amphibian different from that of a fish?
2. Name any two animals that can fly.
3. Mention the features of a bird.
4. What helps birds to fly?

You already know:

- reptiles.
- fishes.
- amphibians.

You will learn:

- birds and their characteristics.

A. There are several animals that can fly. Given below are some of the animals that can fly.

(a) Sparrow (b) Bat (c) Dragonfly (d) Flying lizard (e) Pigeon

Figure 9.6. Flying animals.

What helps them to fly?

Which animals have feathers on their body?

Those animals that have feathers and wings are called **birds**.

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Birds have hollow bones which make their bodies light for flying. Birds have streamlined bodies.

They are warm-blooded animals. They can maintain a constant body temperature regardless of change in the surrounding temperature.

B. Table 9.1 shows the main characteristics of birds.

Copy and complete Table 9.1.

Table 9.1 *Characteristics of Birds*

Sl No	Characteristic	Function
1	Feather	
2	Beak	
3	Hollow bone	
4	Streamlined body	
5	Lay egg	

Why do birds have feathers on their bodies?

Give some examples of birds that you have seen in your locality.

C. Find a books on *Bird of Bhutan*. Draw and name five birds of Bhutan on a chart paper. State one distinctive characteristic of each bird you have drawn. Display it in your classroom.

Check Your Progress

i. How do hollow bones help birds to fly?

ii. Write down the characteristics of birds.

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9.5. Mammals

Test Yourself

1. Are all animals that can fly called birds?
2. What helps birds to fly?
3. Do mammals fly? Give an example.
4. Mention two differences between human and a bird.

You already know:

- reptiles.
- fishes.
- amphibians.
- birds.

You will learn:

- mammals and their characteristics.

A. Make a field trip to the nearest farm.

Write the names of the animals and observe them carefully.

List the animals that have fur on their body.

Do they lay eggs or give birth to young ones?

How do they feed their young ones?

Write down the characteristics of the animals discussed above.

Mammals have fur on their body, give birth and suckle their young ones. They are warm-blooded animals. Examples tiger, goat, buffalo, sheep, deer, etc.

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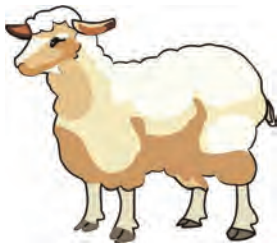
(a) Tiger

(b) Goat



(c) Sheep

(d) Buffalo

(e) Deer

(f) Dog

Figure 9.7. Mammals.

Name some other mammals. Classify them as domestic and wild animals.

B. Select any two mammals that you have seen in the farmhouse during your last visit. Write their importance.

Table 9.2 *Animals and Their Importance*

Animal	Importance

Check Your Progress

i. What do we call animals with fur on their bodies?

ii. Write two characteristic that differentiate a monkey from a snake. Name the animal group that they belong to.

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Think Again

1. Choose the correct answer.

   i. Which of these animals have hollow and light bones?

      A Pigeon.
      B Frog.
      C Lion.
      D Fish.

   ii. Animals that live in water are called

      A terrestrial animal.
      B aquatic animals.
      C aerial animals.
      D fish.

   iii. Which of these is an amphibian?

      A Lizard.
      B Snake.
      C Toad.
      D Crocodile.

   iv. Animals which suckle their young ones belong to

      A amphibian.
      B bird.
      C mammal.
      D fish.

   v. Which of these can breathe through skin?

      A Fish.
      B Frog.
      C Crocodile.
      D Crab.

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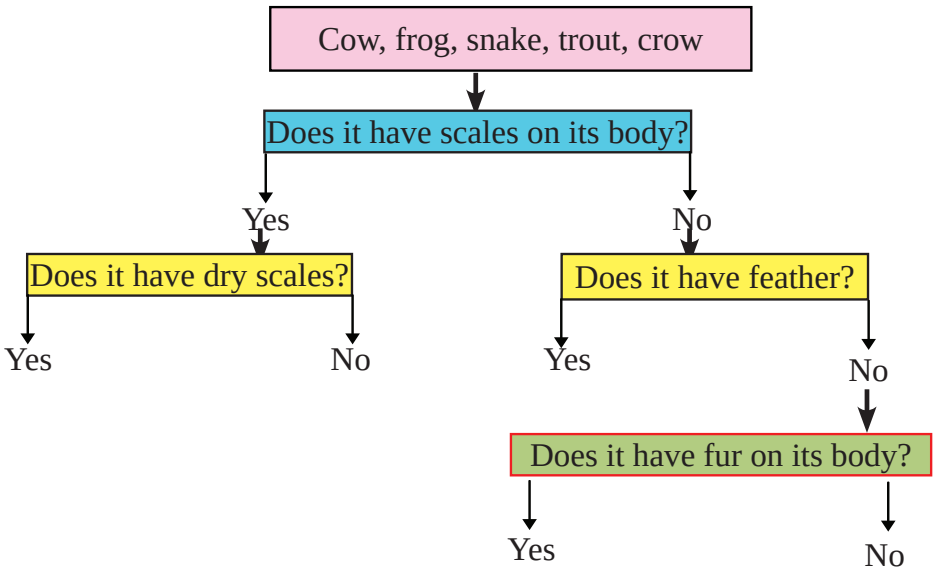
2. Bats can fly but they are not birds. Why?
3. Can human beings live in water? Why?
4. Use the keys given below and classify the animals. Write one characteristic for each animal. Group them into mammals, birds, reptiles, amphibians, and fish.



5. How is the skin of a fish different from that of a reptile?
6. Observe the pictures in Figure 9.8, and identify the bird. Draw an outline of the bird and inside the outline, write down ways to protect these birds.

Figure 9.8.

CHAPTER 10

Diet and Human System

10.1. Balanced Diet for Good Health

Test Yourself

1. Which food group would you choose from the following to give you energy?
   a. Carbohydrate b. Protein c. Vitamin
   d. Mineral e. Fibre f. Water
2. Which food group helps you grow?
3. Why do doctors suggest patients to take more vegetables and fruits?
4. If you want to remain healthy, what type of food would you eat?
5. What will happen if you take only one group of food?

You already know:

- Food contains carbohydrate, fat, protein, vitamin, mineral, fibre and water..

You will learn:

- balanced diet.
- importance of balanced diet.

A. We eat different kinds of food every day. The food that we eat every day is called **diet**.

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Food contains special substances called **nutrients**. Different foods have different nutrients such as carbohydrate, protein, fat, vitamin, mineral, and fibre. All types of nutrients are needed by our body to stay healthy. No single food can give us all the required nutrients in the right amount.

Work in groups

Copy and complete Table 10.1. The first one is done for you.

Table 10.1 *Food and Its Nutrient*

Food Item	Main nutrient Present
Rice	Carbohydrate
Egg	
Meat	
Carrot	
Peas	
Beans	
Wheat	
Milk	
Cheese	
Oil	
Bread	
Cabbage	
Apple	

Write the nutrients present in egg, cabbage, apple, and meat?

If your diet gives you the required amount of carbohydrates, protein, fat, vitamin, mineral, water, and fibre, we call it as balanced diet.

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Nutritionists say we can avoid medicines if we take a **balanced diet** every day.

B. Look at the food guide pyramid given in Figure 10.1. The food guide pyramid help us to divide the food into different sections. It shows the recommended intake of each food group. Each food groups have different amount of daily serving. The number of serving depends on amount of calorie required by a person. For example , an individual who needs 1600 calories must take 6 servings of grain products each day, while an individual who needs 2800 calories must take 11 servings of grains.

Study Figure 10.1 and answer the questions that follow.

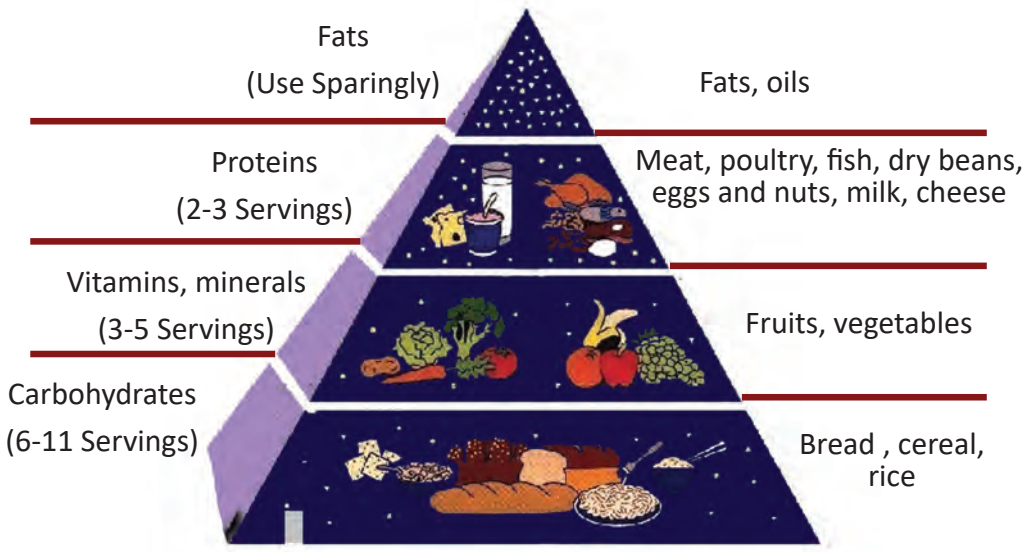

Figure 10.1. Food guide pyramid.

Which food group must be taken in large quantity? Why?

Why does the pyramid suggest eating small amount of fats and oils?

Identify and write down the names of the protective foods from the given pyramid.

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C. Work in groups

Make a list of food you ate for breakfast, lunch, and dinner yesterday. Write the main nutrients present in each food item.

Copy and complete Table 10.2.

Table 10.2 *Meals and Nutrients*

Meal	Food Item	Nutrient Present
Breakfast		
Lunch		
Dinner		

Are you taking all types of food as suggested in the food pyramid?

Which type of food do you take in more quantity?

How can you make your diet a balanced diet?

Check Your Progress

i. What is a balanced diet?

ii. Why is it necessary to have balanced diet in your everyday meals?

10.2. Teeth and their Functions

Test Yourself

1. Name two food items containing carbohydrate.
2. Why should we include fruits in our daily meals?
3. Why is it a good practice to brush your teeth after every meal?
4. Mention two functions of teeth besides chewing.
5. How many teeth do you think you have in your mouth?

You already know:

- balanced diet
- food and nutrients

You will learn:

- types of teeth and their functions.
- taking care of teeth.

A. Think about trying to eat an apple without any teeth.

Try to pronounce these words without touching your teeth with tongue and lips.

Teeth, knife, life, fox, fix, cloth, fourth, and throw.

Why do we need teeth?

Jaws are the part of skull that frame the mouth and hold the teeth. In our mouth, we have upper and lower jaw.

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Work in pairs

Look at the four front teeth in your friend's mouth. The four front teeth in each jaw are chisel shaped. These teeth are called **incisors**.

What do you think they are used for?

Similarly, look at the tooth next to the incisors in your friend's mouth.

What shape is it?

How many of these are present in your mouth?

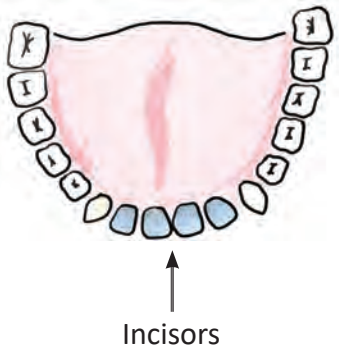

Figure 10.2. Incisors.

These teeth are called **canines**. They are sharp and pointed.

Animals that eat meat have well developed canines.

Name some animals that have canines?

What is the function of canines?

Figure 10.3. Canines.

Feel the teeth at the side of your mouth. Look at the teeth next to the canines in your friend's mouth.

Draw this teeth. What shape is it?

How many of these teeth are present in your mouth?

Write about what these teeth can be used for.

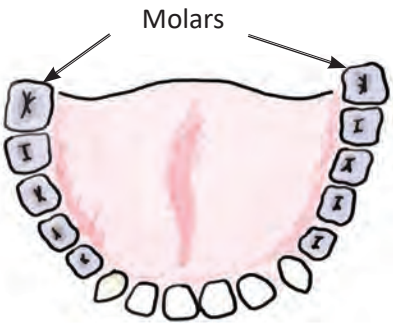

Figure 10.4. Molars.

These teeth are called **molars**.

Name the three types of human teeth.

What are the various functions of teeth?

Draw a diagram showing all three types of teeth.

B. Fresh vegetables and fruits are good for your teeth.

Milk and cheese help your teeth and bones grow.

Sweets and fizzy drinks are bad for your teeth because they are sweet and contain acid .

Sweets stick to your teeth and causes tooth decay due to bacterial growth.

Sort the list of food items into two sets using Table 10.3.

Apple, fizzy drinks, orange, cucumber, cabbage, spinach, cauliflower, peach, sweets, milk, and cheese.

Table 10.3 *Good and Bad Food for Teeth*

Food Which is Good for Our Teeth	Food Which is Bad for Our Teeth

Which food items stick the most to our teeth?

Justify why betel nut (**Doma**) and tobacco are bad for our teeth.

C. We can keep our teeth healthy not only by eating healthy food but also cleaning them regularly.

You may need:

- toothbrush
- toothpaste

Your teacher will demonstrate the correct ways of brushing your teeth as per the steps given below.

Practice the steps along with your teacher.

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1. Put a pea sized amount of toothpaste on your wet brush.

2. Place your toothbrush at a 45 degree angle towards yourgums

3. Brush gently in a circular motion.

4. Brush the outer, inner and chewing surfaces of each tooth.

5. Use the tip of your brush for the inner surface of your teeth.

Figure 10.5. Correct ways of brushing teeth.

Brush your teeth for about five minutes.

Brush all parts of your teeth.

Brush your tongue from back to front to get off bacteria that will make your breath smell.

Massage your gums with your finger.

Remember to clean your teeth after every meal.

Do You Know?

A doctor who checks our teeth is called dentist. The tooth is the only part of the human body that cannot repair itself.

Write the ways to take care of your teeth.

Why should we brush our teeth after every meal?

Check Your Progress

i. What are the different functions of teeth.

ii. How is the teeth of a cow different from hat of a human?

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10.3. Flow of Blood in Our Body

Test Yourself

1. Why do you think blood is important in our body?
2. Name two types of blood vessels in humans.
3. Name the blood vessels that carry blood from heart to other parts of the body.
4. How do we measure pulse rate?
5. What is double circulation?

You already know:

- heart, blood, blood vessels, and their functions.

You will learn:

- pulse rate.
- types of circulation.

A. Place your finger on your temple. Do you feel anything?

Place your finger on your wrist as shown in Figure 10.6.

Figure 10.6. Measuring pulse rate.

Do You Know?

The heart weighs 300 g. In an average life-time it beats 2500 million times and pumps 340 million litres of blood.

Do you feel anything? This feeling is called pulse.

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Pulse is a series of heart beats felt as jerks in blood vessels when heart pumps blood into it.

Count your pulse for 1 minute. Make sure you are calm and comfortable while counting your pulse.

What is your pulse rate in 1 minute?

Compare your pulse rate with your classmates.

	New Born (0-30 days old)	 70-190 beats per minute
	Infant (1-11 months old)	80-120 beats per minute
	Children (1-10 years old)	70-130 beats per minute
	Children over (10 years old and adults)	60-100 beats per minute
	Well trained athletes	40-60 beats per minute

Figure 10.7. Heart rate during rest at different stages.

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B. Observe the schematic representation of human transport system.

