

Basic Science

Teacher's Handbook

for Classes 6, 7 and 8



Bharati Bhawan

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PUBLISHERS & DISTRIBUTORS

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Basic Science for Class 6

1

Matter and Its Nature

LESSON PLAN 1

10 minutes	1. Ask the students what they understand by the term 'matter'. 2. Give them various examples like chalk, desk, pencil box, a glass of water, air, pen, pencil, scissors, etc., and ask them what is common to all these things. Ask them if you can weigh these objects and whether they need any space to be stored in.
25 minutes	3. Give the students examples such as sound, light, heat, etc., and elicit what is different in these from the initial examples. 4. Give various examples. For instance, food gives any living being the energy to do work, and that plants make food using the energy of sunlight. Ask them what the different forms of energy are, for example, sunlight (solar), heat, sound, electricity. 5. Ask if one form can be transformed into another and elicit various examples. 6. Now define energy and ask the students to distinguish between matter and energy.
Closure: 5 minutes	Homework: A1, C1

LESSON PLAN 2

10 minutes	1. Bring into the classroom different solids and liquids and also boiling water in a test tube (to show a gas), and elicit from the students the differences between the solid, liquid and gaseous states.
25 minutes	2. Ask the students whether one state can be changed into another. Give the examples of ice, water and water vapour. 3. Explain the interconversions by making a table and laying emphasis on the terms used for different conversions with suitable examples. 4. Give examples like O_2, N_2 and water vapour to differentiate between a vapour and a gas. 5. Ask the students to raise doubts that they may have regarding the different conversions.
Closure: 5 minutes	Homework: A2, A3, B1, B2

LESSON PLAN 3

10 minutes	1. Ask the students to give five examples of matter that they think is pure and five examples of impure matter. 2. Take the examples given by any three students and write them on the board.
25 minutes	3. Classify the given examples into pure and impure by eliciting responses from the students. 4. Ask them why they think the given substances are pure or impure. 5. Then bring in the concept of element and compound. 6. Show them a periodic table which has all the elements.

	7. Show them everyday examples of elements and compounds. 8. Elicit from them how elements are different from compounds, although both are pure. 9. Summarise what has been discussed.
Closure: 5 minutes	Homework: D

LESSON PLAN 4

10 minutes	1. Give the students examples of different changes. Ask them to analyse each change and classify the change into chemical and physical, giving reasons.
25 minutes	2. Take them for a nature walk and ask them to analyse the changes in nature and classify them. 3. You can also take them to the laboratory and show different experiments distinguishing physical and chemical changes. For example, the boiling of water, the burning of paper, lighting a match, etc.
Closure: 5 minutes	Homework: Give five examples each of physical and chemical changes and justify why the changes are physical or chemical.

LESSON PLAN 5

30 minutes	1. Bring different metals and nonmetals to class. For example, carbon, sulphur, iron, zinc, magnesium, sodium, iodine and bromine. 2. Tabulate the differences between them by observing them.
5 minutes	3. Elicit from the students the definitions of metals and nonmetals, and their properties.
Closure: 5 minutes	Homework: B3, B4, C2, E

LESSON PLAN 6

30 minutes	1. Bring to class a, sugar solution, soda-water bottle, medicine bottle, lime juice, statues of bronze, a knife, spoon, etc. Ask the students to differentiate a mixture from an element and a compound. Define a mixture.
5 minutes	2. Using the same examples, differentiate between homogeneous and heterogeneous mixtures. 3. Elicit examples of both from the students.
Closure: 5 minutes	Homework: A4, B5, F

LESSON PLAN 7

20 minutes	1. Show a bowl of water and a sample of sulphur to the students. 2. Ask them what they are made up of. 3. How is a molecule of an element formed? That of a compound?
10 minutes	4. Ask the students what the fundamental particles in an atom are. Also make them draw the model of an atom.
Closure: 10 minutes	Homework: A5, A6, C3, G

Answers to Exercises

- A.
1. Anything that occupies space and has mass is matter, for example, books, clothes, food, etc.
 2. The change in the state of matter from one to another, for example, from solid to liquid, is called interconversion of state.
 3. The phenomenon of some solids vaporising without melting is called sublimation. Examples of such solids are camphor and naphthalene.
 4. An alloy is a mixture in which a metal is mixed with another metal or a nonmetal. The components are so thoroughly mixed that the whole thing appears to be a single substance, for example, steel, brass.
 5. An atom is made up of electrons, protons and neutrons.
 6. The electron in an atom is negatively charged. The proton is positively charged and the neutron has no charge.
- B.
1. A solid has a fixed volume and a definite shape. A liquid has a fixed volume but no definite shape. It takes the shape of the container. A gas has neither a fixed volume nor a definite shape. It assumes the volume and shape of the container. In other words, a gas occupies all the space available to it.
 2. Substances that ordinarily exist in the gaseous state, for example, hydrogen, oxygen, etc., are called gases whereas substances that ordinarily exist as solids or liquids are called vapours in the gaseous state. For example, sulphur (ordinarily a solid) is called sulphur vapour in the gaseous state.
 3. Magnesium, calcium and iron are examples of metals. Metals are generally hard, ductile (can be bent without being broken) and malleable (can be pressed into sheets or foils). They are also sonorous. (They produce a metallic sound when hit by a hard object).
 4. Carbon, sulphur and phosphorus are examples of nonmetals. They have no lustre. They are nonsonorous, and brittle if solids.
 5. A substance is homogeneous if the different parts of it have the same property and composition, e.g., water, salt and gold. A substance is heterogeneous if the different parts of it differ in property and composition, for example, a mixture of sand and water, and one of rice and stones.
- C.
1. Anything that is not matter but has the capacity to do work is energy. For example, light and heat are not matter but forms of energy because they do not have mass, but they have the capacity to do work. Light helps plants make food and heat helps us cook our food. Electricity and sound are also forms of energy. Electricity makes fans move and trains run. Sound makes your eardrums vibrate so that you can hear.
 2. Metals
 - (a) We use metals in the construction of houses, railway tracks and aircraft.
 - (b) They are also used in making agricultural tools.
 - (c) They are used in the manufacture of utensils.
 - (d) They are used to make automobiles.
 - (e) Metals are used in the transmission of electricity.Nonmetals
 - (a) Coal, which is used as a fuel, is mainly made up of carbon.
 - (b) Oxygen is essential for breathing.
 - (c) Chlorine is used to kill germs present in drinking water.
 - (d) Iodine is used to heal wounds and sprains.
 - (e) Sulphur is used to cure skin diseases.
 3. At the centre of the atom, there is a nucleus, which consists of protons and neutrons. At a distance from the nucleus, there are electrons revolving round it. The nucleus is positively charged due to the protons in it. But the

same number of electrons revolve round the nucleus and balance the positive charge of the nucleus. So the atom has no net electrical charge on it. In other words, the atom is electrically neutral.

- D.* 1. volume 2. mass 3. solid, liquid, gaseous 4. freezing
5. atom 6. molecule 7. the same 8. compound 9. nucleus
- E.* 1. (d) 2. (a) 3. (b) 4. (c) 5. (a)
6. (d)
- F.* 1. No 2. Yes 3. No 4. No 5. No
- G.* 1. Sulphur: b, 1 2. Carbon dioxide: c, 3 3. Chlorine: b, 3 4. Mercury: a, 2
5. Copper: a, 1 6. Oxygen: b, 3 7. Gold: a, 1



2

Food

LESSON PLAN 1

10 minutes	1. Ask the students why food is important for living organisms.
25 minutes	2. Complete the activity given on page 12. Ask the students to name the various parts of a plant from which we obtain food.
Closure: 5 minutes	Homework: Ask the students to complete the activity given on page 13. Discuss the steps involved in completing it with the students. A1, A2, A3

LESSON PLAN 2

10 minutes	1. Ask the students about the different types of food obtained from animals.
20 minutes	2. Divide the students into groups and discuss with them the different types of food they eat. Ask them to prepare a list of common food items. Then discuss the sources of these food items.
Closure: 10 minutes	Homework: Activity on page 14, B4

LESSON PLAN 3

10 minutes	1. Discuss good food habits.
25 minutes	2. Ask the students to make a table showing healthy and unhealthy food. 3. Divide the class into groups and ask them to do the activity on page 15.
Closure: 5 minutes	4. Summarise what has been discussed in class.

LESSON PLAN 4

10 minutes	1. Discuss the classification of animals based on food habits.
25 minutes	2. Divide the class into groups and complete the activity on page 16. 3. Ask the students the method of classifying food based on the nutrients present in it. 4. Conduct the test for starch and ask the students to observe.
Closure: 5 minutes	Homework: A4, A5, A6, A7

LESSON PLAN 5

20 minutes	1. Take the students to the laboratory. 2. Ask them to do the test for fats and proteins and then observe and conclude.
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10 minutes	3. Talk about vitamins and their classification.
Closure: 5 minutes	Homework: A8, A9, A10, A11, C1

LESSON PLAN 6

30 minutes	1. Talk about minerals in our diet. 2. Ask the students why water is important for living beings. 3. Complete the activity given on page 19.
5 minutes	4. Introduce the terms 'dehydration' and 'roughage' with suitable examples.
Closure: 5 minutes	Homework: B2, C2

LESSON PLAN 7

20 minutes	1. Ask the students what they understand by the term 'balanced diet'. 2. Discuss Table 2.2. 3. Discuss Table 2.3.
15 minutes	4. Complete the activity given on page 22.
Closure: 5 minutes	Homework: B1, B3, D, E, F, G, H

Answers to Exercises

- A.
1. To get energy, for growth, repair and maintenance of the body, to fight diseases
 2. The seeds and leaves of fenugreek (methi) and the flower and fruit of the banana are useful.
 3. Grains and seeds are different in that grains are a fusion of seed and fruit.
 4. Herbivores are animals that eat plants. For example, cows, goats, horses, elephants and donkeys are herbivores.
 5. Omnivores are animals that eat both plants and animals while carnivores are animals that eat only the flesh of certain other animals.
 6. Carbohydrates are made of carbon, hydrogen and oxygen. They give us energy.
 7. Glucose is given to sportspersons to provide them a quick supply of energy.
 8. Proteins are needed to make new cells and replace old ones. In other words, they are needed to build and repair tissues.
 9. Plant sources of protein are pulses, soya beans, whole wheat and nuts. Animal sources of protein are milk, eggs, meat and fish.
 10. Fats are made of compounds of carbon, oxygen and hydrogen. Fats not only serve as a reserve of energy but also prevent loss of heat from the body. Fats cushion our internal organs too.
 11. We cook food to make it digestible and to improve its taste.
- B.
1. A diet containing all the nutrients required by the body in the right proportion is known as a balanced diet. A balanced diet contains adequate amounts of fats, carbohydrates, proteins, vitamins and minerals.
 2. Roughage or fibre swells up in the intestine by absorbing water. It thus adds bulk to the faeces and keeps it soft. This helps in the smooth movement of waste through the rectum and prevents constipation. Hence, roughage is a necessary part of our diet.

3. Diseases caused by a lack of nutrients are called deficiency diseases. Children who do not get a balanced diet generally suffer from malnutrition. Such children do not have proper mental and physical growth, and they also catch infections easily. In extreme cases, they start looking old and their skin hangs loosely over a skeletal body.
 4. After vegetables are grown in the field, they are directly taken to wholesale shops. We mostly buy these vegetables from retail shops that get their supplies from the wholesalers.
- C.
1. To find out if there is protein in a particular food, we need to perform the protein test. First, add a few drops of concentrated nitric acid to egg white or a paste of soya bean flour in a test tube. Then heat the test tube until its contents turn yellow. Pour out the acid into a beaker and add a few drops of ammonium hydroxide into the test tube. Shake the test tube. If the contents turn violet, the sample contains protein.
 2. Water is needed for many vital functions of the body.
 - (a) Chemical reactions like digestion occur in the dissolved state.
 - (b) Digested food is carried throughout the body by water.
 - (c) Waste is carried out of the body in the form of sweat and urine.
 - (d) Chemicals and gases are carried throughout the body by water in the blood.
 - (e) Body temperature is regulated through the process of sweating.

Excretion, sweating and breathing make us lose 2–3 litres of water daily. We make up 1.5 litres by drinking water and other liquids. The rest comes from food.

Slice a vegetable, say a potato, into wafers. Weigh them and dry them in the sun until they become brittle. Weigh them again and note the difference in weight. The weight will have decreased due to loss of water from the potato because of drying in the sun.

- | | | | | | |
|----|-------------|---------------|---------------|------------|-----------|
| D. | 1.—C | 2.—A | 3.—D | 4.—B | |
| E. | f, 1, 2 | b, d, g, 4, 6 | g, 2, 3 | a, e, 3, 5 | |
| F. | 1. (c) | 2. (a) | 3. (c) | 4.(c) | 5.(b) |
| | 6. (d) | 7. (d) | | | |
| G. | 1. (a), (d) | 2. (a), (d) | 3. (a), (b) | 4. (a) | |
| H. | 1. proteins | 2. minerals | 3. apiculture | 4. anaemia | 5. iodine |
| | 6. obese | | | | |



3

Classification of Materials

LESSON PLAN 1

10 minutes	1. Ask the students how they count change (coins). Ask them to group coins based on their denominations. 2. Ask the students whether grouping the coins made their task easier or not.
25 minutes	3. Define classification. 4. Discuss the importance of classifying things.
Closure: 5 minutes	Homework: Read page 25. Complete B3, B4.

LESSON PLAN 2

20 minutes	1. Using the examples given in the textbook, ask the students to see, feel and touch materials to observe different properties. Then, ask them to classify the materials based on these properties. 2. Define properties like lustre, smoothness, transparency, ductility and malleability, floating and sinking.
15 minutes	3. Complete the activity given on page 27.
Closure: 5 minutes	Homework: A1 to A4, C

LESSON PLAN 3

10 minutes	1. Elicit from the students the difference between soluble and insoluble, miscible and immiscible.
25 minutes	2. Define solute, solvent. 3. Complete the activity on page 28.
Closure: 5 minutes	Homework: B1, B2, B5, D, E.

Answers to Exercises

- A.
1. The metal will regain its lustre after its surface is rubbed with cloth or sandpaper, or is polished.
 2. Iron and copper are hard solids, and sponge and cotton are soft solids.
 3. Mirrors and stainless steel have smooth surfaces, while stones and bricks have rough surfaces.
 4. Aquatic plants and animals use carbon dioxide and oxygen dissolved in water to survive.
- B.
1. A substance that dissolves in a liquid is called a solute and the liquid that dissolves the substance is called a solvent. Sugar and salt are examples of soluble substances, and wax and sawdust are examples of insoluble substances.

