6

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Teaching Guide

Revised Edition

Amazing Science

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Contents

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Introduction

Science and technology have assumed great importance in the world today. Not only has science changed our life, it has also influenced our thinking. We have used scientific knowledge to raise our standard of living and develop a better relationship with nature.

The study of science develops a spirit of enquiry that enables the scientist to understand the interrelationships that exist in nature. A student of science develops the habit of observing carefully, and collecting data accurately so that scientific phenomena can be seen in their true perspective. This habit not only develops a scientific attitude but also inculcates critical thinking that helps in drawing conclusive results from observations. Thus it enables a student of science to better understand and appreciate the environment as a whole.

The subject of science has always been considered a learning subject at the school level and the student has to go through a rigorous exercise of learning it by heart in order to pass examinations. In reality, science is not a subject to be memorized; it has to be given serious thought and this makes it a difficult subject. But if science is taught in such a manner that students understand its true meaning and develop a scientific approach towards understanding scientific phenomena, its study becomes meaningful as well as interesting.

A teacher can play a very important role in arousing the interest of students by allowing them to discuss facts and ideas and helping them to draw conclusions from them as to why and how things happen.

The teacher can stimulate the thinking process of students by asking questions and also by encouraging them to ask questions. Experimental work enables students to test for themselves the facts that have been learnt by them, thereby making it easier for them to understand the implications of the background to their activities.

This course has been developed to provide information about the world around on which students can base their opinion, verify information, come to conclusions, and use the knowledge thus gained in their everyday life. It will help in maintaining the curiosity and enthusiasm of students who have just started studying science. Concepts developed at this stage will be of use in their studies at an advanced level later. It will help them to develop a better outlook of life. In order to control the learning process the teacher not only encourages and advises but also critically evaluates the work of the students.

About the Pupil's Book:

This science series has been written especially for children both at the primary and secondary levels. It provides information at a child's level of understanding and has a direct appeal for children who need interesting and easy to read material.

Keeping in view the interests, abilities, curiosities, and needs of children, it provides stimulating learning experience and offers enjoyable educational motivation, thus serving as a building block for further learning.

The keyword in science is curiosity. The material in the series is designed to awaken in a child the same urge that motivates a scientist; the desire to know the answer to a question. There is a wide range of topics that will interest and motivate the child.

Teachers will recognize that it deals with those broad areas about which most children frequently express curiosity; that it provides answers to many questions they ask, offering new and exciting information on many fields. It aims to create an awareness, as well as stimulate an interest in science.

The language is simple and easy to read and within the grasp of the students' abilities of each grade. Together, the text and illustrations motivate children to discuss, question, and explore.

The contents have been selected and are presented in such a way as to capture and hold the interest of the students. The objective is to simplify complex ideas and present them in an interesting way. Every effort has been made to keep the language simple.

When it is necessary to use a specialized word, it has been gently introduced into the text. When it is not self-explanatory within the context, it is defined. Clear and well-labelled illustrations have been included, which help to identify and clarify the topics dealt within.

Good pictures and diagrams arouse and develop interest. These make lasting impressions. They help to make the text clear. They also appeal to the child's imagination, while satisfying his/her curiosity and often provoke a favourable reaction.

Simple practicals—interesting and stimulating presentation of factual materials—offer every chance of successful learning experiences. Knowledge of problem-solving techniques so acquired can be applied in everyday life.

It is intended, through this series, to introduce children to many of the interesting and enjoyable things they can learn about and do for themselves. Also to develop in them the quest for knowledge and understanding of how science is shaping the world in which they live.

Syllabus break-up:

The textbook has been divided into four parts, namely biology, chemistry, physics, and the Earth and universe. Each chapter of the Teaching Guide pertains to the topics discussed in the textbook. This makes the work of the teacher easier.

In most schools the school year is roughly divided into three terms, i.e. Spring, Summer, and Winter. It is up to the teacher to select the topics to be taught in each term, but this selection should be well-balanced as sometimes a teacher would prefer to teach the topics that are easier or are better liked by him or her than others. For instance, a biology teacher would prefer to teach biology first and neglect the other parts.

To overcome these problems, each part of the textbook has been written in such a way that each topic is self-explanatory and the answers to the questions at the end of each chapter can be readily found in the text. Definitions and all aspects of each topic have been highlighted for quick reference, and simple experiments have been given wherever possible to make the concepts clear as well as make learning interesting and easy.

The role of the teacher:

It is up to the teacher to devise means and ways of reaching out to the students, so that they have a thorough knowledge of the subject without getting bored.

The teacher must use his/her own discretion in teaching a topic in a way that he/she finds appropriate, depending on the intelligence level as well as the academic standard of the class.

To the teacher:

With your assurance and guidance the child can sharpen his skills.

Encourage the child to share his experiences. Try to relate to real things. Do not rush the reading. Allow time to respond to questions and to discuss pictures or particular passages. It will enhance learning opportunities and will enable the child to interpret and explain things in his/her own way.

Preparation by the teacher:

Be well-prepared before coming to class.

i) Read the lesson.
ii) Prepare a chart if necessary.
iii) Practise diagrams which have to be drawn on the board.
iv) Collect all material relevant to the topic.
v) Prepare short questions.
vi) Prepare homework, tests, and assignments.
vii) Prepare a practical demonstration.

The following may also be arranged from time to time.

i) Field trips
ii) Visits to the laboratory
iii) A show of slides or films
iv) Plan projects

Method of teaching:

The following method can be employed in order to make the lesson interesting as well as informative.

The basic steps in teaching any science subject are:

i) locating the problem
ii) finding a solution by observation and experimentation
iii) evaluating the results
iv) making a hypothesis and trying to explain it

The usual strategy which is easy as well as effective can be adopted:

i) Before starting a lesson, make a quick survey of the previous knowledge of the students by asking them questions pertaining to the topic, from everyday observation of their surroundings, or from things they have seen or read about in books, magazines, or newspapers.

ii) Explain the lesson.
iii) Write difficult words and scientific terms on the board.
iv) Ask students to repeat them.
v) Help students to read text.
vi) Show materials, models, or charts.
vii) Make diagrams on the board.
viii) Perform an experiment if necessary.
ix) Ask students to draw diagrams in their science manuals.
x) Students should tackle objective questions independently.
xi) Ask questions from the exercises.
xii) Answers to questions to be written for homework.
xiii) The lesson should be concluded with a review of the ideas and concepts that have been developed or with the work that has been accomplished or discussed.

Starting the lesson:

Before starting a lesson, the teacher should make a quick survey of the previous knowledge of the students by asking some questions pertaining to the topic from their everyday observation.

It is not necessary that the class should begin with the reading of the textbook. The lesson should begin with the teacher telling an interesting incident or information that will keep the students interested and make them want to know more about the topic which has been introduced. Each topic of the lesson should be explained thoroughly and to check whether students are following, short questions should be asked in between the lecture.

Making a sketch or diagram on the board is a very important aspect of the study of science but too much time should not be spent on it or the students lose interest. An alternative to drawing on the board is a ready-made chart, or one made by the teacher, which can be hung in the classroom. The use of visual material is very effective as it keeps the students interested as well as helps them to build mental pictures which are learnt quickly and can be recalled whenever needed. Students, too, take interest in drawing diagrams and they should be helped by the teacher when diagrams are being made in class. If a diagram is not in the textbook then the students should either copy it from the board or a chart, or the teacher should photocopy it and distribute among the students.

Practicals and experimental work:

The science laboratory of any school should be well-equipped for meeting the requirements of the practical work done at the school level. The science teacher may make suggestions and request for material and equipment to perform simple experiments.

Science students should be taken to the laboratory to see the laboratory in charge at work. They can also see the specimens of various plants and animals on display and be introduced to some scientific equipment, chemicals, and solutions.

Practical work arouses interest in the subject. Some experiments can be easily performed in class. Class activities can be organized in such a way that the whole class can participate in and benefit from them. Students can be asked to work in groups or in pairs, depending on the type of work that is to be done, or the amount of material that is available. Demonstrations by the teacher are unnecessary. A

clear sequence of instructions related to the activity should be given and the students should be allowed to work independently, but the teacher, should be in direct and immediate control of everything. Teachers should also determine the pace of work.

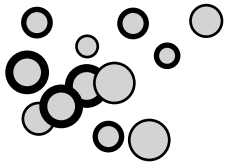
If there is any difficulty or danger encountered at the start of an experiment, or during it, the teacher should be prepared to improvise, and provide an alternative method, or a different experiment giving the same results.

Most of the experimental work should be carried out by the students themselves, as it develops more interest and a sense of responsibility among the students. The basic method or technique should be thoroughly understood by the students before an experiment is performed. The students should be allowed to work independently under strict supervision. A record of the observations should be carefully made, preferably in tabular form. The conclusions or results should be thoroughly discussed in class before writing them down. Written work should be checked carefully and regular tests should be conducted. (Simple experiments have been given in each topic which will enable the teacher to plan and prepare them quickly and with ease.)

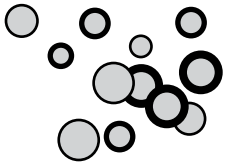
If the steps involved in the experiment and the precautions to be taken are explained clearly and thoroughly, the experiment can be successful and the students will develop a sense of achievement and confidence.

When the discussion of a topic has been completed, it should be summarized by the teacher along with the participation of the students by writing down all the important ideas and concepts that have developed from the text and the experimental work.

These guidelines for teachers will enable them to teach science effectively and develop in their students an interest in the subject which can be maintained throughout the academic year and possibly in their lives as a whole. These suggestions are not mandatory. They can only supplement and support the professional judgement of the teacher and in no way can they serve as a substitute for it.



UNIT 1



Learning to be a scientist

Teaching objectives:

- to define science
- to discuss the nature of work of a scientist
- to discuss the scientific methods followed for answering questions and arriving at conclusions
- to describe a laboratory
- to demonstrate the usage of some basic laboratory apparatus and instruments

Teaching strategy:

Ask: What is science? Explain the meaning of science, who a scientist is and how he works.

Take the students to the laboratory, and with the help of a lab assistant show them the various instruments and apparatus and explain their uses. Rules regarding the use of equipment, and accidents that might happen through ignorance or carelessness in the laboratory should also be explained. Measures to be taken in case of an emergency should also be discussed.

Explain the steps involved in solving a problem with an example from the textbook.

Answers to Exercises in Unit 1:

1. (a) Science is the study of things and events that take place around us.

   (b) A scientist is a person who studies science.

   (c) A scientist uses scientific methods to solve problems.

   (d) A special kind of room where a scientist works is called a laboratory.

2. (a) weight (b) length (c) volume (d) time (e) temperature

3. (a) apparatus (b) reagent (c) fire extinguisher (d) first aid box

   (e) Specimens (f) metres (g) grams (h) litres (i) seconds

   (j) degrees Celsius

4. measuring cylinder, measuring flask, pipette, burette

Additional Exercise:

MCQs

(a) The study of things and events that take place around us is called _____.

science news environment [***science***]

(b) A person who studies science is called _____.

an artist a scientist a scholar [***a scientist***]

(c) A scientist works in a special kind of classroom called a _____.

library study room laboratory [***laboratory***]

(d) _____ have been invented to help scientists in making accurate measurements and calculations for the experiments they perform.

Instruments Tools Models [***Instruments***]

(e) A balance is an instrument used for measuring the _____ of a body.

temperature weight height [***weight***]

(f) Volume is measured in _____.

metres kilograms litres [***litres***]

(g) The instrument used to measure the temperature of a body is _____.

thermometer altimeter ammeter [***thermometer***]

(h) A laboratory must be equipped with a fire extinguisher to _____.

put out fires keep the laboratory cool heat the laboratory [***put out fires***]

(i) Chemicals in a laboratory are kept in _____.

plastic bottles reagent bottles thermos flasks [***reagent bottles***]

(j) A first aid box contains _____.

tools medicines and bandages machines [***medicines and bandages***]

Lesson plan

Date: Time: 40 mins

Unit: 1 **Topic: Learning to be a scientist**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
1. Learning to be a scientist	• to explain what *science* means • to explain what a scientist does and where he/she works	• explain the meaning of the word *science* • describe what a scientist does to find explanations for scientific phenomena	Pictures of some famous scientists and the work they have done A chart of the steps involved in solving a scientific problem	Reading: p 2 Activity: 1 CW: Q1 (a) (b) HW: Q1 (c) (d)

Key words: science, scientist, laboratory, problem, identify, information, experiment

Method: Start the lesson by asking questions: What is science? Explain that science is a way of searching for information that will give us a better understanding of our world.
Explain that scientists carry out research work relating to different fields like the Earth, the universe, materials, force and energy, living things, etc. Often, a team of scientists belonging to different fields work together, each contributing his/her special knowledge or skills towards finding a solution.

Ask: How does a scientist think and work? Explain that the steps a scientist follows in solving a problem are:

1. A scientist defines the problem that s/he wants to solve.
2. S/he thinks of as many ways as s/he can to solve it.
3. S/he chooses the best possible solution or explanation.
4. S/he plans an experiment to see whether the chosen solution or explanation is correct.
5. If the experiment shows that the option is suitable, s/he proves it by doing further experiments.
6. Careful scientists always verify their discoveries.

Lesson plan

Date: Time: 40 mins

Unit: 1 **Topic: Learning to be a scientist**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
2. Looking at a laboratory	• to introduce the names of items of laboratory apparatus and explain their use	• name various items of laboratory apparatus and equipment and explain their use	A visit to a laboratory Charts of laboratory apparatus and equipment A table of scientific measurements	Reading: p 2, 3, 4 Activity: 2 CW: Q2 HW: Draw an instrument used to measure: a. weight b. volume of a liquid c. length of an object d. time e. temperature
Key words: apparatus, instrument, microscope, balance, cylinder, stopwatch, metre rule, measuring tape, thermometer **Method: Ask**: How do instruments help scientists make discoveries? Why do scientists use instruments? Explain that scientific instruments enable scientists to observe facts more accurately than by using their senses alone. Take the students to the laboratory. Explain the safety rules that must be followed while working there. Show students the various instruments used for measuring quantities such as distance, weight, temperature, and time.				

Name: _____ Date: _____

1. Arrange the following steps, used in studying a scientific problem, in the correct order:

   reach a conclusion

   analyze the results

   collect information

   record the results

   perform an experiment

   study the problem

   i. _____ ii. _____

   iii. _____ iv. _____

   v. _____ vi. _____

2. List five things that you should not do in a laboratory.

   i. _____

   ii. _____

   iii. _____

   iv. _____

   v. _____

Name: _____ Date: _____

1. Fill in the table:

Name of the instrument	What it is used for	Unit of measurement
balance		
measuring cylinder		
stopwatch		
metre rule		
thermometer		

2. a. Arrange the following steps that you would use in separating salt and sand from a mixture, in the correct order.

evaporate the filtrate to dryness

salt is left in the evaporating dish

filter the mixture with filter paper

put the mixture in water and stir gently

i. _____

ii. _____

iii. _____

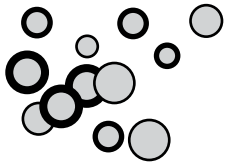
iv. _____

b. Give three reasons why you followed this procedure.

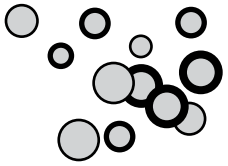
_____

_____

_____



UNIT 2



Living organisms

Teaching objectives:

- to discuss the characteristics of living organisms
- to discuss the differences between living and non-living things
- to discuss the differences between animals and plants
- to describe the conditions that are necessary for the survival of living things
- to define 'environment'
- to describe the types of environment and their important features
- to explain how animals and plants adapt to their environments
- to explain how animals and plants protect themselves
- to explain food chains and food webs, and describe how living organisms are interconnected for their energy requirements
- to explain how wildlife is being destroyed and what measures can be taken to preserve it

Teaching strategy:

Place a potted plant, a clockwork toy, and a live cockroach in a jam jar on your desk. **Ask:** Which of these is a living thing? Depending on the answer, ask why it is a living or a non-living thing. Now wind the toy and ask: Is this a living thing? Ask students to tell the difference between a cockroach and a toy. Show the plant to the students and ask them to compare it to the cockroach. They should be able to explain the differences in colour, movement, shape, etc. **Ask:** Does the plant breathe, move, or eat? Does it have babies? Using all the information obtained from the students, explain the differences between living and non-living things, and between plants and animals.

Ask: What conditions do you think are necessary for life? Can you live without air? Why, or why not? Can you live without water? Why, or why not? What will happen if we close the lid of the jar with the cockroach in it? What will happen if we put this plant in a dark cupboard and do not water it? What will happen to the toy if we put it in the deep freezer? Expanding upon the answers from the students, explain the conditions that are necessary for living things, and their importance.

Ask: What type of area do you live in? What sort of climate do you like? What type of clothes do you wear in winter? What kind of food do you like to eat in summer? Explain that as we adapt ourselves to our surroundings, so do other living organisms. **Ask:** Why do we not see lizards and frogs in winter? Explain the terms cold-blooded, warm-blooded, and hibernation. **Ask:** Do you have a pet animal or fish? How do you look after it? What do you give it to eat? Where do you keep it? Explain the importance of natural and artificial environments, and the features of a natural environment. Explain the features of an artificial environment (such as a fish aquarium or a birdcage) where the animals do not have to search for their food and they cannot change their surroundings. **Ask:** What would happen

if you let your pet free? Explain the meaning of adaptations and the features that enable an organism to live in a particular environment.

Ask: Where do different kinds of food come from? Explain the importance of photosynthesis and that plants are the main producers for all living things and the Sun is the main source of energy. **Ask:** What do plants eat? What does a rabbit eat? What does a dog eat? What does a lion eat? Explain the different kinds of food and the animals which eat it. Explain the concept of food chains and food webs and how living organisms depend on each other for their food requirements. **Ask:** Which animals eat plants? Which animals eat meat? Which animals eat both plants and meat? Explain herbivores, carnivores, and omnivores.

Ask: What happens to animals if we cut down trees? Explain how natural habitat is being destroyed by man's activities. **Ask:** How can we protect wildlife and preserve natural habitats? Explain how humans are polluting the environment and destroying the natural habitats of wild organisms. Discuss the dangers of all this with the students.

Do the activities.

Summarize the lesson.

Answers to Exercises in Unit 2:

1. (a) Cells: They are the building blocks of all living things.
   Tissue: They are a group of similar cells which are specialized to perform a particular function.
   Organ: Different types of tissues group together to form an organ.
   Organ systems: Systems are made up of many organs which work together.
   (b) In multicellular plants, materials are circulated in a system of tubes called the vascular system. The vascular system of plants is composed of specialized tissues called xylem and phloem. Xylem is made up of long, dead cells called vessels. Vessels have thick walls. They carry water from the roots, through the stem to the veins in the leaves. Phloem is made up of long thin-walled tubes called sieve tubes. Sieve tubes are made of living cells whose horizontal walls have tiny holes. Food flows from the leaves to other parts of the plant through the sieve tubes.
   (c) Plants lose water vapour into the atmosphere by evaporation. The water passes through tiny holes called stomata which are found mainly on the lower side of leaves. This process is called transpiration. It is important because it helps in the transportation of water in plants and it also helps plants to keep cool in summer.
   (d) Respiration is the process by which food is oxidized in the body cells to produce energy. The parts of the respiratory system of a mammal are nose, windpipe, bronchi, bronchioles, and air sacs.
   (e) The heart is a muscular organ found in the centre of the chest. It has four chambers. The upper two chambers or atria are thin walled and the lower two chambers or ventricles are thick walled.
   (f) The process by which insoluble food is broken down by the action of enzymes into soluble substances, is called digestion. Food is completely digested in the small intestine.
   (g) brain, spinal cord, and nerves
   (h) A reflex action is an involuntary response to a stimulus such as sneezing.
   (i) writing, reading, speaking

2. (a) vessels (b) sieve tubes (c) Transpiration (d) alveoli
   (e) capillary (f) enzymes (g) villi (h) kidneys
   (i) neurons (j) reflex (k) reflex arc (l) involuntary or reflex action

3. (a) food pipe (b) stomach (c) small intestine (d) large intestine
Refer to the diagram on page 14 of the Pupil's Book.

4. (a) Refer to the diagram on page 15 of the Pupil's Book.

5.

	Plant cell	**Animal cell**
a) cell wall	thick cell wall present	cell membrane present
b) chloroplasts	chloroplasts present	chloroplasts absent
c) vacuole	large central vacuole	small scattered vacuoles

Additional Exercise:

MCQs

(a) All plants, animals, and other living things are made up of _____.

cells water air [***cells***]

(b) A group of similar cells which are specialized to perform a particular function are called _____.

cells tissues organs [***tissues***]

(c) Different types of tissues are grouped together to form _____.

cells tissues organs [***organs***]

(d) _____ systems are made up of many organs which work together.

Cell Tissue Organ [***Organ***]

(e) They _____ system in plants is composed of specialized tissue called xylem and phloem.

vascular digestive respiratory [***vascular***]

(f) Loss of water from the leaves through the stomata is called _____.

respiration circulation transpiration [***transpiration***]

(g) _____ is a process by which food is oxidized in the body cells to produce energy.