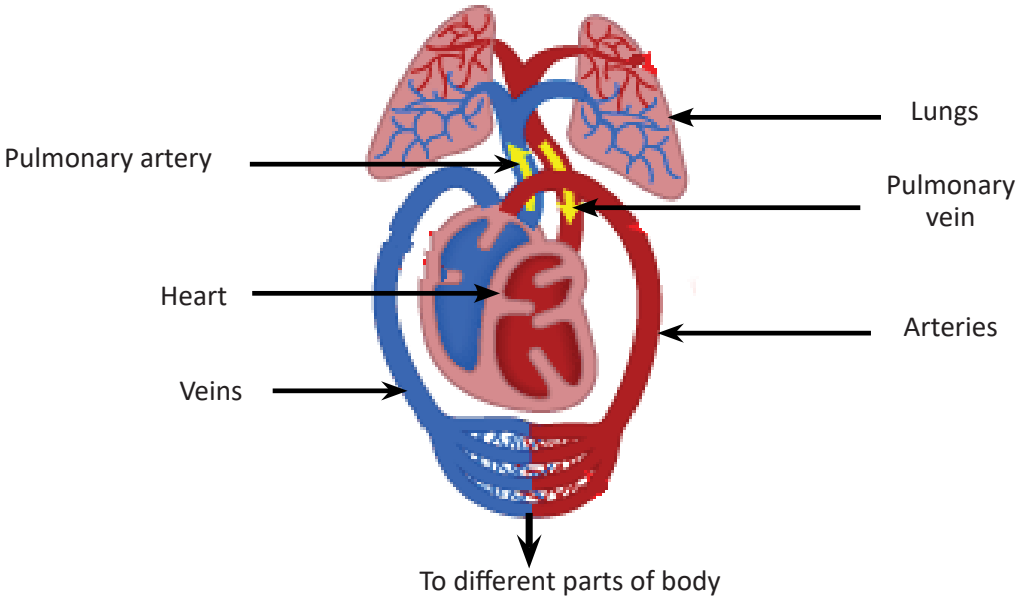

Figure 10.7. Double circulation.

All arteries carry blood containing oxygen except pulmonary artery. Similarly, all veins carry blood containing carbon dioxide except pulmonary vein. Pulmonary vein and arteries carry blood that contains oxygen. Pulmonary artery and veins carry blood that contains carbon dioxide.

Name the blood vessels carrying blood from:

a. heart to lungs

b. lungs to heart

c. body to heart

d. heart to body

In humans, blood flows away from the heart to the lungs and returns to the heart. This circulation is called **pulmonary circulation**. Similarly, the blood also flows from heart to body and back to heart. This circulation is called **systemic circulation**. Thus, human beings have double circulation.

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Watch a video on circulation in human. You may use the link below:https://www.youtube.com/watch?v=f9ONXd_-anM

Explain the importance of two types of circulation in humans.

Check Your Progress

i. How is pulmonary artery different from pulmonary vein?

ii. How is pulmonary vein different from other veins?

http://www.livestrong.com/article/408133-the-definition-of-food-pyramid-serving-sizes/ http://bio-animations.blogspot.com/2008/04/human-body-circulatory-system.html

10.4. Shape, Support and Movement

Test Yourself

1. How many bones are there in an adult human?
2. Name any two muscles found in our body.
3. How do muscles help in the movement of the bones?
4. Why is skeleton important for our body?
5. Why is physical exercise important for healthy living?

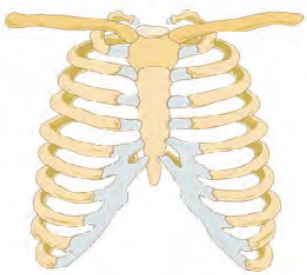
You already know:

- bones make up skeleton.
- muscles are attached to skeleton.

You will learn:

- functions of muscles and skeleton.

A. Skeleton, beside supporting our body, it also protects the internal organs. For example, the skull protects the brain, the rib cage protects the heart and the lungs. The vertebral column protects the spinal cord.



(a) Rib cage

(b) Skull

Figure 10.8. Parts of skeleton.

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List down some bones of skeleton that protect our organs.

How does skull protect the brain?

Try these:

Walk without bending your knees.

Lift an object towards your shoulder without bending your elbows.

What happens?

Your body must be flexible as well as strong. Skeleton allows us to move. Bones of the skeleton are attached to the muscles. When the muscles move, they move bones. This is how we are able to move.

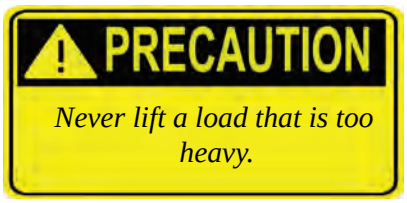
When lifting or carrying an object, it is important to follow the rules on safe lifting and maintain correct body posture. This will help to avoid injuries at work.

Lifting

a. Face the load before lifting it.

b. Stand close to the load.

c. Keep your shoulders and hips facing the same way. Do not twist.



d. Bend your knees and keep your back straight when you lift.

e. Make the muscles in your legs and bottom hard to get ready to lift.

f. Make all your movements smooth.

Carrying

a. Keep your shoulders and hips facing the same way. Do not twist.

b. Hold the load close to your body.

c. Bend your elbows and keep them close to your body.

d. Make all your movements smooth.

Work with a friend.

Lift a chair and carry it. Make sure your friend does it the right way. Do this in turns.

It is better, if you can, to roll or slide the object instead of carrying it.

Our muscles have two main functions. Muscles help in movement. They also give shape to our body.

If you sit, stand and walk in the right way, your muscles will be less tired.

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Check Your Progress

i. Write the main functions of muscles and skeleton.

ii. Why is it important to have good body posture while lifting or carrying an object?

iii. Look at Figure 10.9 and answer the following questions.

a. What do parts A, B, C and D represent in human skeletal system?

b. What controls the movement of A and B?

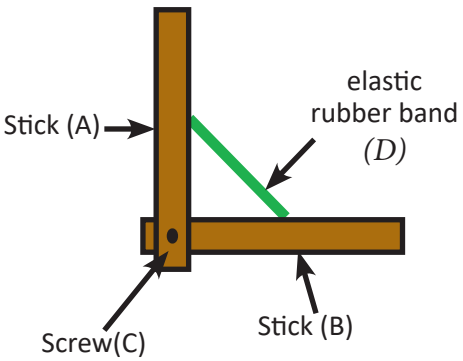

Figure 10.9.

WEBLINK

http://www.bbc.co.uk/science/humanbody/body/factfiles/skeleton_anatomy.shtml

Do You Know?

The strongest muscles in our body are called the masseters. These muscles are in your jaw and assist you in biting. The force of an average bite is equivalent to the force exerted by the weight of 18 house bricks.

10.5. Changes in Human Life

Test Yourself

1. What do you understand by the term life cycle?
2. Changes take place when we grow. Mention a few changes that you have observed in your body.
3. How is your body different to that of an old person?
4. Your father weighs more than you. Why do you think so?

You already know:

- life cycle of animals.

You will learn:

- changes in human life.
- ways to cope up with changes during puberty.
- good touch from bad touch.

A. Growing does not only mean becoming taller. Throughout life, human body changes in size and weight. The Figure 10.10 (a) to (f) shows some of these changes.

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1 year old (Infant)

(a)

Babies grow fast after they are born. They need very special care from family and friends. Most babies learn to walk when they are about one year old.

(b)

5 years old (Child)

When children are five years old they can look after themselves but they still need certain help. They can walk, talk, run, write and do many things.

(c)

14 years old (Adolescent)

Both boys and girls grow fast during this period. They not only become tall but also start to develop many new changes inside their bodies. It becomes possible for them to reproduce.

(d)

20 years (Young Adult)

Generally, the growth rate of young adults slows down in this period. Some of them start to put on weight. Those who eat fatty and sugary food constantly with either little or no exercise are likely to gain lots of weight.


(e)

45-60 years old (Adult)

People in this period of life are called adults. Only few changes such as loss of hair, weight gain, and appearance of wrinkles are noticeable in them.

60 and above (old)

People belonging to this group find difficulty carrying out physical work as they become tired easily. Their skin also becomes more wrinkled, and many of them even start to appear shorter.


(f)

Figure 10.10. Human body change.

What differences do you notice between a child and a young adult?

Why does weight change as humans grow from infancy to adulthood?

Why do you think humans appear shorter when they reach 60-70 years?

B. Look at Figure 10.12 and answer the following questions.

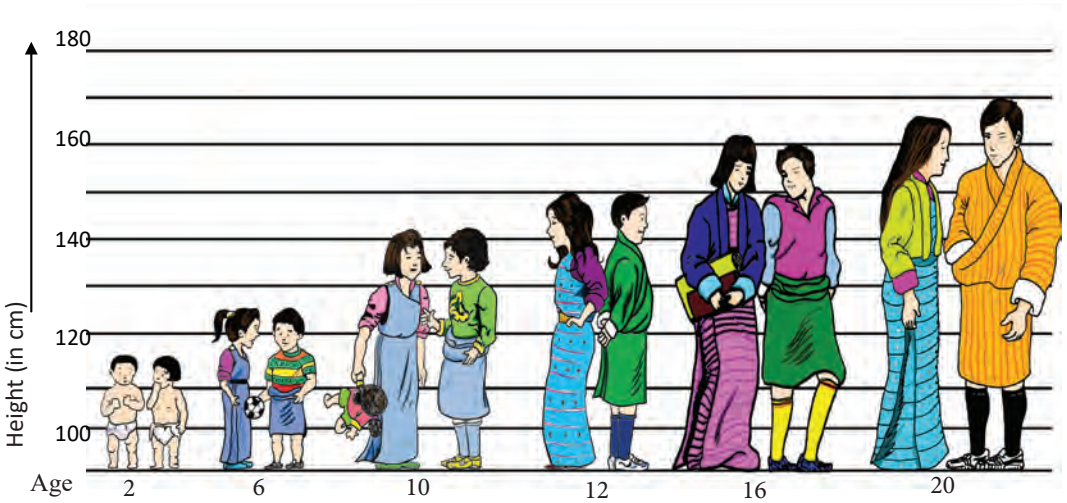

Figure 10.11. Height by age and gender.

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At what age do girls grow faster than boys?

At what age do boys grow faster than girls?

Who on the average is taller at adulthood?

It is very important to know the changes happening in our body. As these changes take place it is equally important to know about good touch and bad touch.

Work in group

Your teacher will provide a link to Google Forms to express your views on good touch and bad touch. Based on the findings, create a video using Scratch to advocate on good touch and bad touch. Share the video with the class.

Who is the best person to talk to if someone touches you in a bad way?

Why can we choose that person?

What can community/government do to stop adults abusing young people?

C. Measuring the growth of small children and babies is a good way of finding out if they are healthy.

Growth is recorded on a special card given to the baby's mother. The health worker records the baby's weight. Here is the Growth Chart of a healthy baby.

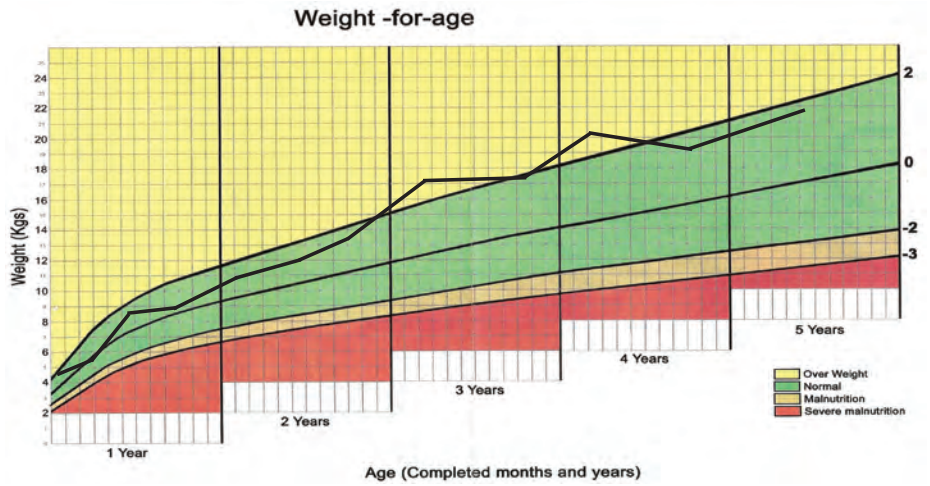
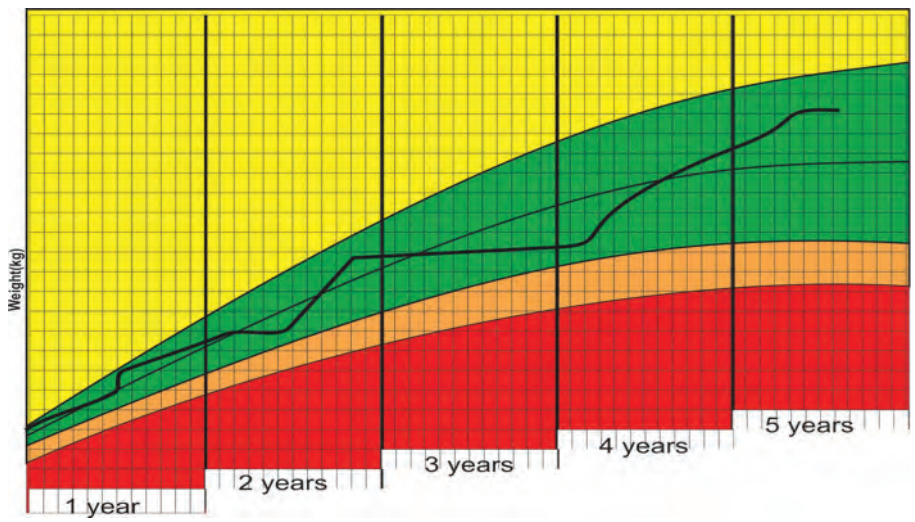
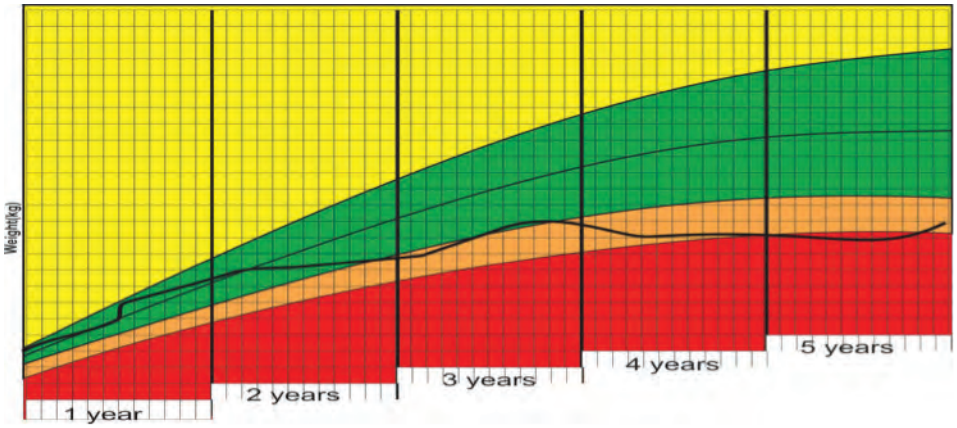


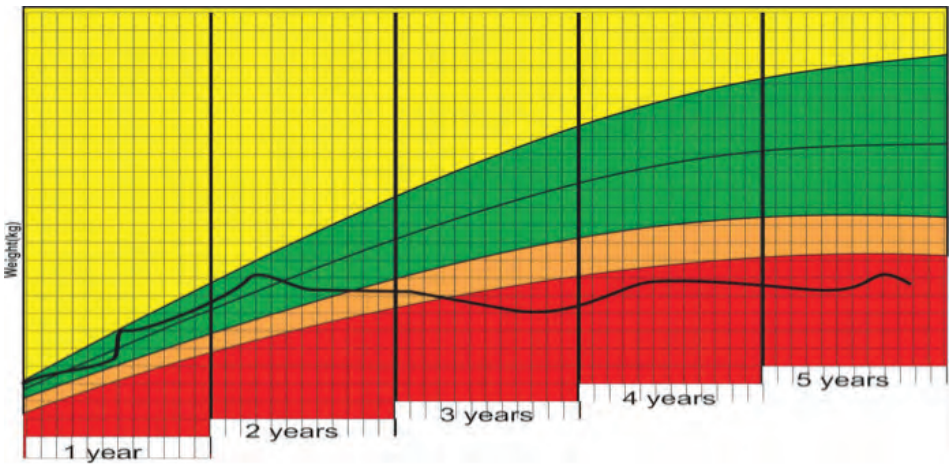
Figure 10.12. Growth chart.