2. A liquid miscible with water will form a solution with it. One immiscible with water will not, and will form a separate layer when mixed with water. Examples of liquids miscible with water are glycerine and shampoo and those of liquids immiscible with water are edible oil and kerosene.
3. Grouping similar things is called classification. An example of classification from everyday life is grouping coins according to their values (for example, 5, 2, 1) and then counting them. This makes our job of counting the coins much easier.
4. Classification helps us
 - (a) have a systematic knowledge of things,
 - (b) have a general idea about all the members of a group,
 - (c) know how the members of one group differ from those of the other groups.
5. (a) Wood: nonlustrous, opaque and hard
 (b) Glass: smooth, transparent, and an object that sinks
 (c) Paper: nonlustrous, opaque and an object that floats
 (d) Iron: lustrous, opaque and malleable

C.	1. (b)	2. (d)	3. (b)	4. (d)	
D.	1. immiscible	2. solvent	3. ductile	4. malleable	5. brittle
	6. lustre				
E.	Edible oil	Immiscible with water			
	Common salt	Soluble in water			
	Iron nail	Sinks in water			
	Plastic block	Floats in water			



4

Clothes and Fibres

LESSON PLAN 1

10 minutes	1. Start the topic by asking the students why we need to wear clothes. Ask them how primitive people made clothes. 2. Show them different types of clothes and ask them to name the fibres.
25 minutes	3. Introduce terms like spinning, weaving, yarn, shuttle, warp, weft, loom, etc. Elicit from the students how cloth is made from fibres. Give examples of various machines like the spinning machine, or the charkha. Using a smart board, show them a charkha and how cloth is made from it.
Closure: 5 minutes	Homework: A1, A2, B1, C1

LESSON PLAN 2

25 minutes	1. Using the examples given in the textbook, ask the students to see and feel different kinds of fibre. Ask them to distinguish between various fibres and also classify them into natural and artificial. 2. Discuss cotton fibre and its uses.
10 minutes	3. Read pages 32 and 33.
Closure: 5 minutes	Homework: A3, B2

LESSON PLAN 3

15 minutes	1. Bring samples of flax and jute fibre to class. Discuss the properties of these fibres.
20 minutes	2. Complete the activities on pages 34 and 35.
Closure: 5 minutes	Homework: A4, A5, C2, D, E, F

Answers to Exercises

- A.
1. Primitive people covered themselves with leaves, barks or animal skin. They also twined animal hair and wool to make primitive robes.
 2. The two types of looms are the handloom and the power loom. Weaving is done manually on a handloom and with the help of electricity on a power loom.
 3. Cotton is used to make clothes, some kinds of paper and cellophane, an explosive called guncotton and to clean wounds after being sterilised.
 4. (a) Flax fibres are mainly used for making linen. Clothes made of linen are often worn in the tropics.
(b) Flax fibre is also used for making fine paper.

(c) It is used for making fishing lines and nets.

5. Air is a bad conductor of heat. Therefore, so is a fabric with air spaces between its fibres. Such a fabric easily absorbs water in the air spaces. Thus, a fabric which soaks up water is a bad conductor of heat.

B. 1. People covered themselves with leaves, barks or animal skin. They pierced holes in animal skin and drew thin strips of leather through these holes to make bigger pieces that would fit them. Slowly, they learnt to twine grass and to weave it to make skirts. They also twined animal hair and wool to make primitive robes.

2. Fibres are classified into natural and artificial (synthetic). Natural fibres are derived from plants and animals. For example, cotton and wool are natural fibres. Artificial fibres are made in laboratories. For example, rayon and nylon are artificial fibres.

C. 1. Spinning is the process by which fibres are twisted together into long threads called yarn. This increases the strength of the fibres. These yarns are wound in reels called bobbins and made into cloth by a process known as weaving.

Thread is woven into cloth on a loom. A line of threads is laid lengthwise over the loom. Then another thread is placed crosswise above and below this line of threads. In a loom, the crosswise thread is attached to a shuttle, which moves the thread forward and backward over the lengthwise threads.

2. Collect different types of fabrics and wrap a bangle tightly with one of them. With a dropper, put a drop of water on the centre of the cloth. Start a stopwatch simultaneously. As soon as the cloth soaks the first drop of water, add another drops. Keep adding drops till the soaked water touches the bangle. Count the drops of water. Read the time taken for the cloth to soak water to the extent fixed by the bangle. Repeat this activity with different types of fabric and record your observations.

D.	1. (d)	2. (a)	3. (a)	4. (d)	5. (d)
E.	1. Jute	2. India	3. needle	4. better	5. faster
F.	(a)—(ii)	(b)—(i)	(c)—(iv)	(d)—(iii)	



5

Separation of Mixtures

LESSON PLAN 1

10 minutes	1. Start the topic by asking the students about pure substances and mixtures. Give them various examples of each and ask them to differentiate between elements, compounds and mixtures.
25 minutes	2. Discuss the different types of mixtures. Provide the students with examples and help them to recognise the type of mixture based on the states of the constituents.
Closure: 5 minutes	Homework: A1, A2

LESSON PLAN 2

20 minutes	1. Discuss with the students the need to separate the constituents of a mixture. 2. Ask them what are the various techniques used for separating the constituents of different types of mixtures.
15 minutes	3. Mimic winnowing by taking roasted groundnuts on your palm and blowing at them.
Closure: 5 minutes	Homework: A3, A4

LESSON PLAN 3

35 minutes	1. Demonstrate magnetic separation as shown on page 41. 2. Demonstrate sedimentation and decantation, and loading using alum. 3. Refer to Figures 5.8 and 5.9 to explain separation using a separating funnel and filtration respectively.
Closure: 5 minutes	Homework: Read pages 41, 42 and 43. Complete B2.

LESSON PLAN 4

35 minutes	1. Demonstrate churning, evaporation and distillation by referring to page 44. 2. Complete the activities on page 45 to demonstrate dissolution and evaporation, and crystallisation respectively. 3. Ask the students what a saturated solution is. Explain the concept with the help of the following experiment. Take some water in a beaker and add salt to it. Keep adding salt to it till no more can dissolve.
Closure: 5 minutes	Homework: A5, A6, B1, B3, C1, C2

LESSON PLAN 5

35 minutes	1. Showing a smart board, explain to the students how common salt is obtained from sea water. 2. Ask the students to draw a table as shown on page 46 and let them summarise in groups the different separation techniques.
Closure: 5 minutes	Homework: B4, B5, D, E, F

Answers to Exercises

- A. 1. (a) homogeneous mixture (b) heterogeneous mixture (c) sediment (d) supernatant liquid
2. Yes. Examples of homogeneous solid–liquid mixtures are salt and water, and sugar and water. Examples of heterogeneous solid–liquid mixtures are sand and water, and chalk and water.
3. Lighter solids are separated from heavier ones by winnowing. An example is the separation of chaff from grain. A mixture of chaff and grain is made to fall from a height. The lighter chaff drifts away while the heavier grain falls vertically on the ground.
4. Cream is obtained by churning. When milk is churned, cream separates from it. Being lighter than milk, it floats over the liquid. Churning is done either manually or by using a mixie.
5. A solution that is not capable of dissolving any more solute at a given temperature is called a saturated solution.
- B. 1. If a solid mixture is stirred or shaken on a mesh, particles smaller than the holes in the mesh fall and the bigger ones remain on the mesh. This process is called sieving. Small sieves are used in kitchens to separate impurities from flour. Bigger sieves are used in construction sites to separate stones from sand.
2. Immiscible liquids form separate layers in a mixture, for example, oil and water. The mixture is placed in a separating funnel and allowed to stand. The different liquids are tapped one by one by opening the stopcock.
3. A mixture of sand and iron can be separated by magnetic separation. If a magnet is moved through this mixture, the iron particles cling to the magnet but the sand particles do not.
4. Make a saturated sugar solution, and filter the solution into a jar. Tie a string to a pencil and place the pencil on the rim of the jar. Now the string hangs in the solution. Leave the set-up undisturbed for a day or two. You will find that colourless crystals of sugar have appeared around the string.
5. Sea water, which is a salt solution, is collected in shallow pits dug on the seashore. The sun makes the water evaporate. When enough water has evaporated, the solution becomes concentrated. Then the salt begins to crystallise. It is then purified and mixed with sodium iodate, which contains iodine.
- C. 1. Take some salt and some water in a pan and place a dry lid over it. Heat the mixture slowly until the liquid begins to boil. After a couple of minutes, remove the lid with a pair of tongs. You will find that water vapour has condensed on the inner side of the lid. Collect this water in a clean vessel by tapping the lid. By repeating this process, you can collect more and more water. The water you have collected is pure water. Finally, you will get a solid residue of the salt that you started with.
2. Put the salt and sand in a beaker. Pour water into it and stir vigorously. Dissolve the salt completely by warming the water from time to time. Filter, and wash the residue 4–5 times with hot water. Evaporate the filtrate to dryness. You will obtain a white solid, which is salt. The residue on the filter paper is sand. This can be dried in the sun.
- D. 1. (d) 2. (a) 3. (c) 4. (d) 5. (a) 6. (b)
- E. 1. mixture 2. heterogeneous 3. homogeneous 4. the crystallisation of a saturated sugar solution
- 5.

Sl. No.	Type of mixture	Example	Method of separation
(i)	A heterogeneous solid–liquid mixture	Muddy water	Sedimentation and filtration
(ii)	A heterogeneous solid mixture	Bran and flour	Sieving
(iii)	A heterogeneous solid mixture containing one soluble constituent	Sand and salt	Dissolution, filtration and evaporation
(iv)	A heterogeneous liquid mixture	Oil and water	Using a separating funnel

- F. (a)—(iv) (b)—(iii) (c)—(v) (d)—(ii) (e)—(i)



6

A Study of Changes

LESSON PLAN 1

5 minutes	1. Ask the students what changes they see around them. Elicit from them the differences between natural and manmade changes.
30 minutes	2. Complete the activities on pages 49 and 50/51. Ask the students what type of change has occurred in each case.
Closure: 5 minutes	Homework: B1, C1, C2

LESSON PLAN 2

15 minutes	1. Complete the activity on page 51. Ask the students why they think a change is reversible or irreversible.
20 minutes	2. Divide the students into groups and ask them to discuss the different types of changes. Instruct them to complete C3.
Closure: 5 minutes	Homework: A1 to A4

LESSON PLAN 3

10 minutes	1. Complete the activity on page 52 and then discuss how to classify changes.
25 minutes	2. Define physical and chemical changes. 3. Discuss the burning of a candle. Refer to Figure 6.10.
Closure: 5 minutes	Homework: B2, B3, D

LESSON PLAN 4

5 minutes	1. Ask the students the different ways in which changes take place.
30 minutes	2. Discuss with them the changes brought about by expansion, contraction, applying pressure and changing state. Divide the students into groups. Ask them to conduct the experiments on fluffy, ductile and malleable, and brittle solids as given on page 55.
Closure: 5 minutes	Homework: A5, A6, A7, E

Answers to Exercises

- A.
1. A reversible change is temporary. It can be reversed by reversing the conditions.
 2. An irreversible change is permanent. It cannot be reversed by reversing the conditions.
 3. Physical changes are those in which no new substances are formed. They can be reversed by reversing the conditions. For example, the melting of wax and glowing of a light bulb are physical changes.

4. Chemical changes are those in which new substances are formed. These cannot be reversed by reversing the conditions. For example, the burning of paper and rusting of an iron nail are chemical changes.
 5. The melting of ice is reversible and an ice cube can be melted by heating.
 6. Heat can cause irreversible changes such as the burning of paper.
 7. On the application of pressure, fluffy solids get misshapen when pressed but get back their original shape after the pressure is released. Ductile and malleable solids can be given the desired shape by applying pressure.
- B.**
1. Heat some sugar in a metallic bowl. The colour of the sugar will first change to brown and then to black. The black residue is carbon, which is different from sugar. This is an irreversible change.
 2. A change during which heat is given out is called an exothermic change. For example, heat is given out while burning wood.
A change during which heat is taken in is called an endothermic change. For example, our tongue feels cold when we put some glucose on it. The glucose takes in heat from our tongue in order to dissolve in the saliva.
 3. A change which is beneficial is a desirable change and that which is not beneficial is an undesirable change. For example, the formation of curd from milk is a desirable change. Corrosion of metals is an undesirable change.
- C.**
1. In order to make a systematic study of a change, we need to check if
 - (i) there is any change in size, shape or colour,
 - (ii) the change is slow or fast,
 - (iii) the change is reversible or irreversible,
 - (iv) any new substance is formed,
 - (v) the change is endothermic or exothermic.
 2. Add a few drops of lemon juice to milk and boil the mixture. In a short while, a thick white substance called cottage cheese is formed. This is called the curdling of milk. Cottage cheese is entirely different from milk. This method is not reversible.
 3. Physical change: (a), (e), (f), (g), (i), (j), (m)
Chemical change: (b), (c), (d), (h), (k), (l), (n)
- D.** 1. (d) 2. (c) 3. (d) 4. (a) 5. (b) 6. (a) 7. (a)
- E.** 1. endothermic 2. exothermic 3. heated 4. more

5.

