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Introduction

This Teaching Guide has been written with the purpose of assisting teachers in transmitting concepts clearly, correctly and effectively in a limited period of time. Ideas to begin, build and conclude a lesson have been given; yet, these are not the only and best way to teach. A good teacher comes up with new ideas and strategies.

When teaching science, in fact any subject, to young pupils, one must never forget that pupils at this stage can only make sense of concrete things and not abstract ones. For example, during a lesson on air, if they do not actually experience the air in a balloon being released, causing it to deflate, they will never truly understand the concept of air since they cannot hold or see it.

A successful teacher uses a number of strategies in the classroom:

- **Posing questions and inviting pupils’ questions**

  In order to keep the pupils engaged in the class, ask short, relevant questions. Write a summary of different responses on the board and then sum it up. For example:

  *When you look in the mirror, what do you see?*

  Expected responses are: *I see myself.*

  *I see my body.*

  *I see my face, eyes, nose…*

  Write the responses on the board and then sum up, e.g. *We see our body, face, eyes, nose in the mirror.* Before beginning a lesson, tell the class the topic and then ask them to think of any question that comes to their mind regarding it.

- **Conducting interactive demonstration**

  The teacher should be well aware of the purpose of the demonstration and should have conducted it **beforehand** to ensure that the results are as desired. Ask a question and have the pupils predict the outcome of the demonstration. They could respond before or after discussing with another child. For example:

  *Which one do you think will sink in water; an egg or an egg shell?*

  There could be various responses to this. Practically demonstrate and then conduct a class discussion. Conclude the discussion by summarizing all the ideas shared.
Using cooperative learning in the classroom

Two examples of cooperative learning strategies are described below:

Think-Pair-Share

Begin by first posing a question to the class that requires the pupils to think critically.

a. Think

Give a certain specified amount of time to the class to think alone about the answer to the question. Pupils will write their own answer.

b. Pair

Pupils pair up with a partner to discuss the question, listen to, and expand on one another's ideas.

c. Share

Pupils share their answers to the question with the entire class.

Jigsaw

Research shows that pupils learn best when they teach others what they have learnt. Jigsaw helps pupils learn and teach one another. It has four steps:

1. Form cooperative groups called HOME groups with each group member being given different material to read or learn. For example, the first group member is given page 1 of an assigned text, the second member page 2, etc.

2. EXPERT groups are formed by grouping pupils with the same assigned material together. This group must study the material together and plan ways to teach the material to their HOME group members and check for understanding.

3. Pupils return to their own HOME groups and take turns teaching their HOME group members the material they were assigned and are now experts on. The goal is that every member of the group should master all the material presented.

4. Check how well the pupils have worked together by taking a quiz or asking them to make a presentation.

How to do Circus Format Activity

This activity usually requires two consecutive periods.

Arrange some tables and chairs (according to the number of pupils) in the class. Name each table as a ‘station’.

Activities must relate to the current topic. Instructions must be written along with the activity. If the pupils are young, give them verbal instructions. Remind the pupils to handle things with care and to leave the station as soon as the bell rings.
Grouping the class
Arrange the pupil into five groups according to the strength of your class.

Allocate time (usually five minutes).
- Group 1 will sit at station 1.
- Group 2 will sit at station 2.
- Group 3 will sit on station 3.
- Group 4 will sit on station 4.
- Group 5 will sit on station 5.

Pupils will perform the activities and record their observations in their notebooks. After five minutes, ring the bell.
- Group 1 will move to station 2.
- Group 2 will move to station 3.
- Group 3 will move to station 4.
- Group 4 will move to station 5.
- Group 5 will move to station 1.

In the same way, pupils will perform all the activities, moving from station to station.

At the end of the activity, they will give a presentation on what they learnt. Give them ten minutes to prepare for their presentations.

Presentations:
Group 1 will give presentation on station 1 activity.
Group 2 will give presentation on station 2 activity, and so on.

You can give your input where necessary, encouraging them with prompting words, etc.

In this entire process, the primary objective is that the pupils are actively involved in the learning process and are not being ‘lectured’. In all cases, do not begin to read the lesson from the textbook before you begin a discussion leading up to it. Reading the text comes after the discussion and brainstorming has taken place.

Using the photocopy masters
The worksheets are a reinforcement of the lesson and can be used for homework or classwork.
Unit 1

Topic: The human body

Teaching objectives:
• To explain briefly the functions of cells, tissues and organs
• To identify the functions of some important bones of the body
• To explain the functions of the human skeleton
• To define joints and explain the functions of hinged, and ball and socket joints
• To differentiate between voluntary and involuntary muscles
• To explain the three types of muscles; (smooth, cardiac and skeletal) and their functions

Key vocabulary:
cell, tissue, organ, skeleton, joint, ligament, tendon, voluntary, involuntary, ball and socket, hinged, cardiac, skull

Advance preparation:
• Start collecting chicken and fish bones before starting this topic. You will need a set of clean, dry bones and a magnifying glass for each group of pupils.
• Prepare or purchase a jigsaw puzzle of the human skeleton along with flashcards for labelling.
• Collect a model or a large chart of the human skeleton.
• Collect wooden ice cream scoops and rubber bands, one for each pupil.
• Use the photocopiable worksheet for labelling the parts of the skeleton.

Optional: Arrange a visit by an orthopaedic doctor as a guest speaker.

Lesson 1: 40 min

Introduction: 5 min
• In order to assess their prior knowledge about the human body, ask the pupils to draw the outline of their friend’s body on a sheet of paper, and write or draw as many things as they know about the human body inside that outline.
• Ask each pupil to share with the class any one thing s/he has written or drawn about the human body.
Main teaching: 30 min

- Engage the pupils in a discussion by asking them to compare a human body with a machine, for example, the computer.
- Draw two columns on the board, one for the machine, and the other for the human body. Write their responses in these two columns. Encourage them to think of as many differences as they can. Also ask them to think about the similarities between them. What do the human body and the computer need in order to work?
- After recording their responses, emphasize that a machine needs human help to work, but the human body is an amazing machine that keeps working by itself. It performs many functions at the same time.
- Now show them an earthworm (you may draw it on the board if this is not possible), and ask: Tell me what you can do that this animal cannot do? How is this creature different from a human being? Earthworms have a soft body and no legs. They are only able to crawl. The pupils will identify some differences. Select a few that refer to bones and muscles, such as sitting, standing, running and walking. How are you able to sit, run, walk and stand as easily as you do? Bones and muscles in the body help you to do all those physical activities.
- Write on the board the key vocabulary and ask the pupils to look up the meanings in a dictionary. If they are working in groups, you can give two words to each group and ask them to illustrate their meanings. At the end of this exercise they can share their work with the rest of the class.

Wind up: 5 min

- Ask the pupils to recall what they have learned in this session. Also ask them which activity they enjoyed most. Why? What have they learned about the musculoskeletal system? What more would they like to learn about it?

Lesson 2: 40 min

Introduction: 5 min

- Recall the key concepts from the previous lesson.
  - Can you name some important bones of the body?
  - What is a skeleton? Is it present in vertebrates or invertebrates?
  - How does the skeleton and the muscles help the body to move?

Main teaching: 30 min

- Divide the class into groups and provide each group with a set of bones and a magnifying glass. Ask the pupils to study them carefully and record their observations. Also encourage them to record questions they would like to ask about bones. They may break, scrape or rub the bones in order to investigate them fully.
- Ask the groups to share their observations with the rest of the class.
- Read the textbook as far as the details of the skeleton on page 5. A reading activity becomes more focused and meaningful if the pupils are given some questions before they begin to read.
You can give the following questions or frame your own:

What are cells?
What are tissues?
What is an organ?
Which is the largest organ of the body?
What is the function of the skeleton?
Where are blood cells produced?
What is a ligament?

What are the names of the smallest and the longest bones of the body? Where is each of them found?

• To save time, divide the questions among the groups and ask each group to share the answers to their particular questions. You can also ask them to give the page number and paragraph relevant to each answer. This will maintain their focus and attention throughout the period.

• Ask them to touch their spine and feel it, and describe what they feel.

Explain: *This is the bone which supports your whole body. It is called the vertebral column or spine. All vertebrate animals have this bone. Can you show me some other bones in your body? They should feel their body and point out bones in the shoulder, arm, elbow, hands, feet and legs, etc. All the bones join together to make a framework for the body, called the skeleton.*

• Point out on the chart and name some bones that they should label on the worksheet or other diagram of a skeleton (skull, clavicle, elbow, wrist, ribs, vertebrae, pelvis, femur, knee).

**Wind up: 5 min**

• Ask questions to summarize the lesson:
  a) What is the human body made up of? (cells)
  b) When cells group together, what do they make? (tissue)
  c) When tissues group together, what do they make? (organ)
  d) What is a group of organs called? (organ system)
  e) What does the musculoskeletal system consist of? (the skeletal and the muscular systems)

**Lesson 3: 40 min**

**Materials:** ice cream scoops, rubber bands

**Introduction: 5 min**

• In this lesson, the pupils will learn about types of joints and their functions. Distribute ice cream scoops and rubber bands to each child. Ask them to tie the scoop to the forefinger of the hand with which they write, with the rubber band. Demonstrate by tying your own finger.

• Ask the pupils to write their name and a few words with their finger tied. *Was it easy or difficult to do so?*

**Main teaching: 30 min**

• Introduce the term ‘joint’ to them and also explain the function of a joint. *Joints are found where two bones meet. Most joints are mobile, allowing the bones to move. Joints consist of*
ligaments, muscles and tendons. Discuss the movable and immovable joints in the human body.

Feel the joints in your arm, from the shoulder to the wrist, in your hands, fingers, legs, and feet. Do you think there is a difference between the shoulder joint and the joint of your knee or elbow, or are they the same? Ask them to move both the elbow and the shoulder and feel the difference in the movements. After hearing their responses, explain that ball and socket joints are capable of moving in all directions, while the hinged joint can only move backwards and forwards.

- You can model how a ball and socket joint works by cupping one hand and making the other into a fist. Place the fist in the cupped hand and rotate the fist around with your wrist or arm. Open and close the classroom door to show how the hinged joint works. Ball and socket joints, such as the shoulder and hip joints, allow backward, forward, sideways, and rotating movements. Hinge joints, such as in the fingers, knees, elbows, and toes allow only bending and straightening movements.

- You can conduct a parcel game to evaluate pupils’ learning. Prepare some written questions related to the concepts they have learned. Put these slips into an empty box. Circulate this box in the class and start clapping. When you stop clapping, the pupil who has the box must pick out a question and answer it. If he/she is unable to answer, the question can be passed on to the next pupil.

Wind up: 5 min
- Sum up the session by asking questions about what they have learned. Surely this is the same as the parcel activity that immediately precedes this? Use the following activity to conclude this lesson.
  What is a joint?
  What is the function of a joint?
  How many types of joints have you learned about in this unit?
  Where is each of these joints found?
  What is the difference between a hinged joint and a ball and socket joint?
  What would it be like if you had no joints in your body?

Lesson 4: 40 min

Materials: a large jigsaw puzzle of the human skeleton

Introduction: 5 min
- Help the pupils to recall what they learned in the previous lessons by giving them a short quiz on the topic with the help of Exercise B on page 8 of the textbook.

Main teaching: 30 min
- Give the pupils a jigsaw puzzle of a human skeleton to complete, along with flashcards, so that they can label the important bones they have learned about. Prepare one large puzzle and distribute pieces of the puzzle among the groups of pupils. Each group should have only one or two pieces of the puzzle.

To prepare the puzzle, take a sheet of strong card and trace or stick on to it an enlarged drawing of the human skeleton. Cut it neatly into puzzle-shaped pieces. Keep the puzzle in an envelope or a small plastic bag. For durability, laminate the pieces of the puzzle.
• Draw an outline of the human body, on the board and ask the pupils to come up and fix their piece of the skeleton in the correct place in order to complete the puzzle on the board. This can be done using blu-tack or a similar adhesive material.

• Pupils should then complete the related worksheet on page 66.

• To prepare for work on muscles, ask the pupils to smile and frown. Raise your palms up. Clench your hands and bring them slowly to your shoulders. What happens in your upper arm? What happens when you extend your arm again?

• Engage them in a discussion about the importance of the muscular system. Leading questions can be:

  Do you think bones alone can perform their job easily?
  Have you ever wondered how food moves down inside your body after you have swallowed it?

• The following activity should be conducted in three steps.
  Each pupil will first read individually. Then s/he will join a group to discuss what he s/he has read. The group will then share their understanding with the rest of the class. Ask them to read pages 5–6 of the textbook about the muscular system. Give them questions to keep them focused.

  a) What is a muscle?
  b) How do muscles help in movement?
  c) How many types of muscles are discussed in this unit?
  d) What is the difference between voluntary and involuntary muscles?
  e) What is a tendon?

  Ask them to share what they have learned by reading.

• Now give them a chicken leg to observe how bones and muscles are attached to each other. Ask them to identify the tendons. Which type of muscle is it?

Teacher’s input:

• Explain the importance and functions of muscles:

  Bones cannot perform their work alone; they need the help of muscles to do this. Food needs to be pushed down towards the stomach after it has been swallowed. This happens with the help of the muscles. The whole body receives blood because the heart, which is a muscle, pumps blood to all parts of it. Without muscles, you could not move your body.

  Muscles not only help the body to move, they also help you to stand straight. A band of muscles that runs up your back holds the spinal column straight and your head erect.

• Discuss how we can strengthen our muscles:

  Muscles get stronger when they are moved. You can see this in your daily life. Football players and athletes have strong muscles. But you do not need to be athletes or football players to have strong muscles. Some very simple activities can make your muscles strong and healthy. Eat healthy foods and drink plenty of clean, fresh water. Water improves the blood circulation. Some exercises, like brisk walking, running, rowing, riding, swimming and playing tennis, or football help make the muscles stronger and healthier.
Wind up: 5 min

- Review the salient points of the lesson by asking the pupils to attempt the related worksheet on page 67.

**EXERCISE (pages 8 and 9)**

**A**

**B**
1. tissue  
2. The heart  
3. vertebrate  
4. a joint  
5. a ligament  
6. a hinged  
7. a ball and socket  
8. smooth/ involuntary  
9. a tendon  
10. musculoskeletal system

**C**
1. The main functions of the skeleton are as follows:
   - It gives strength and support to the body.  
   - It frames the shape of the body.  
   - It protects some important and soft internal organs, such as the lungs, heart and brain.  
   - It helps us to move.  
2. a) A joint is the place in a vertebrate’s body where two or more than two bones meet with the help of a tissue called a ligament.  
   We have studied two types of joints in this unit:  
   i) Ball and socket joint, found in the hip bone, and the shoulder bone.  
   ii) Hinged joint, found in the elbows, knees and the joints of our fingers and toes.  
   b) Sample answer:  
      Hinged joint: When we bend our elbows to hold something, or when we walk or bend our legs, we use the hinged joints of the knee and/or ankle. (Accept other correct actions.)  
      Ball and socket joint: When we spin something into the air, we use the ball and socket joint of our shoulder.  
3. The two types of muscles are:  
   - Voluntary muscles  
     Voluntary muscles can be controlled, for example, the skeletal muscles.  
   - Involuntary muscles  
     Involuntary muscles are smooth muscles that cannot be directly controlled, for example, the stomach, intestines, and bladder.
4. Types of muscles

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<th>Example</th>
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<tr>
<td>cardiac</td>
<td>heart</td>
</tr>
<tr>
<td>skeletal</td>
<td>joint, ligament, tendon</td>
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5. Doing plenty of exercise and eating calcium-rich food helps to build strong muscles and bones.