(a) Healthy



(b) Malnourished



(c) Severely malnourished

Figure 10.13. Types of growth chart

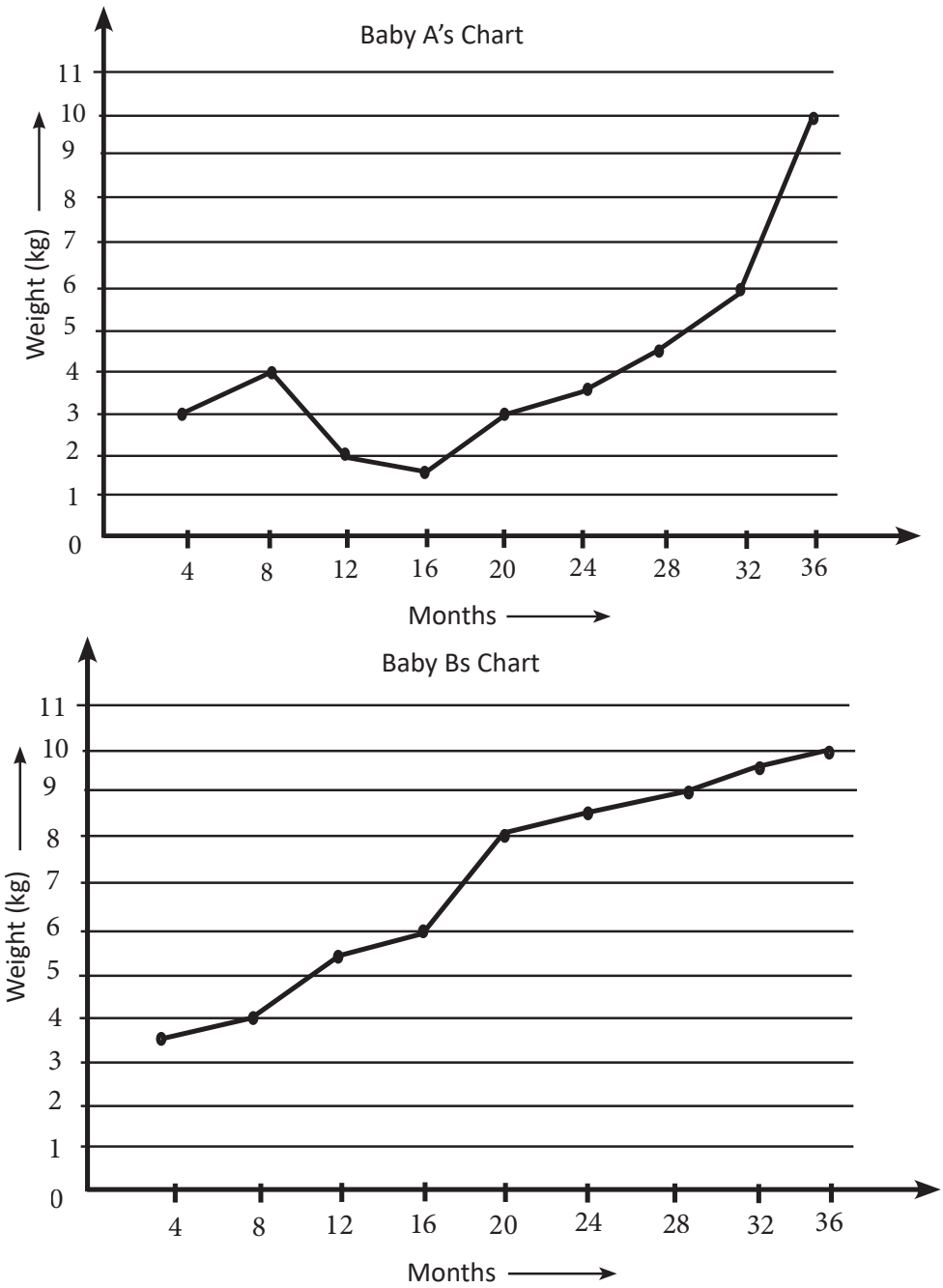
Discuss in groups.

Why does the line going up in the chart healthy growth?

Why is the dropping line in the chart considered severely malnourished?

The growth charts for three children are given in Figure 10.14 (a) to (c).

Read them carefully.



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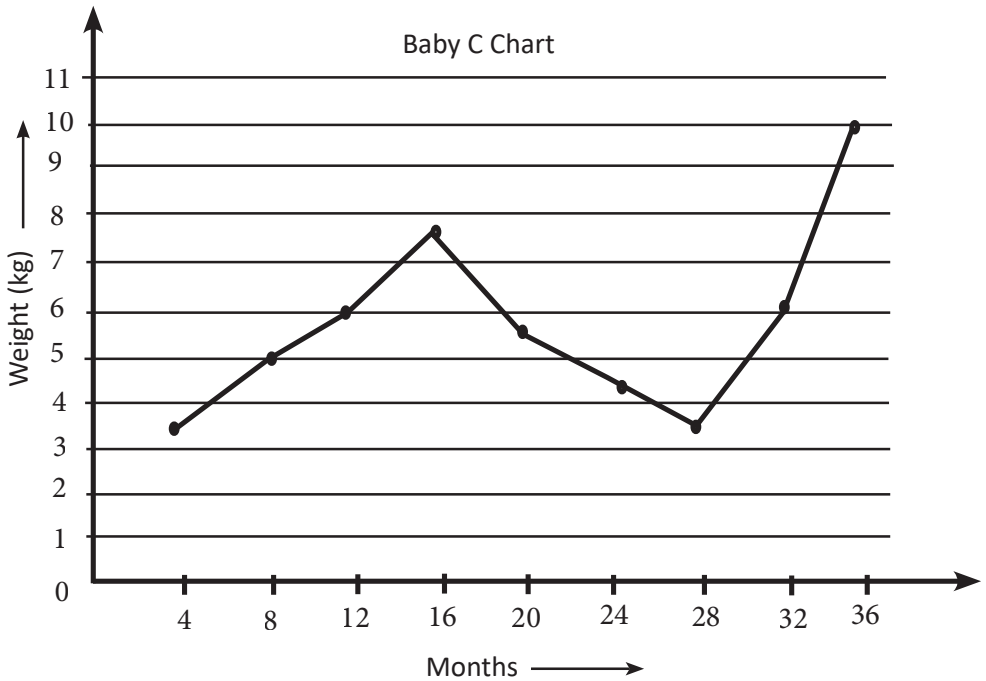

Figure 10.14. Comparing growth chart

Which baby has grown well?

Which baby lost weight after 16 months?

Which baby was ill after 8 months?

When did baby C start to get better?

What was the weight of baby B at 2 years?

When did baby A start to grow fast?

How long did baby C's illness last?

Why do these children have different growth records?

Check Your Progress

i. Why is it important to maintain a health card?

ii. What are the different stages in the human life?

THINK AGAIN

1. Match items of Column A with correct answers of Column B

Column A	Column B
1. Proteins	a. Support
2. Carbohydrates	b. Grinding
3. Canines	c. Energy for activity
4. Skeleton	d. Body building
5. Molar	e. Tearing
6. Muscles	f. Food for protection
	g. Movement

2. Why do we need different types of teeth?
3. What is the importance of double circulation in human body?
4. Growth does not mean only physical growth. Justify the statement.
5. Is Bhutanese diet generally balanced? Discuss.
6. Look at Figure 10.15.
   a. Label the parts A,B,C and D.
   b. What type of blood does Part A carry?
   c. Why is Part D important for human body?

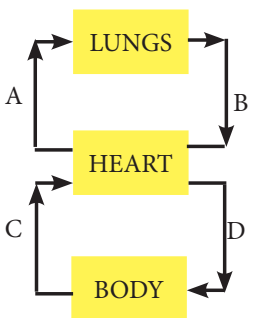

Figure 10.15.

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CHAPTER 11

Work and Energy

11.1. What is Work

Test Yourself

1. What is force?
2. State the effects of force.
3. When do you think the work is said to be done?
4. Give two examples of work done.

You already know:

- force and effect of force.

You will learn:

- work.

A. Work is said to be done when a force moves an object over a distance.

If the force applied does not move the object, work is not done.

Discuss the following activities in groups.

Copy and complete the Table 11.1.

Table 11.1 *Identifying Work Done*

Activity	Has Work been Done?	Why?
Arranging books on the shelf		
Cleaning chalk board		
Sitting on a chair		
Emptying dustbin		
A boy standing with a bucket of water		

Share the findings with the class.

B. Your teacher will bring in sheets of paper with activities written on them for a lucky dip.

Each student will pick up one sheet and carry out the activity mentioned in the sheet.

Rest of the students should observe and complete Table 11.2 in their notebook.

Table 11.2 *Conditions for Work Done*

Activity	Has Force Been Applied?	Did the Body Move Over a Distance?	Work Done/ Work not Done

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Take turns for lucky dip and repeat the process.

Check Your Progress

i. Define work.

ii. A boy pushing a pillar with all his force is not doing any work. Why?

http://www.physicstutorials.org/home/energy-work-power/work

11.2. Simple Machine

Test Yourself

1. What is work?
2. Give a situation in which work done is zero.
3. Name two simple machines that we use in our daily life.
4. Why do we use machine?

You already know:

- work.

You will learn:

- simple machine.
- types of simple machine.

A. We can do many work with our own hands. However, our hands are not efficient to do all kinds of work. For example, we cannot cut a tree with our bare hands. We need an axe. In this case, axe is a simple machine. Simple machine is a device used for making our work easier and faster.

Machines can be big or small. All big machines are made from a combination of small machines. Machines play a very important role in our daily life.

Suppose you want to fix a nail on the wall. Can you fix it without using any tools?

What simple machine will you use to fix a nail?

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Work in groups

Discuss and list down the machines we use to do the following activities.

Copy and complete Table 11.3.

Table 11.3 *Types of Machine*

Activitie	Machine
a. Clipping finger nails	
b. Digging garden	
c. Cutting your hair	
d. Chopping firewood	
e. Hoisting of national flag	

B. The following are the types of simple machines that we commonly use in our day-to-day life. Your teacher will demonstrate the working of each type of machine.

i. Lever

A lever is a strong bar which is capable of turning about a fixed point called **pivot** or **fulcrum**.

Example: a pair of scissors, bottle opener, beam balance, see-saw, etc.

Figure 11.1. Types of Lever.

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ii. Wheel and Axle

In this machine, the wheel is fixed to the axle which turns together.

Example: steering wheel, water tap, wheels and axle in a vehicle, etc.

(a) (b) (c) (d)

Figure 11.2. Wheel and Axle.

iii. Pulley

Pulley is a wheel or disc with a groove along its circular edges.

Example: pulley to draw a bucket of water from a well, pulley in a flag pole, pulleys in lift cranes, etc.

(a) (b) (c) (d)

Figure 11.3. Uses of pulley.

iv. Inclined plane

An inclined plane is a flat surface with one end raised higher than the other. Example: axe, winding stairs, screw, wooden peg, etc.

(a) (d)

Figure 11.4. Inclined plane.

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v. Gear

A gear is a wheel with teeth around its rim. A gear usually fits into another gear to make different parts of the machine which makes it to move.

Common objects having gears in them are: analog clocks and watches, vehicles, drills, bicycle chains, etc.


(a)


(b)


(c)

Figure 11.5. Gears.

Work in pairs

Look at the pictures in Figure 11.6.

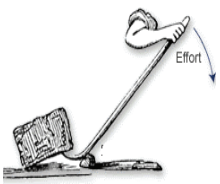

(a)


(b)


(c)


(d)


(e)



(f)


(g)


(h)

Figure 11.6. Types of simple machines.

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Copy and complete Table 11.6.

Table 11.4 *Identifying Simple Machines*

Simple Machine	Example
i. Lever	
ii. Gear	
iii. Wheel and axle	
iv. Inclined plane	
v. Pulley	

Give three functions of a machine.

Can we say that a crowbar is a simple machine? Why?

Check Your Progress

i. List any four simple machines that you use at home.

ii. Copy and complete Table 11.5

Table 11.5.

Sl No	Activity	Simple Machine Used
1	Walking on a staircase	
2	Closing a water tap	
3	Playing on a see-saw	
4	Spinning wool using a spindle	

http://www.mikids.com/Smachines.htm
http://www.cosi.org/downloads/activities/simplemachines/sm1.html
http://www.tutorvista.com/content/physics/physics-i/power-energy-machines/simple-machines.php#

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11.3. Energy Related to Motion

Test Yourself

1. Name different forms of energy.
2. What form of energy is present in a bouncing ball?
3. What are the forms of energy that we get from the Sun?
4. Which has more kinetic energy, light object or heavy object moving at the same speed?

You already know:

- forms of energy.

You will learn:

- factors that affect kinetic energy.

A. When a stretched bow string is released, the arrow flies towards the target.

What form of energy is present in a flying arrow?

Work in groups

You may need:

- rubber band

Stretch a rubber band.

Then release it towards the wall.

What happens?

What form of energy is present in the flying rubber band?

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The energy possessed by the moving object is called **kinetic energy**.

Write some other examples of kinetic energy.

B. Kinetic energy depends upon the speed of the moving object.

Work in groups

You may need:

- a marble
- channel (made of cardboard or metal or chart paper approximately 60 cm long)
- thick books
- target (paper box approximately 5 cm x 5 cm)
- ruler

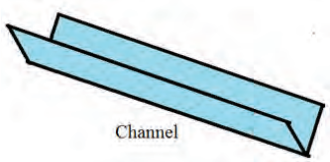

Figure 11.7. Cardboard channel.

Set up the arrangement as shown in Figure 11.8.

Let a marble roll down the channel to strike the target.

Record how far the target moves.

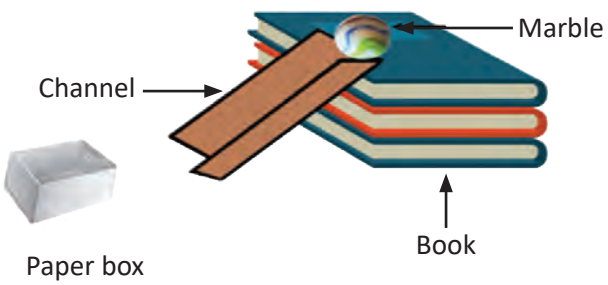

Figure 11.8. Rolling marble.

Increase the speed of the marble by increasing the number of books piled.

Repeat the process.

Copy and fill in Table 11.6.

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Table 11.6 *Height versus Distance Moved*

Number of Books Piled	How Far does the Target Move (cm)
1	
2	
3	

What kind of energy does the moving marble have?

What remains the same throughout your experiment?

What is different throughout the experiment?

In which case does the marble have more kinetic energy?

Why is the number of books increased?

Does the kinetic energy of the marble depend on the speed of the marble? How?

C. Heavy moving object has more kinetic energy.

Work in groups

You may need:

- two marbles of different mass
- channel [made of cardboard or metal or chart paper approximately 60 cm long]
- thick books
- Target (paper box approximately 5 cm x 5 cm)
- ruler

Set up the arrangement as shown in Figure 11.9.

Figure 11.9. Rolling marbles of different mass.

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Roll the light (small) marble. Record how far the target moves.

Repeat with the heavy (big) marble.

Copy and complete the following Table 11.7.

Table 11.7 *Mass versus Distance Moved*

Marble	How Far does the Target Move (cm)
Light (small) marble	
Heavy (big) marble	

Which marble pushes the target further?

Which marble has more kinetic energy?

What remains the same throughout the experiment?

What is different throughout the experiment?

Does the kinetic energy of the marble depend on its mass? How?

Check Your Progress

i. What is kinetic energy?

ii. Name the factors on which kinetic energy depends.

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11.4. Energy Related to Position

Test Yourself

1. State two factors that affect kinetic energy.
2. What form of energy is present in the water in a pond?
3. Sonam is standing on a chair. What kind of energy does Sonam possess?
4. Give some examples of potential energy.
5. Which has more potential energy: light object or heavy object at the same height?

You already know:

- kinetic energy.
- factor affecting kinetic energy.

You will learn:

- factor on which potential energy depends.

A. When the string of a bow is stretched, it has energy stored in it. This stored energy is called **potential energy**.

Potential energy is the stored energy which is due to position or condition of an object.

A raised object has potential energy and it can do work. For example, a raised hammer has potential energy and can drive a nail into a wooden table. Thus, a body which is raised higher has more potential energy.

In groups, discuss and come up with some more examples of objects that have potential energy. Share your findings with the class.

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B. Work in groups

You may need:

- clamp stand
- bob
- string
- matchbox

Suspend the bob from a clamp stand as shown in Figure 11.10.

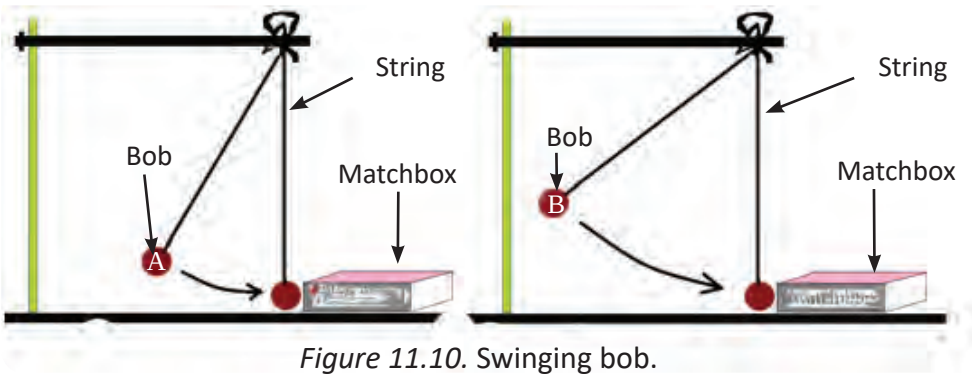

Figure 11.10. Swinging bob.