Change	Slow/fast	Reversible/irreversible	Any new substance formed	Physical/chemical change
(a)	slow	irreversible	yes	chemical change
(b)	fast	reversible	no	physical change
(c)	slow	irreversible	yes	chemical change
(d)	fast	irreversible	yes	chemical change
(e)	fast	irreversible	yes	chemical change



7

The Living and the Nonliving

LESSON PLAN 1

10 minutes	1. Ask the students to identify the living beings and nonliving objects in the classroom. 2. Elicit from them the differences between the two.
25 minutes	3. Complete the activity on pages 59 and 60 and help the students identify plant and animal cells. 4. Define tissue, organ and organ systems. Help the students understand that organisation is an essential characteristic of a living being.
Closure: 5 minutes	Homework: A1, A2, A5, A9

LESSON PLAN 2

10 minutes	1. Ask the students how living beings grow. 2. Distinguish between growth in the living and the nonliving by giving suitable examples.
25 minutes	3. Discuss the lifespans of various organisms by using Table 7.1. 4. Complete the activity given on page 62 and explain reproduction in living beings.
Closure: 5 minutes	Homework: A3, B1, B2, B5

LESSON PLAN 3

10 minutes	1. Differentiate autotrophs from heterotrophs using simple examples given in the text.
25 minutes	2. Discuss respiration. Explain how it is different from breathing. 3. Complete the activity given on page 64 to see how plants respire.
Closure: 5 minutes	Homework: A4, B3, B4

LESSON PLAN 4

10 minutes	1. Discuss how plants and animals excrete.
25 minutes	2. Divide the class into groups and complete the activity given on page 65. 3. Summarise what has been done in class.
Closure: 5 minutes	Homework: A6, B6, C, D

LESSON PLAN 5

30 minutes	1. Take the students to the laboratory. 2. Ask them to complete the activities given on page 65 and 66 to explain the response of living beings to external stimuli.
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5 minutes	3. Explain how animals move in response to stimuli using the experiment where an earthworm moves away from a filter paper soaked in salt solution.
Closure: 5 minutes	Homework: A7, A8

Answers to Exercises

- A.
1. The living and the nonliving are made of matter. They have mass and they occupy space. Matter is made of molecules.
 2. Cells in animals and plants are organised into special groups. Groups of cells which are similar and perform a particular function are called tissues.
 3. Living beings grow, follow a life cycle, reproduce, need food, respire, excrete, respond to stimuli and show movement.
 4. Fish breathe by taking in water. They use the oxygen dissolved in water for the process of respiration.
 5. A group of organs which cooperate with each other to perform a particular function is called an organ system. The mouth, stomach and liver are part of an organ system called the digestive system.
 6. The process of throwing out or expelling waste is called excretion. We expel waste from the body in the form of faeces and urine.
 7. 'Touch me not' is an example of a plant that shows sensitivity to touch.
 8. Plants respond to sunlight and water.
 9. Yes, there are organisms made of one cell. One such organism is the amoeba.
- B.
1. The growth of a crystal is different from that of a living being. Sugar crystals hanging in a solution grow because more sugar is added to them from outside. Living beings, on the other hand, grow because the cells inside grow and multiply. In nonliving things, growth occurs from outside.
 2. All organisms follow a life cycle of birth, growth, reproduction, ageing and death. A living being starts from a single cell. This cell grows and multiplies inside a seed, an egg or the mother's body. A young one grows into an adult. It then reproduces, or produces offspring. Then it grows old, and finally dies. This is known as a life cycle.
 3. All living beings use food to produce energy in their bodies. For this they need oxygen, which they get from the air or water surrounding them. Oxygen combines with food within their bodies to release energy. This is a chemical change in which carbon dioxide and water vapour are produced as wastes, which the body throws out. This process of taking in air (or water), letting oxygen combine with food, and throwing out carbon dioxide and water vapour is called respiration.
 4. Plants do respire and this can be shown by doing an activity. Place a handful of Lantana buds in a piece of muslin. Tie up the cloth to make a pouch. Suspend the pouch in a jar containing limewater. Make sure the bag does not touch the limewater. After some time, the limewater in the jar will turn milky because the buds will respire and give out carbon dioxide.
 5. Animals grow to the adult size and then stop growing. Plants, on the other hand, grow all their lives. They start as tiny seedlings and then keep growing.
 6. Plants throw out gases through the stomata in their leaves. They also store wastes in special cells. Some of these wastes are useful to us. For instance, the rubber we extract from rubber trees is a plant waste called latex. Gum obtained from *Acacia* trees is also a waste product.
- C.
1. cell
 2. an organ
 3. sweat
 4. stimulus
 5. respond
- D.
1. (a)
 2. (c)
 3. (b)
 4. (c)

8

Habitat and Adaptation

LESSON PLAN 1

5 minutes	1. Provide different examples of habitats. Ask the students what a habitat means.
30 minutes	2. Discuss various habitats by giving examples of each type. 3. Introduce adaptations and responses to one's environment. 4. Discuss the components of a habitat, and the climatic and edaphic factors. 5. Explain the biotic component of habitats.
Closure: 5 minutes	Homework: A1, A4, A5, A7, A10

LESSON PLAN 2

10 minutes	1. Introduce the abiotic component of habitats. 2. Discuss how plants in hilly and coastal areas adapt to their conditions.
20 minutes	3. Talk about the importance of light for plants and animals. 4. Give examples to explain the importance of light and the adaptations seen in living things based on the amount of sunlight available in their environment.
Closure: 10 minutes	Homework: A2, C1 to C3, D

LESSON PLAN 3

10 minutes	1. Discuss the different adaptations found in plants and animals related to temperature and water.
25 minutes	2. Introduce terms like aestivation, hibernation, xerophytes and hydrophytes by giving relevant examples. 3. Explain to the students different adaptations seen in plants and animals related to food. 5. Give them examples of different food chains.
Closure: 5 minutes	Homework: A3, A6, A8, A9, B1 to B6, E

Answers to Exercises

- A. 1. The place where an organism (or a whole community of organisms) lives naturally is called its habitat. A river is an example of a freshwater habitat.
2. Nonliving things like air, water, soil, light and temperature constitute the abiotic component of a habitat.
3. Whales need to breathe like us. They come up to the surface of the water to take in air. They can hold their breath for a long time.

4. Vultures and crows are examples of scavengers.
 5. Herbivores are called primary consumers since they feed directly on plants.
 6. Submerged plants have long, thin leaves which can make do with the faint light that reaches them. The thin, segmented leaves also offer little resistance to the flow of water.
 7. Characteristics of the soil are called edaphic factors.
 8. Some animals spend the entire summer in a state of sleep. This is called aestivation.
 9. Whales, seals and penguins can survive in bitterly cold regions because they have a thick layer of fat under their skin. Some animals such as the polar bear, yak and mink have very thick fur.
 10. Bacteria and fungi are examples of two groups of decomposers.
- B.**
1. Fish have gills to help them make use of the oxygen dissolved in water for respiration. They gulp in water through the mouth. The water then flows over the gills, where the oxygen dissolved in water is absorbed. The scales on the body of the fish and their streamlined shape with a tapering head help them overcome the resistance of water while swimming.
 2. A food chain can be defined as a series of organisms linked together by the process of eating and being eaten. Grasshoppers eat plants and they are eaten by frogs, which are, in turn, eaten by snakes.
 3. Organisms have special adaptations that help them protect themselves from being eaten. Insects use camouflage, or blend with their surroundings, to avoid being eaten.
 4. Carnivores have large, curved, pointed canines for gripping their prey and tearing flesh. Their eyes are set in front of their head to help them judge distances better. They also have a keen sense of smell.
 5. Plants like cacti develop adaptations to cope with the intense heat and light and shortage of water in their habitats. These plants are called xerophytes. Cacti store water in their green, spongy stems, which serve as leaves. They have spines instead of leaves to reduce the loss of water. Some trees like *Acacia* have segmented leaves for the same reason. They also have long roots which penetrate deep into the soil.
 6. Plants which float on water have air cavities in their stems and leaves to make them light. Their leaves are covered with a waxy substance so that they do not decay despite being in contact with water.
- C.**
1. Coniferous trees (pines and firs) grow well in less cold regions. The shape of these trees is such that snow does not accumulate on them but slides off. They also have needle-shaped leaves to reduce the loss of water through transpiration. This helps them cope with shortage of water when the ground is frozen in winter.
 2. Camels have special adaptations to cope with the heat and shortage of water in deserts. Their long legs keep them far above the hot sand. Their humps store fat to tide over food shortage. They excrete very little urine to reduce the loss of water. They can also raise their body temperature so as not to feel too hot, and can drink large quantities of water at one go.
 3. Adaptations are structural or functional adjustments (in an organism) that help an organism survive in its habitat. They develop over hundreds of years. Responses, on the other hand, are behaviours to cope with changes in the surroundings in which an organism lives. A camel is adapted to live in conditions of extreme heat, while we respond to a rise in temperature by sweating.
- D.**
- | | | | | |
|--------------|------------------|--------------|----------------|-----------|
| 1. Omnivores | 2. Biodegradable | 3. secondary | 4. hibernating | 5. spines |
| 6. cuticle | | | | |
- E.**
- | | | | | |
|-------------|--------|--------|--------|-------------|
| 1. (a) | 2. (b) | 3. (b) | 4. (a) | 5. (c), (d) |
| 6. (a), (d) | 7. (b) | 8. (c) | | |



9

About Flowering Plants

LESSON PLAN 1

35 minutes	1. Explain how plants are classified. 2. Ask the students to complete the activity given on page 82. Ask them to categorise flowering plants into herbs, shrubs and trees.
Closure: 5 minutes	Homework: A1, C3

LESSON PLAN 2

15 minutes	1. Complete the activity given on page 83. Show the students samples of tap roots and fibrous roots and ask them to differentiate between the two.
20 minutes	2. Demonstrate the activities provided on page 84 and discuss the functions of the root.
Closure: 5 minutes	Homework: A2, A6, B1, B2

LESSON PLAN 3

5 minutes	1. Show the students pictures of a banyan tree, money plant and sugar cane. Ask them what the functions of the roots are.
30 minutes	2. Show the students the shoot of a plant and ask them to identify the different parts of a shoot. 3. Ask them what the functions of the stem are. 4. Complete the activity given on page 86.
Closure: 5 minutes	Homework: B3

LESSON PLAN 4

15 minutes	1. Do the activity given on page 87.
20 minutes	2. Show the students a plant of the gourd family and ask them to identify the stem tendrils.
Closure: 5 minutes	Homework: A7

LESSON PLAN 5

15 minutes	1. Do the activity given on page 88 and ask the students to recognise the different parts of a leaf. Discuss venation and types of leaves.
20 minutes	2. Elicit from the students the various functions of a leaf. 3. Do the activities provided on page 89 and 90. Explain the function of the stomata.

	4. Summarise the functions of a leaf.
Closure: 5 minutes	Homework: A3, A5, B4, C1

LESSON PLAN 6

15 minutes	1. Show the students the tendrils of a pea plant and spines in the cactus plant and discuss modifications in leaves.
20 minutes	2. Complete the activities given on pages 91 and 92, and ask the students to identify the different parts of a flower.
Closure: 5 minutes	Homework: A4, A8, A9, C2, D, E, F

Answers to Exercises

- A.
1. Flowering plants are classified on the basis of size and kind of stem into herbs, shrubs and trees.
 2. The main root growing vertically downwards from the base of the stem is called the tap root.
 3. The main function of a leaf is to prepare food from water and carbon dioxide. Water and carbon dioxide undergo a chemical change to produce glucose.
 4. Any circular arrangement of leaves, petals, sepals, etc., around a common axis is called a whorl. A flower has four whorls.
 5. Thin, linear structures, called veins, arise from the petiole and the midrib. When the veins form a network across the leaf, it is said to have reticulate venation.
 6. Carrot, radish, turnip and sweet potato are examples of roots that store food.
 7. The stem of an onion plant is modified to store food.
 8. In cacti, the leaves are modified into spines to prevent excessive loss of water.
 9. The pea plant climbs with the help of leaf tendrils.
- B.
1. The root performs the following functions:
 - (a) It fixes the plant to the soil.
 - (b) It absorbs water and minerals from the soil.
 - (c) It binds the soil together and stops it from being blown away by the wind or washed away by the rain.
 2. The roots of some plants are modified to help them serve additional functions. For example, a carrot, radish or turnip is a modified tap root. In these plants, the tap root gets swollen with stored food. The plant stores food in the root to use it when it needs to do so. Some roots, like the prop roots of a banyan tree, provide extra support.
 3. The stem performs the following functions:
 - (a) It holds the plant upright and supports the branches.
 - (b) It bears branches, leaves, flowers and fruits. It spreads these organs out in all directions so that they function efficiently. For instance, it helps to spread out the branches and leaves so that the leaves get the maximum possible sunlight.
 - (c) It helps in the transport of water, minerals and food.
 4. The leaf blades of some leaves (like neem and gulmohar) are divided into leaflets. Such leaves are known as compound leaves. A leaf is said to be simple, on the other hand, when it has a single leaf blade, like those of banyan and peepal.

- C. 1. Figure 9.12 on page 88 shows the labelled diagram of a leaf. Thin, linear structures, called veins, arise from the petiole and the midrib. These run across the leaf either parallelly (parallel venation) or in various directions (reticulate venation). They provide support to the leaf, and transport water, minerals and food to and from the leaf.
2. The stalk of a flower is called the pedicel. The uppermost, swollen part of the pedicel is called the thalamus. The green, petal-like growths coming out of the thalamus are the sepals. The sepals enclose and protect the flower when it is a bud. Coloured or white petals grow inside the sepals in a circle. The stalklike growths with swollen, powdery heads are the stamens (the male parts of the flower). The stalklike portion is called the filament, while the swollen tip is the anther. The powdery substance contained in the anther is pollen. The flasklike structure at the centre of the flower attached to the stalk with a swollen tip is called the carpel. One or more carpels form the pistil (the female part of the flower). The swollen base is the ovary, the stalk is the style, and the swollen tip is the stigma. When you cut open the ovary, you can see tiny ovules, which later develop into seeds.

3.