Respiration Transpiration Digestion [***Respiration***]

(h) The muscular organ found in the centre of the chest is _____.

liver heart kidney [***heart***]

(i) The process by which insoluble food is broken down by the action of enzymes into simple soluble substances is called _____.

digestion respiration excretion [***digestion***]

(j) Nerves are bundles of _____ which are covered by a tough sheath.

tendons neurons nephrons [***neurons***]

Lesson plan

Date: Time: 40 mins

Unit: 2 **Topic: Living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
1. Cells	• to explain that all living things have similar characteristics • to explain that all living things are made up of cells • to describe the structure of a cell • to compare an animal and a plant cell	• explain that all living things are made up of cells and have similar characteristics • describe the structure of a typical cell • explain the difference between an animal and a plant cell	A microscope, slides of an animal cell, a plant cell Diagrams of the structures of different kinds of cells	Reading: p 8, 9 Activity: 1, 2 CW: Q5 HW: Write the functions of the following parts of a cell: a. nucleus b. cell membrane c. mitochondria d. chromosome e. chloroplast
Key words: reproduction, cell, cytoplasm, nucleus, cell membrane, mitochondria, chloroplast, vacuole, chromosome, chlorophyll, cell sap **Method: Ask**: What are living things made of? Show the students diagrams of different types of cell, and explain the structure of a typical cell. Take the students to the laboratory and show them slides of a plant cell and an animal cell. With the help of diagrams, explain the structures of a typical animal and plant cell. Explain the functions of each part and ask the students to describe the differences between them.				

Lesson plan

Date: Time: 40 mins

Unit: 2 Topic: Living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Cells, tissues, organs, organ systems	• to explain that organisms are made of cells, tissues, organs and organ systems	• explain that living organisms are made up of cells, tissues, organs, and organ systems • describe the structure of various tissues and systems in living organisms	Pictures and diagrams of cells, tissues, organs, and organ systems in plants and animals	Reading: p 9, 10 HW: Define the following: a. tissue b. organ c. organ system

Key words: cell, tissue, organ, organ system

Method: Start the lesson by asking the students: What are living things made up of? What are cells? Is your body made up of cells that are all alike? Explain that cells divide and grow to reproduce themselves. A group of similar cells doing the same job are called *tissue*. Muscles are made from muscle tissue whose work is to contract. **Ask**: Is a plant made up of the same kind of tissue? Discuss the different kinds of tissue found in plants. Explain the structure of the root and the stem. Explain how each part performs a different function.

With the help of charts and diagrams explain the different types of tissue in animals.

Ask: What is an organ? Explain that different tissues combine to form an organ. The stomach is an organ that digests food. It is made up of muscle tissue, nerve tissue, and blood tissue.

Ask: Can you name any organs of the body? Explain that organs work together to form organ systems, which carry out much larger functions than a single organ is able to do. The digestive system is made up of various organs such as the stomach, liver, and intestines. Another example of an organ system is the circulatory system, which carries blood around the body.

Lesson plan

Date: Time: 40 mins

Unit: 2 **Topic: Living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
3. Transport systems in plants	• to explain how food and water is transported in plants • to explain the significance of photosynthesis for all living things	• explain the structure and function of the vascular system in plants • explain why photosynthesis is important for all living things	Pictures and diagrams of the following: the vascular system in plants the transpiration stream the process of photosynthesis	Reading: p 10, 11 Activity: 4, 5, 6 CW: Q1 (b) HW: Q1 (c)

Key words: vascular system, xylem, phloem, vessel, sieve tube, root hair, transpiration, stomata

Method: Start the lesson by discussing simple, one-celled organisms such as amoeba or euglena. Explain how the transport of materials takes place inside them. **Ask**: How does food taken into the mouth reach all the cells of the body? Discuss the various systems and how they work in a coordinated manner in order to keep the body in working order. Discuss the transport system in plants and, with the help of diagrams and charts, explain how food, water, and air are circulated in the body of a plant.

Ask: From where do green plants get food? Discuss the process of photosynthesis with the help of diagrams and charts.
Ask: How would the world be affected if there were no green plants? Discuss the importance of photosynthesis and its importance for providing food, for maintaining the balance of the amounts of oxygen and carbon dioxide in the atmosphere, and for providing fuels like gas, coal, and petroleum.

Lesson plan

Date: Time: 40 mins

Unit: 2 **Topic: Living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
4. Various systems in humans: The respiratory system	• to describe the respiratory system in human beings	• define respiration • describe the human respiratory system	Charts and diagrams of the respiratory system in humans A sheep's lungs	Reading: p 12 CW: Study the table on p 12 and answer the following questions: 1. Why is there less oxygen in exhaled air? 2. Why is there more carbon dioxide in exhaled air? 3. Why is the amount of nitrogen the same in exhaled and inhaled air? 4. Why is there more water vapour in exhaled air? HW: Q1 (d)

Key words: respiration, nose, windpipe, trachea, bronchi, bronchiole, air sac, alveoli, inhale, exhale

Method: Show the students the respiratory system of a sheep. Blow through the trachea to show how the lungs inflate. Press the lungs to show how the lungs deflate. With the help of charts and diagrams, describe the human respiratory system. Explain the importance of respiration, and how gaseous exchange takes place in the lungs. **Ask**: Where does the air from the lungs go? Explain that the oxygen in the inhaled air is absorbed by the red blood cells and taken to all parts of the body through the blood circulatory system. The digested food already present in the cells is oxidized and energy and carbon dioxide are produced. The carbon dioxide is carried in the blood back to the lungs from where it is breathed out, or exhaled.

Discuss the comparison table on page 12 to explain how gaseous exchange takes place.

Date: Time: 40 mins

Unit: 2 Topic: Living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
5. The circulatory system	• to explain the blood circulatory system in human beings	• define the term *blood circulation* • describe the human circulatory system	Diagrams and charts of the human blood circulatory system A sheep's heart	Reading: p 13 Activity: 7 HW: Q1 (e)
Key words: heart, artery, capillary, vein, atrium, ventricle **Method**: Show the students a sheep's heart. **Ask**: Where is the heart found in the human body? What is the function of the heart? Describe the parts of the heart. Explain the pumping action of the heart and how the heart pumps blood to all parts of the body. Describe the structure of the heart with the help of a chart. Describe the blood circulatory system with the help of a chart. Explain the difference between an artery, a vein, and a capillary. Discuss the importance of the circulation of blood in the body.				

Lesson plan

Date: Time: 40 mins

Unit: 2 **Topic: Living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
6. The digestive system	• to explain the parts of the human digestive system	• define *digestion* • describe the human digestive system	Diagrams and charts of the human digestive system	Reading: p 13, 14 Activity: 8 CW: Q3 HW: Write the name of the part of the digestive system where: a. food is chewed and mixed with saliva b. gastric juice is mixed with the food c. digested food is absorbed by the blood capillaries d. water and salts are absorbed

Key words: digestion, mouth, food pipe, oesophagus, stomach, gastric juice, small intestine, bile, liver, pancreatic juice, pancreas, large intestine, anus

Method: Start the lesson by asking the students: What happens to the food that we eat? What is digestion? Describe the digestive system with the help of a chart, and explain the process of digestion. **Ask**: What happens to the digested food? Explain the process of absorption of food by the blood capillaries in the intestines. **Ask**: What happens to any undigested food? Explain that it is expelled from the body through the anus.

Lesson plan

Date: Time: 40 mins

Unit: 2 Topic: Living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
7. The excretory system	• to explain the human excretory system	• define *excretion* • describe the human excretory system	A sheep's kidney Charts and diagrams of the human excretory system	Reading: p 15 Activity: 9 HW: Q4
Key words: excretion, kidney, ureter, urinary bladder, urethra **Method: Ask**: How are waste products removed from the body? Show the students a sheep's kidney. Explain the structure of the kidney. Explain that its function is to filter blood. With the help of charts and diagrams on the board, explain the process of excretion.				

Lesson plan

Date: Time: 40 mins

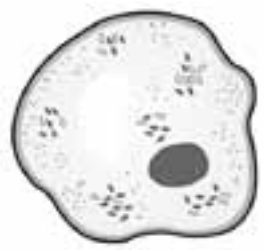
Unit: 2 Topic: Living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
8. The nervous system	• to explain the structure of the human nervous system • to explain how the nervous system works	• describe the structure of the human nervous system • explain how the nervous system works	Charts and diagrams of the human nervous system A sheep's brain	Reading: p 15, 16 Activity: 3 CW: Q2 HW: Q1 (g) (h) (i)

Key words: nervous system, neuron, brain, cranium, spinal cord, vertebral column, nerve, reflex arc, reflex action, voluntary, involuntary

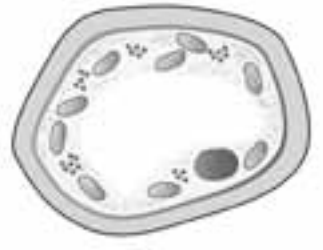
Method: **Ask**: Which part of the body controls all our actions? How do we think? How do we work? Explain that the brain is the main organ in the body and it controls all the other parts. Show the students a sheep's brain. Explain its structure. Show the students a chart of the nervous system and explain its working. Explain the position and the working of the spinal cord. Explain what a reflex action is with examples. Draw a reflex arc on the board and explain how messages are carried to and from the brain to bring about reflex actions in the body. Also discuss voluntary and involuntary actions, with examples.

Name: _____ Date: _____

1. a. Label the cells.



A



B

b. Which cell is a plant cell? _____

c. Give 3 reasons for your answer:

i. _____

_____

ii. _____

_____

iii. _____

_____

2. Arrange the following in order from the smallest to the largest:

organ	organ system	cell	tissue
_____	_____	_____	_____

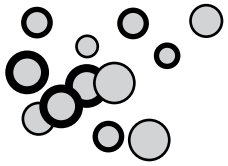
Name: _____ Date: _____

1. Draw a line to match each part to its function:

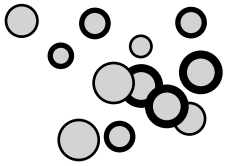
Part	**Function**
xylem	gaseous exchange in leaves
phloem	absorbs water
root hair	transports food in plants
stomata	gaseous exchange in the lungs
alveoli	carry oxygenated blood
red blood cells	transports water in the plant
artery	returns deoxygenated blood to the heart
vein	absorb oxygen
capillary	forms a connection between an artery and a vein

2. Fill in the blanks to complete the description of the process of excretion in human beings.

Blood containing waste substances enters the kidney, through the _____ arteries. Blood is filtered by _____ and waste substances, along with excess _____ , pass down the _____ into the _____ where it is stored in the form of _____ for sometime. When the bladder is full, urine is passed out of the body through the _____.



UNIT 3



Sensitivity in living organisms

Teaching objectives:

- to explain that all living things respond to changes inside and outside their bodies
- to explain how simple organisms respond
- to describe how plants and animals respond
- to describe how coordination takes place in our bodies
- to explain the structure and working of the nervous system
- to explain the position and function of the glands of the endocrine system
- to explain the structure and functions of the brain and the sense organs

Teaching strategy:

Introduce the topic of sensitivity by asking the students some questions:

Ask: Do plants move? Will a plant run away if you hit it? What characteristics of a plant help you to know that it is living? Where does an amoeba live? What is the green layer seen on the surface of stagnant water? Explain that all living organisms are sensitive to changes in their environment. Explain that plants move their parts, such as sunflowers which turn to face the Sun. Roots always grow downwards towards soil and water. Some flowers open and close according to light intensity. Explain that chlamydomonas and euglena can detect changes in light intensity using their eyespot. In an amoeba the whole cytoplasm is sensitive.

Explain that movements of the root and the shoot are called tropic movements. Perform the experiments described in the book, and explain that these movements are caused by a chemical substance called auxin. **Ask:** In which direction will the root and the shoot grow if the plant is on its side? Explain that auxin collects in the lower half of the stem and root, which slows down the growth of the root cells, and the root curves downwards.

Ask: How do animals respond to changes in their surroundings? Explain that simple organisms can sense general stimuli such as light, or temperature changes. **Ask:** How do we receive information from our surroundings? Explain that we have special organs called sense organs, which help us receive stimuli from our environment. **Ask:** What happens when we put food in our mouth? Explain that as the food passes down the alimentary canal, different glands pour their secretions to help digest the food. Blood carries the digested food to the cells. Explain that the working together of all the organs and organ systems is called coordination. **Ask:** What happens when you touch something hot or when you smell food? Explain that our senses help us to receive stimuli, and our body reacts to these stimuli to bring about responses. **Ask:** Which organ coordinates all stimuli and responses in the body? Explain that brain is the main organ which controls all parts of the body and helps them to work together.

Shell a complete walnut and explain that the human brain is of the same shape. Show the students a model of the human brain. Explain the name and functions of each part.

Ask: What is the nervous system made up of? With the aid of a chart or a diagram made on the board, explain the structure of the nervous system. Draw a neuron or nerve cell and explain how neurons are linked together to make up the brain, spinal cord, and nerves. Draw a reflex arc on the board and explain the path of a stimulus to the brain or spinal cord and the response produced. **Ask:** Why do you sneeze, cough, or blink your eyes in strong light? Explain that these are reflex actions which are produced spontaneously without the intervention of the will. **Ask:** What kind of actions are reading, speaking, walking, etc? Explain that we read, speak, and walk by our own will. These are called voluntary actions.

Ask: In which part of your body do you feel happiness or fear? What are your reactions when you feel happy or sad?
Explain that emotions affect the whole body. There is no specific organ that reacts. The heart beats faster, the breathing rate increases, you may start blushing, or become pale, etc. These reactions are produced due to the release of special chemical substances in the blood. These chemical substances are called hormones. There are several glands in various parts of the body, which produce hormones that control different reactions of the body. This system of glands is called the endocrine system, and the glands are called endocrine glands. Explain the position of the endocrine glands with the aid of a chart or a diagram.

Explain the structure of the eye, ear, and skin with the aid of models or draw diagrams on the board with coloured chalk. Take care to label these correctly. Explain the functions of each part. Draw a section of a taste bud and explain how the taste buds help you to distinguish different tastes. **Ask:** Can you tell the taste of some food with your nose pressed between your finger and thumb? Why? Explain that the sense of taste is enhanced by the sense of smell. Perform the experiments and activities at the end of the lesson to provide a better understanding of the topic. Encourage children to make diagrams and models of the various organs and systems described in the lesson. Before attempting the exercise, read out the summary for a quick review of the lesson.

Answers to Exercises in Unit 3:

1. (a) In single-celled organisms, the whole cytoplasm is sensitive to changes in the environment.
   (b) The ability of an organism to respond to a stimulus is called sensitivity.
   (c) The movement of plants towards light and gravity are called tropic movements.
   (d) Auxin is a chemical substance which is made in the cells at the tips of the roots and shoots. Auxin speeds up the growth in stems, and slows down the growth in roots.
   (e) Higher animals respond to changes in their environment by taking appropriate action.
   (f) The working together of all the organs and systems of the body is called coordination. Coordination in the body is brought about by two systems:
   the nervous system,
   the endocrine system.

2. (a) eyes, ears, nose, tongue, skin (b) sight (c) salty, sweet, sour, bitter
   (d) smell (e) Plants (f) Auxin (g) brain
   (h) Motor (i) Auditory nerve (j) semicircular canals and vestibule

3.

Part	Function
sense organ	detects stimuli
eyespot	helps to detect changes in light intensity in a Eugilena
auxin	speeds up stem growth
brain	controls all parts of the body
ear	sensitive to the stimulus of sound
semicircular canals	maintain the balance of the body
sweat glands	produce sweat
pupil	controls the amount of light entering the eye
taste buds	sensitive to taste
olfactory nerve	connects the nose to the brain

4. Refer to page 26 of the Pupil's Book.
5. Refer to page 25 of the Pupil's Book.
6. Refer to page 24 of the Pupil's Book.

Additional Exercise:

MCQs

(a) Some unicellular organisms such as euglena have an eyespot which helps them to detect changes in _____ intensity.

light sound heat [***light***]

(b) The ability of an organism to respond to a stimulus is called _____.

reactivity sensitivity creativity [***sensitivity***]

(c) The bending of the shoot towards light is called _____.

phototropism geotropism hydrotropism [***phototropism***]

(d) The responses of the root and shoot are controlled by chemicals called _____.

medicines auxins fertilizers [***auxins***]

(e) The working together of all the organs and systems of the body is called _____.

synthesis coordination reactions [***coordination***]

(f) The endocrine system is made up of a number of _____.

cells glands nerves [***glands***]

(g) Bundles of _____ form a nerve.

axons cells glands [***axons***]

(h) Certain parts of the body which respond to hormones are called _____.

target organs sensory organs organ systems [***target organs***]

(i) The _____ is the largest sensory organ of the body.

nose eye skin [***skin***]

(j) Sense organs are made up of _____ cells.

small sensory body [***sensory***]

Lesson plan

Date: Time: 40 mins

Unit: 3 **Topic: Sensitivity in living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
1. Sensitivity in living organisms	• to explain that all living things are sensitive • to describe sensitivity in simple organisms • to describe sensitivity in plants	• explain that all living things respond to changes inside and outside their bodies • describe sensitivity in simple organisms and plants	A microscope Slides of euglena, chlamydomonas, amoeba, touch-me-not plant Some seedlings	Reading: p 21, 22 Activity: 1, 2, 8 CW: Q1 (a) (b) HW: Q1 (c) (d)

Key words: sensitivity, eye-spot, stimulus, response, tropism, phototropism, geotropism

Method: Introduce the topic of sensitivity by asking some questions: **Ask**: Do plants move? Will a plant run away from danger? What characteristics of a plant help you to know that it is living? Where does an amoeba live? What is the green layer seen on the surface of stagnant water?

Explain that all living organisms are sensitive to changes in their environment. Plants move some parts, for example, sunflowers turn to face the Sun, roots always grow downwards towards soil and water, some flowers open and close according to light intensity. Simple organisms like the euglena and chlamydomonas can detect changes in light intensity using their eye-spots. In an amoeba the whole cytoplasm is sensitive.

Explain that the movements of the root and shoot are called tropic movements. Carry out Activities 1 and 2 on page 27 and explain that tropic movements are caused by a chemical substance called auxin, which is found at the tips of the roots and shoots. Discuss the role of auxins in tropic movements and the growth of plants.

Lesson plan

Date: Time: 40 mins

Unit: 3 Topic: Sensitivity in living organisms	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Sensitivity in animals	• to explain how animals respond to changes in their environment • to describe coordination • to explain how coordination takes place in our bodies	• give examples of how animals respond to changes in the environment • explain what coordination is and describe how coordination in brought about in the body • describe the nervous system and the endocrine system	Charts and diagrams of the nervous system and the endocrine system A sheep's brain	Reading: p 22, 23 CW: Draw a nerve cell and label it. Q1 (e) HW: Q1 (f)

Key words: stimulus, coordination, nerve tissue, nervous system, endocrine system, gland, brain, spinal cord, impulse, dendrite, sensory nerve, motor nerve

Method: **Ask**: How do animals respond to changes in their environment? How do we receive information from our surroundings? Explain that simple organisms can sense general stimuli such as light or temperature changes. We have special organs called sense organs, which help us respond to stimuli from our environment.

Ask: What happens when we put food in our mouth? Explain that as the food passes down the alimentary canal, different glands pour out their secretions to help digest the food. Blood carries the digested food to all the cells of the body. Explain that the working together of all the organs and organ systems is called coordination.

Ask: What happens when we touch something hot? What happens when we smell food? Explain that our senses receive stimuli, and our body reacts to these stimuli to bring about responses.

Ask: Which organ coordinates all the stimuli and responses in the body? Explain that the brain is the main organ which controls all parts of the body, and enables them to work together.

Ask: What is the nervous system made up of? With the aid of a chart or a diagram on the board, explain the structure of the nervous system. Draw a nerve cell and explain how neurons are linked together to make up the brain, the spinal cord, and nerves. Draw a reflex arc on the board and explain the path of a stimulus to the brain or the spinal cord, and the response produced. Show the students a chart of the endocrine system.

Ask: In which part of your body do you feel happiness or fear? Explain that there are no specific organs for these reactions. These reactions are produced by the release of special chemical substances in the blood called hormones. With the help of charts, discuss the position of the various endocrine glands and the reactions that they produce.

Lesson plan

Date: Time: 40 mins

Unit: 3 **Topic: Sensitivity in living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
3. Sense organs: Ear	• to explain the structure and the working of the ear	• describe the structure of the ear • explain how the ears enable us to hear	Diagrams, models, and charts of the ear	Reading: p 24, 25 Activity: 7 CW: Q6
Key words: outer ear, middle ear, inner ear, eardrum, ossicle, oval window, Eustachian tube, cochlea, vestibule, semicircular canal **Method**: Explain the structure of the ear with the help of models, charts, or diagrams on the board. Label the parts clearly and explain the functions of each part. Explain how the semicircular canals help to maintain the balance of the body.				