Place a matchbox close to the bob.

Pull the bob to position A.

Release the bob.

What do you observe?

Repeat the activity by raising the bob to position B.

What do you observe?

Which position of the bob is pushing the matchbox further? Why?

How did you make the test fair?

What can you conclude from the activity?

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C. A heavy body has more potential energy.

You may need:

- clamp stand
- two bobs of different mass
- string
- matchbox

Suspend the small bob from a clamp stand as shown in Figure 11.11.

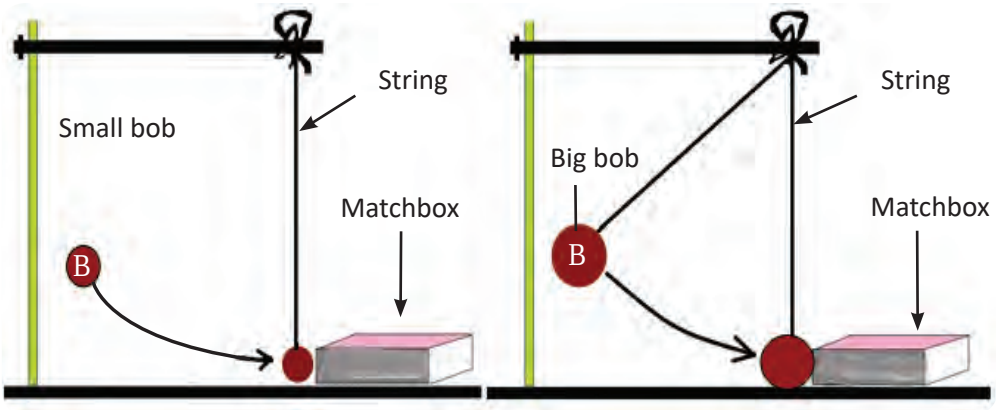

Figure 11.11. Swinging bob of different mass.

Place a matchbox close to the bob.

Pull the bob to position B.

Release the bob.

What do you observe?

Repeat the activity with the heavier bob from the same position B.

What do you observe?

Which bob is pushing the matchbox further? Why?

How did you make the test fair?

What can you conclude from the above activity?

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D. Work in pairs

Use downloaded PhET simulation or the given URL to answer the questions.

https://phet.colorado.edu/sims/html/energy-skate-park-basics/latest/energy-skate-park-basics_en.html

Take a screenshot of simulation at different positions and copy paste it on MS word.

Display the print out in the class.

What happens to kinetic energy when speed increases?

How is kinetic energy and potential energy related in the simulation?

What happens to the total energy when there is a change in kinetic and potential energy?

Check Your Progress

i. What is potential energy?

ii. Name the factors on which potential energy depends.

iii. Less pain is experienced if you happen to fall from a lesser height. Why?

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11.5. Conservation of Energy

Test Yourself

1. What is energy?
2. Mention the sources of energy.
3. What happens to the energy of an arrow after it is released from the bow?
4. What happens to the energy of an arrow after it hits the target?

You already know:

- energy change.

You will learn:

- conservation of energy.

A. The law of conservation of energy states that energy can neither be created nor destroyed but can be changed from one form to another.

Work in groups

You may need:

- bob
- string
- clamp stand

Suspend the bob with string from the clamp stand.

Take the bob to height A.

What kind of energy does the bob

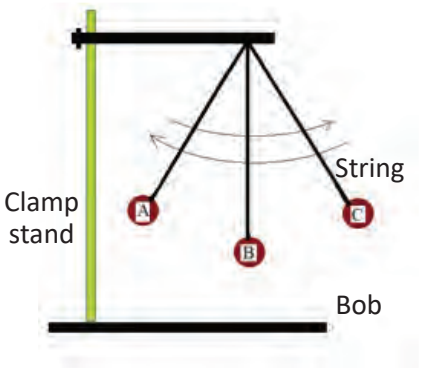

Figure 11.12. Energy at different positions.

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possess at position A?

Now release the bob.

What do you observe?

What kind of energy does the bob possess now?

Draw the positions of bob indicating the different types of energy at different positions.

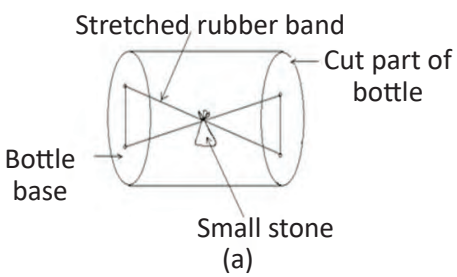
Write the energy change of the swinging bob.

The experiment shows that potential energy is converted into kinetic energy, and the kinetic energy is changed back to potential energy. The cycle repeats without gain or loss of energy. Therefore, the energy is conserved.

B. Work in groups

You may need:

- transparent plastic bottle
- rubber band
- iron nail
- string
- stone
- sellotape
- a pair of scissors



Cut the bottle from the middle.


(b)


(c)

Figure 11.13. Demonstrating conservation of energy.

Use the nail to make two holes at each end of the bottle.

Cut the rubber band and thread it through the holes as shown in Figure 11.13.

Use the string to tie the stone at the point where the two parts of the rubber band cross.

Place it on the floor and give it a gentle push.

What happens? Why?

Write the energy changes that take place.

Check Your Progress

i. State the law of conservation of energy.

ii. What energy changes take place in a glowing electric bulb?

11.6. Fossil Fuel and Nuclear Fuel

Test Yourself

1. Name the forms of energy.
2. Which form of energy is the most important? Why?
3. What type of fuels do you use at home to cook food?
4. Where do these fuels come from?

You already know:

- oil is used in vehicles, for lighting lamps, and for heating purposes.

You will learn:

- fossil fuel and nuclear fuel.

A. Fossil fuel is formed from dead remains of plants and animals buried under the earth millions of years ago.

After millions of years, these buried remains of plants and animals turn into fossil fuel. Crude oil is a type of fossil fuel. The crude oil is separated into liquid petroleum gas (LPG), petrol, kerosene, diesel, fuel oil, bitumen, etc., by fractional distillation. These substances are separated as different fractions based on their boiling points. We use petroleum products as fuel for automobiles, industries, cooking, etc.

Burning of fossil fuel emits carbon dioxide (CO_2). This gas contributes to air pollution and global warming.

Using electric car (e-car) powered by renewable energy helps to reduce the emission of CO_2. Suggest other ways to reduce air pollution.

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(a)

(b)

Figure 11.14. Fossil.

Use Scratch software to create awareness on the impacts of burning fossil fuel.

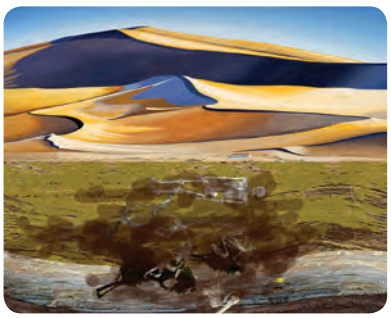
If the living things die today, how long will it take them to turn into fossil fuel?

How do we make use of kerosene, petrol, and bitumen?

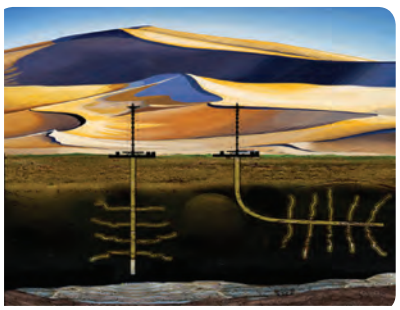
Name some fossil fuels used for cooking.

Do you think fossil fuels will last forever? Why?

B. Look at the pictures in Figure 11.15 and study each of them.



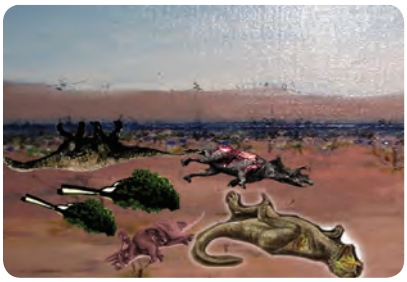
(a) Compressed dead bodies



(b) Fossil fuel formed

(c) Covered by soil

(d) Living



(e) Dead

Figure 11.15

Arrange the picture numbers along with the caption in sequence to get the fossil fuel. Note down the number in your notebook.

From the coal, we get fuel like coke, phenol, pesticides, explosives, synthetic fibre, dyes and paints. We also get biogas which is a clean fuel and does not leave any ash after burning.

Petroleum products are primarily used as fuel. They are also used to make lubricating oils, candles, petroleum jelly, grease, polish, medicine, ointment, cosmetics, asphalt (bitumen- used for surfacing roads) to manufacture plastic, synthetic rubber, synthetic fibre, etc.

We know that fossil fuels are used for cooking, running vehicle and other machineries.

Write down some of the impacts of using fossil fuels.

C. The other kind of fuel is nuclear fuel. For example, substances like uranium and plutonium. When atoms of uranium and plutonium break to form new substances, huge amount of heat energy is released which can be changed to electrical energy.

Small amounts of nuclear fuel produce huge amount of energy. For example, 3000 million kg of coal = 1 kg of nuclear fuel.

Nuclear fuel does not produce smoke or carbon dioxide. It also produces very small amount of waste, but it is very dangerous.

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Search information about nuclear fuel and fossil fuel. Collect as many information as possible to prepare a class debate for the topic "fossil fuel is better than nuclear fuel."

Check Your Progress

i. Write three differences between fossil fuel and nuclear fuel.

ii. What are the ways to reduce the use of fossil fuel?

http://www.brainpop.co.uk/uk/science/energy/fossilfuels/
http://www.brainpop.co.uk/science/energy/nuclearenergy/

THINK AGAIN

1. Write true or false for each statement.
   i. A winding staircase is an example of a pulley.
   ii. The energy in a stretched bow is potential energy.
   iii. Energy cannot change from one form to another.
   iv. Computer is an example of simple machine.
   v. Work is said to be done when a force moves an object over a distance.
2. Why do mountain roads have many windings?
3. Two stones of 2 kg and 4 kg were dropped from the top of the building. Which stone will have more impact on the ground? Why?
4. A huge stone could not be rolled off the road by many people. How can it be done by a few people?
5. Look at the three pictures in Figure 11.16, answer the following questions.

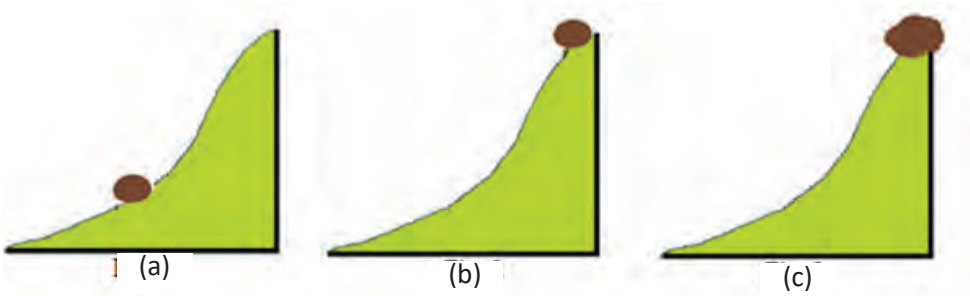

Figure 11.16

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i. Which rock has the minimum potential energy? Why?

ii. Which rock has the maximum potential energy? Why?

6. Why is the use of nuclear fuel unsafe for human beings?

7. There are two categories that machines can be divided into, and they are 'simple' and 'complex'. Simple machines redirect force to make work easier. Complex machines have two or more simple machines that work together.

Give one example each for simple and complex machine.

CHAPTER 12

Earth, Moon and Sun

12.1. Poles and Equator of the Earth

Test Yourself

1. What is the axis of the Earth?
2. What is rotation?
3. What is revolution?
4. Name two poles of the Earth.
5. Which imaginary line divides the Earth into two halves?

You already know:

- rotation and revolution of the Earth.

You will learn:

- poles and equator of the Earth.

A. Look at the globe. The globe is a model of the Earth. At the top of the Earth is the **North Pole**. At the bottom of the Earth is the **South Pole**. The North Pole lies in the frozen Arctic Ocean. The South Pole lies in the ice-covered continent of Antarctica.

You have already learnt that the axis of the Earth is an imaginary line that passes through the Earth from the North Pole to the South Pole.

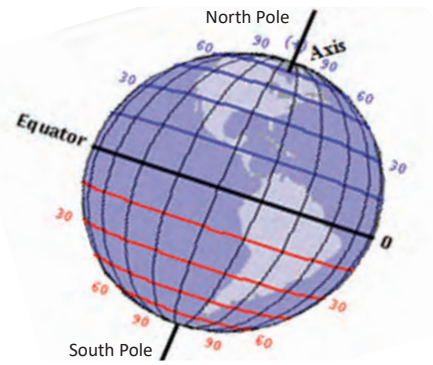

Figure 12.1. The globe.

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Equator is an imaginary horizontal line that divides the Earth into two equal halves.

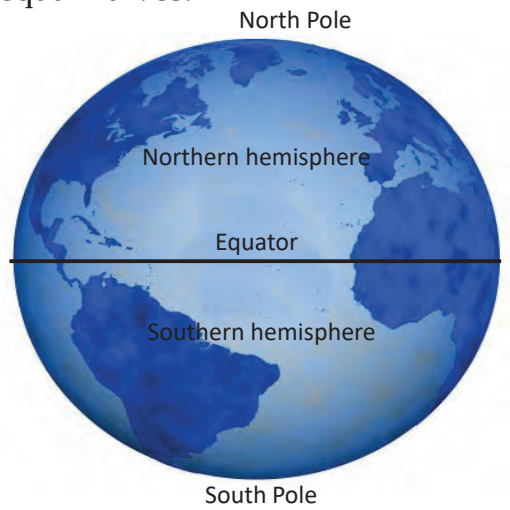

Figure 12.2. Hemispheres of the Earth.

The upper half is known as **northern hemisphere** and the lower half is known as **southern hemisphere**. When it is winter in the northern hemisphere, it is summer in the southern hemisphere.

Work in groups

Discuss and make a model of the Earth showing poles, equator, axis, and the hemisphere.

Write:

What you needed.

What you did.

Display your work in the class.

Check Your Progress

i. Draw the Earth with its axis, equator, poles, and the hemispheres.

ii. What is an equator?

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12.2. Polar Days and Polar Nights

Test Yourself

1. Equator divides the Earth into two hemispheres. Name them.
2. Name the poles of the Earth.
3. Why do the Northern Hemisphere and the Southern Hemisphere have opposite seasons?
4. Why can't we see the Sun in Bhutan for 24 hours?

You already know:

- rotation and revolution of the Earth.

You will learn:

- polar day and polar night.

A. Do you know that there are places in the world where the Sun is visible for 24 hours?

The duration in which there is continuous sunlight for more than 24 hours is called **polar day**. The duration in which there is no sunlight for more than 24 hours is called **polar night.**

Approximately from March 20 to September 21, the sun is visible continuously for 24 hours in the northernmost of the Arctic Circle whereas the southernmost of the Antarctic Circle, the sun is visible continuously for 24 hours approximately from September 21 to March 20.

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For example, In Hammerfest, the northernmost city in the world and one of the two oldest towns in Norway, the polar night lasts for almost two months.

Work in groups

You may need:

- globe

On a globe, locate places where people experience polar days and polar nights.

Discuss and explain the causes of polar days and polar nights.

Check Your Progress

i. What is polar day and polar night?

ii. Places near the Earth's poles have low temperature. Explain.

http://www.worldatlas.com/aatlas/imageh.htm
http://www.kidsgeo.com/geography-games/latitude-longitude-map-game.php

12.3. Solar Eclipse

Test Yourself

1. What is a shadow?
2. How is shadow formed?
3. At what times of the day is our shadow the longest and the shortest?
4. What will happen if the moon comes in between the Earth and the Sun?

You already know:

- formation of shadow.

You will learn:

- region of a shadow.
- solar eclipse.

A. Light travels in a straight line. Shadows are formed when an opaque object blocks the light coming from a source.

Work in groups

You may need:

- torch or candle
- duster

Make the room dark.