Sl. No.	Herbs	Shrubs	Trees
1.	Small plants with soft green stems	Medium-sized plants which can grow up to 8 or 9 feet. The stem is hard and woody.	Tall perennial plants with a thick, hard, woody stem called trunk.
2.	May or may not have branches	They look bushy because they have many branches, which start from the base of the stem and grow in every direction.	Branches arise from the trunk after a certain height.
3.	They could be creepers or climbers.	They are known as hedge plants.	Some trees like date palm and coconut do not have branches.
4.	Examples: Rice, marigold	Examples: China rose, crepe jasmine	Examples: Mango, guava

- D. 1. fibrous roots 2. internode 3. bark 4. tap 5. parallel
 6. Top to bottom—Stigma, Style, Anther, Filament, Petal, Sepal, Ovule, Ovary, Thalamus, Pedicel
 7. axillary bud
- E. 1. (c) 2. (c) 3. (d) 4. (a) 5. (c)
- F. Spine (d) (3) Tendril in pea (d) (5) Scale leaves (e) (6) Sepal (a) (1) Tap root (g) (6)



10

Movements of the Body

LESSON PLAN 1

5 minutes	1. Ask the students what helps us to move.
30 minutes	2. Discuss the functions of the bones by showing them the photograph of a human skeleton or taking them to the lab if you have a skeleton in the lab. 3. Show them X-rays, if possible, of fractured and dislocated bones and pictures of casts, etc.
Closure: 5 minutes	Homework: A1, A2, C1

LESSON PLAN 2

30 minutes	1. Discuss the parts of a human skeleton and the main function of each portion. 2. Discuss in depth the skull, spine, ribcage, bones of the shoulder, arm and hand, hip bones, and the bones of the leg and foot.
5 minutes	3. Ask the students to summarise what has been discussed.
Closure: 5 minutes	Homework: A10, B1, C3

LESSON PLAN 3

25 minutes	1. Demonstrate the activity given on page 101 and introduce the different types of joints.
10 minutes	2. Complete the activity on page 102 and discuss locomotion, ligaments, tendons, etc.
Closure: 5 minutes	Homework: A3 to A8, B3, B4, C2, C4

LESSON PLAN 4

25 minutes	1. Show the students visuals of the movements of snakes, fish and birds, and discuss the special features of these vertebrates that help them move.
10 minutes	2. Make the students write short notes on the topic discussed.
Closure: 5 minutes	Homework: C5, C6

LESSON PLAN 5

25 minutes	1. Show the students visuals of the movements of earthworms, insects and snails, and discuss the special features of these invertebrates that help them move.
10 minutes	2. Make the students write short notes on the topic discussed.
Closure: 5 minutes	Homework: A9, B2, B5, C7, D, E, F

Answers to Exercises

- A.
1. Three organ systems help us move the different parts of our body—the muscular system, the nervous system and the skeletal system.
 2. A baby has 300 bones in all. But as it grows, some of the bones fuse together, or join. An adult has 206 bones.
 3. A place where two or more bones join is called a joint.
 4. Joints are of two types—fixed and movable. Hinge joints, ball-and-socket joints, pivot joints and gliding joints are examples of movable joints. The joints between the teeth and the jaw bones are examples of fixed joints.
 5. Every bone capable of movement has muscles attached to it by tough, elastic, cordlike tissue called tendon.
 6. Ligaments, which bind bones, make it possible for them to move by stretching and relaxing.
 7. In a hinge joint the convex surface of one bone fits into the concave surface of another bone, allowing movement in only one direction. For example, the hinge joint at your elbow allows you to bend your forearm and straighten it. It does not let you bend your arm backwards and sideways.
 8. The head moves from side to side because it rests on a pivot joint at the top of our spine. In such joints, a bony ring rotates around a pivot, or sticklike bone.
 9. A snail has a large, flat foot, which helps it move forward. The foot secretes a slimy substance, which helps the snail to glide over the ground, dragging its heavy shell with it. The movement of the foot is controlled by muscles attached to it.
 10. The hip bones and the vertebrae are joined to form the pelvic girdle.
- B.
1. The cartilage is a layer of rubbery tissue that covers the surface of the bone where it joins another bone. This reduces friction between the surfaces when the bones rub against each other.
 2. Insects have a hard covering, or an exoskeleton, over their body. They have three pairs of jointed legs and strong muscles to pull these legs. The legs are joined to the body by ball-and-socket joints. When an insect walks, three legs support the body, while the other three move the body forward.
 3. Gliding joints occur between the vertebrae and between the bones of the wrists and ankles. The cartilage between these bones allows small movements, somewhat like the movement of a spring. These are not freely moving joints.
 4. A pivot joint has a bony ring that rotates around a pivot or sticklike bone. This allows twisting movement about the joint. For example, the head moves from side to side because it rests on a pivot joint at the top of our spine.
- C.
1. The skeletal system is made up of the bones of our body. It acts as a framework, or gives shape to the body. The bones also protect delicate internal organs, and help us to move. It is the movement of the bones that helps us bend, run, walk, and so on. The muscles attached to the bone help them move.
 2. In ball-and-socket joints, the rounded head of one bone fits into the hollow, cup-shaped socket of another. The bone that fits into the socket is free to move in all directions about the joint. The joint of the upper arm and the shoulder bone is an example of this type of joint.
 3. Running through the centre of the chest is the breastbone, or sternum. Joined to it are strong, curved, flexible bones called ribs. The ribs curve around and join the vertebral column at the back, to form a protective cover for the lungs and heart. This cover is called the ribcage. The ribs are attached to the sternum in such a way as to allow the ribcage to expand when we inhale, or breathe in.
 4. When a muscle attached to a bone contracts, it pulls the bone and makes it move. But it cannot push it back. So, another muscle is required to pull it back in the opposite direction. That is why muscles work in antagonistic pairs. One muscle pulls a bone away from the joint, while its partner pulls it back. The biceps and triceps in the upper arm are an example of such pairs of muscles. The contraction of the biceps pulls the forearm up, while the contraction of the triceps pulls it back down.
 5. Fish move by wavelike movements which travel from the head to the tail. This movement is made possible by strong muscles attached to the vertebral column. The vertebral column is like a flexible rod that can move from side to side. The muscles on the two sides of the body work antagonistically. When the muscles on one side

contract, the muscles on the other side relax. This is what makes the wavelike motion of the body possible. The fins help the fish steady itself, change direction or turn. They also act as brakes. The lashing of the tail fin from side to side gives the fish a forward thrust.

6. The wings of a bird, when spread out, have a large surface area as compared to that of the body. This helps a bird fly against the force of gravity. When a bird's wing moves through the air, its front is wider than its back, which tapers and drags a little. The top of the wing is curved outwards, while the bottom is curved inwards. This shape creates a higher air pressure under the wing. As a result, the air gives the wing an upward thrust. Since the feathers of the wing interlock to form an air-resistant structure, the air pushing from below cannot pass through. The extra need for oxygen is met by additional air sacs in the body.
7. When an earthworm moves, the bristles at the rear end hold firmly to the ground, while the front of the body is free to stretch forward with the help of strong muscles. Then the bristles under the front of the body anchor the front part of the body, while those under the rear end relax. This makes it possible for the earthworm to pull up the rear end with the help of its muscles. Then the process is repeated, and the animal moves forward with the help of a wave of contractions travelling down the body.

<i>D.</i>	1. three	2. vertebrae	3. invertebrates	4. locomotion	5. hip bone
<i>E.</i>	1. (d)	2. (d)	3. (c)	4. (a)	5. (c)
<i>F.</i>	Bones in an adult	two hundred and six			
	Ribs	protect the heart and lungs			
	Vertebrae	protect the spinal cord			
	Triceps contract to	pull the arm down			
	Biceps contract to	pull the arm up			
	Bones in a baby	three hundred			



11

Measurement

LESSON PLAN 1

5 minutes	1. Ask the students why we need to measure any object. Elicit from them the importance of measurement by asking relevant questions.
30 minutes	2. Do the activity given on page 108 and discuss the two parts of measurement. 3. Ask the students to measure the dimensions of a book using various things. Discuss the need for a standard unit. 4. Discuss the SI units.
Closure: 5 minutes	Homework: A1, A5, B2

LESSON PLAN 2

30 minutes	1. Explain the important points that need to be remembered while measuring the length of any object. Also discuss how to use a ruler correctly. 2. Ask the students to demonstrate the use of a ruler.
5 minutes	3. Summarise what has been discussed in class.
Closure: 5 minutes	Homework: A3, B1, B3

LESSON PLAN 3

35 minutes	1. Demonstrate the activity given on page 112 and discuss how to measure the length of a curved line or edge. 2. Ask the students what the unit of mass is. 3. Bring a beam balance to class and demonstrate how to measure mass.
5 minutes	4. Summarise what has been discussed in class.
Closure: 5 minutes	Homework: A6, C1, C2

LESSON PLAN 4

25 minutes	1. Discuss the importance of measuring time. 2. Complete the activity given on page 114. Explain terms like pendulum and oscillation.
10 minutes	3. Ask the students to name the types of clocks they have seen. 4. Summarise what has been discussed in class.
Closure: 5 minutes	Homework: A2, A4, A7, A8, D

Answers to Exercises

- A. 1. A standard unit is a standard or a fixed measure of a physical quantity, such as length or time.
2. The SI unit of mass is kilogram (kg), the unit of length is metre (m) and the unit of time is second(s).
3. In scientific measurements, it is better to take three readings and calculate the average to avoid making mistakes.
4. Galileo discovered that a swinging pendulum takes a fixed time to complete one oscillation. This helped in the invention of the pendulum clock.
5. The measurements taken by using parts of the body were not accurate because the length of the body parts are not uniform.
6. The beam balance is an instrument used to compare the mass of an object with the known mass of a standard weight.
7. A pendulum is just a weight hung from a fixed point so that it can swing freely.
8. The Babylonians were perhaps the first to come up with smaller units of time. They divided the day into 24 hours and an hour into 60 minutes.
- B. 1. (a) The ruler must be placed along the length of the object we wish to measure.
(b) Our eye must be exactly above the point where we are making our measurement.
(c) It is not necessary to place the 0-mark at the starting point of the length we are measuring.
2. In ancient times, people must have felt the need to measure how far one village was from another. If they wanted to know the size of their crop fields, they would have needed to measure area. When they traded with each other, they would have needed to measure the length of cloth, for example.
3. When we use a broken ruler to measure the length, we can use the 1-cm or any other full mark as the reading corresponding to one end of the length. However, we must subtract this reading from the reading corresponding to the other end of the length to get the exact measurement.
- C. 1. Place the piece of paper on which the curved line is drawn on a drawing board or cardboard. Fix pins vertically on the board wherever the line changes direction. Make a knot at one end of a string. Pierce a pin through the knot and fix the pin at one end of the curved line. Stretch the string along the pins and mark it with a pen where it touches the last pin. Measure the length of the string from the knot to where you have marked the end by stretching it along a ruler. This is the approximate length of the line.
2. Open the legs of the dividers so that the distance between the pointed ends is 0.5 cm. Place the pointed end of one leg at one end of the line. Then place the pointed end of the other leg along the line. Rotate the first leg around the second leg and place it further along the line, and so on, until you reach the end of the line. Count the number of times you have to place the dividers along the curved line and multiply this number by 0.5 cm. The product gives the approximate length of the line. If a small portion of the curve is still left at the end, measure it separately by adjusting the legs of the dividers and add this to the product.
- D. 1. unit 2. 1000 3. exactly above 4. cubit 5. second 6. clock



12

Motion

LESSON PLAN 1

5 minutes	1. Give examples of motion. Ask the students to define motion.
30 minutes	2. Discuss Figure 12.1 and elicit the difference between rectilinear and curvilinear motion. 3. Discuss rotational and circular motion with suitable examples.
Closure: 5 minutes	Homework: A1 to A4, B1, B2

LESSON PLAN 2

30 minutes	1. Demonstrate the motion of a pendulum. Ask the students to discuss oscillatory motion and relate it to periodic motion.
Closure: 5 minutes	Homework: B3, C, D

LESSON PLAN 3

25 minutes	1. Revise the types of motion with relevant examples. Discuss the occurrence of different kinds of motion at the same time.
10 minutes	2. Summarise the chapter by asking the students to write the important points.
Closure: 5 minutes	Homework: A5, E

Answers to Exercises

- A. 1. A body is said to be in motion in relation to an observer if its position with respect to the observer changes with time.
2. The houses are in motion in relation to us; they seem to be moving backwards.
3. When a body moves in a straight line, its motion is described as rectilinear, e.g., a ball dropped from a height.
4. If we throw a tennis ball in the air, its motion is curvilinear.
5. The earth rotates about its axis while revolving around the sun.
- B. 1. Yes, it is possible. Suppose you are sitting near a window in a train. To you the trees outside will seem to be moving backwards. But to a person standing outside, they will seem to be stationary.
2. In circular motion, the position of the body itself keeps changing with time, but in rotational motion, the position of the body does not change. The movement of the earth around the sun is an example of circular motion, while the movement of a potter's wheel is an example of rotational motion.
3. (a) Oscillatory motion is the periodic motion of a body about its position of rest. Yes, it is always periodic.
(b) The rotation of the earth about its axis is repeated every 24 hours. This is another example of periodic motion.
- C. 1. (a) 2. (c) 3. (a) 4. (a)
- D. 1. linear 2. rotational 3. rotational 4. circular
- E. 1. false 2. true 3. false 4. false 5. false



13

Light

LESSON PLAN 1

5 minutes	1. Complete the activity given on page 122 and ask the students why light is important.
30 minutes	2. Demonstrate the first activity given on page 123 and discuss how light travels. 3. Complete the second activity given on page 123 and discuss rays and beams.
Closure: 5 minutes	Homework: A1, A2, C2

LESSON PLAN 2

30 minutes	1. Complete the activity given on page 124 and help the students to conclude that light travels in straight lines. 2. Do the activity given on page 125 and discuss the difference between transparent, translucent and opaque objects.
5 minutes	3. Ask the students to summarise what has been discussed.
Closure: 5 minutes	Homework: C1

LESSON PLAN 3

25 minutes	1. Complete the activities given on pages 125 and 126 and discuss the formation of shadows. 2. Discuss the activity given on page 127.
10 minutes	3. Do an activity as per Figure 13.10 and explain how the size of a shadow changes with the angle between the rays of light and the object.
Closure: 5 minutes	Homework: A3, A4, B1, B2, B3

LESSON PLAN 4

25 minutes	1. Complete the activity given on page 128 and get the students to conclude that a shadow does not always let you judge the shape and thickness of an object.
10 minutes	2. Do an activity based on Figure 13.11 and discuss the sharpness of a shadow. 3. Discuss lunar and solar eclipses and their formation by referring to Figures 13.12 and 13.13. 4. Summarise what has been discussed.
Closure: 5 minutes	Homework: A5, C3

LESSON PLAN 5

25 minutes	1. Do the activity given on page 130 and ask the students what they noticed about the images. 2. Demonstrate the activity on page 131. Refer to Figures 13.17 and 13.18.
10 minutes	3. Ask the students to write the main points of what has been discussed.
Closure: 5 minutes	Homework: A6, A7, B3, B4, D, E

Answers to Exercises

- A.**
1. Anything which emits light is a luminous object. For example, a candle, the sun.
 2. We see nonluminous objects by the light reflected from them.
 3. The light in these streams falls on the dust particles of air, gets turned and enters our eyes. This helps us to see the stream of light.
 4. A shadow is the dark space behind an opaque object where light is blocked by the object.
 5. When the earth comes between the moon and the sun, the earth's shadow falls on the moon. This is called a lunar eclipse.
 6. The bouncing off of light at a surface is called reflection.
 7. In the image formed in the mirror, the left and right sides get reversed.
- B.**
1. When an opaque object is placed in the path of light, it stops the light from passing through. It cannot light up the space behind it. So a shadow is formed.
 2. The size of the shadow of a stick depends on the angle the rays of the sun make with the object. The slanting rays of the sun (early in the morning and in the late afternoon) cast longer shadows. The shadow is the shortest when the stick is parallel to the direction of the rays, that is, when the sun is directly overhead.
 3. As the distance between the source of light and the object increases, the shadow becomes smaller. And as the distance between the object and the screen increases, the shadow on the screen becomes larger.
 4. Mirrors are made of polished glass, with a layer of metal at the back. This layer of metal is the main reflecting surface of a mirror. The glass lets you see the reflected image. A coat of paint behind the metal layer protects it from damage.
 5. A mirror reflects the light coming from an object. When this reflected light reaches our eyes, we see a copy of the object in the direction of the reflected light. This is the image of the object.
- C.**
1. Substances which allow light to pass through them are said to be transparent, for example, glass. Substances which allow only some light to pass through them are called translucent, for example, tracing paper. Substances which do not allow light to pass through them are called opaque, for example, wood.
 2. If we try to look at something through a bent tube, we will not be able to see it. But if we look at it through a straight tube, the object is visible. This shows that light travels in a straight line.
Remove the lid of a small cardboard box and make slits on all its sides. Next, switch on a small torch and cover it with the box. Streams of light coming out of the slits spread in all directions. This shows that light spreads out in all directions from its source.
 3. When the moon comes between the sun and the earth, the moon's shadow falls on the earth. This is called a solar eclipse. In the small region where the moon's umbra falls, people cannot see the sun. This region has a total solar eclipse. People see a part of the sun in regions where the penumbra falls. These regions have a partial solar eclipse. See Figure 13.13 on page 129.
 4. Cut out one end of a cardboard box and fix a tracing paper over the open end. Then, make a small hole at the centre of the opposite face. When we point the hole towards bright objects like a tube light, we will see an inverted image of the tube light on the tracing paper screen. The images are inverted because light travels in a straight line. The rays travelling from the top and bottom of an object cross the pinhole and continue to travel in a straight line. When they fall on the screen, the rays from the top half of the object are below the rays from the bottom half. Thus the image formed is inverted.
- D.**
1. (b)
 2. (c)
 3. (c)
 4. (c)
 5. (c)
- E.**
1. penumbra, umbra
 2. parallel rays, convergent rays, divergent rays
 3. ray box, mirror, reflected ray