Lesson plan

Date: Time: 40 mins

Unit: 3 **Topic: Sensitivity in living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
4. Eye	• to describe the structure of the eye and explain the functions of each part	• describe the structure of the eye • explain the functions of each part of the eye	Diagrams, models, and charts of the eye	Reading: p 25 Activity: 3 CW: Q5
Key words: cornea, iris, pupil, lens, retina, rods and cones, optic nerve **Method**: Explain the structure of the eye with the help of models, charts, and diagrams on the board. Label the parts carefully and explain the functions of each part. Explain how the iris controls the amount of light entering the eye.				

Lesson plan

Date: Time: 40 mins

Unit: 3 **Topic: Sensitivity in living organisms**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
5. Skin, tongue, nose	• to explain the structure of the skin, tongue, and nose • to explain the functions of each part	• describe the structure of the skin, the tongue, and the nose • explain the functions of each part	Models, diagrams, and charts of the skin, the tongue, and nose	Reading: p 25, 26 Activity: 4, 5, 6 CW: Q2, Q4 HW: Q3

Key words: epidermis, dermis, sweat gland, oil gland, blood capillary, taste bud, smell receptor, olfactory nerve

Method: Explain the structure of the skin with the help of models, charts, and diagrams on the board. Label the parts clearly and explain the functions of each part. Explain how the skin helps to maintain a constant body temperature in mammals.

Explain the structure of the tongue. Explain how the tongue helps to distinguish between various tastes.

Explain the structure of the nose. Explain how the nose distinguishes between different kinds of smells. Discuss the importance of the sense of smell.

Name: _____ Date: _____

1. Give the scientific names for the following parts of the sensory organs of the human body.

Part of the body	Scientific name
a. The coloured part of the eye	_____
b. The nerve which connects the eye to the brain	_____
c. The outermost layer of the skin	_____
d. The layer of the skin which contains nerves and hair follicles	_____
e. A thin membrane in the ear which vibrates when sound waves strike it	_____
f. Help to maintain the balance of the body	_____
g. Helps to adjust air pressure in the middle ear	_____
h. Controls the amount of light entering the eye	_____
i. Is sensitive to taste	_____
j. Nerve that connects the nose to the brain	_____

2. Which part of the following organisms responds to changes in their surroundings?

   a. euglena _____

   b. chlamydomonas _____

   c. amoeba _____

   d. green plant _____

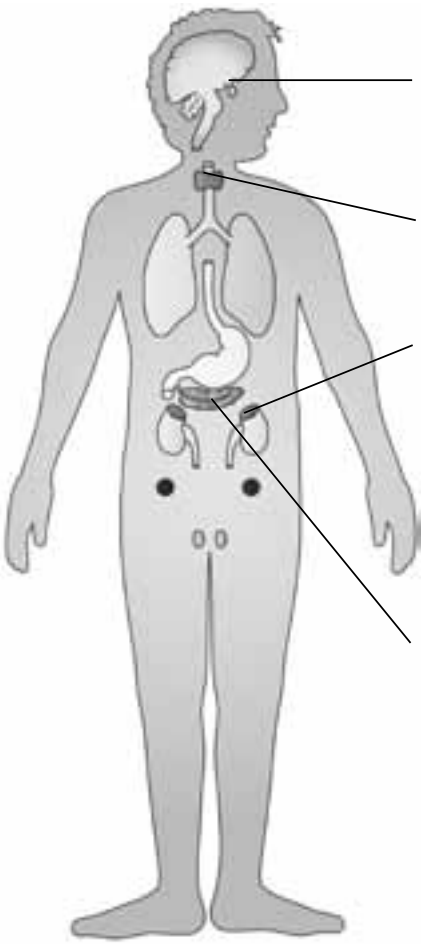
   e. human body _____

Name: _____ Date: _____

A B

1. Extend the shoots in flowerpots A and B to show how plants respond to light. (The two flowerpots are placed in sunlight.)

2. Label the organs of the endocrine system.



Photosynthesis and respiration in plants

Teaching objectives:

- to explain that most of our food comes from plants
- to explain that green plants can make their own food
- to describe the structure of a leaf in relation to the function that it performs
- to describe the process of photosynthesis
- to explain how glucose is made in a leaf
- to explain how the food is utilized by the plant
- to explain that plants respire
- to describe how leaves are adapted for respiration
- to explain how respiration and photosynthesis help to keep a balance in the composition of gases in the atmosphere

Teaching strategy:

Show the students some green plants having roots, stems, and leaves. Ask them the function of each part. **Ask:** Are plants living things? Discuss the various activities that living things do, with special reference to plant activities. **Ask:** Do plants eat? Why are leaves green? Explain the presence of chloroplasts and how they help absorb sunlight. **Ask:** What will happen to a plant if we keep it in the dark for some time? Discuss the importance of sunlight to the process of photosynthesis.

Draw the structure of a leaf on the board and label it. Discuss the function of each part of the leaf. Show the students some slides of the transverse sections of leaves under the microscope. Explain the structure of the different tissues of a leaf and the functions that they perform. **Ask:** What do we get from plants? Discuss the importance of plants for all living things. Write the word PHOTOSYNTHESIS on the board. Draw a line between PHOTO and SYNTHESIS. Ask the students the meanings of the two words. Explain that photo means 'light' and 'synthesis' means 'manufacture'. The two words put together mean: 'manufacture in the presence of light'. Discuss the process of photosynthesis and how the leaves are adapted for the function that they perform.

Explain the importance of xylem and phloem and their functions. **Ask:** What happens to the glucose that the leaves manufacture? Explain the uses of food in the plant. **Ask:** Does the plant use up all the food that it manufactures? Discuss storage of food in plants and how it is utilized.

Ask: Do plants breathe? How can you tell? Do plants have lungs or special parts where gaseous exchange occurs? Explain that plants are living things and like all living things plants must respire in order to produce energy and stay alive. Define respiration and explain where and how respiration in plants occurs. Discuss the structure of the leaf and the position of stomata in relation to respiration. Write the equation of photosynthesis and respiration on the board. **Ask:** Can you tell the difference between the two

processes? Explain that both processes are the opposite of each other. Compare and contrast both processes. Perform the activities on photosynthesis and respiration that are given in the Pupil's Book and ask the students to draw conclusions from them about the processes. Draw a cycle of the oxygen and carbon dioxide balance in nature. **Ask:** How is the composition of air kept fairly constant? Why is it important for the gases in the air to remain balanced? How do plants help to maintain a balance in nature? Discuss the importance of the oxygen and carbon cycle in nature Summarize the lesson.

Answers to Exercises in Unit 4:

1. a) The process by which green plants make their food in the presence of sunlight and chlorophyll is called photosynthesis.
   b) Photosynthesis occurs in the green leaves of plants.
   c) A green plant needs four things for photosynthesis to take place. These are: carbon dioxide, water, sunlight, and chlorophyll.
   d) The plant makes glucose by the process of photosynthesis. This glucose is converted into starch and stored in the leaves.
   e) Stomata are small holes found on the under surface of leaves.
   f) Carbon dioxide, a raw material for photosynthesis, enters the stomata. Oxygen, which is a by-product of photosynthesis, passes out of the stomata.
   g) Glucose that is made during photosynthesis is used by the plant for producing energy and for growth. It is also changed into starch or oil and stored in the stems, roots, fruits, and seeds. Some of it is used in making cellulose for new cell walls. Some of it is combined with minerals and used to make proteins and other things which plants need for growth.
   h) Respiration is the process leading to the chemical breakdown (oxidation) of food materials to provide energy for living things.
   i) Respiration occurs inside the living cells of plants and animals.
   j) Oxygen from the air enters the stomata and diffuses into the tissues and cells of plants after getting dissolved in the film of water present around the cells. Inside the cells this oxygen oxidizes the carbohydrates and other organic compounds into carbon dioxide and water to produce energy.
2. Refer to page 35 of the Pupil's Book.
3. Refer to Experiment no 4.
4. Refer to experiment no 5.
5. a. all b. day c. food or carbohydrates
   d. glucose e. food, oxygen, carbon dioxide, water
   f. carbon dioxide, water, glucose, oxygen
6. Complete the following table by putting a 'tick' mark in the correct column:

	Photosynthesis	**Respiration**
takes place in all living cells	–	✓
needs chlorophyll	✓	–
takes place in dark or in light	–	✓

oxygen is given out or used up	given out	used up
carbon dioxide is used or given out	used	given out
food is needed	–	✓
energy is given out	–	✓

Additional Exercise:

MCQs

(a) Sugar and starch are _____.

proteins fats carbohydrates [***carbohydrates***]

(b) The three elements needed by plants to make glucose are _____.

carbon, hydrogen, oxygen carbon, oxygen, nitrogen

carbon, hydrogen, nitrogen [***carbon, hydrogen, oxygen***]

(c) Plant roots take in water by their _____.

root caps root hairs root systems [***root hairs***]

(d) Water is transported in plants by _____.

xylem phloem xylem and phloem [***xylem***]

(e) Food is transported in plants by _____.

xylem phloem xylem and phloem [***phloem***]

(f) Stomata are usually present on the _____ surface of leaves.

upper lower both [***lower***]

(g) _____ which is made in the leaves is used for producing energy and for growth.

Glucose Proteins Fats [***Glucose***]

(h) The process of the oxidation of food materials to provide energy for living things is called _____.

digestion excretion respiration [***respiration***]

(i) The green material found in leaves is called _____.

chlorophyll xanthophyll mesophyll [***chlorophyll***]

(j) Photosynthesis takes place during the _____.

day time at night all the time [***day time***]

Lesson plan

Date: Time: 40 mins

Unit: 4 **Topic: Photosynthesis and respiration in plants**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
1. Food from green plants How is food made in a green leaf?	• to explain that most of our food comes from green plants • to explain that green plants can make their own food • to describe the structure of a leaf and explain the function of each part	• state that most of our food comes from green plants • explain how green plants make their own food • describe the structure of a leaf in relation to its function	Some green plants A green leaf, a section of a leaf, a slide of a section of a leaf	Reading: p 32, 33 Draw a diagram to show how a leaf makes food. CW: Q1 (a) (b) HW: Q1 (c) (d)

Key words: photosynthesis, phloem, xylem, stomata, vein, sieve tube, vessel

Method: Show the students some green plants. Ask them to suggest the functions of each part.

Ask: Are plants living things? Do plants eat? Why are leaves green? Explain the presence of chloroplasts and their function of absorbing sunlight. **Ask**: What would happen to a plant if it was kept in the dark for some time? Explain the importance of sunlight for the process of photosynthesis.

Draw a diagram of the structure of a leaf on the board and label it. Explain the functions of each part. Use a microscope to show the students slides of the transverse sections of leaves. Explain the structures of the different tissues of a leaf and the functions that they perform.

Ask: What do we get from plants? Discuss the importance of plants for all living things.

Lesson plan

Date: Time: 40 mins

Unit: 4 **Topic: Photosynthesis and respiration in plants**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
2. Process of photosynthesis	• to explain the process of photosynthesis • to explain how a leaf is adapted for the function that it performs • to explain how plants use the glucose that they make	• describe the process of photosynthesis • explain how the structure of a leaf is adapted for the functions that it performs • explain how food is utilized by the plant	Charts and diagrams of photosynthesis	Reading: p 33, 34 Activity: 1, 2, 3, 4 CW: Q1 (e) (f) HW: Q1 (g)

Key words: sunlight, chlorophyll, carbon dioxide, water, oxygen, glucose, starch, oil

Method: Write the word PHOTOSYNTHESIS on the board. Draw a line separating the word into two parts like this: PHOTO / SYNTHESIS.

Ask the students the meanings of the two words. Explain that 'photo' means 'light' and 'synthesis' means 'manufacture'. Together they mean: 'manufacture in the presence of light'. Discuss the process of photosynthesis and how the leaves are adapted for the functions that they perform.
Explain the importance of the network of veins and the function that they perform.
Ask: What happens to the glucose that the leaves manufacture? Explain the uses of food in the plant.
Ask: Does the plant use up all the food that it manufactures? Discuss the storage of food and how it is utilized later.

Lesson plan

Date: Time: 40 mins

Unit: 4 **Topic: Photosynthesis and respiration in plants**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
3. Respiration in green plants	• to explain that plants respire • to explain how leaves are adapted for respiration • to explain how photosynthesis and respiration maintain a balance in the composition of the atmosphere	• describe the process of respiration in green plants • describe how a leaf is adapted for respiration • explain how photosynthesis and respiration help to maintain a balance in the composition of gases in the air	Charts showing respiration and the oxygen and carbon dioxide balance in nature	Reading: p 34, 35 Activity: 5, 6 CW: Q2, Q5, Q6 HW: Q1 (h) (i) (j)

Key words: respiration, internal respiration, cellular respiration

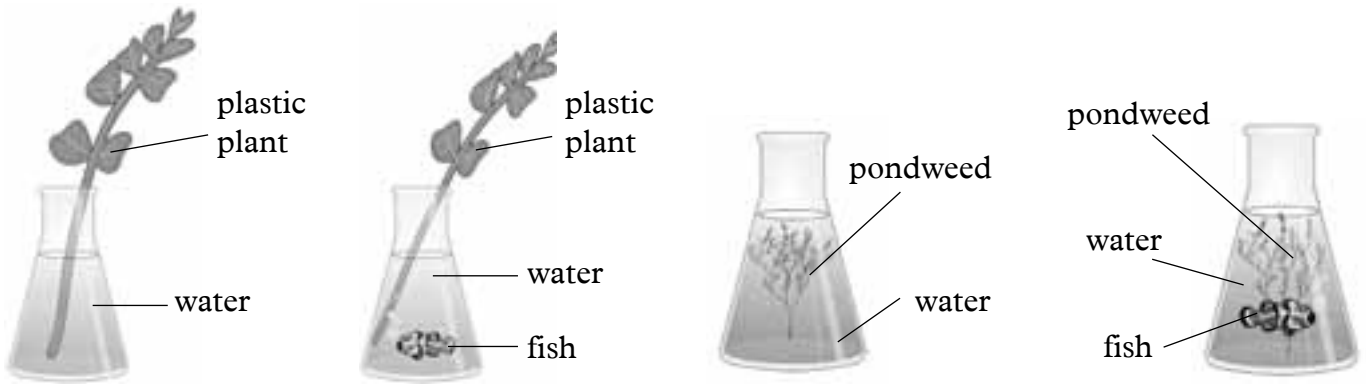
Method: **Ask**: Do plants breathe? How can you tell? Do plants have lungs or special parts where exchange of gases occurs?

Explain that plants, like all living things, must respire in order to produce energy, and to stay alive. Define respiration and explain where respiration in plants occurs. Discuss the structure of a leaf and the position of the stomata.
Write the equations of photosynthesis and respiration on the board.
Ask: Can you tell the difference between the two processes?
Explain that photosynthesis and respiration are the opposite of each other. Discuss the similarities and differences between the two processes.

Draw a diagram of the oxygen-carbon dioxide cycle on the board.
Ask: How is the composition of air kept fairly constant? Why is it important for the gases in the air to remain in balance? How do plants help to maintain a balance in nature?
Discuss the importance of the oxygen-carbon dioxide cycle in nature.

Name: _____ Date: _____

1. The diagram shows an experiment of how plants and animals interact.



A B C D

a. Which flask would contain the most oxygen after one hour? _____

_____

Explain your answer. _____

_____

b. Which flask would contain the most carbon dioxide after one hour? _____

_____

Explain your answer. _____

_____

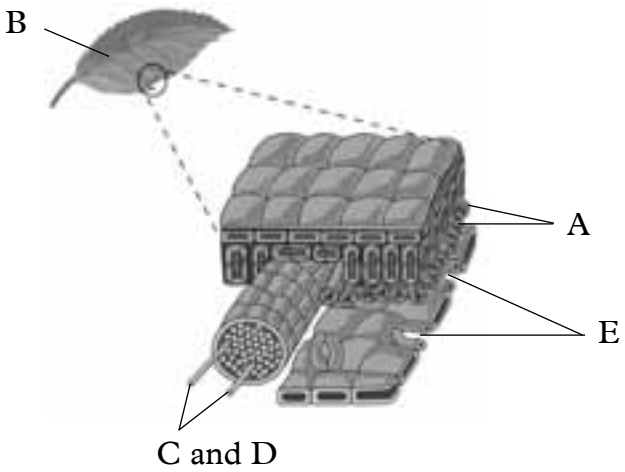
c. In which flask would the fish survive the longest? _____

_____

Explain your answer. _____

_____

Name: _____ Date: _____



1. Name the parts labelled A to E.

2. Explain the functions of the parts of the leaf:

chloroplasts _____

_____

xylem _____

_____

phloem _____

_____

midrib _____

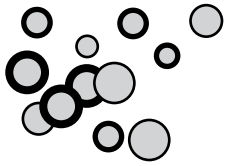
_____

air spaces _____

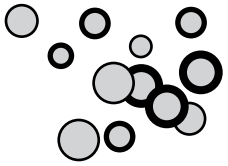
_____

stomata _____

_____



UNIT 5



Air

Teaching objectives:

- to explain what constitutes the atmosphere
- to discuss the various layers of the atmosphere
- to explain atmospheric pressure
- to explain that air has weight
- to explain that air pressure can be measured by a barometer
- to describe the different types of barometers
- to explain the effects and uses of atmospheric pressure
- to describe air pollution

Teaching strategy:

Ask: What do we breathe? Where is air? Can we see air? Can we feel air? What is air made of? Explain that we cannot see air but we can feel it. We can see things moving when the wind blows. Air is a mixture of gases. Oxygen is important for breathing and burning. Carbon dioxide is used by plants to make food by photosynthesis. Nitrogen cannot be used directly by living things, but it is changed into chemical substances which are absorbed by plant roots. Nitrogen is used to make proteins. **Ask:** Does air contain water? Put some ice cubes in a drinking glass and explain the condensation of atmospheric water vapour on the outside of the glass.

Show a chart of the layers of the atmosphere or draw the layers on the board. Explain that the troposphere is the most important layer as it contains all the important gases for living things. **Ask:** Have you heard of the ozone layer? Why is ozone important? Explain that ozone protects us from the harmful ultraviolet rays of the Sun.

Demonstrate by an experiment that air exerts pressure, and has weight. Explain that air pressure is most at sea level and becomes less as we go higher up. **Ask:** Have you seen a doctor take the blood pressure of a patient? Explain that the pressure of the air can also be measured. The pressure of the atmosphere at sea level is 1 kilogram on every cubic centimetre. Draw a centimetre cube on the board and explain that the weight of the air on this small cube is equal to one kilogram. **Ask:** How much pressure of air would there be on our bodies? Why don't we feel the pressure? Explain that our blood pressure equalizes it. Draw a simple barometer on the board. Explain that the height of the mercury column measures the air pressure. Show the students pictures of an anaeroid barometer and an altimeter. Explain their usage. If you climb uphill why do you start panting? Explain that as we go up a hill the air pressure decreases, and we have to breathe faster to take in more air. **Ask:** What do you feel just before a storm? Explain that a low pressure area is created and air rushes in from an area of high pressure to an area of low pressure, and a storm builds up. Changes in air pressure cause changes

in weather. Fill a glass with water. Tell a student to suck it with a drinking straw. **Ask:** What would happen if the glass was tightly closed from the top? Explain that air pressure helps us to suck liquids, fill fountain pens, and syringes and to do many other such things.

Ask: What is the air like in a village or a hilly area? What is the air like in a busy city? Why is the air cleaner in the countryside? Explain the causes of pollution and how we can reduce it. Tell students to make placards and charts to make others aware of the hazards of air pollution.

Do the activities.
Summarize the lesson.

Answers to Exercises in Unit 5:

1. (a) The Earth is surrounded by a layer of air, which extends hundreds of kilometres above the surface of the Earth. This ocean of air is called atmosphere.
   (b) One-fifth of the air is oxygen, four-fifth is nitrogen. Other gases, like carbon dioxide and argon, are in very small amounts.
   (c) The layers of air are: troposphere, tropopause, stratosphere, ionosphere. The troposphere is the layer nearest to the Earth. It has oxygen gas which is very important for all living things.
   (d) The weight of the atmosphere is called atmospheric pressure.
   (e) A simple barometer consists of a long glass tube which is sealed at one end. It is filled with mercury and inverted in a dish containing mercury. The height of the column of mercury in the tube measures the atmospheric pressure, which is equal to 60 mm of mercury at sea level.
   (f) Take an empty tin can and heat it to remove all the air inside it. Now screw on the cap tightly. The can will collapse due to the air pressure outside.
   (g) Changes in air pressure cause changes in weather. As warm air rises it produces an area of low pressure near the ground. Cooler air moves down to take its place. Rain clouds are formed in low pressure areas. Low pressure causes strong dust storms and hurricanes because air rushes from regions of high pressure to regions of low pressure. When there is high pressure the weather is often sunny and fine.