Focus the lighted torch on a wall.

Place the duster in the path of the light in between the torchlight and the wall as shown in Figure 12.4.

Move the duster towards the source of the light.

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Observe what you see.

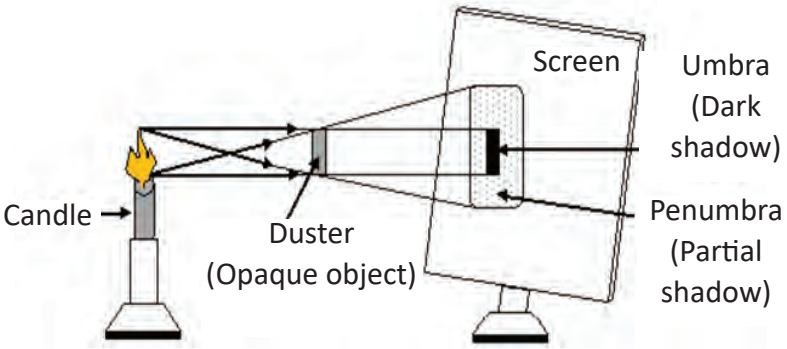

Figure 12.4. Formation of a shadow.

Now move the duster away from the source of the light. Observe what you see.

How many regions do you see in the shadow when the object is closer to the source of light?

What is the difference in the regions of the shadow?

The darkest region of the shadow is called **umbra**.

The partially dark region of the shadow is called **penumbra**.

B. An eclipse is caused by shadow formation. Just as you see shadows of objects on the ground, there are shadows formed in the space.

When the Moon comes in a straight line between the Earth and the Sun, the Moon casts a shadow on the surface of the Earth. This phenomenon is called **solar eclipse**.

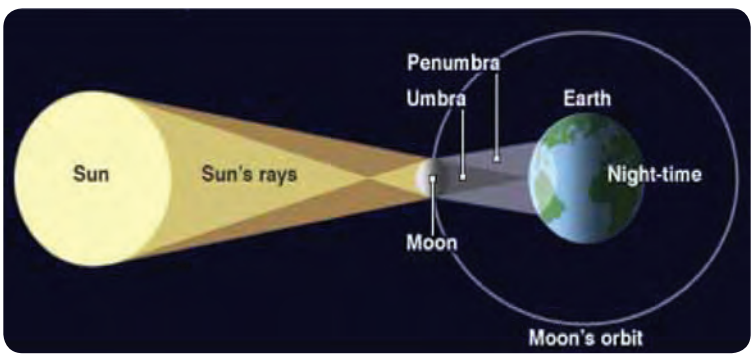

Figure 12.5. Solar eclipse.

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Check Your Progress

i. Draw a diagram of a solar eclipse.

ii. Differentiate between umbra and penumbra.

https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-an-eclipse-k4

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12.4. Lunar Eclipse

Test Yourself

1. What are the different regions of a shadow?
2. What is solar eclipse?
3. How is solar eclipse caused?
4. What happens when the Earth comes in between the Sun and the Moon?

You already know:

- solar eclipse.

You will learn:

- lunar eclipse.

A. Lunar eclipse occurs when the Earth is in between the Sun and the Moon in a straight line. Earth casts a shadow on the surface of the Moon.

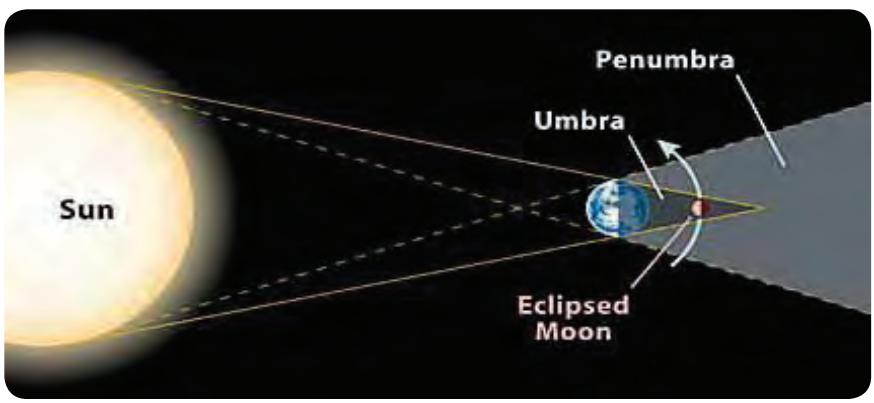

Figure 12.6. Lunar eclipse.

Work in groups

Open the following link and watch the video. Answer the questions that follow:

https://www.youtube.com/watch?v=rCYOj3NdHJM&pbjreload=10

How is the solar eclipse different from the lunar eclipse?

What is the difference between total and partial solar eclipse?

What are the traditional beliefs on solar and lunar eclipse?

Check Your Progress

i. Describe lunar eclipse in your own words.

ii. How is lunar eclipse important in the study of science?

http://www.youtube.com/watch?v=fWNKQ9jGmiM

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Think Again

1. Fill in the blanks.
   a. The Earth spins on its own _____.
   b. Bhutan lies in the _____ hemisphere.
   c. When the Earth comes in a straight line between the Sun and the Moon, _____eclipse occurs.
   d. _____ is the very dark region of a shadow.
2. Complete Figure 12.7 by showing the formation of shadow by a ball on the wall.
3. Why is it not advisable to look at the Sun directly during the solar eclipse?
4. Write the differences between the solar and lunar eclipse.
5. Ask your elders what they think about the solar eclipse and lunar eclipse. Do you agree with them? Why?

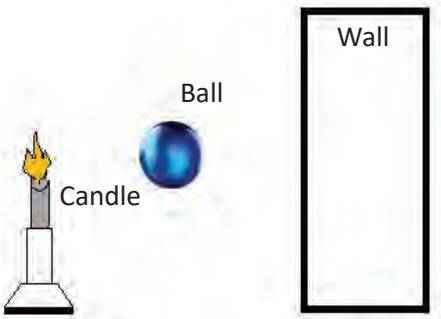

Figure 12.7.

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Annexure - A

Assessment

Assessment in science involves testing of scientific knowledge, skills, values and attitudes. The assessment should be able to diagnose the learning progress or gap of the learner in terms of expected core competencies and learning outcomes. Consequently, it is imperative to use appropriate assessment techniques and tools to provide relevant feedback to the learners and to assess the impact of teaching learning processes.

Holistic assessment entails assessing all the three domains of learning: cognitive, psychomotor and affective. Thus, the assessment practice in science assesses Scientific Knowledge (SK), Working Scientifically (WS), Scientific Values and Attitudes (SV) of the learners.

Purpose of Assessment

Assessment is used to:

i. inform and guide the teaching and learning process.
ii. gauge the efficacy of the teaching and learning process.
iii. assess the relevance of curriculum materials.
iv. help learner's set learning goals.
v. monitor learner's progress in achieving learning outcomes.
vi. generate reports on learner's performance.

Areas of Assessment

The assessment in science focuses on the three domains of learning reflected as scientific knowledge (cognitive), working scientifically (psychomotor) and scientific values and attitudes (affective) as detailed below:

i. **Scientific Knowledge (SK):** The learner meets the requirement reflected in the learning objectives and expected learning outcomes under each unit, chapter, and topic. The learner is able to provide expected scientific information through various ways as asked.

ii. **Working Scientifically (WS):** The learner demonstrates scientific skills such as observing, predicting, inquiring, questioning, investigating, experimenting, measuring, classifying, recording, analyzing, inferring, communicating, etc. and explain how science works.

iii. **Scientific Values and Attitudes (SV):** The learner exhibits interest, curiosity, intellectual drive, creativity, exploring possibilities, inquisitiveness, finding facts, coherent presentation of ideas, reasoning skills, collaborative skills, respect and concern for all, etc.

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Assessment Modalities

The assessment focuses on diagnosing the learning gap through Continuous Formative Assessment (CFA), Continuous Summative Assessment (CSA) and Summative Assessment (SA) using appropriate assessment tools.

Specifically, the assessment is carried out in the following ways:

i. **Home work:** The extended activities given to students encourages independent learning and responsibility to complete the task. The task is assigned only on important topics that require extra time and energy, and to be assessed using appropriate assessment tools such as rubrics, rating scale, and checklist.

ii. **Class work:** The learning activities such as group discussion, presentation, individual work, etc. are assessed using appropriate assessment tools.

iii. **Scrapbook:** It is a collection of pictures, specimens, photographs, etc. related to scientific concepts and ideas along with a brief description and student's personal expression of feelings. It is aimed at instilling a scientific attitude: such as creativity, critical thinking, and self-reflection. The scrapbook is maintained throughout the academic session with periodical assessments. An exercise book can be maintained by each student to make a minimum of 20 entries in their scrapbook. The following are the suggested entries, but NOT limited to:

- clippings from newspaper, magazines, comics, newsletters, fliers, pamphlets, and even including download from internet.
- specimens may include dry leaves, cereals, pulses, dyes, bird feathers, grains, exoskeleton of insects, dried flower petals, nuts, plant parts, etc. with a few statements of the students' reflection.
- write up on any interesting scientific events and natural patterns like rainbows, clouds, bird nests, leaf patterns, insect home, bird's sounds, stream, animal tracks, animal bones, animals caring their young ones, animal teeth with students' personal thoughts and reflections.
- report on any experiment or research work that the students have conducted during the school science activities or science exhibition. The student has to write about, how it has been done, why it is important and how it can benefit in his or her life.

While making entries, students are expected to follow the common format provided below:

- Date and time for each of the entries.
- The sources of the entries.
- Description of the entries.

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- Students personal expression.
- Every entry must contain teacher's comments and feedback.

iv. **Project work:** It is an opportunity for the learner to learn and explore the basics of science through the scientific process of observation, investigation, analysis, and synthesis to generate scientific knowledge and understanding. The project work is given based on the topic of the learner's choice and assigned at the beginning of the academic session to each grade. It is mandatory to assess both process and product of the project work. The product of the project work must be inclusive of write ups, illustrations, models or collection of real objects. The extent of the project work for each class can be guided by the minimum number of words suggested below:

- Class IV: 300-400 words
- Class V: 500-600 words
- Class VI:700-800 words

The format for the project work write-up must include observation, questioning, hypothesis, design, data collection, analysis, conclusion and sharing as explained in the scientific processes. The teacher may use the given sample rubrics to assess the students' project work.

v. **Practical work**: It is a hands-on experience given to the learner to test, develop, and apply the scientific theories learnt in the class. It enhances the deeper understanding of scientific ideas which culminates in the development of scientific skills, temper and positive attitudes and values. A practical work is conducted based on the requirement of the topic and concept.

vi. **Test and Examination**: It is a procedure intended to establish the quality, performance, or reliability of learner's learning. It is used to test the conceptual understanding and competencies of students in subject matters. Tests are generally administered at the end of every chapter while the examinations are conducted at the end of each term.

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Assessment Matrix

Assessment Matrix											
		CFA			CSA					SA	Grand Total
		Domains				Domains					
		SK	WS	SV		SK	WS	SV	Total	Examination	CSA + Exam
Assessment Modalities	Term I	Home work			Home work	1	1	3	5	20	45
		Class work			Class work	1	2	4	7		
		Project work			Project work	1	3	1	5		
		Scrapbook			Scrapbook	1	2	1	4		
		Practical work			Test	4			4		
	Term II	Home work			Home work	1	1	3	5	30	55
		Class work			Class work	1	2	4	7		
		Project work			Project work	1	3	1	5		
		Scrapbook			Scrapbook	1	2	1	4		
		Practical work			Test	4			4		
Grand Total						16	16	18	**50**	50	**100**

Topic-wise time allocation and weighting

Chapter number	Chapter	Maximum time required (mins)	Total Weighting (%)
1	Element, Acid and Alkali	520	8
2	Chemical Change	440	7
3	Separating Mixture	600	9
4	Mass and Weight	280	4
5	Light and Sound	560	9
6	Electricity and Magnetism	520	8
7	Living Things and their Environment	560	9
8	Green Plants	640	10
9	Classification of Animals	600	9
10	Diet and Human System	640	10
11	Work and Energy	640	10
12	The Earth, the Moon and Sun	480	7
	Total	**6480**	**100**

The actual teaching 6480 minutes or 162 periods of 40 minutes in a period.

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Assessment Tool

It is important to use appropriate assessment criteria and tools to obtain the right information on the progress of the learners. This is because the quality of information acquired through assessment is determined by the tools and descriptors chosen for assessment. The assessment tools and samples are given below:

i. **Checklist:** It offers 'yes' or 'no' format in relation to the achievement of specific criteria by a learner. It can be used for recording observation of an individual, a group, or the whole class.

ii. **Rating scale:** It allows teachers to indicate the degree or frequency of the behaviours, skills, and strategies displayed by the learner. It has scale-based criteria to describe the quality or frequency of the work with precise and reliable descriptive words. The teachers can use it to record observations and the learners can use it for self-assessment.

iii. **Rubric:** It presents a set of criteria with a fixed measurement scale and a detailed description of each level of performance. It helps to increase the consistency and reliability of scoring.

iv. **Anecdotal Record:** It helps to record specific observations of a learner based on behaviour, skills, and attitudes in relation to the expected learning outcome. It provides cumulative information and direction for further instruction. It can be used for the ongoing observations.

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Sample Assessment Tools

i. Checklist

	Domains													Teachers feedback	Remedial Actions
	SK				WS						SV				
Name	Name everyday materials	Name some transparent and opaque materials	Categorize things into degradable and non-degradable things.	Classify things in our surroundings into natural and man-made things.	Observation	Experimentation	Recording	Analysis	Conclusion	Communication	Curiosity	Respect	Inquiry	Collaboration		
Dorji	✓	✓	✓	X	X	X	✓	✓	✓	X	✓	X	X	X	SK: 3 ticks WS: 3 ticks SV: 1 tick	

ii. Rating Scale

Domains	Key Areas	Performance Rating					
		Exceeding	Meeting	Approaching	Beginning	Feedback	Remedial Action
SK	Define living things						
	Define non – living things						
	Mention the characteristics of living things						
	Mention the characteristics of non-living things						
	Define habitat						
	State the importance of habitat						
	Define adaptation						
	Give example of the technique used by living things to adapt						
	State the importance of camouflage						
	Explain food chain						
WS	Observation						
	Experimentation						
	Recording						
	Analysis						
	Conclusion						
	Communication						
SV	Curiosity						
	Respect						
	Inquiry						
	Collaboration						

iii. Rubric

	Performance Rating					Remarks/ Feedback
Domains	**Key Areas**	**Exceeding**	**Meeting**	**Approaching**	**Beginning**	
Scientific Knowledge	Sources of light	Identify four or more sources of light	Identify three sources of light	Identify two sources of light	Identify only one source of light	
	Properties of light	Explain two properties of light in their own words	Explain one property of light in their own words but one as given in the book	Explain two properties of light as given in the book	Explain any property of light as given in the book	
	Properties of sound	Explain two properties of sound in their own words	Explain one property of sound in their own words but one as given in the book	Explain two properties of sound as given in the book	Explain any property of sound as given in the book	
Work Scientifically	Scientific skills	Demonstrate observation, experimentation, recording, and communication skills	Demonstrate any three skills	Demonstrate any two skills	Demonstrate any one skill	
Scientific values and attitudes	Scientific attitude and scientific inquiry	Demonstrate curiosity, respect, inquiry and collaboration	Demonstrate any three	Demonstrate any two	Demonstrate any one	

iv. Anecdotal Record

Anecdotal Records are detailed, narrative descriptions of an incident involving one or several learners. They are focused narrative accounts of a specific event. They are used to document unique behaviors and skills of a learner or a small group of learners. Anecdotal Records may be written as behavior occurs or at a later time and comprise of following components:

Anecdotal Record

Developmental Domain: …….

Learner's Name:…….. *Learner's Age:*……..

Time: ……
Observer:……

Setting:…….

Anecdotal:

(Describe exactly what you see and hear; do not summarize behavior. Use words conveying exactly what a learner said and did. Record what the learner did when playing or solving a problem. Use specific language to describe what the learner said and did including facial expression and tone of voice; avoid interpretations of the learner's behavior).

Interpretation:

(What specific inferences can you make from this anecdotal record? What does it tell you about this learner's growth and development? The inferences must be directly related to the domain designated in the anecdote and refer to a specific aspect of the domain.)

Implication for Planning:

(Give a specific activity that you would incorporate into curriculum planning as a result of what you learned about this learner. Make sure that the plan is directly related to the area of development described in the anecdote and the activity is different from the one in the anecdote. Include a brief explanation of why you would create this specific activity.)