**ACTIVITY (page 9)**

1. The pupils should observe the density and size of the bones of different animals.
2. **Procedure:**
   - Place the chicken leg quarter on a dissecting tray.
   - The following parts are present in the specimen:
     - The lower leg of the chicken is called the drumstick. It is the equivalent of the lower leg of the human and includes the tibia and fibula.
     - The upper leg of the chicken is called the thigh, just as it is in humans. Its bone is the femur.
     - The bones above the thigh are part of the hip and backbone of the chicken. The meat is the muscle. The strong, white cords, called tendons, hold the muscle to the bones.
3. Some protective equipment includes: helmet, face protection and mouth guards, knee, thigh and elbow pads.

**Unit 2**

**Topic: Teeth**

**Teaching objectives:**
- To compare milk teeth and permanent teeth
- To locate the four types of teeth and explain the function of each
- To create an awareness of the importance of dental care and hygiene

**Key vocabulary:**
permanent tooth, milk tooth, canine, incisor, molar, premolar, plaque

**Materials:**
a large model of a jaw with teeth
a large tooth brush
a chart or poster of teeth
Lesson 1: 40 min

Introduction: 5 min
• Display pictures from magazines that show people smiling, eating and talking.
  Could you smile without a mouth? What do your teeth do for your smile? Teeth make our smiles attractive; make us look happy.
• Ask the pupils to pronounce the words ‘teeth’ and ‘toothbrush.’ Then ask them to try to say these words without letting their tongue touch their teeth. Say the word ‘smile.’ Now try to say ‘smile’ without your upper and lower teeth touching. What other letters would be hard to pronounce if you didn’t have teeth? (The letters S, D, T, and Th…)
• What are your favourite foods? Make a list of some of these. Which of these foods could be easily eaten without teeth? Which ones must be chewed? The primary function of teeth is to chew the food for digestion. But they also help you to speak clearly. They also make your smile beautiful.

Main teaching: 30 min
• How many of you have baby brothers and sisters? How many teeth do they have? Is a baby’s food different from the food that you eat?
• Explain the following with the help of a chart:
  Two kinds of teeth grow during a human’s life:
  a) primary or milk teeth
  b) permanent teeth
  Primary, or milk teeth start erupting in the mouth when a baby is about six or seven months old and fall out by the age of eleven. There are twenty primary teeth. These are distributed equally in the two jaws. A child usually has a complete set of primary teeth by the age of three. They are slightly different from adult teeth. Baby teeth are also called deciduous teeth, because they fall out (as leaves fall from deciduous trees in autumn). Adult teeth and baby teeth have the same internal structure, though adult teeth are larger.
  Permanent teeth start to appear when a child is about six or seven years old and the last permanent teeth (the wisdom teeth) appear when the child becomes an adult. As the primary teeth are the base of the permanent teeth, having good oral hygiene is very important. They help in digestion, speech and general facial appearance. There are thirty-two permanent teeth in total.

Wind up: 5 min
• Ask the following questions to assess learning:
  Why are teeth important?
  How are milk teeth different from permanent teeth?
Lesson 2: 40 min

Introduction: 5 min
- Give the pupils a mirror to check their teeth.
  Also show them the model jaw and chart to illustrate the differences in shape and size of the teeth.

Main teaching: 30 min
- Read *Tooth types* on pages 10–11 of the textbook. Encourage the pupils to use the dictionary or refer to the glossary for the meanings of unfamiliar words.
- Now ask them about what they have read. After hearing their responses, show them the model jaw and ask them to identify the four types of tooth.
- Discuss the pupils’ own experiences of losing their teeth and ensure they understand that they will not keep having new sets of teeth. The pupils may talk about the order in which their teeth fell out or the teething experiences of their younger siblings.
- The pupils can now do Exercise C on page 12.
- Discuss Activity C on page 13.
  Animals that eat only meat are called **carnivores**. Animals that eat only plants are called **herbivores**. **Carnivores** and **herbivores** have different types of teeth, suited to the type of food they eat.

Wind up: 5 min
- Ask the following questions to assess learning and understanding:
  How many types of teeth are there in a permanent set of teeth?
  What are the names of these teeth?
  What are they used for?

Lesson 3: 40 min

Introduction: 5 min
- The focus of this lesson is dental hygiene. Discuss:
  What are some of the things you do to keep your teeth clean?
  Why do we need to clean our teeth?
  Some germs in our mouth stick to the teeth and make a sticky layer on them. This is called **plaque**. Plaque can result in a cavity (a little hole in the tooth), so we need to clean plaque away.
  How can we clean our teeth?
- Show pupils how to brush their teeth using a large toothbrush and the model of the jaw, gently brushing back and forth, reaching to the sides of the teeth.
- Mix three or four drops of red food colour with a few tablespoons of water in a paper cup. Ask a volunteer to swish the coloured water around in his/her mouth for ten seconds and carefully spit it out into a second cup or nearby sink. Have the volunteer look in a magnifying mirror and identify the red areas indicating plaque. Ask the volunteer to brush their teeth with toothpaste and a new toothbrush. Then repeat the procedure. See how much of the plaque is gone and discuss the areas where plaque hides.
• **Perform a flossing demonstration.**
  Discuss dental floss and flossing. Show the pupils some floss, and then ask two pupils to demonstrate flossing, using yarn. One pupil holds his/her hands together with fingers straight up and tight against each other. These represent the teeth. The other pupil uses yarn to floss between the fingers. A variation is to smear tempera paint representing plaque between the fingers that represent the teeth. In this way, the pupils will see how the floss cleans between the teeth.

• Make the pupils aware of the dangers of eating pan, betel nut and gutka.

**Wind up: 5 min**

• Ask the following questions to conclude the lesson:
  *What is plaque? How does it hurt or damage teeth? How can we get rid of it?*
  *What might happen if teeth are not brushed or flossed?*
  *Do you think the direction in which you brush your teeth (up and down, side to side, or circular) is important? Why or why not?*

**EXERCISE (page 12)**


B 1. A child’s first set of teeth are called baby teeth or milk teeth.
  2. Teeth decay if they are not brushed regularly.
  3. Molars, or the back teeth, are used for grinding food.
  4. Answers will vary.

**ACTIVITY (page 13)**

1. All activities are based on discussions between the pupils and the teacher.
2. Any solid food would be difficult to eat without incisors.

**Unit 3**

**Food and balanced diet**

**Teaching objectives:**
- To explain what is meant by balanced diet
- To classify foods based on their food values
- To interpret the food pyramid
- To recognize the role of physical fitness in maintaining good health

**Key vocabulary:** balanced diet, nutrient, food pyramid
**Materials:** an assortment of food items, pictures of foods, glue stick, sticky tape, sheets of card, markers

**Advanced preparation:**
Collect real food items and pictures of food from old newspapers and magazines or the Internet. Prepare or purchase a large chart of the food pyramid.

**Optional:**
- You may invite a dietician to be a guest speaker. The pupils can ask questions about suitable diets for people of different age groups.
- You may also plan some cooking activities. For example, making soup or preparing a fruit salad or sandwiches with the class will make this lesson more interesting and interactive. Simple tasks, like washing and peeling fruits, or measuring ingredients, will evoke enthusiasm in the pupils.

**Lesson 1: 40 min**

**Introduction: 5 min**
- Ask the pupils general questions about their food habits. For example:
  - *What is your favourite food?*
  - *Why do you like it the most?*
  - *What do you usually eat for breakfast/ lunch/dinner?*

**Main teaching: 30 min**
- Discuss the importance of food in our lives. Ask the pupils to think for a moment and tell you what might happen to their body if they did not eat food for many days.

  *We all need food. It gives us energy. Our body is like a machine. It has to do many things, so it needs a lot of energy, and this energy comes from the food we eat. When our body is well nourished, we feel good, look good, grow properly and are able to work hard. But if we do not eat enough food, we have less energy. As a result, we cannot study and work. We feel tired and lazy. We may become weak and sick. So we need to eat good food.*

- Now explain that food contains some very important things called **nutrients.** *Nutrients perform very important functions in the body. Some foods contain nutrients which help us to grow. Some contain nutrients that help our body to fight against disease, while some give us energy. If we eat only one kind of food, the body cannot do all these jobs. So we need to eat a variety of foods.*

- *What do you think would happen if you ate nothing but fast food? Eating fast or ‘junk’ food is bad for the health. It makes people overweight and causes disease.*

- *Foods can be divided into five groups according to what they do.*

**Group activity**
- Ask the pupils to look at page 15 of the textbook and read the information about food groups.
- Divide the class into five groups representing the five food groups.
- Each group will be given one food group to present to the class.
- Give them some newspapers or magazines that contain pictures of foods from the different food groups. They can also make drawing food items and colour them.
• Ask them to cut out pictures of foods from their assigned food group and stick them on the sheets of card.

• Ask each group in turn to share what they learned about their allocated food group. They should talk about the various food items that are part of that group, their nutrients, etc. Encourage the other pupils to ask questions.

Wind up: 5 min
• Show them any picture or real food item and ask them which food group it belongs to. What nutrition does it provide to our body?
• A display of assorted food items will help recap the lesson quickly. The pupils can identify the food group to which each item belongs. Alternatively, make a collage of healthy and junk food on the board and ask the pupils to sort them according to type.

Lesson 2: 40 min
Introduction: 5 min
• Ask the pupils to draw three columns in their notebooks. Write what you ate for breakfast, lunch and dinner yesterday. You may also include any snack that was eaten between meals.

Main teaching: 30 min
• Ask the pupils to evaluate their meals according to the food groups. (Since pupils do not control what they are given to eat, this must be handled sensitively so that no pupil is made to feel uncomfortable because s/he may not have eaten as healthily as others.)
• Ask them to identify which food group each food they have listed belongs to.
• Discuss the importance of maintaining a balanced diet. In the previous session we read that different foods contain different nutrients. These nutrients are very important for our body. They keep us healthy and fit. But at the same time, eating too much or too little of any nutrient or food group can create some disorders or diseases in our body. We need to keep a balance. A balanced diet means eating the right variety of foods in the right amounts. People need different kinds and amounts of foods. We need more food when we are growing. We also need more food if we are working hard. So to be healthy, we must have enough food and the right kinds of food. But how can we know what is the right amount of food for us?

The food pyramid is the food guide which helps us to know which food group we should include more of in our diet, and which we should include little of.
• Ask the pupils to read the paragraph about the food pyramid on page 16 of the textbook. Help them to understand the information provided by the food pyramid.
  1. Which is the largest food group shown in this pyramid? (the grain group)
  2. What does this mean? (We should include more from this group in our diet.)
  3. Which is the smallest group? (oil and sweets)
  4. What does this mean? (It means we should eat least from this group.)
• Ask them to look again at the food record they wrote at the beginning of this session. Select one of them and discuss it with the class. Which food group is dominant in these meals? What should be cut down or added to make it a balanced diet? Again, there is a great need to be very sensitive in doing this and give praise for good choices, as well as constructive advice.
Wind up: 5 min
• Conclude the lesson by asking the following questions:
  1. *What is meant by the term ‘balanced diet’?*
  2. *Do we all need the same amounts and kinds of food?*
  3. *What is the food pyramid?*
  4. *Which food group should we eat most of? Which should we eat least of?*

Lesson 3: 40 min

Introduction: 5 min
• Ask the pupils to recall what they have learned about foods so far.
• Remind them of the following:
  *Eat a variety of foods.*
  *Eat less of some foods, and more of others.*
  *Avoid junk food. Eat healthy food.* (Can they suggest some healthy options?)

Main teaching: 30 min
• Divide the class into groups.
  *You are planning a party for your friends. Plan a healthy, balanced menu for the party. Your menu should include foods from all the food groups.*
• Give the groups of pupils an appropriate time to complete this task. Afterwards, ask each group, one by one, to come up and share its menu.
• Invite others to comment on the group’s choice of food. *Is it a balanced menu? If not, what can be added or reduced to make it balanced?*
• Shift the lesson’s focus to the importance of exercise and physical activities, and drinking plenty of water. Write the following on the board:
  *running, playing football, playing cricket, playing badminton, playing video games, watching television*  
  *Think about these activities. Which ones involve physical activity and exercise? Watching television and playing video games are not physical activities. Everyone can benefit from regular exercise. It improves our blood circulation. A child who is active will:*  
  *feel tired less easily,*
  *be more attentive in school,*
  *maintain a healthy weight,*
  *build and keep healthy bones, muscles and joints, and*  
  *sleep well at night.*
• *Water makes up more than two thirds of the weight of the human body, and without it, we would die in a few days. Water is important to the mechanics of the human body. The body cannot work without it, just as a car cannot run without petrol. In fact, all the cell and organ functions of the entire body depend on water, in order to function.*
Wind up: 5 min
Sum up the key points taught in this lesson by asking the following:

*Why does our body need water?*

*What are the ingredients of leading a healthy life? (Eating right, drinking plenty of water and living an active life.)*

**EXERCISE (pages 17–19)**

<table>
<thead>
<tr>
<th>A</th>
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<tbody>
<tr>
<td>1.</td>
<td>D</td>
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<tr>
<td>2.</td>
<td>C</td>
</tr>
<tr>
<td>3.</td>
<td>A</td>
</tr>
<tr>
<td>4.</td>
<td>B</td>
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</table>

<table>
<thead>
<tr>
<th>B</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>wheat</td>
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<td>2.</td>
<td>bread</td>
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<tr>
<td>3.</td>
<td>carbohydrate</td>
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<tr>
<td>4.</td>
<td>fats and sweets</td>
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<tr>
<td>5.</td>
<td>eggs</td>
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</table>

<table>
<thead>
<tr>
<th>C</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>We need food to grow, gain energy, and remain healthy.</td>
</tr>
<tr>
<td>2.</td>
<td>A balanced diet means eating the right variety of food in the right amounts.</td>
</tr>
<tr>
<td>3.</td>
<td>Proteins are body building foods. They help our body to build up and repair tissues and muscles.</td>
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<tr>
<td></td>
<td>Some sources of protein are fish, beef, mutton, beans, chicken and eggs.</td>
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<tr>
<td>4.</td>
<td>Fibre helps to absorb extra water. It helps the digestive process.</td>
</tr>
<tr>
<td>5.</td>
<td>Carbohydrates are a quick source of energy for the body.</td>
</tr>
<tr>
<td>6.</td>
<td>We need energy even when sleeping. While we are sleeping, our heart, brain, lungs and stomach are performing their jobs. They need energy to carry on their work.</td>
</tr>
<tr>
<td>7.</td>
<td>Use the table given on page 15 to check answers to this question.</td>
</tr>
<tr>
<td>8.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grain</th>
<th>Fruits and vegetables</th>
<th>Milk</th>
<th>Meat</th>
<th>Fats and sweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>spaghetti</td>
<td></td>
<td></td>
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<td>rice</td>
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<td></td>
<td>spinach</td>
<td>milk shake</td>
<td>fish</td>
<td>cooking oil</td>
</tr>
<tr>
<td></td>
<td>carrot</td>
<td>lassi</td>
<td>chicken</td>
<td>cake</td>
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<tr>
<td></td>
<td>tomato</td>
<td>cheese</td>
<td>eggs</td>
<td>sweets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>yogurt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. The food pyramid is a guide. It shows that not all foods are equally healthy. It guides us about how much we should eat from each of the food groups.