14

Electric Circuits

LESSON PLAN 1

15 minutes	1. Do the activity given on page 135 and discuss the cell and its characteristics.
20 minutes	2. Demonstrate the activity given on page 136 and discuss how a battery is made. 3. Ask the students to summarise what has been discussed.
Closure: 5 minutes	Homework: A1, A2

LESSON PLAN 2

15 minutes	1. Complete the activity provided on page 137 and discuss how a cell needs to be connected to light a bulb.
20 minutes	2. Demonstrate the activity given on page 138 and discuss terms like electric circuit and switch. 3. Discuss the electric circuit of a torch.
Closure: 5 minutes	Homework: A3, A4, A5, B1, B2, B3

LESSON PLAN 3

25 minutes	1. Do the activity given on page 140 and discuss the characteristics of conductors and insulators.
10 minutes	2. Ask the students what the different uses of conductors and insulators are. 3. Summarise the topics discussed.
Closure: 5 minutes	Homework: A6, A7, B4, C1, C2, D, E, F, G

Answers to Exercises

- A.
1. When we touch an electrical socket, we may get a bad shock because the mains supply a huge amount of electrical energy. In contrast, cells supply a very small amount of energy.
 2. No, a cell is the basic unit of producing electricity. However, often one cell does not provide enough energy. So we need a groups of cells, or a battery, to run an appliance.
 3. The bulb will glow only when its terminals, the wires connecting them and the two terminals of the cell form a complete loop.
 4. The path along which an electric current can flow is called an electric circuit.
 5. A switch is a device used for opening (breaking) and closing an electrical circuit.
 6. Materials that allow an electric current to pass through them are called conductors. For example, silver, carbon.
 7. Materials that do not conduct electricity are called insulators. For example, plastic and glass.

- B.
1. There will be a '+ve sign at one end and a '-ve sign at the other end. These signs stand for the positive and negative terminals of the cells. The protruding metal cap at one end of the cell is its positive terminal. The flat metal base is its negative terminal.
 2. Inside the cell is a blackish chemical paste. A reaction between this chemical and the metal container provides the electrical energy to run electrical devices.
 3. We can make a switch with two drawing pins, a small block of wood and a paper clip. The pins are the two terminals of the switch. The connection between them is made or broken by the paper clip, which swings around the pin holding it down. [See Figure 14.9(a) on page 138.]
 4. We need a line tester for this purpose. To make one, attach wires to two paper clips. These act as the probes of the tester. Connect the probes to a bulb-and-battery circuit. When they are brought together, the bulb should glow. Now place both the probes on a key, an eraser, and so on. If the bulb glows, the thing being tested conducts electricity. Otherwise, it does not.
- C.
1. Insulators play an important role in electrical circuits and equipment. The electric wires are insulated by a plastic or rubber cover. The insulation on wires ensures that an alternative circuit is not created in case the wires touch, i.e., it prevents a short circuit, which causes a large current to flow. Short circuits can even start a fire. Insulation on wires also protects us from electric shock.
 2. The bulb glows only when the wires connected to it and the bulb itself form a closed path. If there is any break in the path, that is, in case of any break in the wires or the filament of the bulb, it does not glow. Also, it is essential that the wires be connected to opposite terminals of the cell. If they are connected to the same terminal, the bulb does not glow.

- D.
1. False
 2. True
 3. True
 4. False
 5. True

E.

Device	Conductor	Insulator	Chemicals
Wire	✓	✓	
Bulb holder	✓	✓	
Switch	✓	✓	
Torch	✓	✓	✓
Cell	✓	✓	✓
Line tester	✓	✓	

- F.
1. (b) and (c)
 2. (c) and (d)
 3. (a)

- G.
- (b)



15

Magnetism

LESSON PLAN 1

5 minutes	1. Explain to the students how magnetite was first discovered in Magnesia.
30 minutes	2. Discuss the shapes and properties of magnets. Complete the activity on page 143. 3. Do the activities given on pages 144 and 145 and discuss the difference between temporary and permanent magnets. Also discuss the importance of the two poles of a magnet.
Closure: 5 minutes	Homework: A1, A2, A3, A6, B4, C2

LESSON PLAN 2

10 minutes	1. Demonstrate the first activity on page 146. Ask the students what a compass is.
25 minutes	2. Complete the second activity given on page 146 and explain to the students how unlike poles attract and like poles repel. 3. Do the activity given on page 147 and discuss repulsion and attraction between magnets in detail.
Closure: 5 minutes	Homework: A4, A5, A8, C1

LESSON PLAN 3

20 minutes	1. Discuss how the earth behaves as a magnet.
15 minutes	2. Talk about the uses of magnetism. 3. Summarise what has been discussed in class.
Closure: 5 minutes	Homework: A7, B1, B2, B3, D, E, F

Answers to Exercises

- A.
1. When one suspends a bar magnet, one of its poles always points towards the geographical north. This property of a magnet was used by ancient travellers to find their way. A magnetite stone was thus known as lodestone, which means 'way-stone'.
 2. Iron, nickel and cobalt are the three elements that can be permanently magnetised.
 3. Iron and cobalt are magnetic.
 4. The magnet is the strongest at two points—one on each of its ends. We call these points the poles of a magnet.
 5. The unlike poles of the magnet attract, or pull, each other and like poles repel, or push, each other.
 6. A permanent magnet can lose its magnetism if it is dropped from a great height. It can also lose its magnetism if it is heated.

7. No, this statement is not correct. The magnetic north pole and the south pole of the earth are approximately at the geographical south pole and north pole respectively.
8. (a) south pole of the magnet (b) south pole
- B. 1. To prevent loss of magnetism, the best way to store a horseshoe magnet is to place a strip of a magnetic material between its opposite poles. Bar magnets are best stored in pairs, with strips of magnetic material between the opposite poles of the two magnets. The strips of magnetic material used to store magnets safely are called keepers.
2. The needle of a compass or any freely suspended magnet always aligns along the geographical N-S direction. This means that the earth behaves like a magnet.
3. Magnets are used in door closers and stickers. They are used to separate magnetic ores from nonmagnetic rocks. Magnets are used in compasses, loudspeakers, motors and generators. Data, sound and images can be stored by coating special surfaces with magnetic material in computer hard disks, floppies, etc.
4. When we dip a bar magnet in a pile of pins, all the pins which stick to the magnet do so at the two ends of the magnet. This is because the magnet is the strongest at the two poles.
- C. 1. A magnetic compass is a simple device for finding direction. It consists of a magnetic needle that can turn freely about its centre. The needle is encased in a box with a transparent top. Directions are either printed on a card placed below the needle or marked on the top of the box. The north pole of the needle points towards the geographical north when kept away from magnetic materials. To find directions, the box is turned till the north mark on the card falls exactly below the north pole of the needle. In this position, all other directions are as indicated by the card.
- To make a compass, magnetise a needle and pass it through a piece of cork or rubber, so that it can float. Place the needle in a plastic or glass vessel containing water. When the needle comes to rest, it will point to the N-S direction.
2. While unlike poles attract each other, like poles repel each other. We can use this property of magnetic poles to distinguish between a magnet and a similar looking bar of iron or any other magnetic material. To identify the magnet, you will need another magnet, such as the needle of a compass. If you bring the magnetic material near either pole of the magnetic needle, the pole will attract the bar and the needle will swing towards the bar. If the bar is a magnet, one pole of the needle will be attracted to and the other will be repelled by the pole of the magnet facing the compass. Thus, repulsion is a sure test of magnetism.
- D. 1. magnetic, geographical 2. Alnico 3. north 4. poles 5. loses
- E. 1. A, b 2. A, a 3. B, b 4. A, a 5. A, c
- F. 1. (a) 2. (c) 3. (c), (d) 4. (b), (d)



16

Water

LESSON PLAN 1

15 minutes	1. Discuss with the students how water is essential for life.
20 minutes	2. Complete the activity given on page 153 and discuss the uses of water. Divide the class into two groups. Ask one group to speak for, and another group to speak against the motion, 'Potable water should be used for cleaning and bathing'.
Closure: 5 minutes	Homework: A1, A2

LESSON PLAN 2

15 minutes	1. Discuss the agricultural use and industrial use of water.
20 minutes	2. Complete the activity given on page 155 and discuss the conditions that help evaporation.
Closure: 5 minutes	Homework: A3, A4, B1 to B4, C2

LESSON PLAN 3

15 minutes	1. Do the activity given on page 156 and discuss condensation.
20 minutes	2. Discuss the water cycle and its importance using Figure 16.8.
Closure: 5 minutes	Homework: B4, C3, A6

LESSON PLAN 4

20 minutes	1. Divide the class into two groups. Ask the first group to discuss the formation and importance of groundwater. Ask the second group to discuss the importance of surface water.
15 minutes	2. Complete the activity given on page 160 using the same groups. Discuss how droughts and floods occur. Examine how droughts and floods affect lives.
Closure: 5 minutes	Homework: A5, A7, B5, C1

LESSON PLAN 5

25 minutes	1. Ask the students how water can be conserved. Lay stress on the methods of conserving water through rainwater harvesting.
10 minutes	2. Summarise what has been taught.
Closure: 5 minutes	Homework: C4, D, E

Answers to Exercises

- A.**
1. The most abundant compound on earth is water. The main uses of water can be classified into household, agricultural and industrial.
 2. Photosynthesis is a biochemical reaction in which water reacts with carbon dioxide in the presence of sunlight and chlorophyll to form glucose.
 3. When we say that the water requirement of wheat is 500, we mean that 500 L of water is required to grow 1 kg of wheat.
 4. Water is used as a reactant, as a solvent and for the disposal of waste in industry.
 5. When rainwater seeps through the soil, it passes through some rocks and moves downwards till it meets rocks it cannot permeate. Above such rocks, this water accumulates and a reservoir of groundwater is formed.
 6. The deposition of water from the atmosphere onto the earth in any form—liquid or solid—is called precipitation.
 7. Rainwater harvesting is one way of conserving water. It involves making use of rainwater instead of allowing it to run off.
- B.**
1. The change in state from liquid to vapour taking place below the boiling point is called evaporation.
 2. Take a glass, and a shallow dish made of the same material. Pour small but equal amounts of water into them. Let the water evaporate in the sun. Evaporation from the glass is slower than that from the shallow dish. This is because the larger the surface area, the faster is the evaporation of the liquid.
 3. A high temperature, low humidity and a draught help a liquid evaporate faster.
 4. If the air is too cold, as on winter nights, the water vapour condenses at a very low height and forms a fog. A fog may extend from the ground up to a height of about three fourths of a kilometre.
Nearly a kilometre above the surface of the earth, it is cold enough for the water vapour to condense into droplets around dust particles to form clouds.
 5. When it does not rain for a year or a two, we have a drought. There is no water to irrigate farmland, crops get destroyed and thus there is shortage of food. Rivers, ponds and lakes dry up. The water table falls, borewells fail, leading to a shortage of drinking water.
- C.**
1. Crops need water for photosynthesis, for drawing minerals from the soil and to transport substances from one part to another. Also, they lose a lot of water through transpiration. This loss of water is many times greater than the amount required for the other purposes. The soil must contain sufficient moisture to meet the needs of the crop growing on it.
 2. Take small but equal amounts of water in the dish two similar shallow dishes. Place one of the dishes under a moving fan and the other away from the fan. Water under the fan evaporates faster than that placed away from the fan. This is because the draught continuously blows away whatever vapours are formed. This helps fresh vapours to be formed and the water evaporates faster. Clothes dry faster when there is a breeze. This shows that a current of air aids evaporation.
 3. In very high clouds, the water freezes into crystals of ice because it is very cold. These crystals fall as snowflakes when they become heavy. Sometimes rain passes through a very cold layer of air and freezes into hailstones.
 4. The rainwater which falls over land runs off to oceans, either directly or through rivers and streams. Some of it seeps through the soil and collects over rocks it cannot permeate. This water is called groundwater.
Pits or tanks are dug in low-lying areas to collect the rainwater that runs off. This water can be filtered, disinfected and supplied for consumption.
- D.**
- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (c) | 2. (d) | 3. (c) | 4. (c) | 5. (d) |
|--------|--------|--------|--------|--------|
- E.**
- | | | | | | |
|----------------|--------------|------------------|-----------|----------|--------|
| 1. biochemical | 2. transport | 3. transpiration | 4. hotter | 5. merge | 6. air |
|----------------|--------------|------------------|-----------|----------|--------|



17

Air—The Breath of Life

LESSON PLAN 1

20 minutes	1. Complete the activity on pages 164–165 and discuss the presence of air.
15 minutes	2. Discuss the displacement of air by water and vice versa. Also ask the students to figure out whether soil contains air after completing the activity given on page 165.
Closure: 5 minutes	Homework: A1, A2, B2, C1

LESSON PLAN 2

15 minutes	1. Complete the activity on page 166 and discuss whether water contains air. Ask the students who swim if they can breathe under water.
20 minutes	2. Do the activity on page 167. Also, discuss the composition of air.
Closure: 5 minutes	Homework: A3, B1

LESSON PLAN 3

10 minutes	1. Do the activity on page 168 and discuss the condition required for burning.
25 minutes	2. Do the activity on pages 168/169 and discuss the proportion of oxygen and nitrogen in air. 3. Discuss the oxygen–carbon dioxide balance in air using Figure 17.13.
Closure: 5 minutes	Homework: A4 to A8, B3, C2

LESSON PLAN 4

15 minutes	1. Elicit from the students the uses of air by asking relevant questions.
20 minutes	2. Summarise the topics discussed by asking the students to write down the important points.
Closure: 5 minutes	Homework: B4, C3, D, E

Answers to Exercises

- A.
1. The pores in soil are filled with air. When water enters these pores, it displaces air. That is why air bubbles come out when soil is added to water.
 2. In order to grow, the roots of plants require oxygen. Air present in the soil provides the roots with oxygen.
 3. Oxygen and nitrogen are two elements present in air. Carbon dioxide and water vapour are two compounds.
 4. Oxygen and nitrogen are the two major components of air. The oxygen–nitrogen proportion in air is 1:4 approximately.