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Rubric for Presentation

Domain	Key Areas	Criteria				Remarks
		Exceeding	Meeting	Approaching	Beginning	
SK	Preparedness	Demonstrate clear and logical flow of ideas supported by relevant visual aids.	Contains any three components.	Contains any two components.	Contains any one component.	
	Content	Present variety of ideas that are relevant to the topic.	Presents some ideas that are relevant to the topic.	Presents limited ideas that are relevant to the topics.	Presents ideas that are not relevant to the topic.	
WS	Presentation skills	Communicate the ideas, attains to all the audiences, uses proper gestures and completes within time.	Contains any three components.	Contains any two components.	Contains any one component.	
SV	Collaboration	Seek suggestions, responses to the queries and shows a positive learning attitude.	Contains any three components.	Contains any two components.	Contains any one component.	

Rubric for Homework

Domains	Criteria	Performance Rating			
		Exceeding	**Meeting**	**Approaching**	**Beginning**
SV	Completion	All of the assigned work is complete.	Most of the assigned work is complete.	Some of the assigned work is complete.	Little or a few of the assigned tasks are complete.
SK	Accuracy	All of the answers are correct.	Most of the answers are correct.	Some of the answers are correct.	Little or a few of the answers are correct.
WS	Presentation	Work is neat, error free and legible with relevant illustrations.	One component is missing.	Two components are missing.	Three or more components are missing.
WS	Originality	Display of original and creative ideas.	Partial display of original and creative ideas.	Little display of original and creative ideas.	No display of original and creative ideas.
SV	Submission date	Submitted on due date	Submitted one day after the due date	Submitted two days after the due date.	Submitted three days after the due date.

Rubrics for Scrapbook

Domains	Criteria	Exceeding(4)	Meeting(3)	Approaching(2)	Beginning(1)
WS	**Cover design**	Cover has title of the book, name of the author and grade, cover is very attractive.	Cover has all the three components but the cover is less attractive.	Cover has only two components and cover is less attractive.	Cover has only one of the components and cover is very simple.
SK	**Format**	The work contains date, reasons for the entry, source or place of collection, regular feedback from teacher and has critical reflections.	Missing 1 of the 4 components a n d reflection is less critical.	Missing 2 of the 4 components and poor reflection.	Missing 3 of the 4 components and reflection is absent.
WS	**Entries**	Included 16-20 entries with varieties. All the entries have detailed information.	Included 11-15 entries with few varieties. Few entries do not have detailed information.	Included 6-10 entries with fewer varieties. Most of the entries do not have information.	Included 1-5 entries with one or two varieties. Only one or two entries have information.
WS	**Presentation**	The scrapbook entries are well organised,	The scrapbook entries are less organized.	The scrapbook entries are poorly organized.	The scrapbook entries are not organized.
SK	**Creativity**	Scrapbook entries are unique and grab attention throughout.	Scrapbook entries are generally related to commonly observed phenomenon.	Scrapbook entries are mostly related to commonly observed phenomenon.	Scrapbook entries are not related to scientific Phenomenon.

Rubric for Project work

Domains	Key Areas	Performance Rating			
		Exceeding	Meeting	Approaching	Beginning
SV	Observe	Phenomena observed is systematic, objective and verifiable.	Phenomena observed is systematic, objective but not verifiable.	Phenomena observed is objective but not systematic and not verifiable	Phenomenon observed is subjective and not verifiable.
SV	Question	Clearly stated, focused, and relates to variables	Loosely stated, focused, and relates to variables	Loosely stated and relates to variables	Loosely stated and does not relates to variables
SK	Hypothesize	Feature variables and predict the relationship between variables	Predict the relationship between variables	Feature the variables	Makes no sense
WS	Design	Procedure is detailed and sequential.	Procedure is not detailed and sequential.	Lack detailed and sequential procedure	Procedure is not shown
	Collect data	Appropriate method, relevant and sufficient data	Appropriate method, relevant but not sufficient data	Inappropriate method, sufficient but irrelevant data	Inappropriate method, insufficient and irrelevant data
	Analyse	Appropriate mathematical procedures or appropriate charts with clear interpretation	Appropriate mathematical procedures or appropriate charts but no clarity in interpretation	Inappropriate mathematical producers or charts but no clarity in interpretation	Inappropriate mathematical producers or charts and unclear no interpretation
	Conclude	Restates the hypothesis, supports or refutes it, and explains the role of the test in making the decision.	Restate the hypothesis, supports or refutes it,	Supports or refutes the hypothesis	Restate the hypothesis
	Share	Focus on communicating the central idea, using evidences in the logical format	Focus on communicating central idea with evidences	Focus on central idea	No focus on central idea

Annexure - B

Model Question Paper

Subject: Science **Full Marks: 100**

Class: VI **Time: 2 Hrs**

Question 1

Direction: Each question is followed by four possible answers. Choose the correct answer and circle it. (25 marks)

1. Which of the following is an element?
   A. Water
   B. Salt
   C. Sugar
   D. Gold

   Answer: Gold

2. The following steps are to make an indicator using onion. Arrange them in correct order.
   I. Leave the paper to dry.
   II. Crush the onion using mortar and pestle.
   III. Soak the strips of filter paper for 10 – 15 minutes.
   IV. Mix them with warm water in a beaker to make a thick solution.

   A. I, II, III, IV
   B. II, I, IV, III
   C. II, IV, III, I
   D. IV, I, III, II

   Answer: II, IV, III, I

3. Which of the following contains alkalis?
   A. Lemon.
   B. Soap.
   C. Chilli.
   D. Oranges.

   Answer: Soap

4. An unripe mango is sour, but on ripening, it becomes sweet. The change occurring in the mango is

A. physical change.
B. colour change.
C. chemical change.
D. taste change.

Answer: chemical change

5. Which one of the following processes removes the hardness of water?

A. Decantation
B. Sedimentation
C. Boiling
D. Filtration.

Answer: Boiling

6. If sugar is dissolved in water, it forms

A. salt solution.
B. sugar solution.
C. bubbles.
D. ice.

Answer: sugar solution.

7. Sea water is collected in shallow pits and allowed to stand to obtain salts. Heat of the Sun changes the water into vapours leaving behind the salt. The process involved is

A. condensation.
B. melting.
C. freezing.
D. evaporation.

Answer: evaporation

8. When a stone and a feather are dropped from the balcony at the same time, the feather takes longer time to reach the ground because

A. gravitational pull is less on feathers.
B. feathers float in air.
C. feathers have less weight.
D. feathers have small surface area.

Answer: feathers float in air.

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9. Karma weighs 70 kg in Phuntsholing but his weight in Gasa was 65kg. The difference in weight is due to the

   A. decrease in gravity.
   B. increase in gravity.
   C. food he had.
   D. same gravity.

   Answer: decrease in gravity.

10. The instrument used to measure weight is

   A. beam balance.
   B. spring balance.
   C. thermometer.
   D. lactometer.

   Answer: spring balance.

11. Which of the following is not the property of the image formed by a plane mirror?

   A. Virtual
   B. Erect
   C. Laterally inverted
   D. Smaller than the size of the object

   Answer: Smaller than the size of the object

12. Choki had a circuit problem at her home. Later she corrected the circuit problem. This new connection had single switch for each appliance to be used. What is her new circuit connection?

   A. Series
   B. Parallel
   C. Perpendicular
   D. Double

   Answer: Parallel

13. Which are the correct ways of increasing the strength of electromagnet made of a nail, wires and cells?

   I. Increasing the number of cells.
   II. Using rusted nail.

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III. Increasing the number of coils of wire round the nail.
IV. Using new nail.

A. I, II, IV, III
B. IV and II
C. II and III
D. I, III and IV.

Answer: I, III and IV

14. They have smaller leaves and fewer branches than other plants. In some, leaves are modified into spines to reduce the loss of water. This best describes

A. xerophytes.
B. epiphytes.
C. lithophytes.
D. mesophytes.

Answer: xerophytes.

15. Which one of the following food chain is in correct sequence?

A. Leaves ⟶ caterpillar ⟶ small birds ⟶ large birds
B. Large birds ⟶ small birds ⟶ caterpillar ⟶ leaves
C. Small birds ⟶ caterpillars ⟶ leaves ⟶ large birds
D. Large birds ⟶ caterpillars ⟶ small birds ⟶ leaves

Answer: Leaves ⟶ caterpillar ⟶ small birds ⟶ large birds

16. Petals of flowers are colourful to attract insects for

A. fertilisation.
B. pollination.
C. diffusion.
D. mating.

Answer: pollination.

17. *Oryxylum* (Tsampaka) seeds have wings to

A. fly.
B. float in air.
C. look like butterfly.

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D. hang from seed pods.

Answer: float in air.

18. The structure that helps fish to breathe in water is

A. scales.
B. fins.
C. gills.
D. tails.

Answer: gills.

19. Birds can fly because they

A. have large feet.
B. have solid bones.
C. have streamlined body.
D. have eggs inside their body.

Answer: have streamlined body..

20. The correct steps for carrying things is

I. Make all your movements smooth.
II. Bend your elbows and keep them close to your body.
III. Keep your shoulders and hips facing the same way. Do not twist
IV. Hold the load close to your body.

A. I, II, IV and III
B. II, II, III and I
C. III, IV, II and I
D. IV, I, III and II

Answer: III, IV, II and I

21. The skin becomes more wrinkled and most people appear shorter. Hard work becomes more difficult and tiring. These features best describe

A. a child
B. an adolescent
C. an infant
D. an old age

Answer: an old age.

22. Which of the following activity shows work done?

A. Pushing the wall
B. Standing still
C. Pulling the desk
D. Staring at the ceiling

Answer: Pulling the desk

23. What type of energy is present in a bouncing ball?

A. Potential energy
B. Kinetic energy
C. Solar energy
D. Chemical energy

Answer: Kinetic energy

24. Which of the following statements shows the correct conversion of energy?

A. Electric bells: Electrical energy into sound energy.
B. Solar cookers: Solar energy into electrical energy.
C. Radio: Sound energy into chemical energy.
D. Cars: Chemical energy into solar energy.

Answer: Electric bells: Electrical energy into sound energy.

The paragraph below is to be used for question 25.

'They are imaginary lines that run around the Earth from East to West. All the lines are circular and parallel to each other but they are of different circumference.'

25. The above paragraph describes the

A. longitudes.
B. altitudes.
C. latitudes.
D. axis.

Answer: latitudes.

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Question 2

Direction: Fill in the blanks. Write only the answer against the number in the answer sheet. (10 marks)

1. In making your own indicator, flower petals are crushed to prepare a solution, so that the colour of the petals is …….. by the filter paper.

Answer: absorbed

2. Hard water does not form …….. easily.

Answer: lather

3. The mixture of water and oil is an example of …… liquid.

Answer: immiscible

4. The mixture of solute and solvent is called ……..

Answer: solution

5. Things weigh less on the Moon due to less……..

Answer: gravity

6. The shrillness of the sound is called …..

Answer: pitch

7. Magnetic lines of force always run from ……. to …….

Answer: North Pole to South Pole

8. An ……..... develops into fruits.

Answer: Ovary

9. This animal has dry scaly skin. They live on land. They lay eggs with hard shell. These are the characteristics of ……..

Answer: reptiles

10. A…….. is the sharp and pointed teeth.

Answer: Canine

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Question 3

Direction: Match the following. Write only the alphabet against the number in your answer sheet. ***(10 marks)***

Answer:

Column I	Column II	Answers
i. Interchanges of left and right between the object and image	a. Au	c.
ii. Gives green colour to the plant.	b. Al	g.
iii. Plants which are adapted to grow in average supply of water	c. Lateral inversion	e.
iv. Crocodiles	d. Refraction	i.
v. Frog	e. Mesophytes	j.
vi. Bending of light when it passes from one medium to another	f. Hydrophytes	d.
vii. Helps in flowering	g. Nitrogen	h.
viii. Plants which are adapted to grow in water body	h. Potassium	f.
ix. Gold	i. Reptiles	a.
x. Aluminium	j. Amphibians	b.

Question 4

Direction: *Write True or False against the number in your answer sheet. (10 marks)*

1. The presence of soluble salts of calcium and magnesium in water makes it soft.

Answer: False

2. The particles are more closely packed in water than in kerosene.

Answer: True

3. Powerful sound travels farther than weak sound.

Answer: True

4. The strength of a magnet lies at the middle of a magnet.

Answer: False

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5. Buffaloes are not seen in Gasa.

Answer: True

6. Cotyledon protects the embryo.

Answer: False

7. Amphibians are cold-blooded animals.

Answer: True

8. Fizzy drinks are good for our teeth because they are sweet and contain acid.

Answer: False

9. The energy related to position is called kinetic energy.

Answer: False

10. Axis of the Earth is an imaginary line that goes through the Earth from the North Pole to the South Pole.

Answer: True

Question 5: Short Answer Questions (SAQ)

Direction: *Answer the following question as directed. All answers must be written in your answer sheet. The marks are given in the bracket for each question. (25 Marks)*

1. How will you test whether a solution is an acid or an alkali? (2)

Answer: Acid and alkali can be tested using indicators such as litmus paper, phenolphthalein, and methyl orange. Using the indicators, the result will be as follows.

Indicators	Colour Change	
	in Acids	in Alkalis
1. Blue Litmus paper	*turns red*	*no change in colour*
2. Universal Indicator	*turns red*	*turns blue*
3. Red Litmus paper	*no change in colour*	*turns blue*

2. How is digestion a chemical change? (2)

Answer: Digestion is a chemical change as new substance is formed, the identity of original substance is lost and we can't get back the original substance.

3. What is distillation? (1)

Answer: Distillation is a process of conversion of a liquid into its vapour and then condensing the vapour back into liquid by cooling them.

4. Name some local methods of separation that is not widely practiced today. Why?

Answer: Using flails and stick are some of the methods of separation that are not practiced today because of the introduction of modern methods which are easier and faster.

5. Why is the wind shield of a car not made up of frosted glass? (2)

Answer: Wind shield of a car is not made up of frosted glass because it allows only small amount of light to pass through which would make it difficult to see through it.

6. Why are magnets of various shapes? Name some of them. (2)

Answer: Magnets are of various shapes to be used in different appliances. Bar magnet, electromagnet, and horse shoe magnet are some of the examples.

7. Why do wild animals like elephants and wild pigs attack our crops? (2)

Answer: Animals like elephants and wild pigs attack our crops because their habitats are affected by human beings. And there is no food for them, thus they invade the farmers' crop fields.

8. Answer the following questions. (2)

(i) Leaves are called 'food factories' of a plant. Justify. (1)

Answer: Leaves contain chlorophyll and are able to trap sunlight which helps to prepare food for plant. Thus leaves are called food factories.

(ii) By using the equation given below, define photosynthesis in your own words. (1)

$$\text{Water} + \text{Carbondioxide} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Food} + \text{Oxygen}$$

Answer: Photosynthesis is a process by which plants prepare their own food using water and carbon dioxide in the presence of sunlight and releasing oxygen.

9. Why do birds have sharp and pointed beaks?

Answer: Birds have sharp pointed beaks to make their body streamlined while flying and to grab the food.

10. What is double circulation?

Answer: In humans, blood flows from heart to lungs and back. This circulation is called pulmonary circulation. Similarly, the blood also flows from heart to body and back. This circulation is called systemic circulation. Thus, double circulation takes place in human beings.

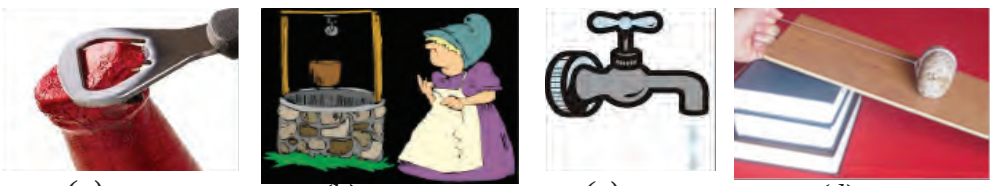
11. Which bones of skeleton protect lungs and heart? (1)

Answer: Rib cage.

12. Why does the line going up represent healthy growth in a child's health card? (1)

Answer: Because it shows weight is increasing proportionately with age indicating healthy growth.

13. What type of simple machine is represented in Figure 12.8.



(a) *(b)* *(c)* *(d)*

Figure 12.8.

(i) Figure 12.8 (a)
(ii) Figure 12.8 (b)
(iii) Figure 12.8 (c)
(iv) Figure 12.8 (d)

Answer: Figure a: Lever.
Figure b: Pulley.
Figure c: Wheel and axle.
Figure d: Inclined plane.