10. The grain group should form the largest portion of our diet.

11. Drinking plenty of water is important, because water carries all the materials to the cells of our body.

Exercise makes us feel good. It improves our blood circulation and keeps the bones and muscles healthy and strong.
**ACTIVITY (page 20)**

All the activities related to this unit have been explained comprehensively in the textbook.
Unit 4
Animal kingdom

Teaching objectives:
• To explain why scientists classify things
• To develop an awareness of the different types of animal that live on the Earth
• To classify animals as vertebrates and invertebrates, and further classify them as cold-blooded or warm-blooded
• To classify the vertebrates into five main classes

Key vocabulary:
vertebrate, invertebrate, cold-blooded, warm-blooded, reptile, bird, mammal, amphibian, fish

Materials: stickers or pictures of various types of animals, sticky tape, glue

Optional:
Arrange a visit to the zoo.

Lesson 1: 40 min

Introduction: 5 min
• A brainstorming session will introduce this lesson. Write Animals of the world on the board. Ask the pupils to suggest the names of as many different animals as they can. Write their responses on the board.
• Since this activity will lead to the introduction of vertebrate and invertebrate groups of animals, write the two terms on one side of the board.

Main teaching: 30 min
• Draw two large boxes on the board, one below the other. Label them A and B.
• Join all the names of invertebrate animals to box A with lines and those of vertebrate animals to box B. This will be your mind map. Do the pupils notice any common characteristics between the members of the two groups?
17 Part 2 | Living things

• Explain the terms vertebrate and invertebrate.

There are hundreds of thousands of animals in the world. It is not easy to study all the animals at one time. To make this task easier, scientists use a system to classify animals into different groups. Classification means to put things into groups, or classes, according to their characteristics. Scientists classify animals to help us understand how living things are alike and different, and how they are related to one another. They classify animals into two major groups: vertebrate and invertebrate.

• Explain that all animals that have a backbone belong to the class known as vertebrates, and those animals that do not have a backbone belong to the class known as invertebrates.

• Remind them of what they have learnt about skeletons. The skeleton provides a framework for the body and the vertebrae help it to stand upright. Vertebrae are not present in insects, so they are invertebrates. Invertebrates do not have a backbone.

• Now introduce the terms warm-blooded and cold-blooded. Write these phrases on the board and ask the pupils to look up their meanings in the dictionary.

Read the paragraph about this concept on page 22 of the textbook.

Earlier we classified animals as vertebrates and invertebrates, depending on the presence or the absence of a backbone in their body.

Animals can also be classified on the basis of their body temperature.

Draw the following table to explain this concept.

<table>
<thead>
<tr>
<th>Warm-blooded</th>
<th>Body temperature</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>mammals (including humans) and birds</td>
<td>almost constant</td>
<td>can be active all the time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cold-blooded</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>reptiles, fish and amphibians</td>
<td>not constant</td>
<td>active in summer and inactive in winter</td>
</tr>
</tbody>
</table>

Wind up: 5 min

• Summarize the lesson by asking the pupils what they have learnt in this lesson.

What is meant by classification?

Why do scientists classify things?

What is the difference between vertebrate and invertebrate animals?

Give some examples of each kind.

What do you understand by the terms warm-blooded and cold-blooded?

Lesson 2: 40 min

Introduction: 5 min

• Review classification by asking the pupils what they have learnt about it. What is meant by classification, and why do we classify things? Why do we classify certain objects as tools, others as food, and so on? Establish that classification—the arrangement of objects, ideas, or information into groups, or classes, makes things easy to find, identify, talk about, and study.
Main teaching: 30 min

DART Activity
DART is a teaching methodology. The term stands for Direct Activities Related to Text. A text is given to the pupils. They read it, and then perform an activity based on the information given in the text. This activity can be in the form of exercises, hands-on activity, completion of a table, or drawing, etc. It enables the teacher and the pupils to use the textbook very effectively in the class, and encourages focused reading skills.

You can conduct it as a group, pair or individual activity.

• Ask them to read the text on page 23 of the textbook. Put pupils into pairs and ask them to answer the following questions based on the data given on this page.
  1. How many classes of vertebrates are warm-blooded?
  2. Can you find out one basic difference between mammals and the rest of the animal groups? (mammals give birth to babies and do not lay eggs)
  3. Which class of animals has scales on their body?
  4. How many classes of animals lay eggs in water? What are those?
  5. Ducks can live both on land and in water. How is this different from an amphibian such as the frog? (Ducks have feathers and are warm-blooded. Amphibians have smooth, damp skin and are cold-blooded. Therefore, the duck is not considered amphibian, it is a bird.)
  6. How many classes of animals breathe through their lungs?
  7. Did you find out about any animal you thought was a fish, but is actually a mammal? (dolphin, whale)

• Give them some reading time and then discuss their responses, ensuring that every pupil takes part.

The following information can be used by the teacher as an explanation of this topic.

Fish
Fish are vertebrates that live underwater and breathe through gills. Most fish have scales that cover their bodies and help them move in the water. They lay eggs in the water, and unlike mammals who take care of their young, fish do not take care of their eggs.

Amphibian
Amphibians are vertebrates that live on land and in water. Many amphibians begin life in the water and have gills. Later they develop lungs and are able to move onto the land. They are cold-blooded. Frogs, salamanders, newts, and toads are all amphibians.

Reptile
Reptiles are cold-blooded vertebrates that have lungs, and their bodies are covered with scales. Reptiles, like birds, lay eggs. They do not look after their young. Snakes, lizards, crocodiles and turtles are all reptiles. Sea turtles are also reptiles that are able to live in water.

Bird
Birds are warm-blooded vertebrates that have lungs, two wings, two legs, and a beak. They are the only animals whose bodies are covered with feathers. Though most birds fly, there are a few who are flightless, e.g. penguin and kiwi. Birds lay eggs and take care of their young.
Mammals

Mammals are vertebrates that breathe with lungs and feed on milk from their mothers when they are young. Most mammals give birth to their young ones that need to be cared for by a parent. Humans are mammals that are looked after by their parents. Only a few mammals, such as the platypus and echidna, found only in Australia and New Guinea, lay eggs. Dolphins, porpoise and whales are mammals that live in the sea, but they breathe through lungs, not gills, so they need to come to the surface in order to breathe oxygen from the air.

• Collect some pictures of vertebrates from newspapers, magazines, or the Internet, or buy a sheet of animal stickers. There should be a variety of animals and all classes should be covered.
• Distribute these among the pupils so that each child has one picture. The pupils should stick the picture in their books.
• Ask them to write the names of any two examples of the same class of animal.

Wind up: 5 min

Exercise C, on page 25 will conclusively summarize the concepts taught.

EXERCISE (pages 24–25)

A 1. Classification means to put things into groups or classes, according to their characteristics. Scientists use classification to make the identification and study of things easier.

2. a) Cold-blooded animals take on the temperature of their surroundings. They are warm, when their environment is warm, and cold if their environment is cold. Fish, frogs and snakes are examples of cold-blooded animals.

b) Warm-blooded animals maintain a constant body temperature. This means that they do not depend upon the temperature of their environment to keep them warm.

3. Vertebrate animals have a backbone.
Invertebrate animals do not have a backbone.

4. Answers will vary.

5. i) Birds have feathers on their body and most are able to fly.
ii) They lay hard-shelled eggs.
iii) They have a beak.

6. a) A fish:
   • It is a vertebrate.
   • It is a cold-blooded animal.
   • Its body is covered with scales.
   • It lives and lays its eggs in water.
   • It breathes through gills.

b) A mammal:
   • It is a warm-blooded vertebrate.
   • Its body is covered with hair.
   • Most mammals give birth to babies.
• The young feed on milk produced by the mother.
• Mammals breathe through their lungs.

c) An amphibian:
• It is a cold-blooded vertebrate.
• It has moist, slippery skin.
• It can live both on land and in water.
• It lays eggs in the water.
• It breathes through its skin and lungs.

7. a) A crocodile has dry scales on its body, while a frog’s skin is moist and slippery.
   b) It lays eggs on land while the frog lays eggs in water.
   c) A frog breathes through its skin when it is in water and through its lungs when it is on
      land.

8. A bat is a mammal because it possesses all the characteristics of mammals. It is warm-blooded. It has hair on its body. It gives birth to live babies. It feeds its babies with its own milk.

B 1. b) salamander
2. d) They all lay eggs.
3. a) frog
4. c) skin
5. d) salamander
6. b) lungs
7. d) They are warm-blooded.
8. c) feathers
9. b) platypus
10. d) mosquito

C 1. cold-blooded  2. warm-blooded
3. invertebrates  4. vertebrates

**ACTIVITY (page 25)**

1. First brainstorm with the pupils and then compile a list of such animals on the board. The pupils can then select those that are used for transport, farming, or as a source of food.

2. Discuss with the pupils why it is important to keep zoo animals in an environment that closely resembles their natural habitats. Discuss why there have been numerous deaths reported of zoo animals.

3. Endangered species are at risk of extinction. This means that they will no longer exist upon this planet if care is not taken to preserve their species. Animals like the tiger, panda, houbara bustard, and the blind dolphin of the River Indus are just a few examples of animals that are endangered.
Unit 5
Animal reproduction

Teaching objectives:
- To explain reproduction in egg-laying animals
- To familiarize the pupils with the different parts of the egg and their functions

Key vocabulary:
yolk, embryo, hatch, incubate, albumen

Materials: hard boiled eggs, raw eggs, saucer, white card, yellow glazed paper, glue stick

Optional: Plan a field trip to a poultry farm. Arrange for the pupils to see eggs in incubators, eggs hatching (if possible), the chicks and hens.

Lesson 1: 40 min

Introduction: 5 min
- Ask the pupils to recall what they learned about reproduction of different groups of animals in the unit, Animal kingdom. Use page 23 of the textbook to do so. Fish, amphibian, reptile, bird and mammal are the five groups of vertebrate animals. How many of these reproduce by laying eggs?

Main teaching: 30 min

DART Activity:
- Ask the pupils to read only the paragraph headed “Animals reproduce” on page 26 of the textbook.
- Give them sufficient reading time, and then ask the following questions.
  1. What is an egg? (The egg is the beginning of the animals’ life cycle.)
  2. What is the growing animal inside the egg called? (embryo)
  3. Where does the embryo get its food from? (from the yolk)
  4. What is another name for the yolk? (albumen)
  5. Why do some animals sit on their eggs? (They do so to keep the eggs warm. Almost all birds create the required temperature by sitting on the eggs, incubating them, and transferring their body’s heat to the egg. However, make sure that the pupils are aware that only birds incubate their eggs. Reptiles, amphibians and fish do not do this.)
  6. Insects also lay eggs. They are invertebrates. So we now know that apart from mammals, all the other members of the animal kingdom reproduce by eggs. What is the outside of an insect’s egg made from? (It is made of a hard material called chitin.)
- Crack open a raw egg and point out the parts. The yellow yolk is the food the growing embryo eats. The white/clear albumen provides additional food and water, as well as a protective cushion for the growing embryo. The hard shell protects the embryo.
Ask the pupils to identify each part of the cracked egg, and draw and label their own diagram, (Ex C on page 28 of the textbook).

They can also cut out the parts of an egg from white card and yellow glazed paper, and stick it in their notebooks.

Wind up: 5 min

The crossword puzzle on page 29 of the textbook can be attempted to reinforce the main points of this topic.

**EXERCISE (page 28)**

**A**

1. The yellow part inside the egg is called the yolk. This is the food store for the embryo.
2. The clear, sticky liquid inside the egg is called the albumen or egg white. The albumen cushions the growing embryo against shocks, protects it from drying out and provides additional nutrients for its growth.
3. The egg shell of insects is made up of chitin.
4. No mammals, except the duck-billed platypus and echidnas, lay eggs. They give birth to live babies.
5. Fish do not take care of their eggs. Since their eggs can be damaged or eaten by other animals in the water, they lay many eggs.
6. The eggs of fish and frogs are very soft. They do not have a shell around them and they may dry out in the air, so they are protected by a jelly-like substance.
7. The embryo which is growing inside the egg gets its food from the albumen and yolk.

**B**

1. embryo
2. egg shell
3. yolk
4. albumen or egg white
5. chitin
6. fish, birds, reptiles and amphibians

**ACTIVITY (page 29)**

1. You can see the insides of the egg, which are being held inside by a membrane. Explain that the membrane is like a skin around the egg. Ask the pupils to think about why this membrane might be helpful to a chick growing inside an egg. Explain that it keeps out dirt, germs and other harmful substances, while still letting air in.
Teaching objectives:
• To develop an awareness of the different types of plant
• To classify plants into broad groups; simple plants and higher plants
• To discuss and compare each variety of simple and higher plant based on their special features

Key vocabulary: chlorophyll, photosynthesis, algae, fungi, moss, fern, conifer, flowering plant, angiosperm gymnosperm, vascular system

Materials: magnifying glass, a real fern plant, any flowering plant

Lesson 1: 40 min

Introduction: 5 min
• Use the flowering plant to introduce the topic.
  Ask the pupils in turn to examine closely the various parts of the plant with the magnifying glass. Without going into detail, draw their attention to the veins in the leaves, the thickness of the stem, the reproductive parts of the plant, etc.

Main teaching: 30 min
• Draw on the board the figure of a human being, an animal and a plant.
  Discuss: Just like humans and other animals, plants are also living things. All living things need food, air and water to grow and remain alive. Both animals and plants reproduce. But there are many differences between them. Can you identify how plants are different from animals? (They will come up with many differences, including differences in body parts, and the fact that most plants continue to grow throughout their lifetime. While for most animals, growth is, to an extent, limited. Plants are capable of making their own food with the help of sunlight, whereas animals are not.)
• Conclude the discussion by pointing out the three main differences between animals and plants:
  1. Plants possess chlorophyll and can produce their own food. Animals cannot produce their own food. Instead, they depend on other living things for their food.
  2. Plant cells have cell walls made up of cellulose whereas animal cells do not have cell walls.
  3. Most animals can move their whole body from one place to another, but plants cannot.