2. (a) hundreds of kilometers (b) pressure (c) 760 mm of mercury
   (d) Barometer (e) Low air pressure (f) decreases
   (g) air pressure (h) high (i) altimeter (j) barometer

3. Choose the correct answer:
   (a) 1 kg (b) high pressure to low pressure (c) storms
   (d) lower to higher altitudes (e) temperature (f) altimeter
   (g) 760 mm (h) pilot (i) air (j) high altitudes

4. (a) low (b) low (c) high
   (d) high (e) low (f) low (g) high

5. (a) nitrogen (b) oxygen (c) argon
   (d) sulphur dioxide (e) carbon monoxide (f) soot

6. (a) carbon dioxide, nitrogen, oxygen (b) carbon dioxide, nitrogen, oxygen
   (c) oxygen (d) carbon dioxide (e) carbon dioxide
   (f) oxygen (g) carbon dioxide (h) oxygen (i) carbon dioxide

Lesson plan

Date: Time: 40 mins

Unit: 5 **Topic: Air**	Teaching objectives	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
1. Air	• to explain the composition of the atmosphere • to explain the properties and uses of gases in the air	• describe the composition of air • explain the properties and uses of oxygen, nitrogen, and carbon dioxide	A pie chart showing the composition of air Pictures showing uses of oxygen, nitrogen, and carbon dioxide gases	Reading: p 41, 42 Activities: 1, 2, 3 CW: Q6 HW: Q1 (a) (b)

Key words: atmosphere, oxygen, nitrogen, carbon dioxide, argon, oxide, respiration, combustion, fertilizer, carbonic acid, fire extinguisher, dry ice

Method: Begin the lesson by asking: Where is air? Can we see air? Can we feel air? What is air composed of?

Explain that we cannot see air but we can feel it. We can see things moving when the wind blows. Air is a mixture of gases. Discuss the properties and uses of oxygen, nitrogen, carbon dioxide.

Lesson plan

Date: Time: 40 mins

Unit: 5 **Topic: Air**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
2. Layers of the atmosphere	• to describe the layers of the atmosphere • to explain how the atmosphere prevents the Earth from becoming too hot	• identify the layers of the atmosphere • explain how the atmosphere protects the Earth from becoming too hot	Diagram showing the layers of the atmosphere	Reading: p 42, 43 HW: Q1 (c)
Key words: troposphere, tropopause, stratosphere, ionosphere **Method**: Show the students the diagram of the layers of the atmosphere. Explain that the troposphere is the most important layer as it contains all the important gases for living things. **Ask**: Have you heard of the ozone layer? Why is the ozone layer important? Explain how the ozone layer protects us from the harmful ultraviolet rays of the Sun.				

Lesson plan

Date: Time: 40 mins

Unit: 5 Topic: Air	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Atmosphere and wind	• to explain what wind is • to identify the effects of temperature on the atmosphere	• explain how winds are caused • explain what thermals and land and sea breezes are	Diagrams of thermals, land, and sea breezes	Reading: p 43, 44 CW: Draw a diagram of land and sea breezes. HW: Q. What is a thermal? How are thermals useful?

Key words: wind, thermal, breeze

Method: **Ask**: Have you seen birds such as eagles floating in the sky? How does a glider float in the sky?

Explain that a thermal is a rising current of warm air which enables birds and gliders to float in the air.

Ask: What is a breeze? How is a breeze caused? Explain that land and sea breezes are caused by the changes in air pressure due to warm and cool air. Air moves from areas of high pressure to areas of low pressure. Warm air has low pressure and is light. Cool air has high pressure and is heavy. Changes in temperature during daytime and night time cause land and sea breezes.

Lesson plan

Date: Time: 40 mins

Unit: 5 Topic: Air	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. Atmospheric pressure	• to define atmospheric pressure • to explain that air has weight • to describe the effects of atmospheric pressure • to explain how air pressure can be measured • to identify uses of air pressure	• explain that air exerts pressure called atmospheric pressure • explain that air has weight • describe the effects of atmospheric pressure • explain how atmospheric pressure can be measured • identify ways in which air pressure can be useful	Balloons, stick, glass dish, glass tube, metre rule, barometer, drinking straw, glass tumbler, tin can, syringe	Reading: p 44, 45, 46 Activity: 4 CW: Q2 HW: Q3, Q4

Key words: atmospheric pressure, weight, barometer, altimeter, syringe

Method: Demonstrate by experiments described on pages 44 and 46 that air has weight and it exerts pressure.

Explain that air pressure is greatest at sea level and decreases as we go higher up.

Ask: Have you seen a doctor take a patient's blood pressure? Explain that air pressure can also be measured. The pressure of the atmosphere at sea level is 1 kg on every cubic centimetre. Draw a centimetre cube on the board and explain that the weight of air on this small cube is one kilogram.

Ask: How much pressure is there on our bodies? Why do we not feel the pressure?
Explain that our blood pressure is equal to the external air pressure.

Draw a simple barometer on the board. Explain that the height of the mercury column measures the air pressure. Show the students pictures of different kinds of barometer and an altimeter. Explain their use. **Ask**: When you climb uphill, why do you start panting? Explain that as we go uphill the air pressure decreases, and we have to breathe faster to take in more air.

Ask: What do you feel just before a storm? Explain that a low pressure area is created and air rushes in from an area of high pressure to an area of low pressure and a storm builds up. Explain that changes in air pressure cause changes in the weather.

Discuss the uses of air pressure in daily life.

Lesson plan

Date: Time: 40 mins

Unit: 5 **Topic: Air**	**Teaching methodology**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
5. Air pollution	• to explain what air pollution is • to explain the causes of air pollution and its harmful effects	• define air pollution • identify the causes of air pollution • describe its harmful effects	Pictures of air pollution	Reading: p 47 HW: Q5
Key words: air pollution, acid rain **Method**: **Ask**: What is the air like in a village? a hilly area? a busy city? Why is the air cleaner in the countryside? Discuss the causes and effects of pollution and how we can reduce it. Ask the students to make posters to make others aware of the hazards of air pollution.				

Name: _____ Date: _____

1. Identify the following gases:

Description	Gas
a. Colourless, heavier than air, soluble in water, does not help in burning	_____
b. Colourless, combines with oxygen to form oxides, combines with hydrogen to form ammonia	_____
c. Colourless, slightly soluble in water, combines with many elements to form their oxides	_____

2. Write the name of the gas which is used for:

a. breathing and burning _____

b. cutting and welding _____

c. making fertilizers _____

d. freezing food _____

e. putting out fires _____

f. making fizzy drinks _____

Name: _____ Date: _____

1. Write the names of the layers of the atmosphere.

a. _____

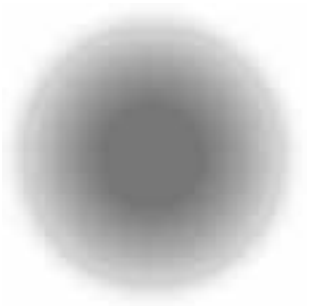
b. _____

c. _____

d. _____

e. _____

2. Draw arrows from the text in the boxes to show how the atmosphere protects the Earth from becoming too hot:



Sun

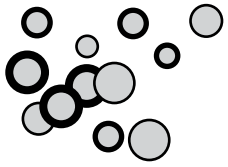
heat from the sun

Some heat escapes into space.

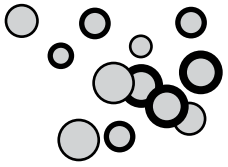
some heat absorbed by the clouds and dust particles

Heat warms the Earth.

Earth



UNIT 6



Elements, mixtures, and compounds

Teaching objectives:

- to explain the structure of atom
- to define mass number
- to explain atomic mass
- to define a molecule and explain how it is formed
- to define an element and explain that there are more than 117 known elements
- to explain that elements can be divided into metals and non-metals and to know the properties of metals and non-metals
- to define a mixture
- to describe the various types of mixtures
- to define a solution and discuss various types of solutions
- to explain the methods by which the components of a mixture can be separated
- to define a compound
- to describe physical and chemical changes
- to explain the physical and chemical properties of a substance

Teaching strategy:

Ask: What would happen if a piece of silver or coal is pounded with a hammer for a long time? Explain that it will be crushed into almost invisible particles but they will still be the same. (This will help develop the concept of an element being a pure substance). Show the students a piece of charcoal and a piece of iron and ask the difference between the two. Explain the differences between metals and non-metals.

Mix sugar and salt in a clean dish and ask the students to taste it. Mix salt and crushed charcoal and ask the students if they can see the two kinds of particles. Mix powdered charcoal and iron filings and ask the students if they can see the two types of particles. Bring a bar magnet near the mixture and ask the students what they can observe. Explain the properties of mixtures. With the help of experiments given in the textbook, explain types of mixtures.

Ask: Can you think of a way to separate a mixture of salt and sand? Children should perform an experiment in the laboratory to separate salt and sand. Mix iron filings and sulphur powder in a china dish and show the mixture to the students. Stir a bar magnet in the mixture, the iron filings will stick to it. Put the filings back in the dish and heat it. Explain the changes and why they take place. Explain the formation of compounds and the differences between mixtures and compounds.

Ask: What happens when ice melts? What happens when a piece of paper is burnt? Explain the meaning of physical and chemical changes with the help of examples. Show students some substances such as sugar, sulphur powder, iron filings, common salt, etc. and ask the students to describe them. Explain that they have just described the physical properties of these substances. Explain what are the physical properties. Refer to the previous experiment of heating iron filings and sulphur powder and explain the chemical nature and properties of substances.

Do the activities at the end of the lesson.
Summarize the lesson.

Answers to Exercises in Unit 6:

1. (a) An atom is made up of tiny particles called electrons, protons, and neutrons. Electrons are negatively charged particles that revolve around the nucleus in a specific path called an orbit. Protons are positively charged particles found in the nucleus of an atom. Neutrons are neutral particles which are also present in the nucleus. The mass of a neutron is equal to the mass of a proton.

   (b) (i) An element is a substance that is made up of the same kinds of atoms. For example, the element carbon is made up of carbon atoms only.

   (ii)

Element	Symbol
carbon	C
nitrogen	N
hydrogen	H
oxygen	O
sulphur	S
iodine	I
phosphorous	P
calcium	CA
chlorine	CL
zinc	Zn

   (iii)

Latin names	Symbol
cuprum	Cu
argentum	Ag
aurum	Au
hydrargyrum	Hg
ferrum	Fe
kalium	K
natrium	Na
plumbum	Pb
stannum	Sn

(c)

Compound	Formula
sodium chloride	NaCl
sodium hydroxide	NaOH
potassium hydroxide	KOH
carbon dioxide	CO_2
water	H_2O
sugar	$C_{12}HO_{11}$
glucose	C_6HO_6
copper oxide	CuO
copper sulphate	$CuSO_4$
ammonia	NH_3

(d)

Metals	Non-metals
good conductors	bad conductors
shiny	dull
solids	solids, liquids, gases
high melting and boiling points	low melting and boiling points
can be drawn into wires and beaten into foil and plates	cannot be drawn into wires or beaten into foil and plates

In metals, the atoms are so tightly packed that the electrons overlap one another forming metallic bonds.

(e) A mixture is not a pure substance. It is made of two or more substances which are not chemically combined. For example, a mixture of sugar and salt.

(f) An aqueous solution is a mixture of water and any substance that is solvent in it. For example, a solution of water and common salt or sugar.

A dilute solution is one in which a smaller amount of solute is dissolved in the solvent.

A concentrated solution is one in which a lot of solute is dissolved in the solvent. For example, one tablespoon of salt in two cups of water is more dilute than three tablespoons of salt in two cups of water.

Concentrated solutions can be mixed with solvents to make dilute solutions, e.g. fruit juice concentrates can be mixed with water to dilute them.

(g) A mixture of salt and sand can be separated by adding water and then filtering the solution. Sand will be left on the filter paper. The filtered solution is heated; the water evaporates and pure salt is left behind.

(h) When two or more atoms combine chemically, they form a compound. For example, hydrogen and oxygen combine chemically to form water.

(i) ionic bond

(j) covalent bond

(k)

Properties	Ionic compounds	Covalent compounds
(i) physical state	solid	solid, liquid, gas
(ii) melting point	high	low
(iii) conductor	good	bad
(iv) solubility	in water	in covalent solvents
(v) type of bond between aloms	ionic	covalent between atoms

(l) A solution which cannot dissolve any more solute at a fixed temperature.

2. Fill in the blanks.

(a) atoms (b) Proton (c) electron
(d) atomic number (e) mass number (f) two
(g) eight (h) chemical bond (i) positively (j) covalent

3.

	Symbol	Protons	Neutrons	Electrons	Atomic No.	Mass No.
(a) hydrogen	H	1	–	1	1	1
(b) carbon	C	6	6	6	6	12
(c) sodium	Na	11	12	11	11	23
(d) chlorine	Cl	17	18	17	17	35
(e) oxygen	O	8	8	8	8	16

4. Choose the correct answer.

(a) an element (b) is a bad conductor of heat and electricity (c) various gases
(d) solute (e) an emulsion (f) filtration (g) metals (h) metal

5. Match the statements.

(a) is a pure substance. (b) is formed by a chemical reaction.
(c) contains particles that are not chemically combined.
(d) is passing a mixture through a filter paper.
(e) is formed when oil and water are mixed.
(f) is dissolved in a solvent.
(g) is a layer formed by settling of particles at the bottom.
(h) are good conductors of heat and electricity.

Lesson plan

Date: Time: 40 mins

Unit: 6 **Topic: Elements, mixtures, and compounds**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
1. Atoms	• to describe the structure of an atom • to explain how electrons are distributed in an atom • to explain what an element is • to compare metals and non-metals	• describe the structure of an atom • explain how electrons are distributed in an atom • define what an element is • explain the differences between metals and non-metals	Charts and diagrams of atoms, samples of metals and non-metals	Reading: p 52, 53 Activity: 1, 2, 3 CW: Q1 (a) Q3 HW: Q1 (d)

Key words: atom, electron, proton, neutron, orbit, shell, nucleus, atomic number, mass number, atomic mass, element, metal, non-metal

Method: Draw a diagram of an atom on the board. Label it and explain that all matter in the world is made up of atoms.

Describe the structure of an atom. Explain the charges on the particles of an atom.

Ask: What is the mass number of an atom? What is the atomic mass of an atom? Explain what atomic mass and mass number mean.

Explain the way that atomic mass and atomic number are written next to the symbol or short form name of the atom.

Draw a sodium atom on the board. Write the number of protons, neutrons, and electrons of the atom.

Ask: Are all the electrons in one shell? Explain the distribution of electrons in the K, L, M, N shells. Also explain that the outermost shell cannot hold more than eight electrons.

Ask: What is an element? Explain that an element is a substance that is made up of only one kind of atom.

Ask: What is a metal? How can you distinguish a metal from a non-metal? Discuss the properties of metals and non-metals.

Lesson plan

Date: Time: 40 mins

Unit: 6 Topic: Elements, mixtures, and compounds	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Mixtures and solutions	• to define *mixture* • to define *solution* • to describe different kinds of solution • to define the term *solubility* • to describe the different kinds of mixture	• explain that a mixture is not a pure substance • explain that a solution is a mixture • describe the different kinds of solution • explain what solubility is • describe the different kinds of mixture	A can of cola, lemon squash, vinegar, salt, water, coins, sugar, beaker, spoon, paint, chalk, cooking oil	Reading: p 54, 55, 56 Activity: 5, 6 CW: Q2, Q4 HW: Q1 (e) (f)

Key words: mixture, solution, solute, solvent, soluble, insoluble, aqueous, dilute, concentrated, saturated, suspension, solubility, suspension, emulsion

Method: Stir a teaspoon of salt into a glass of water.

Ask: Can you see the salt in the water? Can you taste the salt in the water? Can salt and water be separated easily? How?

Explain the properties of a mixture and describe the types of mixture with examples. Explain that the mixture of salt and water is called a solution. The salt is the *solute,* the *solvent* is water. We can say that salt is *soluble* in water.

Ask: Is sand soluble in water? Explain the difference between soluble and insoluble. Describe the characteristics of an aqueous (liquid) solution. **Ask**: What will happen to the solution if we add more salt to it? Explain the difference between a dilute and a concentrated solution.

Ask: What will happen if we add even more salt to the solution? Explain that the solution will become saturated. No more salt will be able to dissolve in it. Discuss some everyday examples of solutions.

Ask: Are ketchup and milk solutions? Explain that such mixtures are called suspensions.

Explain what the solubility of a salt means. Ask the students to study the graph. Explain that temperature can affect the solubility of a salt.

Stir some powdered chalk into a beaker of water. **Ask**: Is the mixture clear? Has the chalk dissolved in the water?

Explain what a suspension is. Stir a teaspoon of cooking oil into a beaker of water. **Ask**: Has the oil dissolved in the water?

Explain the formation of an emulsion.

Lesson plan

Date: Time: 40 mins

Unit: 6 **Topic: Elements, mixtures, and compounds`**	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Methods of separating mixtures	• to explain how the components of a mixture can be separated	• describe the methods by which the components of mixtures can be separated	Stand, funnel, filter paper, beaker, tripod, burner, china dish, distillation flask, condenser, beaker, black ink, dropper	Reading: p 57, 58 HW: Q1 (g)

Key words: filtration, filtrate, evaporation, crystallization, distillation, paper chromatography

Method: Demonstrate practically the various methods of separating mixtures.

Explain that an insoluble substance can easily be separated by passing the mixture through a filter paper.

A soluble solute can be separated from the solvent by heating the solution to evaporate the solvent, and then allowing the saturated solution to cool slowly. Crystals of the solute will be formed.

Ask: How can a pure solvent be obtained from a solution?

Demonstrate the process of distillation. Explain that the solution is heated and the solvent evaporates and condenses and is collected as a pure substance.

Ask: How can you find out what a coloured substance is made up of?

Demonstrate paper chromatography. Show how the coloured substances in black ink separate out in the form of rings when water is added to it drop by drop.

Lesson plan

Date: Time: 40 mins

Unit: 6 Topic: Elements, mixtures, and compounds	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
4. Compounds	• to explain what a compound is • to explain the differences between a mixture and a compound • to explain the methods of forming compounds • to describe the properties of compounds	• explain that a compound is made up of two or more atoms • explain that the particles of a compound are chemically combined and cannot be separated easily • describe the formation of different types of chemical bonds and explain their properties	Diagrams of atoms, ionic and covalent bonds	Reading: p 58, 59 Activity: 4 CW: Q1 (i) (j) Q4 HW: Q1 (h) (k)

Key words: compound, chemical bond, ionic bond, covalent bond, metallic bond, ionic compound, covalent compound

Method: **Ask**: Are the atoms of a mixture joined to each other? Can they be separated easily? What is a compound? How are atoms joined to each other in a compound?

Explain with charts and diagrams on the board, the formation of chemical compounds. Explain that ionic bonds are formed when electrons are taken or given away by atoms. Positive ions are formed when electrons are given away by an atom. Negative ions are formed when atoms receive electrons. Explain the formation of ions of sodium and chlorine atoms to make the compound sodium chloride (common salt). Explain the properties of ionic compounds.

Draw two hydrogen atoms on the board. Explain that the two atoms come close to each other and begin sharing electrons, thus forming a covalent bond. Explain the properties of covalent compounds.

Ask: How are atoms arranged in metals? Explain that the atoms in a metal are so tightly packed that their electrons overlap each other and cannot be separated easily. Draw overlapping atoms of a metal to explain the properties of metals.

Lesson plan

Date: Time: 40 mins

Unit: 6 **Topic: Elements, mixtures, and compounds**	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
5. Symbols of elements and formulae of chemical compounds	• to explain the symbols of elements • to explain the formulae of some common compounds	• explain what symbols signify • write the formula of some common compounds	Charts of symbols of elements, and formulae of compounds	Reading: p 59, 60 CW: Q. Make a chart of symbols of some common elements, and chemical formulae of some common compounds. Q1 (b) HW: Q1 (c) (d)

Key words: element, compound, symbol, formula

Method: Show the students charts of symbols of some common elements. Explain that a symbol is a short way of writing the name of an element.

Some symbols are letters of the name of the element, for example, carbon C, oxygen O, etc.

Some symbols are two letters of the name of an element, for example, calcium Ca, Zinc Zn, etc.

Some symbols are derived from the Latin names of elements. For example, the Latin name of sodium is natrium and its symbol is Na.

Ask: How can we write the chemical name of a molecule of a compound? Explain that we must know the elements that are found in it and then we write the formula using symbols. For example, carbon monoxide is written as CO, and sodium chloride is written as NaCl.