14. What are the factors that affect the potential energy? (2)

Answer: Height of the object raised, weight of the object and acceleration due to gravity are the factors that affect the potential energy.

15. When do polar days and polar nights occur? (1)

Answer: *Polar night refers to the day with no sunshine for 24 hours. This happens during winter. Polar day refers to the day with 24 hours of sunshine. This happens during the summer.*

Question 6:

Direction: *Answer the following questions as directed in your answer sheet. (20 Marks)*

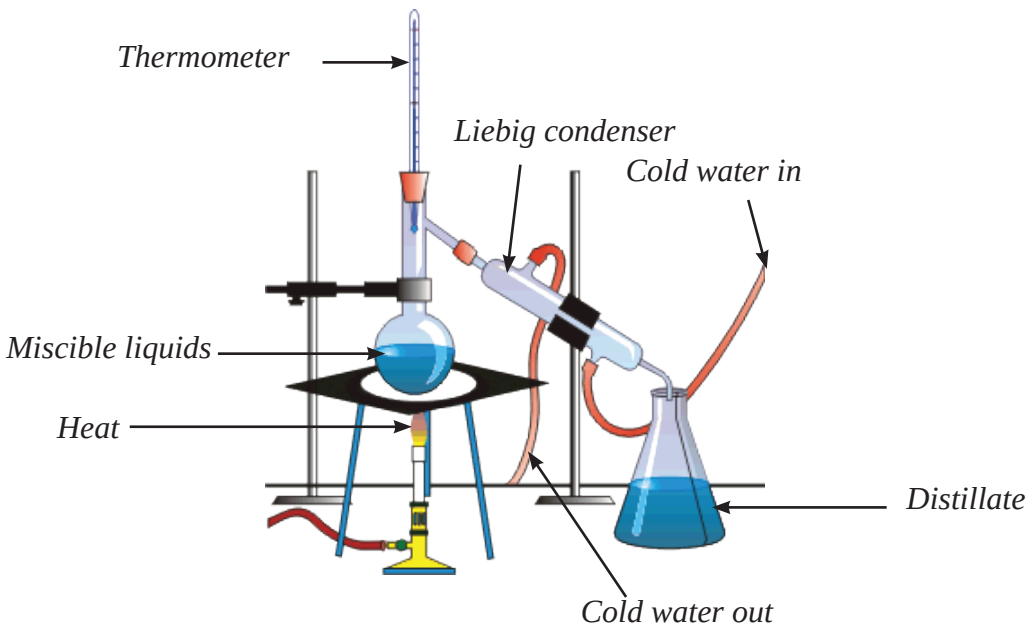


Figure 12.9.

1. Study the following experiment shown in Figure 12.9 and answer the questions that follow.

i. What does the above experiment show? (1/2)

Answer: Process of Distillation.

ii. What happens in the Liebig condenser? (1/2)

Answer: In Liebig condenser, the vapour comes in contact with cold water and gets condensed into water droplets.

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iii. Is the water collected in the bowl safe for drinking? (1/2)

Answer: The water collected in the bowl is safe for drinking but does not contain minerals.

iv. In carrying out the above experiment, what precautions should you take? (1/2)

Answer: i. Safe handling of heat.

ii. Safe handling of glass apparatus.

2. Explain an experiment to show that sound travels through a liquid. (2)

Answer: Take a bucket of water. Fit funnels at both ends of the rubber pipe. Immerse one end of the rubber pipe in the water. Then, hit two spoons inside the water. Listen carefully from the other end of the rubber pipe. In this experiment sound travels through water which is a liquid medium.

3. Why are most of the circuit connections in our homes and offices are parallel connection? (2)

Answer: Parallel circuit is used in our homes and offices because all the appliances that are connected will get equal amount of voltage to function. Further, if one connection does not work other will still work.

4. How can you make people aware of HIV/AIDS? (2)

Answer: Stage skit on how HIV/AIDS is being transmitted from one person to another.

Design posters to educate people on HIV/AIDS.

Encourage people to use condoms or refrain from having multiple sex partners.

5. Answer the following questions. (2)

(i) What are the conditions required for the proper growth of the seeds? (1)

Answer: Sunlight, water and air.

(ii) What happens to the seed if there is no water? (1)

Answer: Seeds will dry and will not germinate.

6. Why dogs are called mammals? (2)

Answer: Dogs are called mammals because they have fur on their body, they give birth, and feed their young ones with milk.

7. Make a balanced diet meal for breakfast, lunch, and dinner for your cousin sister who is admitted in the hospital. (2)

Answer: Breakfast: Rice porridge, fruit juice and egg

Lunch: Rice, Meat, Vegetables, Fruits, curd

Dinner: Veg Noodles, milk, apple

8. Write down the steps how fossil fuels are formed. (2)

Answer: i. Plants and animals die.

ii. They are buried by soil.

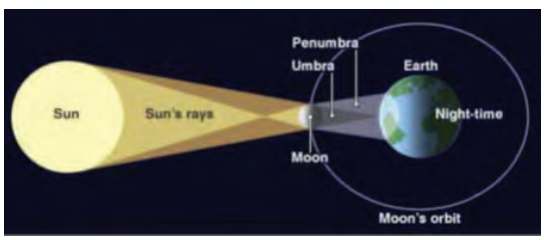
iii. Dead remains are compressed by soil for hundreds of years.

iv. Fossil fuels are formed.

9. With the help of a diagram, explain how solar eclipse is caused. What are the beliefs of your community about it?(2)

Answer: When the Moon lies in a straight line between the Earth and the Sun, the Moon blocks the light coming from the Sun. Thus, the Moon casts a shadow on the surface of the Earth. This phenomenon is called solar eclipse.

Communities in the village generally believe that solar eclipse occurs when the demon eats the Sun and therefore blow horns and beat drum to scare away the demon.



10. How is lunar eclipse formed? (2)

Answer: Lunar eclipse is formed when the Earth is in between the Sun and the Moon in a straight line. The Earth casts a shadow on the surface of the Moon.

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Annexure - C

Writers

Sl #	Name	Address
1	Mr. Wangpo Tenzin	REC
2	Mr. Surjey Lepcha	REC
3	Mr. Basant Pradhan	College of Sc. & Tech
4	Mr. Bhim K Sharma	Damphu MSS
5	Mr. Bhim P Raika	Drukgyel HSS
6	Mr. Bhoj Raj Rai	Kuengaa HSS
7	Mr. Chador Tenzin	Gaselo LSS
8	Mr. Chencho Tshering	Gomtu MSS
9	Mr. Cheni Dorji	Kilikhar MSS
10	Mr. Cheten Tshering	Meldregang MSS
11	Mr. Desang	SAP. MoE
12	Mr. Endrais Rai	Tashidingkha MSS
13	Mr. Ganga Ram	Meldrelgang MSS
14	Mr. Geewanath Sharma	DCRD
15	Mr. GR Mohan	Col of Edu, Samtse
16	Mr. Gyembo	Pelrithang MSS
17	Mr. Jamyang Drukda	Gasa PS
18	Mr. Jas Raj Subba	Col of Edu, Paro
19	Mr. Jigma Tenzin	Dotey LSS
20	Mr. Jigme Tshering	Bayling HSS
21	Mr. Karma Dorji	Drukgyel HSS
22	Mr. Karma Jigme	Chapcha MSS
23	Mr. Karma Wangdi	Yadi MSS
24	Mr. Kinley Gyeltshen	Drashiding MSS
25	Mr. Lobzang Wangchuk	Wamrong LSS
26	Mr. Namgyel Wangchuk	Lhamoizingkha MSS
27	Mr. Nandu Giri	Col of Edu, Samtse
28	Mr. Nazim	Drukgyel HSS
29	Mr. Rinchen Thinley	Bjee CPS
30	Mr. Rinzin Dorji	Gaselo HSS
31	Mr. Robin Gurung	Shaba MSS
32	Mr. Sampa Tshewang	Drukgyel HSS
33	Mr. Samten	Pangna CPS
34	Mr. Sangay Phuntsho	Yurung LSS
35	Mr. Sangay Tshering	Drukgyel HSS
36	Mr. Santosh Kumar	Drukgyel LSS
37	Mr. Sonam Leki	Yebilaptsa MSS
38	Mr. Tashi Phuntsho	EMSSD
39	Mr. Tsheten	Drukgyel LSS
40	Mr. Tshewang Namgay	Pelrithang MSS
41	Mr. Tshewang Norbu	Moshi CPS
42	Mr. Ugyen Lhendup	RSPN
43	Mr. Ugyen Tshering	Bajo HSS
44	Mr. Yeshey Drakpa	Sarpang HSS
45	Ms. Bichitra Sharma	Kuengaa HSS
46	Ms. Choeki Wangmo	Jyenkhana PS
47	Ms. Dema Lhamo	Galing CPS
48	Ms. Hari Maya	Col of Edu, Paro
49	Ms. Jambay Lhamo	Col of Edu, Paro
50	Ms. Jigmi Lhadon	Gaselo LSS
51	Ms. Kaka Choden	Shaba PS
52	Ms. Karma Utha	Col of Edu, Samtse
53	Ms. Karma Yangchen	EMSSD
54	Ms. Nanda Devi Mukhia	Changangkha LSS
55	Ms. Pema Choki	Gelephu LSS
56	Ms. Sital Thapa	Lango LSS
57	Ms. Sukmit Lepcha	Dungsi MSS
58	Ms. Sushma Dhahal	Dotey LSS
59	Ms. Tshomo	Tenzin HSS
60	Ms. Wangchuk Bidha	Samtse HSS
61	Ms. Yangchen Tshomo	Changmey PS
62	Ms. Yeshi Yangzom	Labtshaka PS
63	Ms. Zomba Lhamo	Woochu LSS
64	Mr. Tashi Dorji	Kanglung PS

Writers (Second Edition)

Sl.#	Names	Agency/School	Remarks
1	Wangpo Tenzin	REC	Writer
2	Bhoj Raj Rai	REC	Writer
3	Wangchuk	REC	Writer
4	Karma Dorji	REC	Writer
5	Phuntsho Norbu	REC	Writer
6	Khem Prasad Thapa	Minjiwoong CS	Writer
7	Tashi yangzom	Khasadrapchu MSS	Writer
8	Susma Pradhan	Kuzhugchen MSS	Writer
9	Singye Thinley	Phuntshothang MSS	Writer
10	Tahi Zangpo	Darla MSS	Writer
11	Pema Tshering	Katsho LS	Writer
12	Tsheltrim Pelzang	Trashigang MSS	Writer
13	Tashi Lhamo	Yangchengyatshel MSS	Writer
14	Kinga Chedup	Wangbama CS	Writer
15	Bal Bdr. Gurung	Loselling MSS	Writer
16	Tobgay	Wangbama CS	Writer
17	Tshering Zangmo	Shari HSS	Writer
18	Namgay Dorji	Shari HSS	Writer
19	Thinley Wangchuk	Taju PS	Writer
20	Ugyen Tshomo	NECS	Writer
21	Krishna	Consultant, NECS	Writer
22	OM Tshering Lepcha	Norbuling CS	ICT and Art Work
23	Chencho Thinley	Lungtenzampa MSS	Language Editor
24	Pratima Rai	Khangkhu MSS	Language Editor
25	Karma Wangmo	REC	Typesetting and Layout
26	Kinzang Peldon	REC	Typesetting and Layout

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Nutrients per 100 grams of raw portion												
Food Type	Food Commodites	ENERGY (kcal)	PROTEIN (g)	FAT (g)	CALCIUM (mg)	IRON (mg)	IODINE (µg)	VIT. A (µg RE)	THIAMINE (mg)	RIBOFLAVIN (mg)	NIACIN (mg NE)	VIT. C (mg)
VEGETABLES	AMLA	58	0.5	0.1	50	1.2		9	0.03	0.01	0.2	600
OILS AND FATS	ANIMAL FAT	900	0.0	100.0	0	0.0	0	0	0.00	0.00	0.0	0
FRUIT	APRICOTS, DRIED	270	4.0	0.5	62	4.5		300	0.08	0.09	2.9	5
FRUIT	AVOCADO PEAR	121	1.4	11.3	19	1.4	1	265	0.05	0.15	2.3	18
FRUIT	BANANA	88	1.5	0.1	9	1.4	8	60	0.03	0.03	0.7	9
CEREALS	BARLEY, DEHULLED	337	12.5	2.3	33	3.6		7	0.65	0.29	8.1	0
PULSES & OILSEEDS	BEANS, BLACK (USA)	341	21.6	1.4	123	5.0		5	0.80	0.19	6.2	0
PULSES & OILSEEDS	BEANS, BLACKEYE / COWPEAS (USA)	336	23.5	1.3	110	8.3		15	0.90	0.20	6.2	2
PULSES & OILSEEDS	BEANS, DRIED	335	20.0	1.2	143	8.2		0	0.50	0.22	6.2	0
PULSES & OILSEEDS	BEANS, GREAT NORTHERN (USA)	339	21.9	1.1	175	5.5		1	0.70	0.20	6.3	5
PULSES & OILSEEDS	BEANS, KIDNEY, ALL TYPES (USA)	333	23.6	0.8	143	8.2		2	0.50	0.20	6.6	5
PULSES & OILSEEDS	BEANS, NAVY / PEA BEANS (USA)	335	22.3	1.3	155	6.4		1	0.65	0.23	6.5	3
PULSES & OILSEEDS	BEANS, PINK (USA)	343	21.0	1.1	130	6.8		0	0.80	0.20	6.0	0
PULSES & OILSEEDS	BEANS, PINTO (USA)	340	20.9	1.1	121	5.9		2	0.60	0.20	5.6	7
PULSES & OILSEEDS	BEANS, SMALL RED (USA)	350	22.0	1.0	150	7.0		0	0.70	0.20	6.2	0
PULSES & OILSEEDS	BEANS, SOYA	416	36.5	19.9	277	15.7	6	7	0.87	0.87	10.4	6
MEAT	BEEF, MODERATELY FAT	237	18.2	17.7	11	3.6	6	0	0.07	0.15	6.6	0
MISCELLANEOUS	BP-5 COMPACT FOOD	458	14.7	17.0	600	10.0	100	470	0.52	0.52	6.5	40
MISCELLANEOUS	BREAD, WHITE	261	7.7	2.0	37	1.7	6	0	0.16	0.06	5.6	0
CEREALS	BULGUR WHEAT	350	11.0	1.5	29	3.7		0	0.28	0.14	4.5	0
CEREALS	BULGUR WHEAT, FORTIFIED, (USA)	342	12.3	1.3	110	2.9		662	0.44	0.26	3.5	0
OILS AND FATS	BUTTER	725	0.0	81.0	12	0.2	38	714	0.01	0.02	0.2	0
FISH	CANNED FISH	305	22.0	24.0	330	2.7	19	0	0.40	0.30	6.5	0
FISH	CANNED FISH IN WATER	150	20.0	8.0	36	1.0	19	33	0.03	0.06	5.4	0
MEAT	CANNED MEAT	220	21.0	15.0	14	4.1		0	0.20	0.23	6.6	0
PULSES & OILSEEDS	CASHEW NUT	566	18.2	46.9	37	6.7	11	0	0.42	0.06	5.8	1
ROOTS AND TUBERS	CASSAVA, FLOUR	342	1.5	0.0	55	2.0		0	0.04	0.04	0.8	0
ROOTS AND TUBERS	CASSAVA, FRESH	160	1.4	0.3	16	0.3		8	0.09	0.08	0.9	21
MILK & PRODUCTS	CHEESE, CANNED	355	22.5	28.0	630	0.2	39	120	0.03	0.45	5.4	0
MEAT	CHICKEN, CANNED	215	21.0	14.0	14	1.5		120	0.08	0.16	10.4	0