• Ask the pupils to quickly compile a list of the things in the classroom and inside their school bags. (table, chair, cupboard, window, door, pencil, eraser, book, etc).
  Write their responses on the board. Ask them to identify how many of these come from plants. *What else do we get from the plants?* Write their responses on the board.

• Together with the pupils read and discuss page 30 of the textbook and ask related questions. *In what way do plants provide shelter to animals?* (They provide shade from heat and sunlight.) *How are plants useful for the environment?* (They keep it clean by absorbing carbon dioxide and releasing oxygen in the air.)
  *What three things are used by the plants in order to photosynthesize?* (Water, sunlight, and oxygen) *What is the plant kingdom?* (All the plants on Earth make up the plant kingdom.)

• Display the fern and flowering plant. Ask the pupils to examine them both carefully. Explain that they should note any differences between the two.

**Wind up: 5 min**
• Conclude the lesson by explaining the differences between simple and higher plants.

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**Lesson 2: 80 min**

**Advanced preparation:**
Collect and display a variety of plants, both flowering and non-flowering.

**Circus Format Activity:**
• If possible, allot two consecutive periods for this activity, since the pupils will need to perform activities on the five activity stations consecutively. It is important to maintain continuity to ensure effective teaching and learning.
• Set up five pupil work stations in the classroom.
• Provide a real plant sample and a magnifying glass at each station. You could contact a nursery keeper to provide the different types of plants that are needed for this session. Or, if you are unable to provide real plant samples, use pictures or artificial plants. This should be the last option as science requires close and real observation of the natural world.
  
  **Station 1:** sample of algae in a jar
  **Station 2:** sample of mosses
  **Station 3:** sample of fern (try to get a mature fern that bears spores)
  **Station 4:** cone (Since conifers are huge trees, you cannot have a real one in the classroom so you could use an artificial one or provide a cone with the clear picture of a conifer)
  **Station 5:** a potted flowering plant
• Label the samples as A, B, C, D and E.
Introduction: 10 min
• Divide the class into five groups. In order to maintain classroom and time management, give the pupils clear instructions.
  Explain that there are five work stations in the classroom. You are going to perform all five activities, one by one.
  a) You will spend 10 minutes on each station. In these ten minutes you should examine the plant on that table and write about it and draw it.
  b) After 10 minutes I’ll clap/ ring the bell.
  c) You will stop working as soon as you hear the signal.
  d) Then, when I give the instruction, leave your station and without running, move to the next station.

Main teaching: 60 min
• Since this is the exploration stage, pupils should observe each plant sample and make notes at each station. It is not necessary to provide any reading material or other teacher input. Allow the pupils to examine, explore and investigate in their groups. They should write their observations and draw each plant in their notebook.
• Ask questions to assess their progress:
  How many parts does each plant have?
  How would you describe the shape, size and colour of the leaf?

Wind up: 10 min
• Ask the groups to share their observations.

Lesson 3: 40 min

Introduction: 5 min
• Ask the pupils to take out their observation notes and recall the activities of their previous lessons.

Main teaching: 30 min
• Ask them to turn to the unit, Plants in their textbook and read pages 31 to 33.
• Ask them the following questions.
  a) Which is the simplest plant of all?
  b) What is the root-like structure of mosses called?
  c) How does moss get water?
  d) Which structure anchors moss to the soil?
  e) Why does moss grow near water?
  f) What are the specialized leaves of ferns called?
  g) Explain the basic difference between angiosperm and gymnosperm.
• Explain why fungi are not classified as plants or animals. The information given on page 33 will be useful for this. Explain that previously, botanists used to classify the fungus as a plant, because its cells have cell walls, which is a characteristic of plants. But after more advanced
research, it was discovered that this cell wall is made of a different material from a plant cell wall; the plant’s cell wall is made up of cellulose, while the fungus’ cell wall is made up of chitin. Unlike plants, fungi cells do not contain chloroplasts, and thus cannot prepare their own food.

Wind up: 5min
• In order to recap the new concepts and scientific terms introduced in this unit, the pupils should attempt Exercise A, on page 34 of the textbook.

EXERCISE (pages 34–37)

3.  F unicellular 4. G multicellular
5.  D fronds 6. B angiosperms
7.  A chlorophyll

B 1. c moss 2. b fungi
3.  c spore 4. d spores
5.  b produce spores 6. a vascular
7.  a moss 8. a photosynthesis
9.  d chlorophyll 10. b wool

C 1. chlorophyll 2. photosynthesis
3. algae 4. botany
5. fronds 6. spores
7. rhizoids 8. flowering plants
9. conifers 10. gymnosperm

D 1. a) **Photosynthesis**
   The food making process of plants is known as photosynthesis. Plants make their food with the help of carbon dioxide, water, chlorophyll and sunlight.

   b) **Fronds**
   The leaves of ferns are known as fronds.

   c) **Cellulose**
   The wall of a plant cell is made of cellulose.

   d) **Vascular plants**
   Plants which have a well-developed system to transport water and food through the plant are known as vascular plants. They have proper roots, stems and leaves.

2. Two ways in which plants are different from animals are:
   a) Plants can produce their own food because they possess chlorophyll. Animals do not have chlorophyll so they cannot produce their food.
   b) The cells of plants have cell walls made of cellulose. Animal cells do not have cell walls.

3. a) Plants provide shelter and food to many other animals.
b) Plants release oxygen during photosynthesis which animals need for breathing.

c) Chemicals taken from plants are used to make medicines.

d) Plants provide materials such as wood to make houses, furniture and paper.

Note: Encourage the pupils to think about and come up with other uses of plants.

4.

<table>
<thead>
<tr>
<th>Class of plants</th>
<th>Which body parts are present?</th>
<th>How does water and food travel in this plant?</th>
<th>Method of reproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algae</td>
<td>simple body, no distinguishable parts</td>
<td>live in water to absorb water directly</td>
<td>by spores or fragmentation</td>
</tr>
<tr>
<td>Moss</td>
<td>does not have true roots, stem and leaf but has root like structures known as rhizoids</td>
<td>Water is absorbed by the whole body of the plant.</td>
<td>by spores</td>
</tr>
<tr>
<td>Ferns</td>
<td>have true roots, stem and leaves</td>
<td>through their roots and stem or through their vascular system</td>
<td>by spores</td>
</tr>
<tr>
<td>Conifers</td>
<td>have all parts except fruits and flowers</td>
<td>through their roots and stem or through their vascular system</td>
<td>by seeds</td>
</tr>
<tr>
<td>Flowering plants</td>
<td>have all parts including flowers and fruits</td>
<td>through their roots and stem or through their vascular system</td>
<td>by flowers</td>
</tr>
</tbody>
</table>

5. **Similarities**

Like mosses, ferns also lack fruits and flowers.

Fern also reproduces by spores.

**Difference:**

Unlike mosses ferns have a vascular system. They possess true roots, stem and leaves.

6. No, algae and mosses cannot grow in the desert because they both lack roots, stem and leaves, so they need to grow near water. However, the desert is a waterless environment.

7. Mosses have root-like structures called rhizoids which fix them in the soil.

8. Both of them are vascular, seed-bearing plants.

Conifers do not produce flowers and fruits.

The seeds of conifers are not enclosed in a fruit or flower, whereas the seeds of flowering plants are enclosed in their flowers or fruits.

9. a) To grow taller, a plant must have a well-developed vascular system.

   b) To live in the desert a plant must have long roots which can search for water for the plant, and thick leaves to prevent water loss through transpiration.

10. Fungi are a special case. They cannot be classified as a plant because they cannot produce their own food; secondly, their cell walls are not made of cellulose.

    They cannot be classified as animal because their cells have cell walls.
Unit 7

Pollination and fertilization

Teaching objectives:
• To study the structure and parts of a flower
• To explain the processes of pollination and fertilization

Key vocabulary: sepal, petal, stamen, pistil, anther, filament, pollen, nectar, stigma, style, ovary, ovule, pollinator, pollination, fertilization

Materials: a flower for each pupil, sticky tape, magnifying glasses, a large chart showing the structure of a flower and the process of pollination and fertilization

Lesson 1: 40 min

Introduction: 5 min
• Discuss the structure of a flower with the pupils. Begin by making a list of all the flower parts they know. Show them the large chart of the flower, and discuss the locations of the parts of the flower.
  The following parts should be included in this discussion: pistil, stigma, ovary, ovule, stamen, anther, petal, and sepal.

Main teaching: 30 min
• As the pupils become familiar with the different flower parts, give each of them a real flower to study. They should dissect their flower by carefully removing each part, starting from the outside and working inward, counting how many of each part are present in the flower.
• They should record their observations or stick and label these parts in their science notebooks.
• When the pupils have identified all the flower parts, discuss their functions. Ask the pupils to read page 40 of the textbook.

Note: Since this unit introduces many new and unfamiliar scientific terms, proceed slowly, so that the pupils are able to absorb and understand what they are learning.

Wind up: 5 min
• Assess their understanding by asking these questions.
  1. What are the four basics parts of the flower?
  2. What are the names of the male/ female parts of the flower?
  3. What is the job of the sepal/ petal/ stamen and pistil?

Lesson 2: 40 min

Introduction: 5 min
• To review the previous lesson, the pupils should be given a few minutes to read pages 39 and 40 of the textbook.
Main teaching: 30 min

- Ask the pupils how they think the pollen travels from the anther to the stigma.
- Write the terms pollination and fertilization on the board.
- Ask them to look for the meanings of these two terms in the textbook’s glossary.
- Listen to their responses first, and then explain that depending on the type of flower, pollination might require wind, water or animals, such as insects and birds. The information below will help you provide a clear and comprehensive explanation.

Without flowers, many plants would be unable to reproduce, and many insects would be unable to find enough protein or carbohydrates to survive.

What is pollination?

Pollination takes place when pollen from the anther lands on the stigma. The pollen then travels down to the ovary and here the ovules are fertilized, enabling the plant to reproduce. Most plants have flowers with both male and female parts present in them. Plants rely on insects, such as bees, to take the pollen from the anther to the stigma.

Who are the pollinators?

Bees, wasps, flies, butterflies, moths and beetles are some common insect pollinators. Birds, including the hummingbird, also help in pollination.

Note: The following website has some good photos showing bird pollination:
http://www.fs.fed.us/wildflowers/pollinators/birds.shtml

Pollination by insects

An insect can pollinate a flower accidentally when the pollen is rubbed off its body. Plants produce nectar, a sugary liquid, which many insects feed on inside the flowers. Pollen is a useful source of protein for some insects, such as bees. Insects are attracted to the flowers by their scent, colour and nectar. They carry pollen from flower to flower, while collecting nectar and pollen for themselves. After pollination, the plant produces a seed which mostly grows protected inside the ovary.

Pollination without insects

Not all flowers are pollinated by insects; plants may use the wind, birds or even bats as pollinators! In wind-pollinated plants, such as grasses, cereals and some trees, the flowers are very simple, with no bright colours or attractive smells, as they do not need to attract insects. These plants possess both male and female reproductive parts and produce a lot of pollen.

Importance of pollen

Pollen is not only important for pollination, it is also important to many insects. Why is that so? It is high in protein and vitamins and it is food for the pollinators. Plants and insects depend upon each other so that they cannot exist without one another. This is why:

a) Insects carry pollen from flower to flower as they sip nectar.
b) Insects depend on pollen and nectar for food.

So the insect gets to eat, and the flowering plant is able to reproduce.

What is the relationship between pollination and fertilization in flowering plants?

The reproductive parts of flowering plants are found within the flowers. Sometimes both male and female parts are located in the same flower, while in other species they are located on separate flowers. These
male and female parts must connect in order for fertilization to take place and new plants to be created. In many instances, this happens with the help of other living things, such as insects and birds, or with the help of wind and water.

**Anther to stigma**

*Pollen travels from the anther to the stigma by wind, insects or water. If the pollen lands on the stigma of the same species, fertilization begins.*

**Pollen tube**

*The pollen produces a pollen tube that grows down the style to the ovary, ovule and egg. The sperm cells then travel down the tube to the egg.*

**Fertilization**

*One of the sperm fertilizes the egg, and this becomes a seed. The other sperm cell joins with cells in the ovule and creates food for the fertilized egg and fruit.*

- Read the complete lesson with the class. Ask them the following questions:
  
  **What is pollination?**
  
  **How is cross-pollination different from self-pollination?**
  
  **How are the flowers that are pollinated by wind different from the flowers pollinated by insects?**
  
  **Explain how plants and insects are dependent on pollen and flowers for survival.**

**Wind up: 5 min**

- Evaluate the pupils’ understanding by asking them to do Exercise A on page 44 of the textbook.

**EXERCISE (pages 44–47)**

| A | 1. E | 2. F |
| 3. A | 4. C |
| 5. B | 6. D |
| B | 1. pollination | 2. sepals |
| 3. stigma | 4. pollen tube |
| 5. calyx | 6. insects |
| 7. anther | 8. wind |
| 9. nectar | 10. fertilization |

**C**

1. **Cross-pollination**

   If the pollen grains of a flower fall onto the stigma of another flower, it is called cross-pollination.

   **b) Self-pollination**

   If the pollen of a flower falls onto the stigma of the same flower, it is called self-pollination.
2. a) When the male cells combine with the female cells to produce a new organism, it is called fertilization.
   b) The process of fertilization is explained, step by step, on page 43 of the textbook.

3. Grasses, cereals and some trees, which do not have brightly-coloured petals, are pollinated by the wind.

4. The flower is the reproductive organ of a plant. Flowers help in the reproduction of plants.

5. Page 40 can be used as reference by the pupils to construct and complete this table. Answers 6, 7 and 8: Work will vary according to the pupils’ imagination and creativity.

D

```
S  T  Y  L  E
P
P
A
C  A  L  Y  X
L  T
N  S  T  I  G  M  A
P  E  T  A  L
H  F  A  E
F  E  R  T  I  L  I  Z  A  T  I  O  N
R  O  I
W  O
E  N
N  E  C  T  A  R
```

**ACTIVITY (page 47)**

All the activities are hands-on and actively engage children in the learning process, rather than just ‘memorizing’ facts. Hands-on activities encourage questioning, reasoning and promoting ‘cause and effect’ thinking. Encourage and support the pupils in all these activities.

_I hear and I forget_
_I see and I remember_
_I do and I understand_

_Chinese proverb_
Part 3 | Materials and matter

LESSON PLANS

Unit 8
Mixture and solution

Teaching objectives:
• To demonstrate that mixtures can be obtained by mixing two or more substances together
• To explain that these substances can be solid, liquid or gas
• To demonstrate that some substances, such as sugar and salt, produce clear solutions when dissolved in water
• To explain the differences between solution, solvent and solute
• To demonstrate that the solubility of solutes is dependent on temperature

Key vocabulary:
mixture, solvent, solute, solution, homogenous, soluble, insoluble

Materials needed:
transparent glasses or beakers, spoons, warm water, tap water, salt, sugar, coffee grains, jelly crystals, flour, chalk powder

Lesson 1:

Introduction: 5 min
• Before the pupils begin to read the unit, discuss: While studying the unit on plants, you found out that the study of plants is known as botany. In this unit we will study another branch of science, chemistry. Chemistry is the study of matter, its properties and the interactions between different types of matter. Chemistry helps you to understand the world around you. Cooking is chemistry. Everything you can touch or taste or smell is made up of chemicals.
• Ask the pupils to predict what will happen if they mix:
a) sand in water  b) sugar in water
Write their predictions on the board.
• Science develops the imagination. When pupils draw what they think about a concept, it becomes clearer in their minds. Ask them to draw in their science notebooks how each of the substances would look after being mixed with water.