Name: _____ Date: _____

1. Complete the table to differentiate between metals and non-metals.

Properties	Metals	Non-metals
shiny		
conductors of heat and electricity		
melting points		
states found in		
produce sound on being beaten		
can be drawn into wires		
can be beaten into plates		

2. Write the properties of ionic and covalent compounds in the correct boxes below.

Ionic compounds	Covalent compounds

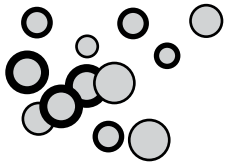
Properties: hard solids, do not conduct electricity, high melting and boiling points, good conductors of electricity, soluble in water, soluble in covalent compounds, do not conduct electricity, low melting and boiling points, found in all three states

Name: _____ Date: _____

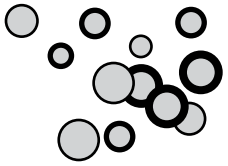
1. Draw the following atoms and write their names:
   a. atomic mass 12, atomic number 6
   b. atomic mass 23, atomic number 11
   c. atomic mass 35, atomic number 17

2. Which two atoms would make an ionic compound? _____ and _____

3. Write the name of the compound. _____



UNIT 7



Energy

Teaching objectives:

- to define energy
- to explain the different forms of energy
- to explain the sources and properties of energy
- to discuss the sources and importance of nuclear energy
- to explain that energy can be controlled and converted for useful purposes
- to discuss the energy resources of today
- to discuss the energy resources of the future

Teaching strategy:

Place your finger on an ice cube in a plate. **Ask:** What is happening? Why does the cube melt? Explain that the heat of the hand increases the speed of the vibrating molecules and this helps to bring about a change in state. **Ask:** What are fire crackers made up of? What happens when you light a fire cracker? Why does a cracker make a crackling sound when it is lit? Explain the energy changes that take place. **Ask:** How do green plants make their food by photosynthesis? Explain the energy changes that take place. **Ask:** What is energy? Explain the meaning of energy and how it can be used to do useful work.

Ask: What are the different kinds of energy? Explain the forms of energy and that energy can change its form. **Ask:** What are the energy changes that take place when a piece of paper is burnt? Explain that energy can neither be created nor destroyed. Explain that all things need energy to work. **Ask:** Why do we eat food? Where does energy in food come from? Explain that energy in food is the energy of the Sun which has been trapped by green plants during the process of photosynthesis.

Ask: How is the Sun's energy recycled? Explain the food cycle. **Ask:** What is a solar cell? Explain how the Sun's energy is used to generate electricity. **Ask:** What is an atom bomb? Explain the process of nuclear fusion and fission. Explain how nuclear energy can be used for peaceful purposes. **Ask:** How does a windmill work? How is electricity generated by a dam? Explain the use of natural elements such as wind and water to produce energy. Explain the working of a waterwheel. Explain how our bodies act as energy controllers and converters for various activities. **Ask:** From where do we get energy for our homes and factories? Explain the current and future resources of energy.

Answers to Exercises in Unit 7:

1. (a) Energy is the ability to do work. All things need energy to move and work.

   (b) All energy on the Earth comes from the Sun. It is called solar energy.

   (c) Millions of years ago plants and animals got energy from the Sun. When they died their bodies slowly changed into oil and coal which are called fossil fuels.

(d) Kinetic energy is the energy in a body which is due to its moving atoms. Potential energy is the stored energy in a body which is due to its position.
(e) Chemical energy is the energy which is stored in chemical substances. It may be released in the form of kinetic energy or heat.
(f) Sound energy moves in the form of sound waves which are produced by vibrating bodies.
(g) The breaking apart of the nucleus of an atom is called nuclear fission. It releases huge amounts of heat energy.
(h) Solar energy is produced by the Sun due to fusion of hydrogen atoms which crash into each other making larger atoms of helium gas.
(i) Energy cannot be made out of anything and neither can it be destroyed. But it can change its form.

2. (a) energy (b) solar (c) heat (d) Petrol (e) kinetic
   (f) chemical (g) digested (h) fission (i) fusion (j) biogas

3. (a) potential (b) electrical (c) chemical (d) nuclear (e) sound
   (f) chemical (g) potential (h) kinetic (i) electrical

Additional Exercise:

MCQs

(a) The energy of the Sun is called _____.
lunar energy solar energy electrical energy [***solar energy***]

(b) Oil and coal are called _____.
petrol fuels diesel fuels fossil fuels [***fossil fuels***]

(c) Moving atoms have _____ energy.
potential kinetic sound [***kinetic***]

(d) _____ energy is the stored energy of a body due to its position.
Potential Kinetic Electrical [***Potential***]

(e) The vibrations produced by a vibrating body travel in air as _____ waves.
light heat sound [***sound***]

(f) Fireworks have _____ energy which is released in the form of sound, heat, and light.
electrical chemical physical [***chemical***]

(g) The splitting of atoms is called _____.
fusion fission synthesis [***fission***]

(h) Fats and carbohydrates produce _____ energy for our bodies.
heat light sound [***heat***]

(i) When biogas mixes with carbon dioxide gas _____ gas is produced.
chlorine ammonia methane [***methane***]

(j) Energy from the ground is called _____.
mechanical energy kinetic energy geothermal energy [***geothermal energy***]

Lesson plan

Date: Time: 40 mins

Unit: 7 Topic: Energy	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Energy	• to explain what energy is • to discuss the types of energy	• explain what is meant by energy • identify the types of energy	Pictures of animals, plants, people, aeroplane, ship, car, wind, waves, electric poles, a ball, sand	Reading: p 68, 69 Activity: 1, 2, 3, 4 CW: Q1 (a) (b) HW: Q1 (c) (d)

Key words: energy, solar energy, fossil fuel, kinetic energy, potential energy

Method: Show the students pictures of different things that use energy. **Ask**: What is energy? Explain that energy is the ability to work. All things need energy to work. **Ask**: Where do we get energy to work and play? Explain that we get energy from the food we eat. **Ask**: How does energy get into food? Revise how green plants use the energy from the Sun (solar energy) to make their food by photosynthesis.

Ask: What does a car, a steam engine, an aeroplane need to move? Explain that all fuels come from solar energy which was trapped in coal and mineral oil millions of years ago. Explain the formation of fossil fuels.

Ask: Do atoms have energy? Explain that atoms are always moving so they have kinetic energy. When an ice cube is heated, its molecules begin to move faster and faster, and finally they break away from each other and the ice melts to form water.

Hold a ball in your hand. **Ask**: Does this ball have energy? Let the ball fall from your hand onto a pile of sand. **Ask**: Does this falling ball have energy? Explain with more examples the difference between kinetic and potential energy.

Lesson plan

Date: Time: 40 mins

Unit: 7 **Topic: Energy**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
2. Kinds of energy	• to describe the various kinds of energy • to discuss the uses of energy	• describe the various kinds of energy and their sources • identify the uses of different kinds of energy	Pictures of electrical appliances, things that make sound, a nuclear power station, food	Reading: p 70, 71 CW: Q1 (e) (f) HW: Q1 (g) Q3

Key words: electricity, sound energy, chemical energy, nuclear energy, fission, fusion, food energy

Method: **Ask**: What is energy? Explain that we are using energy all the time. **Ask**: Where does all the energy in the world come from? Explain the meaning of energy and how it can be used to do useful work.

Ask: What are firecrackers made of? Why does a firecracker make a crackling sound when it is lit? Explain the energy changes that take place.

Discuss the various kinds of energy that we use and their sources. Explain that nuclear energy is generated by fusion and fission of atoms. Nuclear energy can be used to make an atom bomb, but it can also be used to generate electricity.

Ask: How do green plants use energy from the Sun? Explain the energy changes that take place.

Lesson plan

Date: Time: 40 mins

Unit: 7 **Topic: Energy**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
3. Energy changes	• to explain how energy changes from one form to another • to explain that energy can neither be created not destroyed	• explain that energy can change its form • explain that energy can neither be created nor destroyed	Pictures of different machines that use energy	Reading: p 71, 72, 73 CW: Q1 (i) HW: Q2

Key words: chemical energy, electrical energy, electromagnetic energy, microwaves, radio wave, biogas, methane

Method: **Ask**: What are the different kinds of energy? Can energy be created? Can energy be destroyed? Explain the kinds of energy and how energy can change its form. **Ask**: What are the energy changes that take place when a piece of paper is burnt? Explain that energy can be changed from one form to another, but it can be neither created nor destroyed. **Ask**: How is the energy of the Sun recycled? Explain the food cycle with the help of a chart or a diagram on the board. **Ask**: How does a windmill work? How is electricity generated by a dam? Explain the use of natural elements such as wind and water to produce energy.

Ask: What is biogas? Explain how animal waste can be used to generate methane gas which can be used as fuel.

Discuss the transfer of energy in the environment. Revise food chains and food webs and how energy is transferred from the Sun to plants and then to other living organisms. Explain that at each stage in the food chain some energy is lost to the environment and therefore the number of animals at each stage in the chain decreases.

Discuss the different types of energy converters shown on p 73.

Lesson plan

Date: Time: 40 mins

Unit: 7 **Topic: Energy**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
4. New energy sources	• to examine new energy sources • to discuss how natural elements can be used as energy sources	• identify the energy sources of the future • explain how they can be used to generate energy	Pictures of solar panels, solar cells, windmills, floating rafts, geothermal energy	Reading: p 74, 75 Activity: 5 CW: Q. Which new energy source do you think would be most effective and cheapest to produce in our country? Give reasons for your answer. HW: Q1 (h)

Key words: primary source, secondary source, renewable source, non-renewable source, solar, wind, water, geothermal

Method: **Ask**: Where do we get electricity for our homes, businesses, schools, and factories? Discuss the four primary sources of energy. Explain that electricity is a secondary source of energy because it is produced from a primary source. With the help of pictures, discuss the new energy sources and their uses.

Ask the students to make a chart of the new energy sources and write a few lines about each.

Name: _____ Date: _____

1. Starting from the Sun, draw a diagram to show how energy is transferred in an environment.

2. Fill in the blanks to complete the paragraph below.

_____ gas is a valuable and cheap source of energy. When plants and animals _____, they give off this gas. When animal waster and manure mix with _____ gas, a gas called _____ gas is formed. It can be collected and used as _____, for cooking _____ and for boiling _____.

Name: _____ Date: _____

1. Fill in the table to show the energy input and output of some useful energy converters:

Converter	Energy input	Energy output
radio		
television		
electric drill		
washing machine		
calculator		
iron		
light bulb		
telephone		

2. a. Write the names of four new energy sources.

i. _____ ii. _____

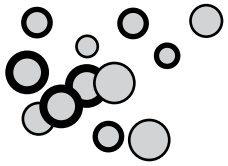
iii. _____ iv. _____

b. Which one would it be useful, as well as economical, to produce in your part of the country?

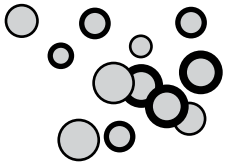
_____

c. Explain your answer. _____

_____



UNIT 8



Work and machines

Teaching objectives:

- to define a simple machine
- to describe the various types of simple machines
- to explain the use of simple machines
- to explain how a machine helps us to do more work with less effort
- to explain that machines need energy to work
- to define friction
- to explain the advantages and disadvantages of friction
- to describe the methods of reducing friction

Teaching strategy:

Ask: Can you name some machines which we use? Show a bottle opener to the students. Tell them it is a machine. Open a bottle of coke with an opener. Explain the use of the bottle opener as a simple machine. Explain that a machine helps us to do useful work with less effort. Cut a piece of cloth with a pair of scissors. Explain that a pair of scissors is a simple machine. Explain the meaning of a machine and its use. **Ask:** Why is it better to use a machine rather than trying to do the same work with your hands? Explain the types of machines and the useful work that they do. Explain the mechanical advantage of machines. Show students the various types of levers and their use in everyday life.

Ask: How can you push a heavy load uphill? Explain the use of an inclined plane. Show the students a wedge and explain that its shape is made up of two inclined planes. Explain how it works to cut hard things. Explain how it helps to increase and change the direction of the applied force. Show the students a screw. Explain how it is used to hold two pieces of wood or metals together. Show the students a simple wheel and an axle of a toy car. Wind a piece of string in the groove of the axle and attach a metallic object to the free end. Explain how heavy things can be hauled up by using a wheel and an axle. **Ask:** Can heavy objects be lifted by applying a downward force? Explain the action of a pulley. Explain how the mechanical advantage can be increased by increasing the number of pulleys.

Ask: What happens when you rub two stones together? Explain the heating up of the moving parts of a machine when they rub against each other. Explain the meaning of friction. **Ask:** Is friction useful or harmful? Explain the advantages and disadvantages of friction. **Ask:** Why do we put oil or grease in the moving parts of machines? Explain the methods of reducing friction.

Answers to Exercises in Unit 8:

1. (a) A machine is a device or tool which helps us with our work.
   (b) Effort is the amount of force that is applied to do work.
   Work is the distance that a machine moves when a certain force is applied to it.
   Power is the amount of work done by a machine during a certain period of time.
   (c) Mechanical advantage is the extra force that is gained by using simple machines. Less effort is applied to do more work.
   (d)

Simple machine	example
lever	bottle opener, nut cracker
inclined plane	wooden plank
wedge	knife, axe
screw	car jack, nuts and bolts
wheel and axle	water wheel, car wheels
pulley	crane
gears	car gear, cycle gears

   (e) A block and tackle is a pulley system with more than one pulley. The pulleys are the blocks and the rope is the tackle.
   (f) The lifting force of the block and tackle can be increased by increasing the number of pulleys.
   (g) Gears are wheels with cogs or notches around the edge. Each gear fits with another to pass on the motion of the machine. They are useful for changing the direction and speed of movement.
   (h) Gears move the hands of a clock.

2. Fill in the blanks.

(a)	energy	(b)	rubbing	(c)	force	(d)	power
(e)	pulley	(f)	pulley	(g)	increases	(h)	inclined plane

4. Refer to diagram on page 84.

Additional Exercise:

MCQs

(a) A machine is a device which helps us with our _____.

rest work play [***work***]

(b) The amount of work that a machine does depends on the amount of _____ applied.

effort work friction [***effort***]

(c) The amount of work done by a machine during a certain period of time is called the _____ of that machine.

work effort power [***power***]

(d) A _____ is a simple machine in the form of an arm which can lift a heavy load by applying very little effort.

lever pulley wedge [***lever***]

(e) A heavy load can be raised easily by pulling it along a sloping surface called _____.

a lever a pulley an inclined plane [***an inclined plane***]

(f) A _____ is a simple machine which changes the direction of force as well as increases it.

lever wedge screw [***wedge***]

(g) A _____ is a special kind of inclined plane with a huge mechanical advantage.

lever wedge screw [***screw***]

(h) A load attached to the _____ end of the rope will be pulled up if effort is applied to the wheel end of the rope.

wheel axle lever [***axle***]

(i) A is a simple machine made up of wheels _____.

wheel and axle block and tackle pulley [***pulley***]

(j) Wheels which have notches or cogs cut around the edge are called _____.

wheels gears pulleys [***gears***]

Lesson plan

Date: Time: 40 mins

Unit: 8 Topic: Work and machines	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Work and machines	• to define a machine • to explain what effort, work, and power are	• define a machine • explain the meanings of effort, work, and power	Pictures of different kinds of machines	Reading: p 79 CW: Q1 (a) (c) HW: Q1 (b)

Key words: machine, effort, work, power, force

Method: **Ask**: What is a machine? Can you name some machines that we use every day? Is a clock a machine? Explain that a machine is a device that helps us with our work; even a teaspoon or a knife is a machine.

Ask: Can a machine work on its own? Explain that machines need some kind of energy to function. A car needs petrol, a fan needs electricity. The energy can be electrical, mechanical, or chemical. Discuss the different kinds of energy that are needed by machines.
Ask: How do things move? Explain that force is needed to make something move. Describe the things that force can do.

Ask: How does a machine work? Explain that a machine transfers force from one part to another, and keeps changing direction. Explain that the amount of work that a machine does depends on the amount of effort applied.

Ask: What is effort? Explain that effort is the force that is applied. For example if one person pushes a car, it will move slowly and will travel a short distance. If two people push the car, the force will be doubled and the car will move further and faster. Also explain that the amount of work done by a machine during a certain period of time is called the power of that machine.

Lesson plan

Date: Time: 40 mins

Unit: 8 Topic: Work and machines	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
2. Simple machines	• to introduce simple machines • to explain the mechanical advantage that simple machines provide	• identify simple machines • explain that simple machines provide a mechanical advantage	Diagrams of the three types of lever A see-saw, a pair of scissors, a nut cracker, a wheel barrow, a hockey stick, a fishing rod/bottle opener, an inclined plane, an axe	Reading: p 80, 81 Activity: p 83 [Make an alligator long-arm] CW: Q. Draw the three kinds of lever. Mark the positions of the fulcrum, load, and effort. HW: Q1 (c) (d)

Key words: simple machine, mechanical advantage, lever, effort, load, fulcrum, inclined plane, wedge

Method: **Ask**: Can you name some machines that we use daily? Show the students a bottle opener. Explain that it is a machine. Use it to open a bottle of a soft drink. Explain that a machine helps us to do useful work with less effort. A pair of scissors is also a machine.

Ask: Why is using a machine better than trying to do the same work with your bare hands? Explain the types of simple machine and the useful work that they do. Explain the meaning of *mechanical advantage*.

Show the students various types of lever and their use in everyday life. Explain the position of the load, the fulcrum, and the effort applied that helps a machine to make work easier.

Ask: How can we push a heavy load uphill? Explain the use of an inclined plane. Show the students an axe or a knife. Explain that an axe is made up of two inclined planes. Explain that when we strike the axe downwards, it creates a strong sideways force that splits the wood. A sharp axe will have a greater splitting force than a blunt one.

Lesson plan

Date: Time: 40 mins

Unit: 8 Topic: Work and machines	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Some more simple machines	• to name and describe some other simple machines	• identify a screw, a wheel and axle, a pulley, a block and tackle, and gears as simple machines • explain how these simple machines make our work easier	A screw, a nut and a bolt, a car jack, wheel and axle of a a toy car, a pulley, rope and weight, a block and tackle, gears of a toy car, a pendulum clock, a bicycle, an egg beater	Reading: p 82, 83, 84 Activity: p 85 CW: Q2, Q3, Q4 HW: Q1 (e) (f) (g) (h)

Key words: screw, wheel and axle, pulley, block and tackle, gear

Method: Show the students a screw. Explain how it is used to hold two pieces of wood or metal together.

Show the students the simple wheel and axle of a toy car. Wind a piece of string in the groove of the axle and attach a metallic object to the free end of the string. Explain how heavy things can be hauled up by using a wheel and axle.

Ask: Can heavy objects be lifted by applying a downward force? Explain the action of a pulley. Explain that the mechanical advantage can be increased by increasing the number of pulleys in the system.

Show the students a mechanical toy that has wheels with toothed edges. Explain that some machines have wheels that have notches or cogs cut around the edges. Wheels like these are called gears. One gear fits into another and passes on the movement of the machine. Gears are also useful for changing the direction and the speed of the movement.

Show the students a diagram of a racing bicycle with gears. Explain how the gears help to make the bicycle go faster. Also show the students a pendulum clock and explain that gears inside the clock help to move the arms of the clock. A clockwork toy can also be shown to explain the function of gears.

Explain the application of pulleys and gears in machines to make them work.

Name: _____ Date: _____

1. Fill in the blanks to complete the statements:

A machine is a device which helps us with our _____. Machines need some kind of _____ to function. The activity of the parts inside the machine makes them _____ up. Some of the energy is changed into _____ and the rest is used for doing useful _____. The amount of work that a machine does depends on the amount of _____ that is applied. The amount of work done by a machine during a certain period of time is called the _____ of the machine. The _____ is the extra force that is gained by simple machines. This means that _____ effort needs to be applied to do _____ work.

2. Draw lines to match the name of the machine to its description:

Description	Name
A machine in the form of a long arm	gears
A sloping plane	block and tackle
Two sloping planes put together	inclined plane
A rod with spiral grooves on it	wheel and axle
A circular wheel with a groove round it; it turns on a rod, passing through the centre of the wheel.	screw
A simple machine made up of a wheel which turns on an axle	wedge
It has a rope wound over the groove. A system made up of more than one pulley	lever
Machines with wheels having notches or cogs cut round the edges, which fit into one another to pass on the motion of the machine	pulley

Reflection of light

Teaching objectives:

- to explain the reflection of light and the laws of reflection
- to describe the characteristics of an image formed by a plane mirror
- to explain how reflection takes place on smooth and rough surfaces
- to describe spherical mirrors and explain how they reflect light
- to explain where the image is formed by a spherical mirror when the object is placed at different distances from it
- to discuss how spherical mirrors are useful

Teaching strategy:

Ask: What happens when light falls on a shiny surface? Explain that the bouncing back of light from a shiny surface is called reflection. Draw the experiment of reflection by a plane mirror on the board. Explain how the incident ray is reflected at the same angle. Help the students set up their own experiment, and draw the reflection of rays by a plane mirror. Explain the laws of reflection. **Ask:** What is the size of the image formed in a mirror? At what distance is the image made? Is the image inverted or upright? Can the image be seen on a screen placed in front of the mirror? Explain the characteristics of an image formed by a plane mirror.

Ask: How does light reach our rooms in the daytime? Explain the reflection of light on smooth and rough surfaces by diagrams on the board. **Ask:** What is the shape of a shaving mirror? Show the students a shaving mirror and a rear view mirror of a car. **Ask:** What kind of an image can you see in both? Explain the shapes of convex and concave mirrors with diagrams on the board, and label their parts. Tell the students to move the mirrors away from their faces and then bring them near.

Ask: When do you see a clear image? Explain the formation of images of objects placed at different distances by spherical mirrors. **Ask:** What is a concave mirror used for? What is a convex mirror used for? Explain that as a concave mirror makes a large image, it is used in shaving and make-up mirrors. Explain that as convex mirrors give a wider view they are used in cars and other vehicles.