5. No, the composition of air is not fixed.
 6. The proportion of carbon dioxide in air in urban areas is greater than that in rural areas.
 7. The amount of water vapour in air is greater in the rainy season than in the dry season.
 8. Carbon dioxide is formed when carbon is burnt in air.
- B.**
1. To see that water contains dissolved air, we can heat some water very slowly on a low flame. We will see air bubbles forming.
 2. Invert a glass tumbler over a burning candle. The candle will burn only for a short while. This is because the amount of air in the tumbler is limited. The burning stops as soon as the oxygen inside the tumbler is consumed. Open the lid of a plastic jar. Make holes in the jar and invert it over a burning candle. The candle will continue to burn till the end because it gets a continuous supply of oxygen.
 3. Soot and dust are harmful particles that may enter our respiratory tract and lungs. If inhaled, they may cause many problems. The hair in our nostrils trap these particles and prevent them from reaching the respiratory tract.
 4. Air is used for photosynthesis, respiration and as a source of some gases like nitrogen and argon. It helps in hearing and also in regulating temperature.
- C.**
1. Invert an empty glass tumbler and push it right into a trough containing water. No water will enter the tumbler. When we tilt the tumbler, bubbles start coming out of it and water starts entering it. The tumbler is initially full of air. When we tilt it, the air inside it finds its way out in the form of bubbles.
 2. Fill a bottle with water, close its mouth with your thumb and invert it into a bucket of water. Remove your thumb and hold the bottle with its mouth under water. Introduce one end of a bent straw into the bottle and blow into it from the other end. Bubbles will rise up the liquid and collect in the upper part of the bottle. The level of water in the bottle falls as air collects in the bottle and finally becomes the same as that in the bucket. This shows that air can cause the downward displacement of water.
 3. Animals use huge amounts of oxygen and release large amounts of carbon dioxide during respiration. But during photosynthesis, plants use up carbon dioxide and release oxygen in the air. Thus the balance of oxygen and carbon dioxide in the air is maintained. This shows that plants and animals depend upon each other for oxygen and carbon dioxide.
- D.**
- | | | | | | |
|--------|--------|--------|--------|--------|--------|
| 1. (c) | 2. (c) | 3. (c) | 4. (b) | 5. (b) | 6. (c) |
|--------|--------|--------|--------|--------|--------|
- E.**
- | | | | | | |
|--------|--------|------------|-----------|--------------|---------|
| 1. air | 2. air | 3. mixture | 4. oxygen | 5. supporter | 6. dust |
|--------|--------|------------|-----------|--------------|---------|



18

Waste

LESSON PLAN 1

10 minutes	1. Ask the students to name the different types of waste we generate. 2. Ask the students why we need to be concerned about waste disposal.
25 minutes	3. Ask the students to complete the activity on page 176 and discuss the difference between biodegradable, nonbiodegradable and toxic wastes.
Closure: 5 minutes	Homework: A1, B1, C3

LESSON PLAN 2

10 minutes	1. Classify the types of waste into industrial, agricultural and biomedical.
25 minutes	2. Ask the students to complete the activity given on page 178. Discuss 'reduce, reuse and recycle'.
Closure: 5 minutes	Homework: B3, B4

LESSON PLAN 3

30 minutes	1. Complete the activity given on page 179 and discuss segregation, collection and landfills.
5 minutes	2. Summarise what has been discussed in class by asking the students to write down the important points.
Closure: 5 minutes	Homework: A2, A3, B2

LESSON PLAN 4

30 minutes	1. Do the activity given on page 180 and discuss the types of composting.
5 minutes	2. Summarise what has been discussed by asking the students to write down the important points.
Closure: 5 minutes	Homework: A4, C2

LESSON PLAN 5

30 minutes	1. Using Figure 18.8, explain the production of fuel gas. 2. Discuss the use of incinerators and the impact of waste.
5 minutes	3. Summarise what has been discussed.
Closure: 5 minutes	Homework: A5, C1, C4

LESSON PLAN 6

30 minutes	1. Divide students into groups and discuss the different ways by which we can reduce the problem of solid waste disposal.
5 minutes	2. Summarise what has been discussed.
Closure: 5 minutes	Homework: D, E

Answers to Exercises

- A.
1. Waste can be classified into domestic, industrial, agricultural and biomedical on the basis of its source.
 2. Landfills are natural slopes or man-made troughs that are filled with garbage.
 3. Leaching is the seepage of dissolved substances from decomposing garbage into the soil. The dissolved substances are called leachate.
 4. Organic waste is biodegradable. In other words, it can be decomposed by natural decomposers.
 5. Incineration is a method of disposing of waste by thermal treatment, or burning.
- B.
1. Domestic waste consists of vegetable and fruit peels, food left over, paper, glass, plastic, metal (cans), batteries, medicines and garden waste.
 2. In domestic waste, chemicals present in batteries are toxic, or poisonous. Medicines, glass and other sharp-edged things are hazardous, or dangerous. Industrial solid waste contains many chemicals, which contaminate land and water. Biomedical waste is hazardous because it contains blood, stool, sputum samples, soiled bandages, and so on.
 3. Landfills should be far away from habitation to ensure that the rotting garbage does not spread diseases nor pollute the land and water used by the people. Also, toxic waste should not be dumped into landfills. In addition, they are covered with soil to prevent open rotting and scattering by scavengers.
 4. Recycling is the process of treating a used material so that it can be used again. For example, recycling saves the resources needed to make paper from wood, and mine and refine metals.
- C.
1. **Advantage**—Burning of waste reduces its volume and the ashes can be disposed of more easily than unburned waste.
Disadvantages—It is a waste of material that can be recycled. Also, precautions have to be taken to see that harmful gases and particles are not released into the air. To do so costs money. In addition, a lot of the municipal waste in our country is 'wet' waste. Fuel is required to burn such waste, which also means a waste of money and resources.
 2. Compost is a natural fertiliser produced by the decomposition of organic waste from kitchens, farms, vegetable markets, sugar mills, and so on. Layers of waste are buried in huge pits with layers of soil in between. When the pit is full, it is covered with a final layer of soil. Bacteria present in the soil act on the waste and convert it into compost. This is called composting.
 3. Organic waste, which is decomposed by natural decomposers, is called biodegradable waste. Things of plant or animal origin are biodegradable. Plastic, metals, etc., do not decompose, and are called nonbiodegradable.
 4. If solid waste is not disposed of properly and left to rot in the open, it can become a breeding ground of microorganisms, flies and mosquitoes. This leads to the spread of many diseases. Rainwater can wash off rotting waste into water bodies and contaminate them. Organisms which cause disease, present in the waste, can spread water-borne diseases like dysentery and cholera.
Pesticides and other chemicals enter the food chain through agricultural and industrial waste respectively. They are poisonous.
- D. 1. toxic 2. domestic 3. infectious 4. decompose 5. vermicomposting
- E. 1. (d) 2. (a) 3. (c) 4. (b) 5. (a)



Basic Science for Class 7

1

The Language of Chemistry

LESSON PLAN 1

15 minutes	1. Show the students the tables given on page 1 and discuss the symbols of elements.
20 minutes	2. Define valency and discuss the valencies of some common elements. 3. Explain the rules to obtain the formulae of compounds.
Closure: 5 minutes	Homework: A1, A2, A3, B

LESSON PLAN 2

15 minutes	1. Discuss variable valency.
20 minutes	2. Explain compound radicals to the students. 3. By giving examples, discuss how to represent a chemical equation.
Closure: 5 minutes	Homework: A4, A5, C1, D, E, F, G, H

Answers to Exercises

- A. 1. The formula of a substance represents a molecule of the element or compound. It gives the number(s) of atoms of the same or different elements present in the molecule.
2. The capacity of an element to combine with other elements is known as its valency. For example, one atom of Cl combines with one atom of H to form a molecule of hydrogen chloride.
3. Compound radical
4. Iron and copper are two elements that have variable valency. Two compounds formed by each of these are (i) CuCl; CuCl₂, and (ii) FeO; Fe₂O₃.
5. A balanced chemical equation is one in which each element on the reactant side has the same number of atoms as on the product side. Chemical equations must be balanced because no atoms are gained or lost during a chemical reaction.
- B. BaCl₂—2, PCl₃—3, PCl₅—5, NH₃—3, MgSO₄—2, CaCO₃—2, Na₂O—1, CaO—2, Ca(OH)₂—2, FeSO₄—2, FeCl₃—3, Fe₂O₃—3, NaOH—1, Al(OH)₃—3, Na₂CO₃—1
- C. 1. A group of atoms of different elements, which behaves like a single atom and has a valency, is known as a compound radical. The valency of the carbonate (CO₃) radical is 2 and that of the phosphate (PO₄) radical is 3. Some compounds that contain compound radicals are sodium hydroxide (NaOH, where the valency of Na is 1 and that of OH is also 1), nitric acid (HNO₃, where the valency of H is 1 and that of NO₃ is 1), sodium carbonate (Na₂ CO₃, where the valency of Na is 1 and that of CO₃ is 1).

D. 1. symbol 2. formula 3. transposed 4. gained

E. 1. (c) 2. (c) 3. (d) 4. (b)

F. (a) (ii) (b) (i) (c) (v) (d) (vi) (e) (iv) (f) (iii)

G. 1. True 2. True 3. False 4. True 5. False 6. True

H.	Water	H ₂ O	Hydrogen chloride	HCl	Nitric acid	HNO ₃
	Calcium oxide	CaO	Sodium chloride	NaCl	Sodium nitrate	NaNO ₃
	Carbon dioxide	CO ₂	Potassium chloride	KCl	Sodium carbonate	Na ₂ CO ₃
	Carbon monoxide	CO	Magnesium chloride	MgCl ₂	Potassium carbonate	K ₂ CO ₃
	Magnesium oxide	MgO	Zinc chloride	ZnCl ₂	Calcium carbonate	CaCO ₃



2

Acids, Bases and Salts

LESSON PLAN 1

5 minutes	1. Ask the students to give examples of acids and bases they see in everyday life.
30 minutes	2. Complete the activity given on page 9 and the tests given in Figures 2.1 to 2.4 and discuss different ways of determining whether a substance is acidic or basic. 3. Give a list of household substances as given in Table 2.1 and ask the students to identify the ones that are basic. Then, ask them to identify the acidic substances.
Closure: 5 minutes	Homework: A1, D5

LESSON PLAN 2

30 minutes	1. Show the students acids like HCl and H ₂ SO ₄ , and lemon and orange juice and ask them to name a few mineral acids. 2. Using chemical equations, discuss the formation of acids and acidic substances in the presence of air. 3. Introduce concentrated and dilute acids, and acid rain.
5 minutes	4. Summarise what has been discussed by asking the students relevant questions.
Closure: 5 minutes	Homework: A2, A3, B1, C3

LESSON PLAN 3

30 minutes	1. Do the experiments given in Figures 2.6 and 2.7. Using chemical equations, discuss the general behaviour of acidic substances. 2. Show the students Table 2.2 and discuss the uses of acids.
5 minutes	3. Summarise what has been discussed in class.
Closure: 5 minutes	Homework: C1, C2

LESSON PLAN 4

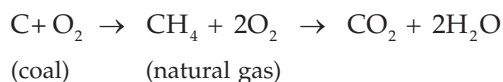
25 minutes	1. Discuss bases. 2. Complete the activity given on page 13. Discuss neutralisation reactions using the chemical equations given on the same page.
10 minutes	3. Using the equations given on page 14, discuss how bases are formed. 4. Ask the students what the general uses of bases are. 5. Summarise what has been discussed in class.
Closure: 5 minutes	Homework: A4, A5, B2, C4

LESSON PLAN 5

25 minutes	1. Using the equations given on page 15, discuss how salts are formed. 2. Using Table 2.3, discuss the common salts found in nature.
10 minutes	3. Show the students Table 2.4 and discuss the common uses of salts. 4. Summarise what has been discussed by asking the students to write the important points in their notebooks.
Closure: 5 minutes	Homework: A6, D1 to D4, E, F, G

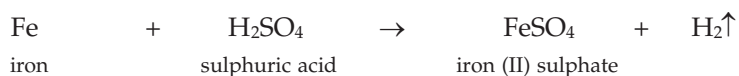
Answers to Exercises

- A. 1. Tomato juice—acid; Soap solution—base; Toothpaste—base; Lemon juice—acidic; Vinegar—acidic
 2. Hydrochloric acid (HCl), sulphuric acid (H₂SO₄) and nitric acid (HNO₃).
 3. Acids turn blue litmus red, and react with bases and certain metals to form salts. Acidic substances have a sour taste.
 4. Bases are compounds that react with acids to form salts. Basic substances generally taste bitter and turn red litmus blue.
 5. Soluble bases are called alkalis. Common bases soluble in water are sodium hydroxide (NaOH) and potassium hydroxide (KOH).
 6. When a base reacts with an acid, a neutral substance (salt) and water are formed.
- B. 1. Carbon dioxide is an acidic gas which is discharged into the atmosphere on the burning of fuels like coal and natural gas. Coal contains mainly carbon, and other fuels contain carbon compounds which give CO₂ on burning. Thus, large amounts of CO₂ are discharged into the air.



2. Basic substances have the following general properties.
 (a) They taste bitter.
 (b) They turn red litmus blue.
 (c) They react with acids to form neutral substances (salts).
 (d) Caustic alkalis corrode glass and some metals like aluminium, zinc, tin and lead.
- C. 1. Acids have the following general properties.
 (a) Acidic substances have a sour taste.
 (b) Acids turn blue litmus red.
 (c) They corrode most metals, i.e., chemically act on them, forming new compounds called salts. That is why sour things (e.g., pickles and vinegar) are not kept in metal pots.

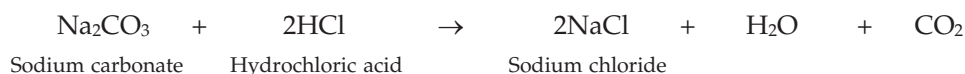
Hydrogen is produced when acids react with most of the common metals.