Main teaching: 30 min

Group activity:
• Give the pupils the materials to perform the experiment and see if their predictions were correct. Each group should have a set of materials consisting of two beakers or glasses, each half filled with water, sugar grains, sand and a spoon. Ask them to prepare the two types of mixtures.
• After they have completed this activity, ask them to share their observations.
• Explain that when you mix things together physically you make a mixture. In this activity you prepared mixtures of sand and water, and sugar and water. When you mixed sand and water, you observed that the sand remained separate from the water and it settled at the bottom of the beaker. But when you mixed sugar into water, you observed that the sugar could no longer be seen in the water. When sugar and water were mixed together, the sugar seemed to disappear. Where has the sugar gone? It has not gone anywhere. It is still present in the water. You can check its presence by tasting the sweet liquid. It has, however, become invisible, because it has completely dissolved in the water. This clear, homogeneous mixture is known as a solution. Homogenous means that the parts of the solute are evenly distributed throughout the liquid. A homogeneous mixture has the same uniform appearance and composition throughout. Many homogeneous mixtures are commonly referred to as solutions. So which one is a solution—sand+water or sugar+water? A sugar solution is homogeneous, since only a transparent, colourless liquid can be seen.
• Discuss some common mixtures found in the home, e.g. tomato ketchup, shampoo, mayonnaise, etc. Can the pupils come up with some examples of their own?
• Show them homogenous and heterogeneous particles’ diagrams on the board. In the diagram of a homogenous solution, show two types of particles arranged evenly throughout the container. The diagram of a heterogeneous mixture should show the particles unevenly distributed throughout the liquid.
• Explain that there are two parts to a solution, a solute and a solvent. In this case, the sugar is the solute and water is the solvent.
• Now read pages 48 and 49 of the textbook with the pupils.

Wind up: 5 min
• Ask the pupils to share their understanding. Ask them the following questions.
  What is a solution? What is a solute and a solvent? What does homogenous mean?

Lesson 2:

Introduction: 5 min
• Ask the pupils to recall what they did in the previous lesson.
  Which substance dissolved completely in water: sand or sugar?
Main teaching: 30 min

- Introduce the terms **soluble** and **insoluble**.
- Ask the pupils to suggest some examples of materials which are soluble in water, and some materials which are insoluble in water.
- Ask them to read page 49 of the textbook that explains that gases too can dissolve in liquids. Ask them to share what they have read and understood.
- Ask the pupils to read the instructions for Activity 1 on page 52 of the textbook. In this lesson it will be done in two steps, first using cold water and then using warm water.
- Ask them to predict what will happen when these materials are mixed with cold water. Write their prediction on the board.
- Give the materials to the groups of pupils and ask them to perform the experiment. What do they observe? Remind them to use the terms **soluble** and **insoluble** in their explanations.
- Ask the pupils to predict the results when these materials are mixed in warm water. *Will you get the same result if you mix these substances in warm water?* Write their predictions on the board.
- Give them warm water and more glasses or beakers and ask them to perform the experiment again. What do they observe?
  Ask: *Do substances dissolve better in warm water or in cold water?* Explain that the solubility of solutes is dependent on temperature. *When we heat a substance, its particles start moving faster. When we cool it, the particles move more slowly.* You can use the illustration on page 65, of the unit **Heat** for a visual understanding of particles of matter.
- The pupils can fill in the table shown on page 52 of the textbook.
- Make a bullet point summary of the key concepts that were taught in this unit:
  - **A mixture contains at least two different substances (which can be solids, liquids or gases).**
  - **When a solid dissolves in a liquid, it makes a solution.**
  - **A solution is made up of a solute and a solvent.**
  - **The solid that dissolves is called the solute.**
  - **The liquid it dissolves in is called the solvent.**
  - **If a substance does not dissolve in another substance, it is said to be insoluble.** Sand is insoluble, therefore, when sand and water are mixed, they do not form a solution.
  - **Substances such as sugar and salt, when dissolved in water, produce clear solutions: they are said to be soluble in water.**

Wind up: 5 min

- The pupils can attempt any of the exercises given on pages 50 and 51 of the textbook.

EXERCISE (pages 50–51)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>clear</td>
<td>b</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>solvent</td>
<td>a</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>oxygen</td>
<td>a</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>soluble</td>
<td>c</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>insoluble</td>
<td>a</td>
</tr>
</tbody>
</table>
D 1. a) A solute is a substance which can be dissolved in a solvent to form a solution. Examples will vary.
   b) A solvent is a substance in which a solute can be dissolved to form a solution. Examples will vary.
   c) If a substance can completely dissolve in water, it is said to be soluble. Examples will vary.
   d) If a substance does not dissolve in water, it is said to be insoluble. Examples will vary.
2. A solution is a clear, transparent, homogenous, mixture.
3. Answers will vary.
4. No, solutes can also be in gas or liquid form.
   An example of a liquid solute is lemonade. Lemon juice, which is liquid, is mixed with water to make lemonade.
   An example of a gas solute is the presence of oxygen in water that enables sea animals to breathe and survive in water.
5. Adding carbon dioxide to fizzy drinks makes them taste better and creates bubbles and fizz in the drink.

E

ACTIVITY (page 52–53)

1. The purpose of this activity is firstly to show that not all substances dissolve to make solutions, and secondly, to demonstrate that the solubility of solutes is dependent on the temperature of the solvent, which in most cases is water. Details of the activity are given in the lesson plan 2.
2. Activity 2 allows the pupils to explore reversible and irreversible changes in states of matter. This activity is a forerunner of this topic that is included in Book 5. Simply explain that mixing materials can cause them to change, sometimes temporarily and at other times permanently. The use of the terms reversible and irreversible can be avoided at this stage.
Unit 9

Separating mixtures

Teaching objectives:
• To introduce the various methods of separating mixtures
• To explain that different methods are used to separate different mixtures
• To apply the methods of separation

Key vocabulary:
coarse, fine, filter paper, filtration, decantation, sedimentation, residue, filtrate, evaporation,

Materials: sand, salt, water, beakers or clear glasses, filter paper, a piece of fine cloth, a mixture of salt, sand, poppy seeds and iron filings, petri dish (or other container such as a paper cup for the mixture), Bunsen burner, wire gauze, funnel, magnet, a spoon, evaporating dish, a spatula, goggles, apron

Lesson 1:

Introduction: 5 min
• Ask the pupils to recall the definition of mixture.
• Explain that another property of a mixture is that you can separate the parts using a physical method. For example, if you prepare a fruit salad, which is a mixture, you can easily separate the pieces of the different fruits in it from one another.

Have you ever made a cup of tea using loose tea leaves instead of a tea bag? If you have you may have ended up with a mouth full of tea leaves! To separate the tea (which is a solution) from the leaves, a strainer is used. The tea goes through the holes in the strainer, but the tea leaves are trapped. Why? Because they are bigger than the holes.

Scientists often want to separate mixtures. This means that they want to split the mixture into the things that it is made up of. They use different methods to separate different types of mixture.

Main teaching: 30 min
An inquiry-based approach will be used in this lesson, so the teacher should avoid giving explanations, particularly in this activity. Allow the pupils to learn independently. The teacher should only organize the learning situations.
• Divide the class into small groups of pupils.
• Ask them to recall what mixtures they prepared in the previous unit, Mixture and solution.
• Do not hand over the materials to them at this stage, because they may start playing with them. Show the pupils the mixtures of sand and water, and salt and water. Ask them to identify the substances combined to make both the mixtures.

How can we separate the parts of these two mixtures?
Keep the mixtures on the teacher’s desk and let them discuss this question with their group members.
• Now ask them to plan the experiment they will perform to separate these things. They should write their method, including the list of materials they will need to separate the parts of these mixtures, and the steps they will perform. Draw a table like the one below for the pupils to copy.

Separation of a mixture
Method of separation: ________________________________
Materials needed: ________________________________

Steps of separation
a) Ask each group in turn to share their ideas and discuss the validity of the method.
b) Read the lesson from the textbook and see if their methods match any of those given in it.
c) Now ask them to identify the correct method of separating the mixtures of sand and water, and salt and water.

Wind up: 5 min
• Ask a few questions to evaluate their understanding:
  When is filtration used?
  When is the magnetic method used?
  What types of mixtures can be separated using the evaporation method?

Lesson 2: (80 min)

Introduction: 5 min
• Arrange two consecutive periods for this lesson during which the pupils will apply all the methods of separation they have read about in their textbook.
• Recall the points of the previous lesson. Mixtures can be separated using techniques such as filtration, evaporation, sedimentation, decantation and magnetism. The method used depends upon the type of mixture.
• Divide the pupils into small groups. Show them a mixture of salt, sand, and iron filings. Ask them to identify the parts of the mixture. Write their responses on the board.

Main teaching: 70 min
• Discuss: So far you have learned about mixtures made up of only two substances, but this mixture, consisting of salt, sand, and iron filings, is a combination of three different substances. Each part is different from the other. You have to decide how you can separate the different parts of this mixture. Use your textbook to help you.
• Ask the pupils to discuss within their groups how the different components of this mixture can be separated. Afterwards, invite them to share their findings with the rest of the class. If you see that that they have planned a workable experiment, then give them the necessary materials to perform their own planned experiment.

Different methods of separation
• Explain: Salt, sand, and iron filings all are different from each other, so they cannot be separated by a single method.
a) Sand can be separated from a mixture of sand and water using filtration. This is because sand does not dissolve in water.

b) The method of evaporation is good for separating salt (which is a soluble solid), from water. Remember though, that with this method, you are able to retain only the solid part of the mixture i.e. salt. The water turns into vapour and vanishes.

c) Iron filings can be separated by moving a magnet over the mixture.

• First iron filings will be separated from this mixture, using a magnet. Then the sand and salt will be mixed in water. The mixture of sand and water will be separated using the filtration method. Lastly, the salt will be separated using the evaporation method.

• Now distribute the materials required to perform the experiment. Each group should have the following: mixture sample (a spoonful for each group), petri dish (or other container such as a paper cup for their mixture), Bunsen burner, ring stand, striker, wire gauze, water, funnel, filter paper, plastic wrap, magnet, spoon, evaporating dish, spatula, goggles, apron.

Note: Since the pupils are young, it is advisable to demonstrate the three methods yourself instead of asking them to perform this experiment. Safety rules such as using goggles, ensuring that the petri dish is not cracked, use of apron, potential dangers posed by the burner, etc. have to be enforced.

Demonstration

• Arrange all the materials on a surface that is high enough so that all the actions are easily visible.

• Identify the various materials.

• Brief the pupils about the safety precautions.

• Perform the experiment.

  a) To begin with, separate the iron filings using the magnet.

  b) Stir the sand/salt mixture in water to dissolve the salt. Filter off the sand and wash it with water to remove any salt residue.

  c) Heat the salt solution (filtrate) carefully in a dish to evaporate the water. Eventually, the salt residue will crystallize.

Wind up: 5 min

• Exercise A, on page 57 of the textbook is a quick way of recapping the basic concepts taught in this unit.

EXERCISE (pages 57–58)

B  1. residue, filtrate  2. evaporation  3. sedimentation  4. soluble  5. filtration
D  1. A mixture of an insoluble solid and a liquid can be separated using the filtration method.
   2. A mixture of salt and water can be separated using the evaporation method.
3. First the iron filings will be separated from this mixture, using a magnet. Then the sand and salt will be mixed in water to dissolve the salt. The sand will be separated using the filtration method and the salt will be separated using the evaporation method.

4. In the absence of a strainer or a piece of cloth, the decantation method will be used to separate the tea leaves from the tea.

5. We use the magnetic method of separation to separate the metals from rubbish. In our daily life we see the use of this method in scrap yards.

6. The sand/salt mixture is stirred into water to dissolve the salt. The sand is filtered off and washed with water to remove any salt residue. The salt solution (filtrate) is carefully heated in a dish to evaporate the water. Eventually, the salt residue will crystallize.

**ACTIVITY (page 58)**

1. The aim is to obtain a solution suitable for crystallization by evaporating a lot of the water.
Unit 10
The Earth in space

Teaching objectives:
• To explain, with the help of a globe, that the Earth’s rotation on its axis causes day and night
• To demonstrate that the combined effect of the Earth’s tilt and its orbital motion results in the seasons
• To clarify misconceptions regarding the causes of the changing seasons on the Earth

Key vocabulary: rotation, spin, revolution, season, hemisphere

Materials: globe, torch

Lesson 1: 40 min

Introduction: 5 min
• Begin teaching this topic by providing the pupils with some background information on the topic. Ask them to think about and discuss the following question:

How did the Universe come into being?

Listen to their feedback and then ask them if they have ever seen fireworks exploding in the air. What happens in a firework explosion? There is a big bang, flashes of light, smoke, and the smell of gases. The Universe too began with a Big Bang. This probably happened some four billion years ago. When the Big Bang happened, it created huge amounts of energy. This gigantic explosion caused all matter to compress into a hot, dense mass just a few millimeters across. Immediately after the Big Bang, the Universe expanded, producing huge star groups. These gradually formed the stars, moons and planets.

Main teaching: 30 min
• Remind the pupils about the position of the Earth in the solar system. Earth (or the Earth) is the third planet from the Sun. It is the densest planet and the fifth-largest of the eight planets in the Solar System. The Earth is constantly in motion; it rotates on its axis and also revolves around the Sun.
• Ask them to find out the meanings of these terms: rotation, revolution and axis, from the
dictionary or from the glossary.

• Give them the examples of a fan or a spinning top to explain to them what it means by spin
or rotation. Now use the globe to explain that the Earth moves in two ways; it spins on its axis,
and it revolves around the Sun.

• Select some pupils to perform a role play to show these two movements of the Earth. One
pupil should play the role of the Sun and the other that of the Earth. When they understand the
two distinct movements of the Earth, it is easier for them to understand the reasons for day and
night and the occurrence of the seasons.

• Explain to them that they are going to find out why we have day and night.
Ask a pupil to stand near a lamp or torch, facing the light. Ask the pupil to pretend that the
lamp is the Sun and his/her body is the Earth. Ask: Can you see the Sun now? Is it day or night?

Spin your body to the right so that you cannot see the Sun anymore. Is it day or night now?
Now spin slowly so that you can just begin to see the Sun appearing on your right side. It was just
night time and now it is starting to be light. What time of day is it? (sunrise). Have the pupil turn a
little more. Ask: What time of day is it? (noon, afternoon) What meal do you usually eat when the
Sun is at its brightest in the middle of the day? (lunch)

Now spin slowly again to the right until you can barely see the Sun on your left side. Ask: It is
beginning to get dark again. What time of day is it now? (evening, sunset, or dusk) What activities
do you do at this time of day?
Discuss how it takes twenty-four hours for the Earth to complete its rotation. This equals one
day and one night. We know we can measure days on a calendar. As the Earth moves on its axis, the
Sun appears and disappears, making day and night, while you carry out all those activities we just
talked about. Let us again consider the rotation of the Earth causing day and night, using a globe.