Summarize the lesson.

Answers to Exercises in Unit 9:

1. (a) When rays of light fall on a polished surface, such as a plane mirror, they bounce back to produce an image. The bouncing back of light is called reflection.

   (b) Place a mirror on a white sheet of paper and mark its position MM'. Place two common pins A and B in front of it and observe their image from the opposite side. At the point where the images of pins A and B appear to be in a straight line, place two other pins P and Q to mark their positions. Remove the pins and the mirror. Join points AB and PQ, and extend them to meet MM' at O. Draw a line OL perpendicular to MM'. Measure angle AOL and angle LOP. They are equal.

   (c) The characteristics of an image formed by a plane mirror are: The image is upright, laterally inverted, virtual, and is of the same size as the object. It is formed as far behind the mirror as the object is in front of it.

   (d) When light falls on a rough surface, it is scattered in all directions. This irregular reflection of light helps sunlight to reach inside houses in the daytime.

   (e) When an object is close to a concave mirror an upright and magnified image is formed.

   (f) An image formed by a convex mirror is always small, upright, and virtual.

2. (a) upright, laterally inverted (b) equal (c) real
   (d) convex (e) laterally (f) irregular (g) the centre of curvature
   (h) infinity (i) concave (j) convex

3. (a) Refer to pages 91 and 92 of the Pupil's Book.
   (b) Refer to pages 91 and 92 of the Pupil's Book.
   (c) Refer to pages 91 and 92 of the Pupil's Book.

4. a) regular reflection
   b) irregular reflection

5. Refer to pages 91 and 92 of the Pupil's Book.

6. Refer to pages 91 and 92 of the Pupil's Book.

7. A H I M O T V W X

8. a) concave mirror b) convex mirror c) concave mirror

9. Convex mirror as it gives a wider view.
   Concave mirrors magnify objects which is why they are used in makeup mirrors.

Additional Exercise:

MCQs

(a) The bouncing back of rays of light from a shiny surface is called _____.

refraction dispersion reflection [***reflection***]

(b) The incident ray, reflected ray, and the normal ray all lie in the same _____.

plane angle path [***plane***]

(c) The angle of incidence and the angle of reflection are _____.

equal unequal normal [***equal***]

(d) The image formed by a plane mirror is _____.

real virtual blurred [***virtual***]

(e) When parallel rays of light fall on a rough surface, they are reflected at different _____.

angles sides planes [***angles***]

(f) An image formed by a convex mirror is _____.

small, upright, virtual small, upright, and real

large, upright, and virtual [***small, upright, and virtual***]

(g) Concave mirrors _____ objects.

diminish magnify reduce [***magnify***]

(h) Convex mirrors give a _____ view.

wide narrow angular [***wide***]

(i) When a ray of light coming from an object is parallel to the principal axis of a spherical mirror, it passes through the principal _____ after reflection.

image object focus [***focus***]

(j) An image formed by an object far away from a concave mirror is real, _____, and smaller than the object.

upright laterally inverted inverted [***inverted***]

Lesson plan

Date: Time: 40 mins

Unit: 9 Topic: Reflection of light	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Reflection of light	• to explain how light is reflected • to explain the laws of reflection • to describe the characteristics of an image formed by a plane mirror • to discuss different kinds of reflection	• explain the reflection of light • explain the laws of reflection • describe the characteristics of an image formed by a plane mirror • differentiate between regular and irregular reflection of light	A plane mirror, pins, sheet of white paper, a full length mirror	Reading: p 88, 89 Activity: 1, 2 CW: Q4, Q7 HW: Q1 (a) (b) (c) (d)

Key words: plane mirror, reflection, incident ray, reflected ray, normal ray, angle of incidence, angle of reflection, regular, irregular reflection, scattering

Method: Start the lesson by asking: What happens when light falls on a shiny surface? Explain that the bouncing off of light from a shiny surface is called reflection.

Draw on the board the diagram of the experiment: *To study the laws of reflection* (p 88). Explain that the incident ray is reflected at the same angle. Help the students to set up their own experiment, and draw a diagram of the reflection of rays by a plane mirror.

Explain the laws of reflection. **Ask**: What is the size of the image formed in a mirror? At what distance from the mirror is the image formed? Which way up is the image? Can the image be seen on a screen placed in front of the mirror?

Explain the characteristic of an image formed by a plane mirror.

Ask: How does light reach our rooms in the daytime? Use diagrams on the board to explain the reflection of light from smooth and rough surfaces.

Lesson plan

Date: Time: 40 mins

Unit: 9 **Topic: Reflection of light**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
2. Optical instruments	• to explain the use of mirrors in optical instruments	• describe the use of plane mirrors in optical instruments	Diagrams and pictures of a telescope, periscope, projector, microscope, kaleidoscope	Reading: p 90 Activity: Draw two optical instruments and mark the places where mirrors have been used. Draw rays to show how an image is formed by them.

Key words: telescope, periscope, projector, microscope, kaleidoscope

Method: Show the students pictures of a telescope, a periscope, a projector, a microscope, and a kaleidoscope. Use charts and diagrams to explain how reflecting surfaces are used in various optical instruments.

Ask: What are these optical instruments used for? Explain that a telescope is used for observing heavenly bodies in space. A periscope is used in submarines for observing things on the surface of the sea. A projector is used for showing pictures on a cinema screen. A microscope is used for observing very tiny cells and organisms. A kaleidoscope is used for observing colourful formations of beads or other coloured objects.

Lesson plan

Date: Time: 40 mins

Unit: 9 **Topic: Reflection of light**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
3. Spherical mirrors	• to describe spherical mirrors • to explain how spherical mirrors reflect light • to describe the characteristics of an image formed by a spherical mirror • to explain the uses of spherical mirrors	• describe spherical mirrors • explain how spherical mirrors reflect light • describe the characteristics of images formed by spherical mirrors • list some uses of spherical mirrors	Convex mirror, concave mirror, diagrams and charts showing the formation of images by spherical mirrors A shaving mirror A car rear view mirror	Reading: p 91, 92 Activity: Q6 CW: Q2, Q3, Q5 HW: Q1 (e) (f) Q8, Q9, Q10

Key words: concave mirror, convex mirror, virtual image, real image, centre of curvature, principal axis, principal focus

Method: **Ask**: What is the shape of a shaving mirror? Show the students a shaving mirror and a rear view mirror of a car. **Ask**: What kind of image can you see in each mirror? Explain the shapes of convex and concave mirrors with diagrams on the board, and label their parts. Ask the students to move the mirrors backwards and forwards. **Ask**: At what point do you see a clear image of yourself? Explain the formation of images of objects placed at different distances from spherical mirrors.

Ask: What is a concave mirror used for? What is a convex mirror used for? Explain that a concave mirror produces a large image. It is used in shaving and make-up mirrors. A convex mirror gives a wider view so it is used in cars and other vehicles.

Name: _____ Date: _____

1. Underline the correct word(s) to complete each sentence.

   a. Light travels from one point to another in a straight / curved line.
   b. The bouncing back of rays of light when they fall on a polished surface is called refraction / reflection.
   c. The incident ray, the reflected ray, and the normal ray all lie in the same / different plane.
   d. The angle of incidence is greater than / equal to the angle of reflection.
   e. The image formed by a plane mirror is upright / inverted.
   f. The image formed by a plane mirror is virtual / real.
   g. The size of the image formed by a plane mirror is bigger than / equal to the size of the object.
   h. The distance of the image from the plane mirror is the same / different from the distance of the object from it.

2. Draw two rays coming from an object which strike a plane mirror at different angles to prove the laws of reflection.

Name: _____ Date: _____

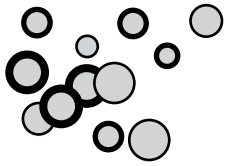
1. Where will the image be formed by a concave mirror, when the object is placed in different positions?

Place of the object	**Place of the image**	**Kind of image formed**
At the centre of curvature		
At the principal focus		
Beyond the centre of curvature		
Between the principal focus and the pole of the mirror		

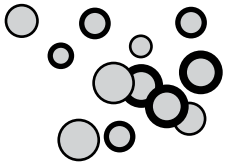
2. Draw rays to show the reflection of light on:

A smooth surface A rough surface

3. Draw a periscope and mark the positions where plane mirrors are placed.



UNIT 10



Sound

Teaching objectives:

- to define oscillation and explain how it can be used to create waves
- to describe the kinds of waves and how they are produced
- to explain how sound is produced
- to discuss the speed of sound and the factors that affect it
- to explain that sound waves can travel through solids, liquids, and gases, but not through vacuum
- to explain the characteristics of sound and the factors they depend on
- to explain that an echo is a reflection of sound
- to describe how echoes can be useful
- to discuss the difference between music and noise
- to explain how noise can cause pollution

Teaching strategy:

Ask: What kinds of sounds can you hear in a busy street? What sounds do you like? Make a pendulum by tying a bob to a piece of string. Pull it to one side to make it swing. Explain that the to and fro movement that takes to complete one oscillation is called a period. Count the number of oscillations that the pendulum makes in one minute. Calculate the number of oscillations in one second. Explain that the number of oscillations completed in one second is called the frequency of the oscillation. Draw a pendulum on the board. Explain the mean and extreme position of the bob. The distance that the bob travels from the centre to the extreme position is called its amplitude.

Tie a rope to a fixed point. Move the free end from side to side. Explain that a transverse wave is being made. Fix a soft spring at one end and pull it backwards and forwards, waves will travel along the spring. Sections of the spring will be compressed and others will be loose. Explain that the tight coil of the spring is called a compression and the loose coil is called a rarefaction. Such waves are called longitudinal waves. Sound waves are also made in this way. Sound waves are longitudinal waves, which are produced by a vibrating body.

Compressions and rarefaction produced by vibrating bodies produce sound waves that travel in air. **Ask:** Do you know the speed of sound? What is the speed of light? Which travels faster, sound or light? How do you know? Explain that during a thunderstorm the flash of lightning can be seen before the clap of thunder. Take two balloons and inflate them. Heat one of the balloons till it bursts. Prick the cold balloon with a pin at the same time. **Ask:** Which balloon made a louder sound? Explain that sound waves travel faster in hot air.

Ask: Can you hear sound through a door? Explain that sound waves need a medium to travel in. Sound can travel in solids, liquids, and gases. The denser the medium, the faster the waves will travel. Explain the experiment of an electric bell in a jar. The sound of the ringing bell will gradually decrease as the air is evacuated from the jar, because sound waves cannot be produced without a medium.

Ask: Which will produce a louder sound, a small drum struck lightly or a big drum struck strongly? Explain that the amplitude of the vibrations produced by the bigger drum will be large and so a louder sound will be produced. Also the bigger drum has a larger surface area, therefore it will produce a louder sound than the smaller drum. **Ask:** Can you hear a louder sound if you stand near a vibrating body or if you are away from it? Explain that sound waves spread in all directions, and the sound becomes weaker as the distance from the vibrating body increases.

Ask: What is the difference between the sound of a whistle and that of a buzzer? Explain that the sound of a whistle is shrill because it has a high pitch. The pitch of the sound depends on the frequency of the sound waves produced by a vibrating body. A fast vibrating body has a high frequency. It produces a shrill sound. Send two children out of the class. Tell them to say 'hello' from behind the door. **Ask:** Can you tell who said 'hello' first? Explain that voices and sounds of musical instruments can be recognized by their timbre. Timbre is the combination of sound waves of different frequencies which collectively make up a particular sound.

Ask: What can you hear when you clap or shout in an empty hall? Why does your voice resound? Explain that when sound waves strike a hard surface, they are reflected back. This reflection of sound is called an echo. Explain how echoes are used in echo sounders in ships to calculate the depth of the sea. Explain how bats use echoes to detect obstructions in the dark.

Ask: How do you feel in a crowded room where everyone is talking? Why do little children begin to cry in a noisy room? What is noise? Explain that noise is an abrupt change in the frequency and amplitude of sound waves. Noise is a kind of pollution that can produce harmful effects in the body. It can cause headache and even deafness. Summarize the lesson.

Answers to Exercises in Unit 10:

1. (a) The regular to and fro movement of a pendulum is called an oscillation.
   The number of oscillations that are completed in one second are called the frequency of an oscillation. The distance that the bob of a pendulum travels from the central to the extreme position in one oscillation is called its amplitude.
   (b) When a body vibrates its forward movement presses the air in front of it. This is called a compression. When the body moves backwards, the pressed layer of air stretches. This is called a rarefaction. Continuous compressions and rarefactions produced by oscillations make sound waves.
   (c) Sound travels at a speed of 330 metres per second. Sound waves travel faster through hot air than through cold air, but they are not affected by changes in air pressure.
   (d) Sound waves cannot travel in a vacuum. Experiment: Attach an electric bell to a battery with wires, and lower it into a bell jar fitted with an exhaust pump. Close the mouth of the jar with a tightly fitted cork. Pump air out of the flask. The sound of the ringing bell will slowly fade away.
   (e) The loudness of sound depends on the amplitude and the surface area of the vibrating body.
   (f) The specific quality of a particular sound is called its timbre. It is the combination of sound waves of different frequencies, which collectively make up the voice of a person or the sound of a musical instrument.

2. (a) oscillations (b) vibrations (c) compression (d) vacuum (e) longitudinal
   (f) eardrums (g) faster (h) frequency (i) Timbre

3. a) 300 m/s, 500 m/s, 200 m/s, 30,000 m/s b) aircraft, meteorite
   c) i) 330 m ii) 660 m iii) 3300 m iv) 33 m

Additional Exercise:

MCQs

(a) Regular to and fro movements are called _____.
waves oscillations swings [***oscillations***]

(b) The number of oscillations completed in one second is called the _____ of the oscillation.
timing swing frequency [***frequency***]

(c) A bob tied to a string is called a _____.
yoyo orbit pendulum [***pendulum***]

(d) The extreme position of the bob from the central position is called the _____.
amplitude frequency wave [***amplitude***]

(e) Oscillations can be used to make _____.
swings pendulums waves [***waves***]

(f) Waves that travel in the same direction as the oscillations are called _____ waves.
transverse longitudinal circular [***longitudinal***]

(g) _____ cause sound waves to travel through air.
Oscillations Transformations Refactions [***Oscillations***]

(h) The speed of sound in air is _____ m/s.
230 330 430 [***330***]

(i) A shrill sound has a _____ pitch.
high low normal [***high***]

(j) A sound can be recognized by its _____.
frequency pitch timbre [***timbre***]

Lesson plan

Date: Time: 40 mins

Unit: 10 Topic: Sound	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. What is sound?	• to define sound • to describe oscillations • to identify kinds of waves and explain how they are produced	• define sound • describe oscillations and explain how they can be used to make waves • explain how different kinds of waves are produced	A spring wire, a rope, a pendulum, stopwatch	Reading: p 97 Activity: Attach a metal ball to a length of string to make a pendulum. Measure the length of the string. Pull the pendulum about 12cm to one side and let it go. Start the stopwatch at the same time as you let the pendulum go. Count the number of complete swings that the pendulum makes in one minute. Calculate the period and frequency of the oscillation. What is the amplitude of the oscillation? HW: Q1 (a)

Key words: sound wave, oscillation, period, frequency, amplitude, transverse wave, longitudinal wave
Method: Start the lesson by asking: What sounds can you hear in a busy street? Which sounds do you like? Make a pendulum by tying a bob to a piece of string. Pull it to one side to make it swing. Explain that the to and fro movements are called oscillations and the time taken to complete one oscillation is called a period. Count the number of oscillations that the pendulum makes in one minute. Calculate the number of oscillations in one second. Explain that the number of oscillations completed in one second is called the frequency of the oscillation.
Draw a pendulum on the board. Demonstrate the mean and extreme positions of the bob. The distance that the bob travels from the centre to the extreme position is called its amplitude.
Tie a rope to a fixed point on a wall. Move the free end from side to side. Explain that a transverse wave is being formed.
Fix one end of a soft spring to a wall and pull it towards you. Let the spring go. Waves will travel along the spring. Some sections of the spring will be compressed while others will be loose. Explain that the tight portion of the spring is called a compression, while the loose part is called a rarefaction. Such waves are called longitudinal waves.

Lesson plan

Date: Time: 40 mins

Unit: 10 **Topic: Sound**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
2. Sound waves	• to explain how sound is produced • to explain that the speed of sound differs in solids, liquids, and gases • to explain that sound waves travel in a medium	• explain how sound is produced • describe the speed of sound in different mediums • explain that sound waves need a medium to travel in	Bell jar, exhaust pump, clock, balloons, pin, a burner	Reading: p 98, 99 Activity: 1, 2, 3, 4 CW: Q3 HW: Q1 (b) (c) (d)

Key words: compression, rarefaction, wave, vacuum

Method: **Ask**: How are sound waves produced? What kind of waves are sound waves? Explain that sound waves are longitudinal waves that are produced by vibrating bodies. Compressions and rarefactions made by vibrating bodies produce sound waves.

Ask: Do you know the speed of sound? What is the speed of light? Which travels faster, sound or light? How do you know? Explain that during a thunder storm, the flash of lightning can be seen before the clap of thunder is heard.

Ask: Can you hear sounds through a closed door? Explain that sound waves need a medium to travel in. Sound can travel in solids, liquids, and gases. The denser the medium, the faster the waves travel, and the louder the sound.

Inflate two balloons. Heat one balloon till it bursts and simultaneously prick the other balloon with a pin. **Ask**: Which balloon made a louder sound? Explain that sound waves travel faster in warm air than in cold.

Discuss the experiment: *Sound waves in a vacuum* (p 99). Explain that the ticking sound of the clock will gradually decrease as the air is evacuated from the bell jar, because sound waves cannot be produced without a medium.

Lesson plan

Date: Time: 40 mins

Unit: 10 Topic: Sound	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
3. Characteristics of sound	• to describe the characteristics of sound	• describe the characteristics of sound • list the factors on which the quality of sound depends	A drum, a pipe, a guitar	Reading: p 99, 100 Activity: 5, 6, 7 CW: Q2 HW: Q1 (e) (f)

Key words: loudness, pitch, timbre, vibration

Method: **Ask**: Which one will produce a louder sound: a small drum struck lightly, or a big drum struck with greater force? Explain that the amplitude of the vibrations produced by the bigger drum will be large and so a louder sound will be produced. Also, the larger drum has a larger surface area; therefore it will produce a louder sound.

Ask: Can you hear a louder sound better if you stand near a vibrating body or further away from it? Explain that sound waves spread in all directions, and the sound becomes fainter as the distance from the vibrating body increases.

Ask: What is the difference between the sound of a whistle and that of a buzzer? Explain that the sound of the whistle is shrill because it has a high pitch. The pitch of the sound depends on the frequency of the sound waves produced by the vibrating body. A fast vibrating body has a high frequency: it produces a shrill sound.

Send two students out of the classroom. Ask them to say hello from behind the closed door. **Ask**: Who said hello first?

Explain that voices and the sounds of musical instruments can be recognized by their timbre. Timbre is the combination of sound waves of different frequencies which collectively make up a particular sound.

Lesson plan

Date: Time: 40 mins

Unit: 10 **Topic: Sound**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
4. Echo Sound pollution	• to explain an echo • to explain how echoes can be useful • to explain the difference between music and noise • to discuss noise pollution	• explain how an echo is produced • explain how echoes are used • explain the difference between noise and musical sounds • describe the causes and effects of noise pollution	Diagrams and charts to show how an echo is produced Pictures of echo sounders Pictures of congested roads, blaring music, etc. to show noise pollution	Reading: p 100 CW: Q. Define an echo. How are echoes used by a. fishermen? b. bats? c. radar?

Key words: echo, echo sounder, echo detection, radar, noise pollution

Method: **Ask**: What can you hear when you clap or shout in an empty hall? Why does your voice resound?

Explain that when sound waves strike a hard surface, they are reflected. This reflection of sound is called an echo. Explain how echoes are used by echo sounders in ships to calculate the depth of the sea, and how bats use echoes to detect obstructions in the dark.

Ask: How do you feel when everyone in a crowded room is talking? Why do children begin to cry in a noisy room? What is noise? Explain that noise is an abrupt or sudden change in the frequency and amplitude of sound waves. Noise is a kind of pollution that can produce harmful effects in the body. It can cause headache and even deafness.

Name: _____ Date: _____

1. Match the items in lists A and B to complete the sentences.

A	B
a. Sound waves are caused by	330 m/s.
b. Sound waves travel at a speed of	vibrations.
c. Sound waves travel faster through	air pressure.
d. The speed of sound is not affected by	vacuum.
e. Sound waves cannot travel through	hot air.
f. The loudness of sound depends on	high frequency.
g. Shrill sounds have a	on the amplitude of the vibrating body.
h. The combination of sound waves of different frequencies that make up the voice of a person or the sound of a musical instrument is called	high pitch.
i. A fast vibrating body has a high	timbre.

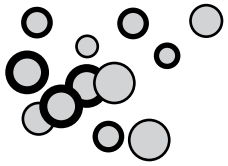
2. The echo sounder of a ship sends a burst of sound waves towards the seabed. 0.2 seconds later the reflected sound waves are picked up by the ship.
[hint: use the formula: speed = distance/time]

   a. How long did it take the waves to reach the seabed?