- (d) Acidic substances react with carbonates and hydrogencarbonates (i.e., bicarbonates) to liberate CO₂ with effervescence.



2. Acidic substances react with carbonates and hydrogencarbonates (i.e., bicarbonates) to liberate CO_2 with effervescence.



We can make use of this property to test for an acidic substance at home. Take some baking soda (sodium bicarbonate) and put a drop or two of the liquid on it. If the test liquid is acidic, carbon dioxide will evolve with effervescence, i.e., gas bubbles will be produced with a hissing sound. Lemon juice and vinegar will cause effervescence, but water will not.

3. Rain with a high acid content is called acid rain. Gases like sulphur dioxide and nitric oxide are found in the atmosphere due to the burning of fossil fuels. These gases react with oxygen to form sulphur trioxide and nitrogen dioxide, which are acidic and are fairly soluble in water. This makes the rain acidic.

Three bad effects of acid rain are as follows.

- (a) It makes the soil acidic and unfit for cultivation.
 - (b) It also makes water bodies like ponds, lakes and rivers acidic. This adversely affects aquatic life.
 - (c) Acid rain corrodes statues and monuments made of metals, marble and cement.
4. Bases are used for various purposes.
- (a) They are used for neutralising acids and acidic substances. For example, when you have hyperacidity, the doctor gives you an antacid. The antacid is generally a base, e.g., magnesium hydroxide, which neutralises the acid.
 - (b) Ammonia is used for manufacturing nitrogenous fertilisers like urea, ammonium sulphate and ammonium nitrate.
 - (c) Caustic alkalis (NaOH and KOH) are used in making soap from oils and fats.
 - (d) Lime is used as whitewash.
 - (e) Coloured oxides of metals like iron, cobalt, chromium and copper are used for making coloured glass.
 - (f) Metal oxides like magnesium oxide (MgO), calcium oxide (CaO) and aluminium oxide (Al_2O_3) melt only at very high temperatures. So they are used for making refractory bricks. Refractory bricks can withstand high temperatures.

D. 1. acids 2. alkali 3. neutralised 4. base

5.	Indicator	Colour	
		Acidic medium	Basic medium
	Litmus	Red	<u>Blue</u>
	<u>Phenolphthalein</u>	Colourless	Red
	<u>Turmeric juice</u>	Yellow	Red-brown
	Red-cabbage juice	<u>Red</u>	Green
	China-rose juice	Red	<u>Green</u>

- E. 1. (b) 2. (d) 3. (b) 4. (d)
- F. 1. (a) (iv) (b) (v) (c) (i) (d) (ii) (e) (iii)
2. (a) (v) (b) (iii) (c) (iv) (d) (ii) (e) (i)
- G. 1. Yes 2. Yes 3. No 4. Yes 5. Yes



3

Changes and Reactions

LESSON PLAN 1

5 minutes	1. Ask the students to list the physical and chemical changes they see in everyday life.
30 minutes	2. Discuss sublimation. Complete the activity on page 20. 3. Recall terms like melting, freezing, vaporisation, condensation, etc. 4. Demonstrate the anomalous expansion of water using Figure 3.2.
Closure: 5 minutes	Homework: A1, A2

LESSON PLAN 2

35 minutes	1. Revise terms like miscible and immiscible and conclude that dissolution is a physical change. 2. Discuss why the burning of a fuel is a chemical change. 3. Complete the activity on page 21 and ask the students to write the conditions for rusting. 4. Discuss other chemical changes.
Closure: 5 minutes	Homework: A3, B1, B2, C1, C2

LESSON PLAN 3

35 minutes	1. Give an example of physical and chemical changes taking place together. 2. Ask the students to differentiate between physical and chemical changes. Use Table 3.1. 3. Using Figure 3.7, discuss why new substances are formed during a chemical change. 4. Describe how changes involve loss or gain of energy.
Closure: 5 minutes	Homework: B3

LESSON PLAN 4

20 minutes	1. Complete the experiments given in Figures 3.10, 3.11 and 3.12, and discuss the various types of reactions.
15 minutes	2. Summarise what has been discussed by asking the students to write down the important points.
Closure: 5 minutes	Homework: A4, D, E

Answers to Exercises

- A. 1. A change in which no new substances are formed and which can generally be reversed by reversing the conditions is called a physical change.
2. A change in which new substances are formed and which cannot be reversed by reversing the conditions is called a chemical change.
3. (a) chemical change (b) physical change (c) chemical change (d) chemical change (e) physical change
4. (a) combination reaction (b) decomposition reaction (c) displacement reaction (d) neutralisation reaction

- B. 1. In a physical change, no new substances are formed. Such a change can be reversed by reversing the conditions.

In a chemical change, new substances are formed and the change cannot be reversed by reversing the conditions. The atoms rearrange themselves during a chemical change. In both physical and chemical changes, energy is either taken in or given out.

2. When salt is dissolved in water, it becomes a salt solution. Salt can be recovered from the solution by evaporating the solvent (water). This is done by heating the salt solution till the water evaporates completely and we are left with the salt. Thus, this reaction is a physical change.
3. A common example of a physical and chemical change happening together is the burning of a candle. The melting of wax and the solidification of molten wax are physical changes. The burning of molten wax is a chemical change.
- C. 1. Energy is either taken in or given out by a substance undergoing a change. This means that heat or light is either absorbed or emitted by a substance during a physical or chemical change. When we put some glucose on our tongue, our tongue feels cool. While dissolving in the moisture of the tongue, glucose absorbs heat from it. This is an example of a physical change. When we burn a matchstick (chemical change), it emits both heat and light.
2. The following activity shows the conditions required for rusting.

Take a few unruined iron nails in a test tube A, and cover them with ordinary water. Leave the test tube on a stand.

Boil some distilled water in test tube B in order to expel the dissolved air. Drop a few unruined nails into it. Put some oil over the water surface to cut it off from the air above. Cork the test tube and allow it to stand.

Take some pieces of anhydrous calcium chloride in test tube C. Slip in a perforated cardboard disc into the test tube. Place a few unruined nails over the disc, cork the test tube and allow it to stand. Remember that anhydrous calcium chloride absorbs moisture and so it will keep the air inside the test tube moisture-free.

When the nails are examined after a few days, it is observed that rusting occurs only in the nails placed in test tube A and not in the other test tubes. This shows that only moist air causes rusting, neither air-free water nor moisture-free air can cause rusting.

- D. 1. (c) 2. (b) 3. (d) 4. (c) 5. (d)
- E. (a) (iv) (b) (iii) (c) (ii) (d) (i)



4

Fibres from Animals

LESSON PLAN 1

30 minutes	1. Show the students the stages of a silkworm's life by preparing a chart/presentation and by using Figures 4.1, 4.2 and 4.3.
5 minutes	2. Discuss the differences between raw silk and spun silk.
Closure: 5 minutes	Homework: A1, A2, A3, B1, B2

LESSON PLAN 2

15 minutes	1. Divide the students into four groups and ask them to discuss throwing, bleaching, dyeing, and weaving respectively.
20 minutes	2. Bring photographs of clothes made with eri, mulberry, tassar and mooga silks. Ask the students to find out the differences between them from the Internet.
Closure: 5 minutes	Homework: A4

LESSON PLAN 3

15 minutes	1. Discuss sheep breeding.
20 minutes	2. Using Table 4.1, discuss the common breeds of sheep in India. 3. Talk about sheep farms and shearing.
Closure: 5 minutes	Homework: A5, A6, A7, B3

LESSON PLAN 4

20 minutes	1. Divide the class into groups and ask them to discuss fibres and fabrics, quality of wool, and the physical and chemical properties of wool.
15 minutes	2. Help the groups differentiate silk and wool from artificial fibres. 3. Complete the activity given on page 34.
Closure: 5 minutes	Homework: C1, D, E

Answers to Exercises

- A. 1. Silk and wool are two animal fibres suitable for making fabrics.
2. The female silk moths lay eggs from which larvae are formed. One source of animal fibres is the silkworm.
3. A cocoon is a soft covering that an insect spins with silky threads to protect itself. The thread is formed by the hardening of a liquid secreted by the insect.

4. The raw silk prepared is twisted to produce silk called thrown silk. The process is called throwing and the people who throw the silk are called throwsters.
 5. The fleece is cut off from the body of certain hairy animals like sheep to obtain wool. The process is called shearing. Sheep are generally shorn twice a year in India.
 6. The best season for the mating of sheep is spring.
 7. The wool obtained from a sheep which has been thoroughly washed a couple of days before shearing is called washed wool. The wool obtained from live sheep is called clipped wool and the wool obtained from dead sheep is called pulled wool.
- B.**
1. During the feeding period, a silkworm sleeps four times (twenty-four hours each time) at intervals of about six days. While sleeping, its skin cracks and on awaking, the worm sloughs off, i.e., leaves the old skin and comes out in a new one. This phenomenon is called moulting in silkworms.
 2. The filament which a cocoon is made up of is too fine and delicate to handle. So, many of them are reeled together to yield a stronger thread, called raw silk. Damaged cocoons are used to make inferior silk, called spun silk.
 3. The quality and quantity of wool depend upon the breed of the sheep. Native sheep may not be of a breed yielding good wool. So they are crossed with exotic breeds (i.e., those found in other parts of the world) which yield better wool. For this purpose, a native ewe and an exotic ram are used. Some exotic breeds used are Merino, Rambouillet and Dorset.
- C.**
1. Wool has the following chemical properties.
 - (i) **Action of heat:** It starts changing colour at 100 °C, but does not catch fire easily. It also becomes yellowish when left in a hot, humid atmosphere for a long time. So, the wool on the body of a sheep living in a hot, humid region may be yellowish.
 - (ii) **Action of acids and bases:** It dissolves in acids and alkalis.
 - (iii) **Action of bleaching agents:** The fibre can be bleached without loss of strength.
- D.**
- | | | | | | |
|----------------|-------|----------|-----------|---------|-------------------|
| 1. sericulture | 2. 24 | 3. breed | 4. better | 5. high | 6. acids, alkalis |
|----------------|-------|----------|-----------|---------|-------------------|
- E.**
- | | | | | |
|-----------|----------|---------|---------|----------|
| (a) (iii) | (b) (iv) | (c) (v) | (d) (i) | (e) (ii) |
|-----------|----------|---------|---------|----------|



5

Heat

LESSON PLAN 1

25 minutes	1. Introduce the concept of heat. Complete the activity on page 36 and elicit from the students that hotness and coldness are relative. 2. Bring a clinical and a laboratory thermometer to class and discuss temperature. Explain the Celsius and Fahrenheit scales to the students.
10 minutes	3. Do the activity given on page 38 and discuss what the students observed.
Closure: 5 minutes	Homework: A1, A2, A3, B1

LESSON PLAN 2

15 minutes	1. Complete the activity on page 39 and discuss the effects of heat on solids, liquids and gases.
20 minutes	2. Talk about heat causing change of state. 3. Do the activity on page 41 and discuss conduction.
Closure: 5 minutes	Homework: A4, A5, A6, A10, B2, C2

LESSON PLAN 3

25 minutes	1. Do the activities on page 42 and discuss convection. 2. Discuss the importance of convection currents.
10 minutes	3. Ask the students to make a labelled diagram showing land and sea breezes.
Closure: 5 minutes	Homework: A7 to A9, B4, C1

LESSON PLAN 4

20 minutes	1. Complete the activity on page 44 and discuss radiation.
15 minutes	2. Summarise the topics discussed by asking the students to write the important points.
Closure: 5 minutes	Homework: B3, C3, D, E

Answers to Exercises

- A. 1. When we heat a pan of water, the water at the bottom rises. Heat gives the water energy to rise.
2. The temperature of a substance is a measure of the degree of hotness of the substance. The two scales used for measuring temperature are the Celsius scale and the Fahrenheit scale.

3. We can measure the degree of hotness of a body by comparing it with a universal standard.
 4. Heat causes a rise in temperature. It also causes expansion and change in the state of matter.
 5. Heat travels from the end of the spoon dipped in the boiling soup to the other through conduction.
 6. We can hold a match while it is burning because the match is made up of wood, which is a bad conductor of heat.
 7. Turning on a heater in a room makes the whole room warm through convection currents.
 8. Heat from the sun reaches the earth by radiation. Radiation is the process by which heat travels without the help of a material medium.
 9. Both heat and light travel in straight lines and in all directions from a body emitting it.
 10. Heat stops flowing when the two bodies are at the same temperature.
- B.**
1. On the Celsius scale, the temperature difference between the freezing point (0°C) and the boiling point of water (100°C) is divided into 100 equal divisions, each corresponding to a difference of 1°C . On the Fahrenheit scale, the temperature difference between the freezing point (32°F) and boiling point (212°F) of water is divided into 180 equal parts, each corresponding to a temperature difference of 1°F .
 2. When the water at the bottom of the pan is heated, it comes in contact with the colder water above and loses some of its heat to the colder water, contracts and becomes denser. This denser water sinks to the bottom. It is again heated and the process is repeated. This sets up a continuous current of water, and the whole water gets heated (by convection).
 3. When radiant heat falls on a body, some of it is absorbed by the body and some is reflected by it. The absorption of radiant heat by a body depends on the colour of the object and the nature of its surface. Shiny, smooth surfaces are better reflectors, while dull and rough surfaces are better absorbers.
 4. (a) Conduction is the process by which heat flows through a substance without the movement of the substance itself. Radiation is the process by which heat travels without the help of a material medium.
(b) Conduction is the process by which heat flows through a substance without the movement of the substance itself. Convection is the process of transfer of heat in a liquid or gas by the movement of the liquid or gas.
- C.**
1. The sea and land breezes which blow in coastal areas are actually convection currents. The sea takes longer to get heated than does the land. So the land is hotter than the sea during the day. The air in contact with the land becomes hot and rises, and the cooler air above the sea rushes in towards the land to take its place. This sets up a convection current, which is called a sea breeze. After sunset, the land cools much faster. The air above the sea is warmer than that above the land. It rises, and the cooler air above the land moves out towards the sea. This is called a land breeze.
 2. Fit a balloon to the mouth of a glass bottle. Then place the bottle in a pan of water and heat it. The balloon will get inflated as the air inside the bottle becomes warm and expands. Take the bottle out of the pan and allow it to cool. The balloon will get deflated as the air inside the bottle contracts. This shows that gases expand on heating.
 3. (a) It is better to wear light shades in summer because darker colours absorb heat more than lighter colours.
(b) Two thin sweaters feel warmer than one thick sweater because the air trapped between two sweaters acts as an insulator. It does not allow the heat from our body to escape easily.
(c) Utensils are made of metals, which are good conductors of heat. This helps us cook or heat food easily. Their handles are made of plastic so as to prevent the heat from the utensils from reaching our hands. As plastic is a bad conductor of heat, it does not allow the heat to pass from the utensils to our hands.
- D.**
- | | | | | | |
|--------|--------|--------|--------|--------|--------|
| 1. (a) | 2. (b) | 3. (b) | 4. (c) | 5. (b) | 6. (d) |
|--------|--------|--------|--------|--------|--------|
- E.**
- | | | | | | | |
|---------|----------|---------|---------|----------|---------|----------|
| 1. True | 2. False | 3. True | 4. True | 5. False | 6. True | 7. False |
| 8. True | | | | | | |



6

Time, Motion and Speed

LESSON PLAN 1

5 minutes	1. Ask the students why we need to measure time.
30 minutes	2. Explain to the students why we need to use a unit for the measurement for time. 3. Do the activity on page 48. By using Figure 6.1, discuss the use of the sundial. Elaborate on periodic events.
Closure: 5 minutes	Homework: A1, A2

LESSON PLAN 2

15 minutes	1. Complete the activity on page 49 and discuss the pendulum clock. Explain terms like time period and frequency.
20 minutes	2. Bring a stopwatch to class and show the students how to measure time intervals with it. 3. Discuss motion and speed. 4. Complete the activity on page 51. Ask the students to discuss their observations in groups.
Closure: 5 minutes	Homework: A2 to A9

LESSON PLAN 3

25 minutes	1. Using Figure 6.7, discuss the distance–time graph. Ask the students to solve the sample problems given.
10 minutes	2. Summarise the topics discussed.
Closure: 5 minutes	Homework: Numericals

Answers to Exercises

- A.
1. A unit of measurement is a known fixed quantity with which we can compare an unknown quantity we wish to measure.
 2. The speed of a moving body is the distance it travels in unit time, or the distance it travels divided by the time it takes to travel that distance.
Since the SI unit of distance (length) is the metre (m) and that of time is the second (s), the unit of speed is metres per second, or m/s.
 3. A body is said to be in motion if its position changes with time.
 4. Stopwatches have switches with which they can be started and stopped at will. They are used to measure time intervals during scientific experiments and sports events.