• Draw a small human figure on a sheet of paper and cut it out. Tape the cut-out to your country
on the globe. Place the globe six feet away from the torch or lamp. Switch off the light. Shine
the torch or lamp on the cut-out figure.

Ask the pupils to watch the figure on the globe. Slowly rotate the globe to the right until a full
circle has been made. This represents one day or twenty-four hours. Repeat the action several
times.

Optional: Observing the shadows made by the Sun during the course of a day provides information
about time: midday, sunrise, and sunset. This activity can be done by making a sundial in the school
grounds.

Wind up: 5 min

• Ask the following questions to assess the pupils’ understanding:

What is the meaning of axis?

What is meant by the rotation and revolution of the Earth?

What causes day and night?
Lesson 2: 40 min

Introduction: 5 min
- Collect information from the newspaper and compile a chart of the sunset and sunrise times. These timings collected over a period e.g. week in summer and in winter would suffice.
- Divide the class into groups. Give a copy of the chart to each group.

Ask the following questions.

a) What did you notice about the sunset and sunrise timings? Are these the same throughout the year? (As the Earth moves around the Sun, it tilts. This tilt affects the amount of sunlight that falls on each part of the Earth’s surface. The surface that is pointing towards the Sun gets light for a longer time each day, while the surface that is pointing away from the Sun gets light for a shorter time each day.)

b) When does the Earth experience the longest/shortest days of the year? (A solstice happens twice a year every year, when the Equator is pointing directly towards the Sun. In the northern hemisphere, the shortest day of the year is 21st December, and the longest day of the year is 21st June.)

c) Can anyone guess the reason for the changing times of sunset and sunrise? (Due to the Earth’s tilt, the places that face the Sun have longer days and shorter nights. So it seems that the Sun rises earlier in the morning, and sets later in the evening. On the other hand, the areas pointing away from the Sun have shorter days and longer nights. So here the Sun seems to rise later, and set earlier in the evening.)

Note: Although we talk about the Sun rising, moving across the sky and setting, it is the Earth turning as it travels round the Sun which causes this effect. Make it clear that the Sun does not travel across the sky, it is the Earth that turns as it orbits the Sun.

Main teaching: 30 min
- Show the class some illustrations of different seasons, easily available from old calendars or newspapers. Paste these on the board.

Engage them in a discussion by asking them to describe the scenes.

Can you guess the season in the picture? Why do we have seasons?

- Why is it hotter in summer and colder in winter? (A common misconception is that the Earth is closer to the Sun during the summer, causing summer’s warmer temperatures).

The Earth’s tilt and the seasons
- Ask the pupils to recall what they have learned about the two movements of the Earth, revolution and rotation. What is an axis? Remind them that as the Earth moves around the Sun, it tilts. The tilt of the Earth causes the four seasons to happen. The Earth’s tilt means that while one half of the Earth is facing directly towards the Sun, it experiences summer, and the other half, that is facing away from the Sun, experiences winter.

- Reiterate the following:
  1. The Earth’s movement or orbit around the Sun takes one year. This movement is called revolution.
2. *The axis on which the Earth spins or rotates is tilted.* (Show them by drawing what is meant by tilted.)

These two factors cause different seasons on the Earth. Let us explore it with the help of this activity.

**Demonstrating the tilt of the Earth**

**Materials:** globe, sign to indicate north, masking tape

- One pupil can act the part of the Sun and another can hold the globe and represent the Earth. Place the pupil representing the Sun in the middle of the room, with the pupil representing the Earth standing about six feet away.
- Mark one corner of the room north. If we could extend this corner much higher, the North Star would be at its top.
- Tilt the globe so that the North Pole tilts towards the ceiling at the corner marked north. The pupil holding the globe must be careful to preserve this alignment.
- Mark an egg-shaped orbit around the Sun for the Earth to move along, and walk the ‘Earth’ around the ‘Sun’, making sure to keep the North Pole properly aligned. *When the North Pole points away from the Sun, it is winter in the northern hemisphere. When it points towards the Sun, it is summer in the northern hemisphere.*
- Walk the ‘Earth’ around the ‘Sun’ again, and watch the changes in the southern hemisphere. *When it is summer in the southern hemisphere, what season is it in the northern hemisphere?*

**Wind up: 5 min**

Explain that in this demonstration they observed that the Earth's orbit is slightly egg-shaped. The mathematical name of this shape is **ellipse**. The Sun is not in the centre of the ellipse, but is slightly to one side. (Draw a diagram on the board to show this.)

When the Earth revolves around the Sun, it makes an **elliptical** orbit around the Sun. It is not the distance but the tilt of Earth's axis that results in the different seasons. The sunlight hits different latitudes at different angles, at different times of the year. This tilt causes the Sun to appear higher in the sky during the summer than during the winter. The higher Sun causes more hours of daylight and more intense, direct sunlight, or hotter conditions on the surface of the Earth.

**EXERCISE (pages 62–63)**


B 1. axis 2. rotation 3. revolution 4. one 5. 365
6. orbit 7. axis 8. summer 9. winter 10. day

C 1. b 2. a 3. c 4. b 5. a 6. c

D 1. The summer is hotter than winter because during the summer, the Earth is tilted towards the Sun.
2. There are four seasons: spring, summer, autumn and winter.

**ACTIVITY (page 64)**

1 and 2. These activities can be done as project work, in groups individually. Young pupils will enjoy collecting pictures and data of different seasons.
Unit 11

Heat

Teaching objectives:
- To explain the difference between heat and temperature
- To investigate the effects of heating and cooling on particles of matter
- To explain the working of a thermometer and to show how to read the degrees marked on it
- To demonstrate experimentally that heat travels due to the kinetic energy of particles

Key vocabulary: heat, temperature, thermometer, Celsius, Fahrenheit

Material: empty bottle, a balloon, hot, warm and cold water, water trough, shoe laces or string, red crayon, three buckets, thermometer, sheet of thick card

Lesson 1: 40 mins

Introduction: 5 min
- To understand the concept of heat and temperature, pupils need to understand the concept of energy and what matter is composed of. You should therefore spend some time checking and revising their existing knowledge of these two concepts. It is better not to open the textbook and read the lesson at this point, in order to allow the pupils to discover facts independently.
- Draw a concept map containing pictures and different words related to the topic, e.g.:
  heat energy temperature thermometer ice steam freezer hot cold water Sun
  Ask the pupils to use lines to link words and pictures in a way that makes sense to them. The pupils should then write on the lines to show how the words and/or pictures they have linked are related. For example:
  The Sun’s Energy Heats Water.
Main teaching: 30 min

- Everything which has mass and occupies space is called matter. Matter is made up of particles so tiny that they are invisible to the naked eye. These are called atoms. These particles keep moving all the time. However, they do not all move at the same speed all the time.

  *Can you guess when they start moving faster?*

  *How can we know that they are moving faster?*

Demonstrating the movement of particles of matter

- Display an empty bottle, a balloon and a container full of hot water. Fasten a deflated balloon over the neck of an empty bottle. Ask the pupils to predict what will happen if the bottle is put in the container of hot water. Write their predictions on the board.

- Now put the bottle into the container of hot water and ask them to observe and describe what is happening. *Why do you think the balloon inflated?* (The balloon will start inflating due to the expansion of air particles in the bottle, as it was receiving heat from the container.)

- Discuss: *You have just learned that particles in matter keep moving. You observed in this experiment that when the bottle was put into hot water, the balloon became inflated. This is because there was air inside the bottle. Air is matter and it is made up of particles. The heat from the hot water travelled to the bottle. Due to this, the air particles inside the bottle started moving faster and away from each other, since they had more kinetic energy. When they started moving away from each other they needed more space and moved upward. As the bottle's mouth was covered with the balloon, the particles got inside the balloon and inflated it. This experiment proves that particles of matter move faster when they are heated.*

  Can the pupils tell you when they move more slowly? *When they are cooled or when they have less kinetic energy.*

- Explain the following:

  **Kinetic theory of matter**
  
  *The kinetic theory of matter states that matter consists of atoms or molecules in random motion. Those moving particles can transfer their kinetic energy to other nearby particles. The total kinetic energy of all the particles in an object makes up the thermal energy of that object.*

  **Temperature and heat**
  
  *Temperature and heat are related to thermal energy.*

  - *Temperature is defined as the average kinetic energy of all the atoms or molecules in an object.*
  - *Heat is defined as the flow of thermal energy from an object of one temperature, to an object of another temperature. You feel the flow of heat when warm air from a furnace reaches you.*

Wind up: 5 min

- Review the lesson by asking:

  *When do particles of matter have more kinetic energy?* (When they are heated.)

  *When do they have less kinetic energy?* (When they are cooled.)

- Encourage them to use the term *kinetic energy* when explaining this concept.

- Discuss with the class the following situations that are given on page 66 of the textbook. Write these on the board.

  a) A glass of water is kept out in the Sun.
b) A glass of water is kept in the freezer.

Which of these has more kinetic energy? How can you know this? (A glass of water kept under the Sun has more kinetic energy because it is getting heat from the Sun and its particles are moving faster. Faster movement means more kinetic energy.)

• The teacher should now read and discuss with the pupils the lesson from the textbook.

Lesson 2: 40 min

Introduction: 5 min

• Ask the pupils to recall what they have learned about the kinetic energy of particles.

Main teaching: 30 min

• Sometimes there is confusion between heat and temperature. Heat is a form of energy while temperature is a measure of how hot or cool something is. Ask the pupils to find the meanings of the terms temperature and heat from the dictionary.

• Read page 66 of the textbook and explain the difference between heat and temperature.

Activity

• Conduct the following activity. You will need: thermometers, three pails or buckets; one filled with cold water, one with warm water, and one with hot water. (Ensure that the hot water is not so hot that it scalds your hands.)

What to do

• Call two pupils and ask one to put his hand in the cold water and the other to put his/her hand in the hot water. Both of them should then simultaneously put their hands into the lukewarm water and report how it feels. One will claim it is warm, the other that it is cold.

• Invite others to solve this problem. Who should we believe?

Tell them that we can solve this problem by using a scientific measuring instrument called a thermometer. Just as a weighing scale is used to measure weight, a ruler is used to measure length, and a watch is used to tell the time, the thermometer is a measuring instrument used to measure temperature.

Ask a few pupils to estimate the temperature of the hot water, the warm water and the cold water by dipping their fingers in the buckets of water.

• Write their answers on the board.

• Now use the thermometer to measure the temperature of the water in each bucket in turns. Check whose estimation was the closest.

• Show the pupils a clinical thermometer. Ask them to read page 67 of the textbook that describes the working of the thermometer.

• Ask them to share what they have understood. What is a thermometer? What materials is it made from? How does it work? How do we measure temperature?

Measuring temperature with the thermometer

• Explain to the pupils, while holding up a large thermometer, that the scale on a thermometer is marked in 10s. Ask the pupils to point out certain numbers such as 40 or 60.
• Point out the smaller marks in between each number. Explain that the largest mark that is in between each number is half way between the number below it, and the number above it. For example, the largest mark between 20 and 30 is 25.

• Explain to them that each small mark goes up by one. There are eight small marks between each two numbers (1-4 and 6-9) and one larger mark which we already know as 5, the middle mark. Point out specific numbers such as 42, which is 2 marks above 40, or 27 which is 7 marks above 20.

• Discuss the red line in the middle of the thermometer. Explain that it is either mercury or alcohol that interacts with the temperature outside and makes the red line move up or down. The number that the red line stops at, indicates the current temperature measured in degrees. Explain that when the red line goes up into higher numbers, it is getting hotter, and when it falls to lower numbers, it is getting colder.

• Note what temperature the thermometer reads inside the room, then place the thermometer outside and let it sit for a couple of hours. Draw attention towards the difference between the inside temperature and the outside temperature.

• Ask the pupils to read the temperature shown on the diagram of a thermometer on page 67 of the textbook. Draw three thermometers on the board showing different readings. Label them as A, B and C. Ask the pupils to read them and tell you what temperature these thermometers are showing.

Optional: The teacher can make a model of a thermometer for display in the class.

How to make a thermometer

1. Cut out a cylinder shape from white paper that is 25 cm long and 8 cm wide. Make a slit at the base of the cylinder that is approximately 5 cm long.

2. Cut a slip of red paper that is approximately 20 cm long and 2 cm wide. This red paper will represent heat. Do the same with a blue slip of paper to represent cold.

3. Have the pupils mark degrees on their thermometer. Mark Fahrenheit on the left-hand side, and Celsius on the right-hand side. Make sure the numbers are 5 cm apart.

4. For Fahrenheit, start at the bottom with -40, then moving upward, mark -20, 0, 20, 40, 60, 80, and 100.

5. For Celsius, start at the bottom with -40, then moving upward, -30, -20, -10, 0, 10, 20, 30, and 40.

6. Each morning as a class, test the temperature with an actual thermometer. Have pupils match the temperature on their own thermometers by inserting the red or blue slip of paper—depending on the temperature—through the slit and moving it to the correct number. You might want to compare the temperature with the day(s) before and make a graph for the whole week or month.

7. You can also experiment with the temperature of other properties, such as a cup of tea or iced water. Have the pupils record their findings and discuss.

Wind up: 5 min

• The pupils should attempt the related photocopiable worksheet that will reinforce their learning.
**EXERCISE (pages 68–69)**


C 1. b 2. a 3. a 4. a 5. a

D 1. a) The flow of energy from warmer to cooler objects is known as heat.
   b) The average kinetic energy of particles of a substance is known as temperature.
   c) The total kinetic energy of particles of a substance is known as thermal energy.
   d) Kinetic energy is the energy of motion.

2. Celsius and Fahrenheit are two scales which are commonly used to measure temperature.

3. The thermometer is used to measure temperature.

4. a) When the air around the thermometer gets warmer, the liquid inside the thermometer expands and moves upward.
   b) When the air around the thermometer gets colder, the liquid inside the thermometer contracts and moves downward.

**ACTIVITY (pages 70–71)**

1. This all depends on the thickness and length of the wire. Get the pupils to time how long it takes, and to use wires of different lengths and thicknesses.

2. They will drop off one by one, as the heat travels down the wire.

3. The filament in the bulb will get white hot and give off more heat and light; the water will evaporate; the match will perhaps burst into flame; the bug will explode due to the expansion of the liquid (blood in the bug).

4. Set up this experiment and ask the pupils if it is safe or secure. Can they suggest modifications to make it better? Will the base of the bottle fit across the gap between the pieces of wood? Will the wood burn? In what other way can they suspend the bottle over the candle flame? Can this experiment be used to tell the temperature each day? How can it be modified to do so? There are some of the questions of science which the children should start asking! In the experiment, the water will heat up (so will the air) and force its ways up the straw.