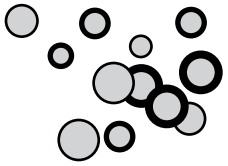
   _____

   b. If the speed of sound in water is 1400 m/s, how deep is the seabed at this point?

   _____



UNIT 11



Exploring space

Teaching objectives:

- to describe outer space
- to discuss the heavenly bodies in space
- to define a satellite
- to explain the difference between natural and artificial satellites
- to describe the different kinds of artificial satellites and their orbits
- to explain the functions of various satellites in space

Teaching strategy:

Ask: What is the sky? Why does the sky appear blue? What is space? Does space have an atmosphere? Explain what space is. Discuss that space contains dangerous rays and particles travelling at high speed. Show the students, charts of space and the heavenly bodies and discuss the formation, structure, and movement of each.

Ask: What is a star? What is the Sun? What are stars made up of? Explain the formation of stars from nebulae by the pull of gravity. **Ask:** What do you see in the sky on a moonless night? Discuss the Milky Way Galaxy and what it is composed of. Discuss the difference between stars, planets, and moons. **Ask:** How far has man been able to travel into space? Discuss space travel and the space craft that are used to travel into space. **Ask:** What is the Moon? What are planets?

Explain what satellites are and explain the difference between natural and artificial satellites. **Ask:** How can an artificial satellite remain in orbit in space? Discuss the Earth's gravity in relation to the motion of a satellite. Explain the orbits of artificial satellites and the use of different kinds of satellites for various purposes.

Ask: Who was the first man to travel in space? Which was the first animal to go into space? Discuss space travel history with the students. Ask them to find information about space travel from the Internet and from magazines and science journals.

Perform the activities.
Summarize the lesson.

Answers to Exercises in Unit 11:

1. a) We get information about distant planets from robot spacecraft called 'space probes'.
   b) A satellite can be defined as any object, either man-made or natural, that orbits or circles around something else. For example the Moon is a satellite of the Earth.
   c) Artificial satellites are satellites that are put into orbit by man. The motion of a satellite is directly related to the Earth's gravity. Once launched in the appropriate orbit these satellites orbit around the Earth without any propulsion speed because they have specific orbital speed to move around the Earth, depending on their distance from the centre of the Earth.
   d) The first artificial satellite was Sputnik I which was launched by the Soviet Union on 4th October, 1957.
   e) An orbit around the Earth is called a 'geo-centric orbit'.

   Polar orbit: The satellite is in orbit over the Earth's poles. It travels from north to south around one side of the Earth, and then back north around the other side. The Earth is also spinning beneath the satellite so it appears that the satellite is traveling in a spiral track over the Earth's surface.

   Geostationary orbit: The satellite travels eastwards in an orbit directly above the equator. It is at a height of about 36,000 km and takes one day to make one complete orbit. Because the Earth is spinning beneath it in the same direction, so it appears to remain stationary at one point on the equator.

2.

Object	**Description**
Navigation satellite	transmits data to ships and aircraft to locate their positions
Communication satellite	relays telephone messages, radio, and TV signals
Astronomical satellite	designed to study heavenly bodies
Earth observation satellite	sends back information about the Earth and its surroundings
Space station	a large space craft that stays in orbit all the time

3. Refer to page 106 of the Pupil's Book.
4. GPS is a space-based global navigation system. It provides location and time information in all kinds of weather, at anytime, and anywhere on the Earth.

Additional Exercise:

MCQs

(a) Space is the area beyond the Earth's atmosphere where there is no _____.

air water light [***air***]

(b) Great clouds of dust and gas in space are called _____.

stars planets nebulae [***nebulae***]

(c) A galaxy is a band of _____ spinning in space.

stars planets moons [***stars***]

(d) Robot space craft are called _____.

satellites probes space stations [***probes***]

(e) Any object that that orbits or circles around something else is called a _____.

planet satellite comet [***satellite***]

(f) An orbit of a satellite around the Earth is called a _____.

polar orbit geocentric orbit geostationary orbit [***geocentric orbit***]

(g) An orbit of a satellite over the Earth's poles is called a _____.

polar orbit geostationary orbit geocentric orbit [***polar orbit***]

(h) Landsat is an Earth observation satellite which has an orbit time of _____.

1 hr 1½ hr 1¾ hr [***1¾ hr***]

(i) _____ satellites transmit data so that ships and aircraft can locate their positions to within 100 metres.

Earth observation Navigation Astronomical [***Navigation***]

(j) A _____ station is a large spacecraft which stays in orbit all the time.

bus train space [***space***]

Lesson plan

Date: Time: 40 mins

Unit: 11 Topic: Exploring space	Teaching objectives	Learning outcomes Students should be able to:	Resources/Materials	Activities/CW/HW
1. Probes and satellites	• to explain what a space probe does • to explain how a satellite works	• describe a space probe and explain its functions • describe various kinds of satellite and explain their orbits	Pictures of space probes, natural and artificial satellites Diagrams of the orbits of satellites	Reading: p 105, 106 CW: Q1 (a) (b) Q3 HW: Q1 (c) (d) (e)

Key words: space probe, satellite, natural satellite, artificial satellite, geocentric orbit, polar orbit, geostationary orbit

Method: Show the students pictures of space probes.

Ask: How have scientists learned about the planets and other heavenly bodies in space? How far is the Moon from the Earth? Has anyone been to the Moon? Explain that astronauts have travelled to the Moon, but robot spacecraft have travelled much further into space. These robot spacecraft are called space probes. Space probes carry cameras and different instruments to study the planets they visit.

Ask: What is a satellite? Explain that a satellite is any object that circles or orbits around another object.

Ask: What does the Moon orbit? What does the Earth orbit? Does the Sun orbit around anything? Explain that the Moon and the Earth are called natural satellites, and so are asteroids, comets, etc.

Ask: What is a rocket? What is a spaceship? With the help of pictures explain about space travel and spacecraft. Discuss what artificial satellites are and how they are used to collect information about space and the planets.

Ask: What is an orbit? With diagrams and pictures explain the orbit of the Earth around the Sun and the orbit of the Moon around the Earth. Explain the orbits of artificial satellites and what they are used for.

Lesson plan

Date: Time: 40 mins

Unit: 11 **Topic: Exploring space**	**Teaching objectives**	**Learning outcomes** Students should be able to:	**Resources/Materials**	**Activities/CW/HW**
2. Uses of satellites	• to explain the uses of satellites	• explain how different kinds of satellites are useful	Pictures of different kinds of artificial satellite	Reading: p 106, 107 CW: Q2 HW: Q4

Key words: communication satellite, Earth observation satellite, navigation satellite, astronomical satellite, space station, global positioning system

Method: With the help of pictures, explain the uses of different kinds of satellite that are used for gathering information about the Earth. **Ask**: How and where do scientists stay in space? Explain that scientists can stay in a large spacecraft that stays in orbit all the time.

Ask: How do mobile phones work? How can you talk to people in far off countries using a mobile phone?

Explain that GPS is a space-based global navigation system that provides reliable location and time information in all kinds of weather, and at all times, anywhere on or near the Earth. GPS stands for Global Positioning System. It is widely used for commerce, banking, science and mobile phone operation.

Name: _____ Date: _____

1. Draw lines to match each object to its description:

Object	Description
a. space probe	a large spacecraft that stays in orbit all the time
b. satellite	a space-based global positioning system that provides reliable location and time information at all times anywhere on or near the Earth
c. artificial satellite	an object that orbits or circles around another
d. geocentric orbit	robot spacecraft that carries cameras and instruments
e. space station	satellites that are put into orbit by man
f. GPS	a large spacecraft that stays in orbit all the time

Test paper 1

Time 2½ hours **Total marks: 100**

1. Attempt the following questions. (All questions carry equal marks.) [50]
   (a) How does a scientist find answers to questions?
   (b) Describe how the transport of materials takes place in plants.
   (c) Define respiration. Name the parts of the human respiratory system.
   (d) Describe the structure of the human heart.
   (e) What is the nervous system made up of?
   (f) What is 'sensitivity'? How do single-celled organisms respond to changes in their environment?
   (g) What are tropic movements? How do auxins control tropic responses in plants?
   (h) What is coordination? How is co-ordination brought about in our bodies?
   (i) How do green plants manufacture their food? What are the things necessary for photosynthesis to take place?
   (j) How can you test a leaf for the presence of starch?

2. Fill in the blanks to complete the statements. [10]
   (a) Scientific equipment is called _____.
   (b) _____ of animals and plants are kept in a laboratory.
   (c) Xylem in plants is made up of long dead cells called _____.
   (d) _____ is the evaporation of water from the leaves of a plant.
   (e) A thin-walled blood vessel which forms a connection between an artery and a vein is called a _____.
   (f) Food is broken down into simple soluble substances by the action of _____.
   (g) The nervous system is made up of specialized cells called _____.
   (h) The eye is a _____ organ which helps us to see.
   (i) _____ are chemical substances in plants that speed up stem growth.
   (j) The _____ is an organ that controls all the parts of the body.

3. Differentiate between: [10]

i)	a villus	an alveolus
ii)	an artery	a vein
iii)	an animal cell	a plant cell
iv)	photosynthesis	respiration

4. Attempt any <u>two</u> questions: [20]

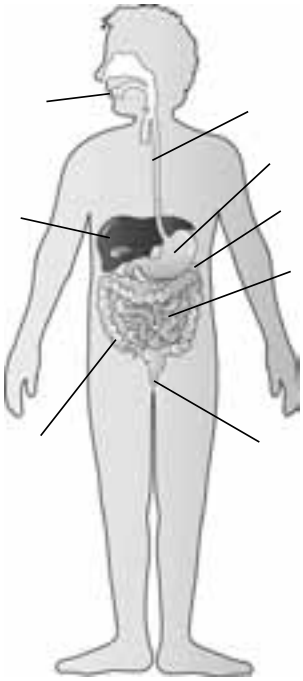
   i) Draw and label the parts of the eye

   ii) Draw the apparatus that can be used to show that oxygen is given out during the process of photosynthesis.

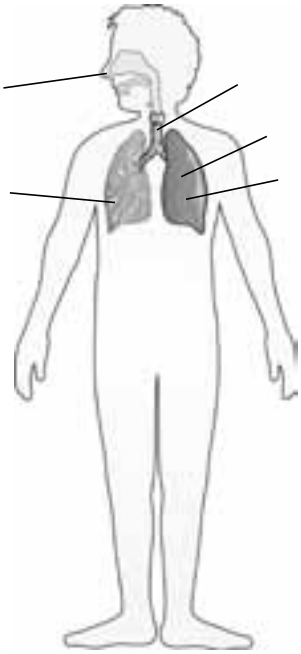
   iii) Draw a diagram of the cycle of photosynthesis and respiration showing how these processes help to maintain a balance in the atmosphere.

5. Label any <u>two</u> of the following diagrams: [10]

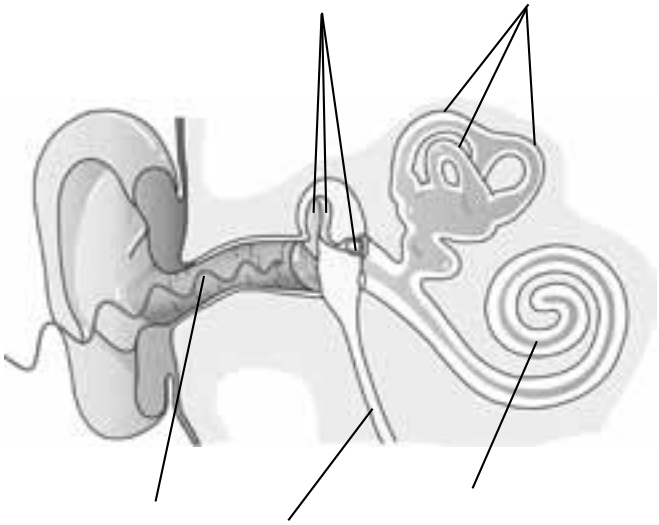
A.



B.



C.



Answers to Test paper 1

1. a) A scientist solves a scientific problem by locating the problem, collecting information, performing experiments, recording the observations, and then drawing a conclusion.

   b) Materials are circulated in plants in a system of tubes called the vascular system. The vascular system is composed of specialized tissues called xylem and phloem. Xylem is made up of long, dead cells called vessels, which have thick walls. They carry water and dissolved minerals from the roots, through the stem to the veins in the leaves.

   Phloem is made up of long, thin-walled tubes called sieve tubes. Sieve tubes are made up of living cells whose horizontal walls have tiny holes like a sieve. Food flows from the leaves to other parts of the plant through the sieve tubes.

   c) Respiration is the process by which food is oxidized in the body cells to produce energy. Oxygen is taken into the body from the air and carbon dioxide is given out.

   The respiratory system is composed of the nose, windpipe or trachea, bronchi, bronchioles, and air sacs or alveoli.

   d) The human heart is a muscular organ found in the centre of the chest. It has four chambers. The upper two chambers or atria are thin-walled, while the lower two chambers or ventricles are thick-walled. By the pumping action of the heart, the oxygenated blood is circulated to all parts of the body, and the deoxygenated blood from the cells is taken to the lungs for removal of carbon dioxide and for getting fresh oxygen.

   e) The brain is a part of the central nervous system and is the main control centre of the whole body. It is made up of nervous tissue which is hollow.
   The brain is located in the skull in a bony box called the cranium. It receives messages from the sense organs and sends orders to the muscles to produce suitable responses.

   The spinal cord is also a part of the central nervous system. It is a thick cord made of nervous tissue which passes through the backbone or vertebral column. It is connected to the brain at the top, and as it passes down the vertebral column it gives off millions of branches called nerves which carry messages between the body and the central nervous system.
   Nerves are actually bundles of neurons which are covered by a tough covering or sheath. The nerves which carry messages from the sense organs to the central nervous system are called sensory nerves. The nerves which carry messages to the muscles are called motor nerves.

   f) All living organisms are sensitive to changes inside and outside their bodies. Animals respond to changes in their environment by moving elsewhere. Plants respond to changes in their surroundings by moving their parts.

   In some simple, unicellular organisms such as amoeba, chlamydomonas, and euglena, the cytoplasm as a whole is sensitive. The eye-spots in euglena and chlamydomonas help them to detect changes in light intensity, enabling them to move away from bright light.

   g) The response or bending of the shoot towards light is called phototropism. This response is necessary because plants need light to make food. The shoot grows towards the light and the leaves turn their upper surfaces towards it. The bending or growth of the roots towards the soil is called geotropism.

   The responses of the root and shoot are controlled by a chemical substance called auxin. Auxin is made in the cells found at the tip of the root and shoot. Auxin speeds up stem growth and slows down root growth.

The activity of auxin is affected by light. When light falls on a plant from above, the stem grows straight. When light comes from one side, the auxin collects on the opposite side. This causes the stem to bend towards light.

h) All the organs of the body work in coordination with each other. This means that they do their work at the right time and at the right speed, to serve the body as a whole. Without coordination, the whole body would just be a collection of organs.

If we observe carefully, we find that our body is performing many functions at the same time. Food is being digested; the blood is circulating the digested food and oxygen to all parts of the body; the kidneys are removing the waste; the lungs are taking in oxygen and removing carbon dioxide.

Brain plays a very important part in the body's coordination. It receives messages from the muscles and sense organs and it sends back messages in return. This is how it controls all the different parts of the body so that they can work together.

Coordination is also brought about by chemical substances called hormones which are produced in a set of glands called the endocrine glands. The endocrine glands release tiny amounts of hormones which circulate with the blood.

Certain parts of the body called target organs respond to the hormones. They control different parts of the body to bring about various responses such as fear, happiness, blushing, etc. Responses to hormones may last for a few minutes or may go on for many years.

i) The process by which green plants make their food is called photosynthesis. Photo means *light* and synthesis means *putting together*. So photosynthesis means *putting together* by *light*. For photosynthesis to take place, a plant must have four things: carbon dioxide, water, chlorophyll, and light.

Process of photosynthesis

Air, containing carbon dioxide, gets into the leaf through millions of stomata. The air then goes into the spaces between the cells that make food. Water and minerals come from the soil. The carbon dioxide dissolves in the water on the cell walls and passes into the cells with the water. The cells that make food contain the green material chlorophyll.

Inside a leaf, the cells that contain chlorophyll make carbohydrates. This is a chemical change which can only take place in the presence of light.

$$\text{Carbon dioxide + water} \xrightarrow[\text{(chlorophyll)}]{\text{(sunlight)}} \text{glucose and oxygen}$$

Glucose made in the leaves is changed into starch so that it can be stored in the cells.

j) Experiment: <u>Test for starch</u>

Method: Cut off a leaf which has been kept in the in the light for a few hours. Boil the leaf for one minute to kill the cells. Put the leaf into a test tube with a little alcohol. Then place the tube in a beaker of hot water for 5 minutes. This will remove all the chlorophyll inside the leaf. When the leaf becomes transparent, remove it from the test tube and wash it with warm water. Put the leaf on a white tile and add a few drops of iodine solution. The colour of the iodine should turn dark blue indicating that the leaf contains starch.

2. apparatus, Specimen, vessels, Transpiration, capillary, enzymes, neurons, sensory, Auxins, brain.

3. i) A villus is a finger-like projection in the intestine, which helps to absorb digested food.
An alveolus is a balloon-like structure in the lungs which helps to exchange gases.

ii) An artery is a blood vessel that takes blood away from the heart. It has thick muscular walls.

A vein is a blood vessel that takes blood to the heart. It has thin walls and it has valves which ensure the flow of blood in one direction only.

iii) An animal cell has no definite shape. It has a thin cell membrane. The nucleus is in the centre of the cell. It has small vacuoles scattered in the cytoplasm.

A plant cell has a thick cell wall made of cellulose. It has a large central vacuole which is filled with cell sap. Its nucleus is to one side.

iv) The process by which green plants make glucose from simple substances like carbon dioxide and water, in the presence of sunlight, is called photosynthesis. It is a building-up process.

The process by which food is broken down to release energy is called respiration. Carbon dioxide and water are produces as a result and energy is released in the form of heat.

Q4 and Q5: see Pupil's Book

Test paper 2

Time 2½ hours **Total marks: 100**

1. Attempt any 8 questions. (all questions carry equal marks.) [40]
   a) What is the atmosphere? What is the fraction of the different gases found in it?
   b) Describe a barometer. How is the weather affected by changes in air pressure?
   c) Describe an atom. How are electrons distributed in an atom?
   d) What is a solution? What are the various kinds of solutions?
   e) Describe the formation of ionic bonds.
   f) Describe the formation of covalent bonds.
   g) What are the various types of mixtures?
   h) Describe the various methods of separating mixtures.
   i) Write the symbols and formulae of the following elements and compounds: carbon, calcium, chlorine, zinc, copper, gold, silver, iron, mercury, sodium, sodium chloride, carbon dioxide, water, glucose, calcium oxide.
   j) What is the difference between ionic and covalent compounds?

2. Attempt any two questions. [20]
   a) Prove by an experiment that the air exerts pressure.
   b) How would you separate a mixture of salt, sand, and iron filings?
   c) How can we separate the components of a mixture of coloured compounds such as black ink?
   d) How could you obtain pure solvent from a solution?

3. Differentiate between: [30]
   a) Symbol and formula
   b) Mixture and compound
   c) Atom and ion
   d) Suspension and emulsion
   e) Mass number and atomic number

4. Draw the following atoms: [10]

hydrogen	atomic number 1	mass number 1
chlorine	atomic number 17	mass number 35

Answers to Test paper 2

1. a) The Earth is surrounded by a layer of air which is like a huge ocean. It extends hundreds of kilometres above the surface of the Earth. This ocean of air is called the atmosphere. The atmosphere is made up of several layers of air, containing mixtures of different gases.

About one-fifth of the air is oxygen, nearly four-fifths is a gas called nitrogen, and the rest is made up of argon, carbon dioxide, and small amounts of other gases.

The troposphere is the layer nearest to the surface of the Earth. It is about 10 kilometres thick at the Poles and 16 kilometres thick at the Equator. One-fifth of the troposphere is made up of oxygen and four-fifths of it is made up of nitrogen. Other gases, such as carbon dioxide, argon, etc. are present in very small quantities.

The tropopause is above the troposphere. It is the boundary between the troposphere and the stratosphere. Going upward from the surface, it is the point where air ceases to cool with height, and becomes almost completely dry. It does not have enough oxygen for living things to survive in.

The stratosphere is above the troposphere. It is 3 kilometres thick and it contains a gas called ozone which is like oxygen. It forms a protective shield around the Earth which stops the harmful rays of the Sun from reaching it.

The top layer of the atmosphere is called the ionosphere. There is very little air pressure present in it. About 1600 kilometres above the Earth the atmosphere fades into Space.

b) A simple barometer consists of a long glass tube which is sealed at one end. It is filled with mercury and inverted in a dish containing mercury. The height of the column of mercury in the glass tube measures the atmospheric pressure which is equal to 760 millimetres of mercury at sea level.