Nutrients per 100 grams of raw portion												
Food Type	Food Commodites	ENERGY (kcal)	PROTEIN (g)	FAT (g)	CALCIUM (mg)	IRON (mg)	IODINE (µg)	VIT. A (µg RE)	THIAMINE (mg)	RIBOFLAVIN (mg)	NIACIN (mg NE)	VIT. C (mg)
PULSES & OILSEEDS	CHICKPEAS	364	19.3	6.0	105	6.2		20	0.48	0.21	4.6	4
MISCELLANEOUS	COCOA	270	17.0	21.0	50	14.0			0.10	0.30	3.1	0
PULSES & OILSEEDS	COCONUT MEAT, RAW	354	3.3	33.5	14	2.4	3	0	0.07	0.02	1.2	3
MISCELLANEOUS	COFFEE, GROUND	56	8.0	0.0	30	1.0	0	0	0.00	0.01	27.0	0
BLENDED FOODS	CORN SOY BLEND (WFP SPECS.)	400	18.0	6.0	181	12.8	2	501	0.44	0.70	10.0	50
BLENDED FOODS	CORN SOY BLEND, (USA)	376	17.2	6.9	831	17.5	56.9	784	0.53	0.48	6.2	40
BLENDED FOODS	CORN SOY MASA FLOUR (USA)	365	9.3	3.8	110	2.9		662	0.44	0.26	3.5	0
BLENDED FOODS	CORN SOY MASA FLOUR, INSTANT (USA)	363	11.4	3.7	110	2.9		662	0.44	0.26	3.5	0
BLENDED FOODS	CORN SOY MILK (USA)	375	21.4	6.8	1,020	17.5	56.9	785	0.59	0.71	6.4	41
BLENDED FOODS	CORN SOY MILK, INSTANT (ICSM)	380	20.0	6.0	900	18.0	56.9	510	0.80	0.60	8.0	40
MEAT	CORNED BEEF, CANNED	233	25.5	14.0	56	4.0	14	0	0.02	0.20	4.5	0
FRUIT	DATES, DRIED	245	2.0	0.5	32	1.2		0	0.09	0.10	3.0	0
MILK & PRODUCTS	DRIED SKIM MILK (DSM)	348	36.1	0.6	1,280	0.3	0	9	0.38	1.63	9.5	13
MILK & PRODUCTS	DRIED SKIM MILK (DSM), FORTIFIED	360	36.0	1.0	1,257	1.0	0	1,500	0.42	1.55	9.5	0
MILK & PRODUCTS	DRIED WHOLE MILK (DWM)	500	25.0	27.0	912	0.5		280	0.28	1.21	6.8	0
EGGS	EGG, DRIED	594	47.4	41.0	231	6.8		270	0.20	1.54	9.9	0
EGGS	EGG, HEN, FRESH	149	12.5	10.0	49	1.4	53	191	0.06	0.51	2.6	0
VEGETABLES	EGGPLANT (AUBERGINE)	26	1.0	0.2	7	0.3	1	25	0.05	0.03	0.7	2
MILK & PRODUCTS	EVAPORATED MILK	151	8.4	9.4	290	0.3	11	105	0.07	0.42	2.2	1
BLENDED FOODS	FAMIX (ETHIOPIA)	402	14.7	7.0	100	8.0			0.10	0.40	5.0	30
FISH	FISH FILLET, COD, FRESH	76	17.4	0.7	16	0.3	110	2	0.08	0.07	4.9	0
FISH	FISH, DRIED, SALTED	270	47.0	7.5	343	2.8		0	0.07	0.11	8.6	0
FISH	FISH, DRIED, WHOLE, FRESHWATER	309	63.0	6.3	3,000	8.5		0	0.10	0.20	19.7	0
FRUIT	FRUIT IN SYRUP, CANNED	60	0.5	0.0	7	0.3		63	0.03	0.03	0.2	5
OILS AND FATS	GHEE, BUTTER OIL	862	0.0	97.8	0	0.0		600	0.00	0.00	0.0	0
MEAT	GOAT, MODERATELY FAT	357	15.2	32.4	11	2.0		0	0.07	0.13	8.9	0
PULSES & OILSEEDS	GROUNDNUTS, DRY	567	25.8	49.2	92	4.6	20	0	0.64	0.14	16.2	0
FRUIT	GUAVA	64	1.1	0.4	24	1.3		145	0.06	0.04	1.3	230
BLENDED FOODS	HEPS (ZAMBIA)	350	15.0	6.0	173	14		501	0.60	0.80	8.8	50
MISCELLANEOUS	HIGH ENERGY BISCUITS (WFP SPECS.)	450	12.0	15.0	250	11.0	75	250	0.50	0.70	6.0	20

Nutrients per 100 grams of raw portion												
Food Type	Food Commodites	ENERGY (kcal)	PROTEIN (g)	FAT (g)	CALCIUM (mg)	IRON (mg)	IODINE (µg)	VIT. A (µg RE)	THIAMINE (mg)	RIBOFLAVIN (mg)	NIACIN (mg NE)	VIT. C (mg)
VEGETABLES	LEAVES, DARK GREEN, e.g. SPINACH	25	2.8	0.8	170	2.1	2	589	0.07	0.09	1.9	26
VEGETABLES	LEAVES, LIGHT GREEN, e.g. CABBAGE	26	1.7	0.4	52	0.7		64	0.15	0.02	0.8	49
VEGETABLES	LEAVES, MEDIUM GREEN, e.g. PUMPKIN	19	3.2	0.4	39	2.2		583	0.09	0.13	1.7	11
FRUIT	LEMON	59	0.5	1.0	90	0.3	2	15	0.02	0.03	0.2	63
PULSES & OILSEEDS	LENTILS	338	28.1	1.0	51	9.0		12	0.48	0.25	6.8	6
FRUIT	LIMES	30	0.7	0.2	33	0.6		3	0.03	0.02	0.2	29
MEAT	LIVER	136	20.0	4.0	10	10.0	9	12,000	0.30	2.50	17.6	30
CEREALS	MAIZE GRAIN, WHITE	350	10.0	4.0	7	2.7		0	0.39	0.20	2.2	0
CEREALS	MAIZE GRAIN, YELLOW	350	10.0	4.0	13	2.7		141	0.39	0.20	2.2	0
CEREALS	MAIZE MEAL, FORT. (WFP SPECS.)	366	8.5	1.7	110	5.3		141	0.83	0.46	5.5	0
CEREALS	MAIZE MEAL, FORTIFIED (USA)	366	8.5	1.7	110	2.9		662	0.44	0.26	4.8	0
CEREALS	MAIZE MEAL, WHITE, DEGERMED	360	8.5	1.7	5	1.1		0	0.14	0.05	1.3	0
CEREALS	MAIZE MEAL, WHITE, WHOLE GRAIN	360	9.0	3.5	6	2.4		0	0.39	0.20	2.0	0
CEREALS	MAIZE MEAL, YELLOW, DEGERMED	360	8.5	1.7	5	1.1		124	0.14	0.05	1.3	0
CEREALS	MAIZE MEAL, YELLOW, WHOLE GRAIN	360	9.0	3.5	6	2.4		141	0.39	0.20	2.0	0
VEGETABLES	MAIZE, FRESH	86	3.2	1.2	2	0.5		84	0.20	0.06	0.9	7
FRUIT	MANGO	65	0.5	0.3	10	0.1		1,168	0.06	0.06	0.6	28
OILS AND FATS	MARGARINE, CORN (USA)	719	0.0	80.5	30	0.0		1,074	0.01	0.04	0.0	0
MILK & PRODUCTS	MILK, COW, WHOLE	66	3.2	3.9	115	0.1	15	56	0.03	0.17	0.8	1
MILK & PRODUCTS	MILK, GOAT, WHOLE	69	3.6	4.1	134	0.1		56	0.05	0.14	1.0	1
MILK & PRODUCTS	MILK, HUMAN	69	1.3	4.1	34	0.1	7	62	0.02	0.03	0.7	4
CEREALS	MILLET, BULRUSH	335	11.0	3.0	22	20.7		0	0.30	0.22	6.7	3
MEAT	MUTTON, MODERATELY FAT	249	15.0	21.0	10	2.4	5	0	0.15	0.20	7.9	0
CEREALS	OATS, ROLLED	370	13.0	5.5	30	3.4		0	0.20	0.08	4.9	0
CEREALS	OATS, WHOLE	375	17.0	7.0	60	4.6		0	0.35	0.09	4.9	0
OILS AND FATS	OIL, VEGETABLE (WFP SPECS.)	885	0.0	100.0	0	0.0		900	0.00	0.00	0.0	0
OILS AND FATS	OIL, VEGETABLE, UNFORTIFIED	890	0.0	100.0	0	0.0		0	0.00	0.00	0.0	0
OILS AND FATS	OIL, VEGETABLE, Vit A FORTIFIED (USA)	884	0.0	100.0	0	0.02		1,800	0.00	0.00	0.0	0
VEGETABLES	ONION	38	1.2	0.2	20	0.2	2	0	0.04	0.02	0.4	6
FRUIT	ORANGE, WHOLE	26	0.8	0.1	33	0.1		3	0.08	0.03	0.4	38

Nutrients per 100 grams of raw portion													
Food Type	Food Commodites	ENERGY (kcal)	PROTEIN (g)	FAT (g)	CALCIUM (mg)	IRON (mg)	IODINE (µg)	VIT. A (µg RE)	THIAMINE (mg)	RIBOFLAVIN (mg)	NIACIN (mg NE)	VIT. C (mg)
OILS AND FATS	PALM OIL, RED	875	0.0	98.9	6	0.0		6,000	0.01	0.02	0.0	0
FRUIT	PAPAYA	32	0.4	0.1	21	0.6		475	0.03	0.03	0.5	52
CEREALS	PASTA, MACARONI	348	12.0	1.8	25	1.6		0	0.18	0.05	4.4	0
FRUIT	PAWPAW	32	0.4	0.1	21	0.6		475	0.03	0.03	0.5	52
PULSES & OILSEEDS	PEAS, DRIED	341	24.6	1.2	55	4.4	2	45	0.70	0.20	2.9	2
PULSES & OILSEEDS	PEAS, DRIED, SPLIT	341	24.6	1.2	55	4.4	2	45	0.70	0.20	2.9	2
VEGETABLES	PEPPERS, SWEET, GREEN, RAW	20	0.9	0.2	10	0.3		111	0.06	0.03	0.6	80
VEGETABLES	PEPPERS, SWEET, RED, RAW	26	1.0	0.3	7	0.4		940	0.05	0.09	1.2	190
VEGETABLES	PEPPERS, SWEET, YELLOW, RAW	27	1.0	0.2	11	0.5		60	0.03	0.03	1.1	184
FRUIT	PINEAPPLE	47	0.4	0.1	16	0.4	0	45	0.06	0.03	0.5	34
FRUIT	PLANTAIN	135	1.2	0.3	8	1.3		390	0.08	0.04	0.9	20
MEAT	PORK, CANNED	271	16.0	22.0	8	2.1		0	0.70	0.16	3.7	0
MEAT	PORK, FATTY	535	10.0	55.0	11	1.8	3	0	0.50	0.15	3.2	0
ROOTS AND TUBERS	POTATO, IRISH	77	2.0	0.1	12	0.8	3	1	0.08	0.03	1.6	20
ROOTS AND TUBERS	POTATO, SWEET, ORANGE	87	1.2	0.3	24	0.7	2	655	0.17	0.00	0.8	23
MEAT	POULTRY	139	19.0	7.0	15	1.5	10	0	0.10	0.15	9.5	0
CEREALS	RICE, LIGHTLY MILLED, PARBOILED	364	7.0	0.5	7	1.2		0	0.20	0.08	4.9	0
CEREALS	RICE, POLISHED	360	7.0	0.5	9	1.7		0	0.10	0.03	5.6	0
BLENDED FOODS	RYE SOY BLEND	400	19.5	7.5	535	8.0		528	0.33	0.53	6.0	30
SUGAR AND SALT	SALT	0	0.0	0.0	0	0.0	0	0	0.00	0.00	0.0	0
SUGAR AND SALT	SALT, IODISED (WFP SPECS.)	0	0.0	0.0	0	0.0	6,000	0	0.00	0.00	0.0	0
FISH	SARDINES, CANNED IN OIL	309	20.0	25.0	400	3.0	23	5	0.05	0.20	12.6	0
PULSES & OILSEEDS	SESAME SEEDS	573	17.7	49.7	975	14.6		3	0.79	0.25	11.0	0
MEAT	SNAIL	82	12.0	2.0	1,500	8.0		62	0.00	0.05	1.3	0
CEREALS	SORGHUM	335	11.0	3.0	26	4.5		0	0.34	0.15	5.0	0
PULSES & OILSEEDS	SOYA BEAN MEAL, DEFATTED	339	45.0	2.4	244	13.7		12	0.69	0.25	13.5	0
PULSES & OILSEEDS	SOYA BEANS	416	36.5	19.9	277	15.7	6	7	0.87	0.87	10.4	6
CEREALS	SOYA FLOUR, FULL FAT, RAW	436	34.5	20.7	206	6.4		36	0.58	1.16	12.7	0
BLENDED FOODS	SOYA FORTIFIED BULGUR WHEAT (USA)	350	17.0	1.5	110	2.9		662	0.44	0.26	3.5	0
BLENDED FOODS	SOYA FORTIFIED MAIZE MEAL (USA)	390	13.0	1.5	110	2.9		662	0.44	0.26	3.5	0
BLENDED FOODS	SOYA FORTIFIED ROLLED OATS	380	20.0	6.0	81	5.3		0	0.74	0.14	4.0	0

Nutrients per 100 grams of raw portion												
	Food Commodites	ENERGY (kcal)	PROTEIN (g)	FAT (g)	CALCIUM (mg)	IRON (mg)	IODINE (µg)	VIT. A (µg RE)	THIAMINE (mg)	RIBOFLAVIN (mg)	NIACIN (mg NE)	VIT. C (mg)
BLENDED FOODS	SOYA FORTIFIED SORGHUM GRITS (USA)	360	16.0	1.0	110	2.9		662	0.44	0.26	3.5	0
BLENDED FOODS	SOYA FORTIFIED WHEAT FLOUR	360	16.0	1.3	211	4.8		265	0.66	0.36	4.6	0
MISCELLANEOUS	SPICES MIXED, GARLIC	145	6.3	0.1	30	1.3	3	0	0.06	0.23	4.3	13
MISCELLANEOUS	SPICES MIXED, TUMERIC	349	6.3	5.1	150	14.8		30	0.00	0.00	2.3	0
SUGAR AND SALT	SUGAR	400	0.0	0.0	0	0.0	0	0	0.00	0.00	0.0	0
PULSES & OILSEEDS	SUNFLOWER SEED, DRIED KERNELS	570	22.8	49.6	116	6.8		15	2.29	0.25	10.3	
MISCELLANEOUS	TEA	40	10.0	0.0	30	1.0	0	0	0.10	0.37	6.0	0
BLENDED FOODS	TENAMIX (TANZANIA)	380	13.3	7.4	200	12.0	50.0		0.30	0.50	0.0	20
VEGETABLES	TOMATO PASTE	82	4.3	0.5	36	3.0		458	0.06	0.15	3.5	22
VEGETABLES	TOMATOES, RED, RIPE	18	0.9	0.2	10	0.3	2	250	0.04	0.02	0.2	13
VEGETABLES	TOMATOES, SUN DRIED	258	14.1	3.0	110	9.1		262	0.53	0.49	10.8	39
BLENDED FOODS	UNILITO (NEPAL)	400	14.0	6.0	100	15.0		400	0.10	1.00	5.0	50
FRUIT	WATER MELON	22	0.5	0.0	8	0.3	0	125	0.02	0.02	0.2	5
CEREALS	WHEAT FLOUR, FORTIFIED (USA)	364	10.3	1.0	110	4.4		662	0.76	0.44	8.7	0
CEREALS	WHEAT FLOUR, FORTIFIED (WFP SPECS.)	350	11.5	1.5	15	4.1		0	0.56	0.30	6.9	0
CEREALS	WHEAT FLOUR, WHITE	350	11.5	1.5	15	1.2		0	0.12	0.04	3.4	0
BLENDED FOODS	WHEAT PEA BLEND	425	15.0	6.0	100	8.0		500	0.13	0.45	4.8	48
BLENDED FOODS	WHEAT SOY BLEND (USA)	355	21.5	5.9	842	17.9	56.9	697	0.54	0.50	8.2	40
BLENDED FOODS	WHEAT SOY BLEND (WFP SPECS.)	400	20.0	6.0	159	12.0	1	600	0.41	0.66	7.9	49
BLENDED FOODS	WHEAT SOY BLEND (WSB)	370	20.0	6.0	750	20.8		498	1.50	0.60	9.1	40
BLENDED FOODS	WHEAT SOY MILK (USA)	357	25.1	5.8	1,031	17.9	56.9	699	0.60	0.73	8.3	41
CEREALS	WHEAT, GRAIN	330	12.3	1.5	36	4.0		0	0.30	0.07	8.9	0
ROOTS AND TUBERS	YAM, FRESH	114	1.5	0.3	15	0.7		0	0.16	0.01	0.5	4
MISCELLANEOUS	YEAST, DRIED	169	35.6	1.5	80	20.0		0	2.33	4.00	15.5	0

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