5. The candle will heat the wire. Experiment#1 has already shown that heat travels along the wire. If one side of the wire is fixed, it cannot move. When the wire gets hot, it will expand, not contract. The expanding wire will roll the needle away from it (clockwise), and this can be seen easily by the rotation of the stick. What would happen to the stick if the wire began to contract? If the stick is not attached to the spoke, it will be difficult to see whether the spoke has rolled at all.

6. In the first experiment, the hot water in the pan is making the air in the bottle hot too. Warm air expands. The balloon will inflate slightly. In the second experiment, be careful that the spiral made of card (or any other material) does not burn. This shows that hot air rises. The spiral will rotate. Alternatively, suspend the spiral from a string and fix it above any hot surface (a radiator).
Unit 12

Circuits and switches

Teaching objectives:
• To examine the working of complete and incomplete circuits
• To explain the function of a switch
• To compare series and parallel circuits
• To make complete and incomplete circuits

Key vocabulary: circuit, current, switch, insulator, conductor, series and parallel circuits open and closed circuit

Materials: electric wires, mini bulbs, batteries, alligator clips, aluminium foil, paper clips, tooth picks, rubber bands, switches

Lesson 1: 40 min

Introduction: 5 min
• Introduce the topic by asking the pupils to note how many things use electricity to work.
• Ask them to explain what they understand by battery-powered and mains-powered appliances. Can they name some mains-powered and battery-powered devices they use in their daily life?

Main teaching: 30 min
• Divide the pupils into groups, or if you can provide enough materials, ask them to do this activity in pairs. Display a battery, two pieces of insulated wire and a mini bulb.
• Ask them to discuss with their group members (if working in groups) or partner (if working in pairs) how they can make the bulb light up, using these materials. Draw pictures to show how you will connect these things to make the bulb light up.
• Now give them the necessary materials and ask them to connect them in a way that will light up the bulb. If any group is unable to light up the bulb, then ask them the reason and encourage others who have built a working circuit to help them.
How does each part of the circuit help to light up the bulb? (The battery provides the energy/electricity, wires take this energy to the bulb, and the bulb uses this energy.)

- Emphasize that:
  a) An electric circuit is a path along which electric current can flow.
  b) It consists of an energy source (e.g. a battery), a pathway (e.g. metal wire), and a device (e.g. a bulb).
  c) When electric current moves around the electric circuit, it carries electrical energy to the bulb, making it light up.

- Take one working circuit in your hand and ask them whether the bulb would still light up if piece of the wire was removed. Any electrical appliance works only if it has a complete circuit. But what does it mean by a complete circuit?
  Ask them to read the definition of complete or incomplete circuit given in their textbook on page 72.
- Using the same material as was used earlier, demonstrate a complete and an incomplete circuit.

Wind up: 5 min
- To assess their understanding, ask them these questions:
  Define electric current.
  What is a circuit?
  How do we make sure that our circuit is complete?
  Can you think of more than one reason why an electric circuit becomes incomplete?

Lesson 2:

Introduction: 5 min
- Ask the pupils to recall what they did and what they learned in their previous lesson. What materials did you use to construct a circuit? What is the difference between a closed and an open circuit?

Main teaching: 30 min
- Divide the pupils into small groups. Remind them that in their previous lesson they made simple circuits which lit up only one bulb. Can you light up two bulbs using the same circuit?
- Ask them to discuss this with their group members and draw how they would connect the materials to light up two bulbs in the same circuit.
  If their suggested circuit does not work, ask them to try out a different method to light up two bulbs. The pupils should share their ideas with the class.
- Read pages 73 and 74 of the textbook which explain the distinctive features of series and parallel circuits.
- Ask them which groups have constructed series or parallel circuits.
- If any group has constructed these circuits, ask them to show their circuits to the class. What are the differences between series and parallel circuits? Use Exercises 3 and 4 on page 76 of the textbook to compare and contrast the two types.
Activity 1: Simple circuits
Draw on the board the following diagrams and explain:

For an electric current to flow through the light bulb, the battery must be connected to the bulb to form a complete circuit, as illustrated below. Diagram B shows a complete circuit.

No current will flow through the light bulb in the other configurations for the following reasons:
A Both wires are touching the metal casing which is connected to one side of the filament—this configuration is an example of a short circuit, because current will flow freely through the casing and back to the battery.
C Both wires are connected to the positive terminal of the battery.
D One of the wires is not connected to the light bulb.

Activity 2: Distinguish between insulators and conductors
• Divide the pupils into small groups. Give them pieces of rubber-coated wire. The rubber at one end of the wire should be peeled off so that they can see the copper wires inside.
• Ask them to examine the wires and discuss the following question with them.
  a) What is the outer part of the wire made of? (rubber)
  b) Why do you think rubber is used as the outer part of an electric wire but not the inner part? (Rubber does not allow the electric current to pass through it, so we do not get a shock when touching the live wire.)
  c) What is the wire inside the rubber casing made of? (copper) How many pieces of copper wire are there? (Let them count.)
  d) Which material in the wire is a conductor and which is an insulator?
  e) What are the two ends of a battery made of? Why? (copper and zinc, as they are conductors)
• After hearing their responses, explain the answers to all the questions you asked above.
• Now give each group this set of materials: alligator clips, aluminium foil, paper clips, any piece of wood such as toothpicks or matchsticks, rubber bands, the circuits they made and a sheet of cardboard or stiff card to set the materials on. Identify all the materials by name.
Part 6 | Electricity and magnetism

- Now guide them in carrying out the activity to discover which materials are conductors of electricity and which are insulators.
- Engage the pupils in a discussion about the use of conductors and insulators in our daily life. *Conductors are used for making wires, since they allow the electric current to flow through them easily. Metals like copper and silver are examples of good conductors.*
  *Insulators are used to cover electric wires to prevent us from getting an electric shock. Plastic and rubber are also used to make electric tools, like handles of testers, or screw drivers, as well as sockets and plugs.*
- Show them the switches of familiar devices, for example: switch of a torch, fan, tube light or electrical home appliances, such as juicer, washing machine, etc. Demonstrate how they can be used to turn an electrical device on or off.
- Ask the pupils to make simple switches using paper clips, foil, and straight pins, and incorporate them in their circuits with a bulb.

**Wind up: 5 min**
- Ask the pupils to attempt Exercise A on page 75 of the textbook. It will help you to evaluate their learning and summarize the important points of the topic.

**EXERCISE (pages 75–77)**

C 1. b  2. a  3. a  4. b  5. c  6. b  
D 1. a) A material which allows electricity to pass through it, for example, metals like copper, and silver is known as a conductor.  
   b) A material which does not allow electricity to pass through it, for example, rubber, plastic or wood is known as an insulator.  
   c) Electric current is the flow of electricity in a conductor.  
   d) A circuit is a complete path through which electricity flows.  
2. A switch is used to turn an electrical device on or off.  
3. Ask the pupils to draw a table of comparison and refer to pages 73 and 74 of the textbook to answer the question.  
4. The pupils should draw their own labelled diagrams.
5. Encourage the pupils to make a long list. Some have been done for you.

<table>
<thead>
<tr>
<th>Appliances at home</th>
<th>Mains-powered</th>
<th>Battery-powered</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>refrigerator</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>remote control</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>printer</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>juicer</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>washing machine</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>clock</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

Note: Many IT appliances like PCs, iPod, iPad, etc. work with the help of mains as well as battery-power.

6. It would be inefficient to install series circuits in a house because:
   a) If one appliance were switched off, all appliances would go off.
   b) No appliance would receive enough voltage to function properly.

Answers to Worksheet Unit 12

1. a) ✔   b) ✗   c) ✔
   d) ✗   e) ✗   f) ✔
   g) ✔   h) ✔   i) ✗

2. a) ✗   b) ✔   c) ✗
Unit 13
Forces and machines

Teaching objectives:
• To explain that tools and machines are used when insufficient manual force is available
• To identify six simple machines and their uses in daily life
• To explain how each type of simple machine is used for specific purposes
• To define a compound machine by identifying the simple machines it is made up of

Key vocabulary: machine, lever, load, effort, fulcrum, inclined plane, wedge, screw, wheel and axle, pulley

Materials: any heavy object, a can, a can opener, a tool box or tray containing examples of the six simple machines

Lesson 1: 40 min

Introduction: 5 min
• Ask the pupils: What comes into your mind when you hear the word machine? Why do we use machines?
• Brainstorm for the machines they use in their daily lives. They will tell you the names of large compound machines, but do not correct them at this point. Write the names of all the machines on the board.
• Ask a pupil to try to lift a heavy object such as a heavy brick or stone, or a thick pile of books. The pupil could also be asked to try to lift a heavy piece of furniture. We know that forces cause objects to move, change direction and shape, increase speed, etc. But not all forces cause changes in movement. Machines are used when the force that we exert is not enough.

Main teaching: 30 min
• Ask the pupils to look up the meaning of the term machine in the textbook’s glossary or the dictionary. Invite them to share the definitions and some examples of tools and machines that make our work easier.
• Ask several pupils to attempt to open a can with their bare hands. *It is impossible to open this can without a machine to help you.*

• Now provide them with a can opener, and assist them to use it to open the can. *The can opener helped to make our work easier and faster.* A machine or tool is any object that helps to make a difficult task easier. Explain that machines are not always very big or complicated. They can be as simple as a straight pin. There are two main types of machine: simple and compound. A simple machine is made up of one, or very few, moving parts, while a compound machine is made up of more than one simple machine.

• Read pages 80 and 81 of the textbook, gradually moving from one machine to another.

• Discuss what the pupils understand about the types of machines and where they can see examples of them in their daily lives.

**Wind up: 5 min**

• Ask them to look around their homes and make a list of the simple machines they use daily. In which room of the house did they find the most simple machines?

**Lesson 2 : 40 min**

**Introduction: 5 min**

• Follow up the homework assignment given to the pupils in the previous lesson.

**Main teaching: 30 min**

**Group activity:**

• This activity can be conducted in two ways according to your own classroom management style and the availability of resources in your school. The two ways are explained below:
  a) Divide the class into small groups. Circulate the set of samples among the groups, one by one. This activity can be completed in two days.
  b) **Circus format:** Set up six work stations. Each station should have one simple machine and a sheet of instructions for the activity. The pupils will move from station to station to perform the activities, using all six simple machines. In order to maintain continuity in this set up you will need two consecutive periods in a day.
    i) Divide the class into six groups.
    iii) Remind them of the **safety precautions** before handing over the materials to them: *It is important that you are careful with the objects you are handling. They are not toys. Some of them have sharp edges or tips, and you could hurt yourself or others if you are not careful.*

**Activities Guide**

1. Lever

**Materials:** wooden ruler, object to lift, tape, can or cardboard tube
What to do:
The pupils should make a lever out of the given materials and explore the relationship of the fulcrum to the load. They will move the fulcrum closer to or further away from the load. They should discover that it is easier to move an object when the fulcrum is closer to the load.

2. Inclined plane

Materials: two boards of different lengths, a piece of string, rubber bands, a ruler, a heavy book

What to do:
The pupils should construct inclined planes with the boards, varying the slope of the board. They should put rubber bands around the book, tie the string to the rubber bands, and pull the books up the different inclines. Next, they should pull the books straight up without using the inclined planes. The pupils should discover that it takes greater force to move an object up the inclined plane with the steepest slope.

3. Wheel and axle

Materials: two toy cars, ruler

What to do:
The pupils should push one car along on its side and the other on its wheels. What differences do they observe in the ease of movement and the distances travelled?

4. Screw

Materials: 9 X 9 inch paper square, tape, pencil, scissors, tabletop

What to do:
The pupils should construct a screw out of an inclined plane by cutting the square diagonally to make an inclined plane. They should tape one of the short edges of the triangle to a pencil, and wrap the triangle around the pencil. They will actually see the inclined plane as part of the screw. They should observe how the screw is made up.

5. Wedge

Materials: paper, blunt scissors, sharp scissors

What to do:
The pupils should cut the paper using both the sharp scissors and the blunt scissors. They should discover that it is much easier to cut the paper with the sharp scissors than with the blunt scissors.

6. Pulley

Materials: cotton reel, string, pencil, object to lift

What to do:
The pupils should make a pulley using the cotton reel, string, and a pencil. They should use this pulley to lift an object. Ask them to compare lifting the object with the pulley and without the pulley. They should discover that it is easier to lift an object using a pulley.

Wind up: 5 min

- Ask them to summarize what they have learned about simple machines from performing these activities.
Lesson 3: 40 min

Introduction: 5 min

- Arrange for a bicycle to be brought into your classroom and displayed, or you may take the pupils into the school grounds or any safe, open area where you can show them a bicycle.
- Ask them to recall the activities they did in their previous lesson.

*So far, you have learned about simple machines. Compound machines are a combination of simple machines. You have all seen this bicycle. Do you think it is a simple or a compound machine? (It is a compound machine.)*

- What simple machines is it made up of? (wheels and axles, screws and lever)
- Explain that bikes are compound machines. *A compound machine is a machine that is made up of two or more simple machines.*
- Does anyone know why we use compound machines? (Just like simple machines, compound machines make work easier.) *Can anyone think of some examples of compound machines?* Compile a class list.
- Conclude teaching this topic by summarizing the key concepts in a table like the one shown below.

<table>
<thead>
<tr>
<th>Simple Machine</th>
<th>What it is</th>
<th>How it helps us work</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>lever</td>
<td>a stiff bar that rests on a support called a fulcrum</td>
<td>lifts or moves loads</td>
<td>shovel, nutcracker, seesaw, crowbar, elbow, tweezers, bottle opener</td>
</tr>
<tr>
<td>inclined plane</td>
<td>a slanting surface connecting a lower level to a higher level</td>
<td>things move up or down it</td>
<td>slide, stairs, ramp, escalator, slope</td>
</tr>
<tr>
<td>wheel and axle</td>
<td>a wheel with a rod called an axle going through its centre: both parts move together</td>
<td>lifts or moves loads</td>
<td>car, wagon, door knob, bike</td>
</tr>
<tr>
<td>screw</td>
<td>an inclined plane wrapped around a pole</td>
<td>holds things together or lifts them</td>
<td>screw, jar lid, vice, bolt, drill, corkscrew</td>
</tr>
<tr>
<td>pulley</td>
<td>a grooved wheel with a rope or cable around it</td>
<td>moves things up, down, or across</td>
<td>curtain rod, tow truck, mini-blind, flagpole, crane</td>
</tr>
<tr>
<td>wedge</td>
<td>an object with at least one slanting side ending in a sharp edge</td>
<td>cuts into or divides an object</td>
<td>knife, pin, nail, chisel, axe, spoon, front of a boat</td>
</tr>
</tbody>
</table>
Windup: 5 min

- Ask the pupils to attempt exercise A on page 82 of the textbook.