The height of the mercury column moves up when the pressure increases, and moves down when the pressure decreases.

A simple barometer consists of a long glass tube which is sealed at one end. It is filled with mercury and inverted in a dish containing mercury. The height of the column of mercury in the glass tube measures the atmospheric pressure which is equal to 760 millimetres of mercury at sea level.

The height of the mercury column moves up when the pressure increases, and moves down when the pressure decreases.

Changes in air pressure cause changes in weather. On the surface of the Earth, air always moves from areas of high pressure to areas of low pressure. Temperature has a great effect on air pressure. As warm air rises, it produces an area of low pressure near the ground. Cooler air moves down to take its place. Rainclouds are formed in low pressure areas. Low pressure causes strong dust storms and hurricanes because air rushes from regions of high pressure to regions of low pressure. When there is high pressure the weather is often sunny and fine.

c) The word atom is derived from the Greek word *atomos*, which means indivisible. An ancient Greek philosopher named Democritus suggested that all matter is composed of tiny indivisible particles called atoms. Modern research has shown that the atom is made up of tiny particles called electrons, protons, and neutrons.

Electron is a particle of the atom. It is negatively charged and it revolves around the nucleus in a specific path called an orbit. Proton is a positively charged particle which is present in the nucleus of the atom. Neutron is a neutral particle which is found in the nucleus of the atom. It has no charge. It is equal in mass to a proton.

The number of protons in an atom is called its atomic number. For example, an oxygen atom has eight protons so its atomic number is 8. The sum of the number of protons and neutrons in an atom is called its mass number or atomic mass.

Electrons in an atom revolve around the nucleus in definite paths called orbits or shells, namely K, L, M, N. The number of electrons in the K shell is 2, in the L shell 8, in the M shell 18, and so on. The last or outermost shell cannot contain more than 8 electrons. As an example, the number of electrons in a sodium atom is 11. The distribution of electrons is: 2 electrons in K, 8 electrons in L and 1 electron in the outermost shell, M.

d) A solution is a mixture in which a solid is dissolved in a liquid. The solid is called the solute and the liquid is called the solvent. For example, if we dissolve sugar in water, sugar is the solute and water is the solvent. In a solution, the particles of the solute cannot be seen and the solution is clear.

An aqueous solution is a mixture of water and any substance that is solvent in it. For example, a solution of water and common salt or sugar.

A dilute solution is one in which a smaller amount of solute is dissolved in the solvent.

A concentrated solution is one in which a lot of solute is dissolved in the solvent. For example, one table spoon of salt in two cups of water is more dilute than three tablespoons of salt in two cups of water.

Concentrated solutions can be mixed with solvents to make dilute solutions, e.g. Fruit juice concentrates can be mixed with water to dilute them.

e) When an atom loses or gives away an electron, it becomes a positively charged ion. On the other hand, when an atom gains or receives an electron, it becomes a negatively charged ion. If two atoms come close to each other, one of the atoms gives away an electron to the other and becomes a positive ion, while the atom that receives the electron becomes a negative ion.

The electrostatic force that holds these ions together to form a compound is called an ionic bond.

f) When atoms come close to each other and begin sharing electrons, a covalent bond is formed. For example, one oxygen atom shares a pair of electrons with two hydrogen atoms to form a molecule of water.

g) Mixtures are of the following types:

1. Liquid and gas: For example, soda water which is a mixture of carbon dioxide and water.
2. Liquid and solid: Lemon juice and sugar are a mixture of a liquid and a solid.
3. Liquid and liquid: Vinegar and water are a mixture of two liquids.
4. Solid and solid: For example, copper and nickel are mixed to form metals from which coins are made.
5. Gas and gas: For example, air is a mixture of many gases.

h) The components of a mixture can be separated easily using the following simple methods.

i. Filtration: When a solution is passed through filter paper, the solid particles are left behind on the filter paper and the clear liquid passes through it. This liquid is called the filtrate.

ii. Evaporation: If the solute is soluble in the solvent, it can be separated from the solvent by evaporating the solvent by heating the solution. When the solvent evaporates, the solid is left behind.

iii. Crystallization: When a solution is heated until most of the solvent evaporates, a saturated solution is left behind. The solution is then allowed to cool slowly so that crystals of the solid are formed. These crystals can be dried between folds of filter paper.

Distillation: This is a way of obtaining a pure solvent from a solution

i) C, Ca, Cl, Zn, Cu, Au, Ag, Fe, Hg, Na, NaCl, CO_2, H_2O, C_6H_{12} O_{22}, CaO

j) Properties of ionic compounds

i. They are usually hard solids.
ii. They have high melting and boiling points.
iii. They are generally soluble in water.
iv. In molten or solution form, they are good conductors of electricity.

Properties of covalent compounds

i. They exist in all three states: solid, liquid, and gas.
ii. They do not conduct electricity.
iii. They have low melting and boiling points.
iv. They are volatile; that is, they evaporate easily.
v. They are soluble in covalent solvents.

2. a) Experiments to prove that air exerts pressure

i. Take an empty tin can and heat it to remove all the air inside. Now screw on the cap tightly. The can will crumple due to outside air pressure.
ii. Fill a glass tumbler to the brim with water. Place a piece of cardboard on it and invert it. Remove your hand. The cardboard will not fall because the air will be exerting pressure on it from below.

b) Experiment: To separate a mixture of salt, sand, and iron filings

Method:

Stir the mixture with a bar magnet. The iron filings will stick to it. Now add water to the mixture of salt and sand and stir gently. Salt will dissolve in water. Pass the solution through a filter paper. The sand particles will be left behind on the filter paper. The filtrate contains salt and water. Heat the filtrate until most of the water has evaporated. Allow the solution to cool slowly; crystals of salt will form.

c) Paper chromatography can be used to separate a mixture of coloured substances, such as those found in black ink.

Experiment

Add a small drop of black ink to the centre of a piece of filter paper and allow it to dry. Add three or four more drops on the same spot. Add some water onto the spot, one drop at a time. The ink spreads out making coloured rings on the paper. The number of rings indicates the number of different coloured substances the ink contains.

d) Distillation is a way of obtaining a pure solvent from a solution.

Experiment

Set up the apparatus.

The solution is heated in the flask. It boils and steam rises into the condenser. Salt is left behind. The condenser is cold, so the steam condenses into water inside it. The water drips into the beaker. It is completely pure and is called distilled water.

3. a) A symbol is a short form name of an element. A formula is the name of a compound written in symbols. For example: the symbol for calcium is Ca and the formula for calcium oxide is CaO.

b) A mixture is not a pure substance. It contains two or more substances which are not chemically combined. Each substance retains its properties and the components can be separated easily. For example, when salt and sugar are put together they form a mixture.

When two or more atoms combine chemically with each other, they form a compound. For example, sodium and chlorine combine to form sodium chloride (common salt).

c) An atom is a neutral particle. The number of the positively charged protons in the nucleus of the atom is equal to the number of the negatively charged electrons in the outer orbits of the atom.

When an atom loses or gains electrons it becomes a charged particle called an ion. When an atom loses an electron it becomes a positively charged ion. When an atom gains electrons it becomes a negatively charged ion.

d) A suspension is a mixture in which the particles of the solute are not soluble in the solvent and can be seen floating in it. For example, if chalk is mixed with water, the particles of chalk will be seen floating in the water and the solvent will appear to be milky. If the particles of a solute are heavy and sink to the bottom of the solvent, they form a layer called sediment.

When oil is added to water and shaken, it forms tiny droplets in the water making a milky solution which is called an emulsion.

e) The number of protons in an atom is called its atomic number. For example, an oxygen atom has eight protons so its atomic number is 8.

The sum of the number of protons and neutrons in an atom is called its mass number or atomic mass.

For example, a carbon atom has six protons and six neutrons, so its mass number is 12. The atomic number and mass number of an atom is written so that, where X is the name of the atom, A is the mass number and Z is the atomic number ${}^{A}_{Z}X$.

For example: ${}^{12}_{6}C$

This represents a carbon atom in which the atomic number is 6 and the mass number is 12.

4. Refer to Pupil's Book.

Test paper 3

Time 2½ hours **Total marks: 100**

1. Attempt any 8 questions. (All questions carry equal marks.) [40]
   a) Where does all the energy on Earth come from? Describe the various kinds of energy.
   b) How is energy transferred in an environment?
   c) What is a machine? What is the mechanical advantage of a machine?
   d) Write short notes on any three: lever, inclined plane, wedge, screw, wheel and axle, pulley.
   e) What is a block and tackle? How does it increase the lifting force?
   f) Describe a gear. What are gears used for?
   g) Define reflection of light. What are the laws of reflection? What are the characteristics of an image formed by a plane mirror?
   h) How are sound waves produced? What are the characteristics of sound?
   i) What are artificial satellites?
   j) Describe some uses of artificial satellites.

2. Differentiate between: [25]
   a) Potential and kinetic energy
   b) Image formed by a convex mirror and an image formed by a concave mirror
   c) Period and frequency of sound waves
   d) Probes and satellites
   e) Geostationary orbit and polar orbit of satellites

3. Answer any 4 Questions: [25]
   a) Draw a concave mirror and label the following on it: radius of curvature, principal focus, focal length, centre of curvature, pole. Draw lines to show the kind of image that will be formed, if the object is placed in front of it.
   b) Prove the laws of reflection by an experiment
   c) Prove by an experiment that sound does not travel through vacuum.
   d) Draw lines to show the polar and geostationary orbits of satellites.
   e) Draw a periscope and draw lines to show it can be used to observe objects.

4. Fill in the blanks to complete the statements: [10]
   a) Oil and coal are called _____.
   b) The energy needed to run machines and engines is provided by burning _____.
   c) Moving particles have _____ energy.
   d) The squeezing together of atoms is called _____.
   e) The amount of effort applied to work is called _____.
   f) The image of an object which can be formed is called a _____ image.

g) A _____ mirror gives a wide view.
h) Sound cannot travel through _____.
i) A fast-vibrating body has a high _____ and it produces a shrill sound.
j) _____ satellites relay telephone messages and radio and television signals.

Answers to Test paper 3

1. a) Energy is the ability to work. All the energy on Earth comes from the Sun. The Sun's energy is called solar energy. It changes into other kinds of energy when it reaches the Earth.

Electricity is the most convenient form of energy. It is clean to use. It can travel over long distances along wires. It can easily be changed into other forms of energy, such as heat and light. Most of the electricity we use in our homes is made by generators at power stations.

Sound is a type of energy. When an object vibrates, it makes the air around it vibrate. The vibrations travel through the air as sound waves. The sound waves move sound energy from one place to another. All moving things make sound. A jet engine produces a great deal of sound energy. Firecrackers produce a lot of noise when they explode.

Fireworks are made of gunpowder and other explosive chemicals. These chemicals contain a lot of energy. Fireworks use this chemical energy. When gunpowder burns, it releases large amounts of energy in the form of sound, heat, and light.

Engines use the chemical energy of petrol. Petrol is burned inside the engine. A lot of kinetic and heat energy is released. Chemical energy in food is used by humans and animals to work and to keep warm.

The atoms of some metals can be changed or split to make new atoms. The nucleus of a uranium atom can be split into two. This breaking apart is called fission. When the nucleus of a uranium atom splits, some of its neutrons escape. These neutrons crash into other uranium atoms causing them to split. This splitting of the atom releases huge amounts of heat called nuclear energy. This heat is used to produce electricity.

Some atoms cannot be split, but they can be squeezed together. This process is called fusion. Hydrogen atoms can be squeezed together, at very high temperatures, to form large atoms. This fusion process releases large amounts of energy. This energy can be controlled and used to produce electricity. Solar energy is produced by the fusion of hydrogen atoms, which crash into each other, making larger atoms of helium gas.

The human body uses energy all the time. Energy is needed for work and play, to keep warm in winters; it is used even when you are sleeping. The energy for your body comes from the food you eat. Food contains chemical energy. Some foods like lettuce and tomatoes contain less energy. Bananas, white rice, eggs, meat, and butter contain a lot of energy. Energy from food is released only after it has been broken down or digested in the body. Fats and carbohydrates produce heat energy for the body. Proteins also produce energy for muscle growth and repair.

b) At the beginning of any food chain is a plant using sunlight to convert water and carbon dioxide into carbohydrate. Animals then feed on plants and use the carbohydrates for energy to grow and move. These animals in turn may be eaten by other animals and so energy passes along the food chain. However, at each stage in the food chain energy is lost. When a rabbit eats a lettuce only a small part of the energy is saved as new growth. Most is used to keep the rabbit alive, and some is just not absorbed from the lettuce during digestion. The same energy waste happens at other stages in the food chain. Because of this waste, the number of animals at each stage in the chain decreases.

c) A machine is a device which helps us with our work. For instance, a car helps us to travel long distances in a short period of time. A clock helps us to measure time.

Machines cannot work on their own, as they need some kind of energy to function. A car needs petrol to burn as fuel and a sewing machine is driven by an electric motor. The kinds of energy which are needed to run machines can be mechanical, electrical, or chemical. All machines need a steady supply of energy to keep them working.

Machines provide a mechanical advantage, which is the extra force that is gained by using simple machines. In other words, less effort needs to be applied to do more work.

d) Lever

A lever is a simple machine in the form of an arm which can lift a heavy load by applying very little effort. The point on which a lever rests and about which it turns is called the fulcrum. The fulcrum can be anywhere along the length of the arm. The power that is applied to lift the load is called the effort and the weight that is lifted is called the load.

Inclined plane

A heavy load can be raised easily by pulling it along a sloping surface rather than by lifting it. For example, a sloping plank can be used to push a wheelbarrow over steps.

Wedge

A wedge is actually two inclined planes put together. It is a simple machine which changes the direction of a force as well as increases it. An axe is a wedge which is used as a cutting machine. The downward movement of the axe creates a strong sideways force that splits the wood. A sharp axe has a greater splitting force than a blunt one.

Screw

A screw is a simple machine that is used to hold two things together. It is made up of a flathead attached to a rod which is pointed at one end. The rod has spiral grooves or threads on it. The screw is a special kind of inclined plane with a huge mechanical advantage. When you turn the head of a screw with a screwdriver, the spiral rod travels quite a long distance. It increases the force applied many times. Nuts and bolts are used to hold two or more parts together. A carjack, in which the screw raises an arm to lift up the car, is another example.

Wheel and axle

A wheel is a circular frame that turns. The axle is a rod that passes through a hole in the wheel. A wheel and an axle can be made to work if a rope is wound round them. A load attached to the axle-end of the rope will be pulled up if effort is applied to the wheel-end of the rope, as is done when drawing water from a well.

Pulley

A pulley is a simple machine made up of wheels. A pulley wheel turns on an axle. There is a groove around the rim of the pulley which holds the rope. A pulley is used for lifting heavy loads. One end of the rope is attached to the object to be lifted and effort is applied at the free end. It changes the direction of the pull. Since pulling is easier than lifting, the work becomes easier. The lifting force can be doubled if two pulleys are used.

e) A system with more than one pulley is known as a block and tackle. The pulleys are the blocks and the rope is the tackle.

You can increase the lifting-force by increasing the number of pulleys in a block and tackle; one is fixed to an overhead beam, while the other is fixed to the load. The rope is fixed to the beam too. Then it goes under the load pulley and over the fixed pulley. You pull on the free end.

f) Inside machines, wheels often have notches or cogs, cut around the edge. Wheels like these are called gears. Each gear fits with another to pass on the motion of the machine. They are also useful for changing the direction and speed of movement.

g) When rays of light fall on a polished surface like a plane mirror, they bounce back in such a way that they can produce an image. This bouncing back of light is called reflection.

When rays of light coming from an object fall on a mirror, they follow certain laws, according to which an image is formed.

Laws of reflection

1. The incident ray, reflected ray, and normal ray all lie in the same plane; that is, they can be drawn on a flat piece of paper.
2. The angle of incidence is equal to the angle of reflection.

Characteristics of an image formed by a plane mirror

1. The image is upright.
2. The image is laterally inverted.
3. The image is of the same size as the object.
4. The image is formed as far behind the mirror as the object is in front of it.
5. The image formed is virtual in nature, that is to say, it cannot be made on a screen.

h) When a body vibrates, it moves to and fro. Its forward movement presses the air pendulum in front of it. This is called a compression. When the body moves backward, the pressed layer of air stretches—this state is referred to as a rarefaction.

Continuous compressions and rarefactions produced by oscillations make sound waves. Sound waves are longitudinal waves. The oscillations which cause them are in the same direction as the motion of the wave.

The loudness of a sound depends on the amplitude of the vibrating body. If the amplitude is large, the result will be a loud sound. The loudness of sound also depends on the surface area of the vibrating body. A small drum will produce a softer sound than a big one. The distance from the vibrating body is another factor which influences the loudness of sound. As sound waves spread in all directions, they become weaker. Hence, if we stand near a vibrating body, we will hear a louder sound than if we are standing away
from it

Another quality of sound is the pitch. Shrill sounds have a high pitch, while flat sounds have a low pitch. The pitch of a sound depends on the frequency of the sound waves produced by the vibrating body. A fast-vibrating body has a high frequency and produces a shrill sound.

When we hear an orchestra playing, we can make out the sounds of the various instruments being played. We can also recognize the voice of a person we know. The specific quality of particular sounds is called timbre. Timbre is the combination of sound waves of different frequencies, which collectively make up the voice of a person or the sound of a musical instrument.

i) Artificial satellites are satellites which are put into orbit by man. The first artificial satellite was Sputnik I which was launched by the Soviet Union on 4th October, 1957. Sputnik II was launched on 3rd November, 1957. It carried the first living passenger, a dog named Laika.

The motion of a satellite or space station is directly related to the Earth's gravity. Once launched in the appropriate orbit these man-made spacecraft orbit the Earth without any

propulsion speed, because satellites have specific orbital speed to move around the Earth, depending on their distance from the centre of the Earth.

j) Satellites called communication satellites are used to relay telephone messages and radio and television signals. It is due to satellites such as these that we are able to watch live events like sports being played anywhere in the world, on our television sets.

Some artificial satellites carry instruments that gather and send back information about the Earth and its surroundings. This information is of great value to weather-forecasters, scientists, military planners, farmers, fishermen, etc. Landsat is one of many such stations. It has an orbit time of 1¾ hours. As it passes overhead, Landsat views a strip of the Earth's surface. The information collected is used to study such things as water pollution, the effects of industry on the environment, and to distinguish different types of crops. Landsat images are also used for map-making.

Navigation satellites transmit data so that ships and aircraft can locate their position to within 100 metres.

Astronomical satellites are designed to study heavenly bodies.

2. a) Atoms and molecules move about or vibrate all the time. Moving atoms have energy called kinetic energy. When an iron bar is cold, its atoms vibrate very slowly. If the bar is heated, its atoms start to move faster and faster. When the piece of iron becomes very hot, the atoms have so much kinetic energy that they break away from each other. Then the solid iron melts and becomes liquid iron.

Potential energy is the stored energy of a body, as a result of its position. A ball put on a high shelf has more potential energy than if it is placed on the floor. The ball gains extra energy because work is done when the ball was placed on the shelf. Potential or stored energy can be changed into kinetic or moving energy. If we push the ball from the shelf onto a pile of sand, it will make a pit in it. The potential energy of the ball on the shelf turns into kinetic energy when it is pushed. When you wind up a toy, energy is stored in the toy's spring. The potential energy changes into kinetic energy as the spring unwinds. It makes the toy work.

b) If an object is close to a concave mirror, an upright and magnified (large) image is formed. As with a flat mirror, the image cannot be picked up on a screen. Such an image is called a virtual image.

If an object is far away from a concave mirror, a small, inverted (upside down) image is formed. It can be picked up on a screen and is called a real image.

A convex mirror forms an upright, virtual image of an object placed in front of it. The image is smaller than the object and close to the mirror.

c) The pendulum of a clock keeps time because it moves backwards and forwards regularly. This type of movement is called an oscillation. The time taken for one complete oscillation is called the period. The number of oscillations that are completed in one second is called the frequency of the oscillation.

d) Robot spacecrafts are called space probes. Space probes carry cameras and many kinds of instruments to study the planets they visit. Most probes study a planet as they fly past it. But some actually land on the planet and report back from its surface.

A satellite can be defined as any object, either man-made or natural, that orbits or circles around something else. For example, the Moon orbits around the Earth and is thus a satellite

of the Earth. The Earth orbits around the Sun and is a satellite of the Sun. Other examples of naturally occurring satellites include comets, asteroids, and other planets.

e) In polar orbits the satellite is in orbit over the Earth's poles. It travels from north to south around one side of the Earth, and then back from south to north on the other side. The Earth is also spinning beneath the satellite; hence it appears that the satellite is travelling in a spiral track over the Earth's surface.

In a geostationary orbit the satellite travels eastwards in an orbit directly above the Equator. It is at a height of about 36,000km and takes one day to make one complete orbit. Since the Earth is spinning beneath it in the same direction, it appears to remain stationary at one point on the Equator.

3. Refer to Pupil's Book.

4. fuel, fuel, kinetic, fusion, power, real, concave, vacuum, pitch, Communication

Notes