Note: The following website, also mentioned in the Teacher’s notes, is a good interactive tool that can be used by the pupils to learn about this topic:
http://edheads.org/activities/simple-machines/

**EXERCISE (pages 82–85)**

**A**
1. D  
2. E  
3. B  
4. A  
5. C

**B**
1. machine  
2. simple  
3. compound  
4. lever  
5. wedge  
6. screw  
7. wedge  
8. inclined plane  
9. pulley  
10. axle

**C**
1. a  
2. b  
3. c  
4. b  
5. effort  
6. c  
7. b  
8. c  
9. c  
10. b

**D**
1. A machine is a device or tool. We use machines to help us do our work more easily and quickly.
2. A simple machine is made up of one or very few moving parts. A compound machine is made up of more than two simple machines.
3. Answers will vary. Avoid capital letters when labelling diagrams.
4. We use a pulley in curtain rods, hoisting a flag up a flagpole, and for drawing/shutting window blinds.
5. Wheel and axles help make movement quick and easy.
6. Inclined planes are machines because they make our work easier. They help us to roll or move objects from lower to higher or higher to lower surfaces. (You may explain with the help of real life examples, such as a shopping trolley on a ramp in the supermarket, flyovers, escalators, stairs, etc.)
7. **Situation 1**
   Ali needs to use a pulley. He will tie the bucket to one end of the rope of the pulley, and from the other end he will easily pull the bucket upward.
8. **Situation 2**
   An inclined plane is the best machine to use in such a situation. He will need a bar with one end fixed to the back end of the truck. The other end of the bar will be fixed to the ground. This will create an inclined plane. Now he can easily pull the bag of rice along this sloping surface.
9. **Situation 3**
   A lever is the best machine to use in this situation. The man should use a rod, putting one end of the rod under the stone and exerting force on the other end. In this way he can easily move the heavy stone.
E

<table>
<thead>
<tr>
<th>Q</th>
<th>W</th>
<th>J</th>
<th>F</th>
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Unit 14
Light

Teaching objectives:
• To compare the speed of light to the speed of sound in order to explain that light travels faster than anything else in the universe
• To explain the reflection of light
• To compare luminous and non-luminous objects
• To explain how and why lunar and solar eclipses happen

Key vocabulary: reflection, luminous, non-luminous, solar eclipse and lunar eclipse

Lesson 1: 40 min

Introduction: 5 min
• Begin with brainstorming what the pupils already know about the topic. What do they remember about the speed of light? Recall transparent, opaque and translucent objects that they have learned about in previous lessons. Read the Do you remember? feature on page 86 of the textbook to refresh their memories.

Main teaching: 30 min
• Discuss the properties of light.
  a) Light cannot bend
  How does light travel? Light can only travel in straight rays, it cannot bend around corners. So when light rays are blocked, shadows are formed.
  a) Speed of light
  Ask them to recall their experiences of thunderstorms or lightning. What happens in a thunderstorm or when there is lightning?
  During a thunderstorm, there is thunder and lightning. Both happen at the same time, but first we see a flash of light in the sky. A few seconds later, we can hear the thunder. This is because light
travels faster than sound. In fact, it travels faster than anything else in the universe. The speed of light is 300,000 km/s, and thus it takes sunlight 8.5 minutes to reach the Earth.

a) Reflection of light

Discuss the reflection of light with the help of this popular fable:

A dog, to whom the butcher had thrown a bone, was hurrying home with it as fast as he could go. As he crossed a narrow footbridge, he happened to look down and saw himself reflected in the still water as if in a mirror. The greedy dog, however, thought he saw a real dog carrying a bone, much bigger than his own.

If he had stopped to think he would have known better. But instead of thinking, he dropped his bone and jumped at the dog in the river, only to find himself swimming to save himself from drowning. At last he managed to scramble out, and as he stood sadly, thinking about the good bone he had lost, he realised what a stupid dog he had been.

- Ask the following questions in order to focus on the purpose behind telling this story.
  - Was there really another dog in the water?
  - What made the dog believe that there was another dog in the water?
  - Would the dog have been able to see his reflection if the water had been flowing, instead of being still?
  - Explain: We can see things because light is reflected. Reflection occurs when light bounces off objects. The amount of reflection depends upon how even and still the surface is. Some materials reflect light better than others. If the surface is rough, the light scatters. If the surface is smooth and flat, the light will bounce off it at equal angles. That is why a flat mirror reflects a good likeness of the object being reflected.
  - Draw on the board a diagram to explain this concept.

Notice the angles at which the rays of light strike the surfaces.

- Luminous and non-luminous objects

Objects that emit light on their own are called luminous objects. They give off heat and light. The best examples of luminous objects are the Sun, stars, a light bulb, fire, etc. Objects that do not reflect light are known as non-luminous objects. Examples of non-luminous objects are wood, plastics, metals, etc. Stones, paper, the Moon and the planets of the solar system are the best examples of non-luminous objects that we observe daily in nature.

- Discuss the picture of the night scene on page 87 of the textbook. Ask the pupils to study the picture and tell you which are luminous and which are non-luminous objects. (luminous – stars,
street lamps, car’s headlights and rear lights; non–luminous - the Moon, cat’s eyes gleaming as they are reflecting the light of the headlights.)

Wind up: 5 min
• Ask the pupils the following questions to assess their understanding.
  When light bounces off a surface, we say it has been ……. (reflected)
  What types of surfaces reflect light best? (smooth and flat)
  How are shadows formed? (Since light can only travel in straight rays, shadows are formed if its path is blocked.)
  Which of these statements is true?
    a) Luminous objects produce light and heat on their own. (true)
    b) Light can pass through any material. (false)
    c) A beam of light hitting a mirror is reflected at a smaller angle. (false)
  Ask the pupils to correct the incorrect statements.

Lesson 2: 40 min

Introduction: 5 min
• Ask the following questions to elicit their existing knowledge about solar and lunar eclipses.
  How many of you have ever heard the word ‘eclipse’?
  How many of you have experienced or observed an eclipse?
  What happens to the Moon during the lunar eclipse?
  What happens to the Sun during a solar eclipse?
  Do you have any ideas about why eclipses happen?

Main teaching: 30 min
Solar and lunar eclipses
• Explain that eclipses are natural events.
  An eclipse happens when light from the Sun is blocked by the Moon or the Earth, as they move. The Earth and everything in the universe is in constant motion. The Earth’s path around the Sun is called its orbit. It takes the Earth one year, or 365 1/4 days, to completely circle or revolve around the Sun. As the Earth orbits the Sun, the Moon does not stay still; it too is orbiting the Earth. Sometimes during their orbits, the Moon and the Earth come in a line with the Sun. When this happens, an eclipse occurs. There are two kinds of eclipses, lunar and solar.
• Remind them of why and how shadows are formed. Light can only travel in straight rays, it cannot bend around corners. So when light rays are blocked, shadows are formed. Similarly, we see eclipses of the Sun and the Moon, due to this property of light.

Lunar eclipse
A lunar eclipse happens when the Earth moves between the Sun and the Moon, blocking part of the Sun’s light from reaching the Moon. During a lunar eclipse, you will see the Earth’s shadow on the Moon. (Draw a diagram on the board to show the alignment of the three during a lunar eclipse.)
Solar eclipse
A solar eclipse happens when the Moon moves between the Earth and the Sun. When this happens, part of the Sun’s light is blocked. (Draw a diagram on the board to show the alignment of the three during a solar eclipse.)

Activity
How does an eclipse happen?
Materials:
- grape (Moon), orange/apple (Earth), toothpick, two little pieces of Styrofoam, torch (Sun), ruler
1. Stick the toothpick through the little pieces of Styrofoam. Place the grape on top of the toothpick about two inches long.
2. Place the orange about three inches behind the grape on the table.
3. Shine the torch (Sun) directly at the grape.
4. Observe the orange (Earth). The grape’s (Moon’s) shadow is falling on the orange (Earth).

Explain that during a solar eclipse, the shadow cast by the Moon covers only part of the Earth’s surface. The shadow moves across the Earth and it becomes dark during the day. However, total darkness only lasts a few minutes.

Ask the pupils to predict what will happen when the Earth comes between the Sun and the Moon. Where will it cast its shadow?

Caution: Never look directly at the Sun! Never observe a solar eclipse through binoculars or telescope, unless you have the proper filters!

Wind up: 5 min
- Ask the pupils to draw and label diagrams to show the positions of the Sun, the Earth and the Moon during lunar and solar eclipses.

EXERCISE (pages 90–92)

B  1. ray  2. luminous  3. non-luminous  4. transparent
   5. translucent  6. opaque  7. of the Sun  8. of the Moon
   9. reflection  10. a lunar  11. a solar  12. reflects
C  1. b  2. b  3. a  4. c  5. b
   6. a  7. b  8. c  9. c  10. b
D  1. Light is a form of energy.
   2. Light travels in straight lines.
   3. a) Objects which produce their own light are luminous. For example, the Sun, fire and a light bulb.
      b) Objects which do not produce their own light are non-luminous. For example, a textbook, wooden desk, eraser, etc.
      c) The glass in a windscreen or spectacles is transparent and we are able to see through it.
d) Objects which allow partial light to pass through them are translucent. For example, butter paper and frosted glass.
e) Objects which do not allow any light to pass through them are opaque. We cannot see through them. For example, wood and stone.

4. The windscreen of a car is made of glass, not wood, because glass is transparent and we can see through it clearly. If it were made out of wood or metal, the driver of the car would not be able to see through it and it would be dangerous.

5. When a thunderstorm occurs, we experience light first, then the sound. This is because light travels faster than sound.

6. The pupils should be encouraged to explain the solar and lunar eclipses in their own words. However, if any pupil has difficulty, the pictorial explanation on page 88 of the textbook can be used for guidance.

7.

<table>
<thead>
<tr>
<th>Objects</th>
<th>Transparent</th>
<th>Translucent</th>
<th>Opaque</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>clouds*</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>aluminium foil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>brick</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>sunglasses</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>butter paper</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>your eyelids</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>clean air</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastic wrap</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>frosted glass</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>cardboard</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>eye lens</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>thin tissue paper</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

* The answer can be variable. On an overcast day, the clouds completely hide the Sun. Then they can be described as opaque. If the Sun is just visible as a brighter spot, then the clouds can be described as translucent. If the Sun can be seen as a bright circle, then the clouds can be described as transparent.

8.

<table>
<thead>
<tr>
<th>Reflective surface</th>
<th>Non-reflective surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>plastic</td>
</tr>
<tr>
<td>mirror</td>
<td>rubber</td>
</tr>
<tr>
<td>metal</td>
<td>cloth</td>
</tr>
<tr>
<td>glass</td>
<td>paper</td>
</tr>
<tr>
<td></td>
<td>wood</td>
</tr>
</tbody>
</table>
ACTIVITY (page 92)

1. This activity demonstrates that light is not white. It is actually made up of seven different colours.

   Explain that a rainbow appears when sunlight hits the water at the right angle, separating the beams of light into different colours, resulting in a rainbow on the wall or ceiling. When the water is disturbed, the light scatters instead of bouncing off. Hence, it does not reflect on the ceiling.
A Label the diagram using the words from the box.

skull, knee, pelvis, vertebrae, ribs, clavicle, elbow, wrist, femur
**Unit 1**

**The human body**

A Fill information on the three types of muscles in the table below.

<table>
<thead>
<tr>
<th>Type of muscle</th>
<th>Some examples</th>
<th>Voluntary/involuntary</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B Fill in the table below with information on the two types of joints.

<table>
<thead>
<tr>
<th>Types of joint</th>
<th>Some examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
</tr>
</tbody>
</table>
Unit 3
Food and balanced diet
A Make your own food pyramid in the outline given below. Remember to label it.

B Create a healthy menu for breakfast/lunch/dinner.

<table>
<thead>
<tr>
<th></th>
<th>grain</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>vegetable</td>
</tr>
<tr>
<td></td>
<td>fruit</td>
</tr>
<tr>
<td></td>
<td>milk</td>
</tr>
<tr>
<td></td>
<td>fats, oils and sweets</td>
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</tbody>
</table>
## Unit 4
### Animal kingdom

Which types of animals have the following features? Tick the correct boxes.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Fish</th>
<th>Amphibians</th>
<th>Reptiles</th>
<th>Birds</th>
<th>Mammals</th>
</tr>
</thead>
<tbody>
<tr>
<td>are vertebrate</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>have feathers</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>have fins</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>are cold-blooded</td>
<td></td>
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<td>have gills</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>have hair</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>are warm-blooded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lay eggs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>have lungs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>have moist skin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>have scales</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>have skeleton</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>have wings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Unit 6
Plants

A Label the four main parts of a flower.

B Label the parts of the pistil or carpel.

C Label the parts of the stamen.
### Unit 9

#### Separating mixtures

Mixtures are a combination of things, and they can be separated by different methods.

A Write the method of separation for the following:

<table>
<thead>
<tr>
<th>Wax and rice</th>
<th>Feathers and iron filing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat and stones</td>
<td>Paddy husk and paddy grain</td>
</tr>
<tr>
<td>Salt and water</td>
<td>Sand and water</td>
</tr>
<tr>
<td>Sand and sugar</td>
<td></td>
</tr>
</tbody>
</table>

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Unit 11
Heat
A Read the temperature shown in each thermometer and write it in the blank below.

- 10°C 25°C 16°C
- 50°F 76°F 60°F

B Shade the thermometers below to show the temperatures given.

- 10°C
- 25°C
- 16°C
- 50°F
- 76°F
- 60°F
## Unit 12

### Circuits and switches

1. Write true or false next to each statement.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Electric energy can be converted to other forms of energy.</td>
</tr>
<tr>
<td>b)</td>
<td>A battery controls the flow of electric currents.</td>
</tr>
<tr>
<td>c)</td>
<td>The components in a circuit are joined by wires.</td>
</tr>
<tr>
<td>d)</td>
<td>If you put more bulbs into a series circuit, the bulbs will be brighter than before.</td>
</tr>
<tr>
<td>e)</td>
<td>Our homes are wired up with series circuit.</td>
</tr>
<tr>
<td>f)</td>
<td>In a series circuit, the electric current has only one path or branch to flow.</td>
</tr>
<tr>
<td>g)</td>
<td>In a parallel circuit, each bulb grows brighter, since they do not share energy.</td>
</tr>
<tr>
<td>h)</td>
<td>A circuit will be incomplete if both wires are connected to the positive terminal of the battery.</td>
</tr>
<tr>
<td>i)</td>
<td>All materials allow electric current to pass through them.</td>
</tr>
</tbody>
</table>

2. You make a complete circuit with one bulb and three batteries. The bulb lights for a second and then goes out. Why? Tick the correct answer.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>The batteries have low voltage.</td>
</tr>
<tr>
<td>b)</td>
<td>Too much electricity flows through the bulb’s filament.</td>
</tr>
<tr>
<td>c)</td>
<td>Not enough electricity flow through the bulb’s filament.</td>
</tr>
</tbody>
</table>
Unit 13
Forces and machines

Inventor’s name: ___________________________________________

Class: ____________________________________________________

A Draw the machine you have invented.

Name of machine: __________________________________________

It is used to ________________________________________________

________________________________________________________________