5. The Italian astronomer Galileo Galilei discovered that the motion of a pendulum is periodic. This was put to use by the Dutch scientist Christiaan Huygens to make the pendulum clock.
6. The time a pendulum takes to complete one oscillation is called its time period.
7. One factor that determines the time period of a pendulum is the length of the pendulum.
8. If the speed of a body travelling along a straight line remains constant, then it is said to be in uniform motion.
9. (a) 90 m (b) 100 kg (c) 10 s (d) 50 kg

Numericals

1. Given: $t = 20 \text{ minutes} = 20 \times 60 = 1200 \text{ s.}$

$$d = 15 \text{ km} = 15 \times 1000 \text{ m} = 15,000 \text{ m}$$

$$\text{Speed (m/s)} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{15000}{1200}$$

$$= 12.5 \text{ m/s}$$

$$1 \text{ hour} = 60 \text{ minutes}$$

$$\text{Time} = 20 \text{ minutes}$$

$$= 20/60 = \frac{1}{3} \text{ hour.}$$

$$\text{Speed (km/h)} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{15 \text{ km}}{\frac{1}{3} \text{ h}}$$

$$= 45 \text{ km/h}$$

2. Distance = 400 km

$$\text{Speed} = 50 \text{ km/h}$$

$$\text{Time} = ?$$

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

$$\text{Time} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{400 \text{ km}}{50 \text{ km/h}}$$

$$= 8 \text{ h}$$

3. Speed = 40 km/h

$$\text{Time} = 6 \text{ h}$$

$$\text{Distance} = ?$$

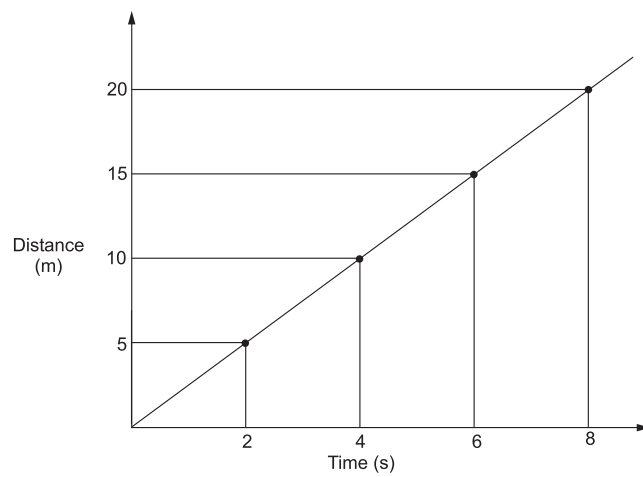
$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{Distance} = \text{speed} \times \text{time}$$

$$= (40 \text{ km/h}) \times 6 \text{ h}$$

$$= 240 \text{ km}$$

4.



5. Speed (m/s) = $\frac{\text{distance}}{\text{time}}$

The time taken to cover a distance of 3 m is 4 s. Therefore,

speed = $\frac{3}{4}$ m/s.



7

Electricity

LESSON PLAN 1

5 minutes	1. Introduce the concept of electric current in class. Ask the students what causes current to flow.
30 minutes	2. Demonstrate, as given in Figure 7.1, how cells are connected to form batteries of higher voltage. Ask the students to observe when and why the bulb glows brighter. 3. Using Figures 7.2 and 7.3, demonstrate open and closed circuits, symbols for common electrical components, and circuit diagrams.
Closure: 5 minutes	Homework: A1, A2, B1, B2

LESSON PLAN 2

15 minutes	1. Complete the activity on page 58 and discuss electrical resistance.
20 minutes	2. Divide the class into groups. Ask the groups to discuss the heating effect of current in detail. 3. Do the activity on page 60 and discuss different types of fuses.
Closure: 5 minutes	Homework: A6, B3, B4, B5, C1, C2

LESSON PLAN 3

25 minutes	1. Complete the activity on page 61 and introduce the magnetic effect of current. 2. Do the activities on pages 62 and 63 and discuss electromagnets.
10 minutes	3. Elaborate on the uses of electromagnets.
Closure: 5 minutes	Homework: A3, A4, A5, A7, B6

LESSON PLAN 4

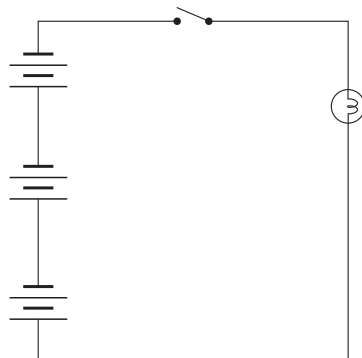
25 minutes	1. Bring an electric bell to the class and explain its working.
10 minutes	2. Summarise all the topics discussed.
Closure: 5 minutes	Homework: C3, D, E

Answers to Exercises

- A.
1. The voltage applied across a bulb causes a current to flow through it.
 2. The higher the resistance, the greater is the heat produced by an electric current. The resistance of the filament of the bulb is higher than that of the wires.
 3. A current-carrying conductor behaves like a magnet and attracts or repels other magnets.

4. The nail also becomes a magnet. The coil-and-nail combination creates a stronger magnet than the coil alone.
5. We use a soft iron core to ensure that an electromagnet loses its magnetism once the current is switched off.
6. Bulbs, electric heaters, electric irons and electric toasters.
7. Electromagnets are used in cranes, electric doorbells, washing machines and motors that drive fans.

B. 1. A circuit diagram is a representation of a circuit using symbols for its components.



2. Battery of two cells



Bulb



Cell

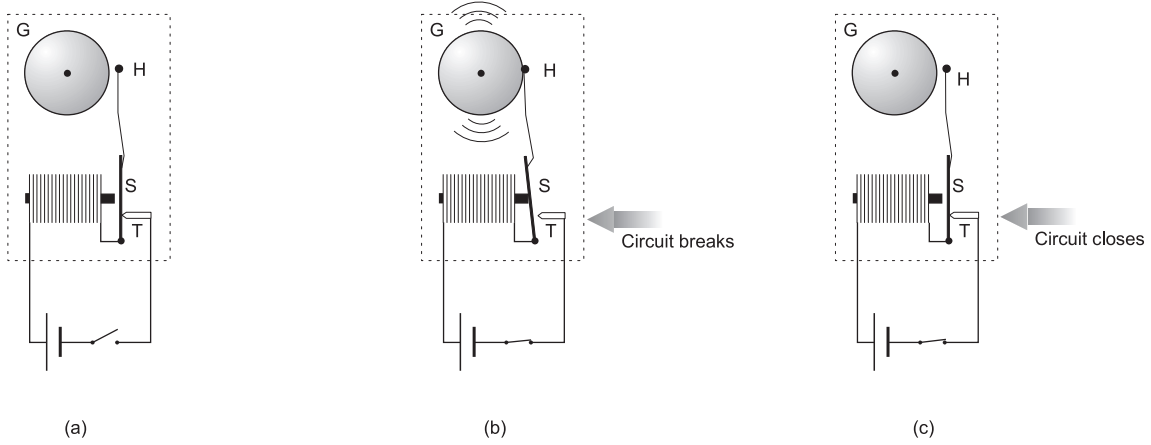


Switch (open)



3. The heat produced by an electric current is directly proportional to resistance, i.e., the higher the resistance, the greater is the heat produced. Also, for a given resistance, the greater the current, the greater is the heat produced.
 4. Electric bulbs work because of the heating effect of electric current. A bulb has a long and thin tungsten filament. The filament has a high resistance. When a current passes through the filament, it gets heated and starts to glow. It does not melt because tungsten has a very high melting point.
 5. Two problems associated with the heating effect of electric current are overload and short circuit. An overload causes excessive heating that can damage the insulation of wires and start fires. A short circuit in wires connected to the mains can be dangerous. It can result in a fire.
 6. A magnet produced by passing an electric current through a coil wound around a soft iron core is called an electromagnet. The strength of an electromagnet depends on the number of turns of the wire and the amount of current passing through it. An electromagnet is not a permanent magnet. Its magnetism lasts only while a current passes through its coil.
- C. 1. The electrical resistance of a piece of a material is a measure of the hindrance it causes to the flow of electric current. The resistance of a piece of material depends on the thickness and length of the material used. A thin wire has a higher resistance than a thick wire. A long wire has a higher resistance than a short wire. The magnitude of the current produced depends on resistance. The lower the resistance, the greater is the current.
2. A fuse is a safety device that opens an electric circuit when excessive current flows through it. It has a special wire whose melting point is lower than those of metals. When the current flowing through the circuit becomes excessive due to a short circuit or an overload, the fuse wire gets hot and melts. This breaks the circuit and prevents any damage.
 3. The electric bell shown has two switches connected in an electromagnet's circuit. The first switch is outside the bell. The second is inside the bell, consisting of the parts S and T. When the outer switch (at your door) is pushed, current flows through the electromagnet inside the bell. This causes the electromagnet to pull the springy iron strip S. As soon as the strip moves towards the electromagnet, its contact with the terminal T is lost. This breaks the circuit inside the bell. So, the electromagnet stops attracting the iron strip. The strip returns to its original position and makes contact with T. This closes the circuit, and the electromagnet attracts the strip once again. This

arrangement causes the strip to move back and forth many times a second. As the strip moves, the hammer H strikes the gong G, producing the sound of the bell.



D. 1. voltage 2. symbols 3. higher 4. overload 5. coil

E. 1. (c) 2. (c) 3. (a)



8

Light

LESSON PLAN 1

15 minutes	1. Introduce the topic by asking the students how light helps us. 2. Demonstrate the activity on page 67 and discuss rectilinear propagation of light.
20 minutes	3. Show the students the working of a pinhole camera and discuss the effects of rectilinear propagation of light. 4. Do the activity on page 68 and discuss reflection.
Closure: 5 minutes	Homework: Read pages 67 and 68; A1, A2, B1

LESSON PLAN 2

15 minutes	1. Complete the activity on page 69 and discuss how light reflects off a mirror.
20 minutes	2. Using Figures 8.7 and 8.8, discuss images and how images are formed by reflection from curved surfaces. 3. Demonstrate the activity on page 71 and discuss divergent and convergent rays.
Closure: 5 minutes	Homework: A3, A4, B2

LESSON PLAN 3

15 minutes	1. Do the activity on page 72 and discuss spherical mirrors.
20 minutes	2. Using Figures 8.12 and 8.13, ask the students to draw diagrams showing images formed by concave and convex mirrors. 3. Demonstrate the activity on page 74 and discuss images formed by refraction.
Closure: 5 minutes	Homework: A6, A8, B3, C1, C3

LESSON PLAN 4

15 minutes	1. Do the activities on page 75 and discuss lenses.
20 minutes	2. Using Figures 8.20 and 8.21, ask the students to draw diagrams showing images formed by convex and concave lenses. 3. Complete the activity on page 77 and discuss white light and the colours of light. 4. Demonstrate the activity on page 78 and discuss Newton's disc.
Closure: 5 minutes	Homework: A5, A7, A9, A10, B4, B5, B6, C2, D, E, F

Answers to Exercises

- A. 1. Light travels in straight lines. It cannot curve or flow around a body. This mode of travelling is called rectilinear propagation.
2. The incident ray and the reflected ray make equal angles with the surface of a plane mirror.

3. The image formed by a plane mirror is virtual, erect and of the same size as the object.
 4. The image is real, inverted and in front of the mirror.
 5. The image is real and inverted.
 6. When an object is closer than the focus of a concave mirror, then we can see an erect and magnified image.
 7. When the object is closer than the focus of a convex lens, we can see a virtual, erect and magnified image.
 8. Concave mirrors are used as compact and shaving mirrors.
 9. Convex lenses are used as reading glasses and magnifying glasses.
 10. Light that is colourless is called white light. It is actually made up of seven colours.
- B.**
1. When the rays from an object cross a pinhole, the rays from the top half of the object are below the rays from the bottom half. Their positions remain unchanged because light travels in straight lines. So, when they fall on a screen, the image formed is inverted.
 2. When parallel rays of light fall on a curved reflecting surface, they meet or seem to meet at the focus of the curved surface. For example, if we allow two parallel rays from a ray box to fall on a convex surface, after reflection, the rays of light will seem to come from (diverge from) a point. In case of a concave surface, they will meet (converge) at a point.
 3. Convex mirrors are used as rear-view mirrors because the image formed is erect and smaller than the object. Since the image is smaller, we can view a wider area.
 4. The set of colours formed on the splitting of white light is called the spectrum of white light. These colours appear in the order violet, indigo, blue, green, yellow, orange and red.
 5. A rainbow is produced by the refraction of light. Lights of different colours bend at different angles. So they separate out on refraction. When sunlight passes through raindrops at certain angles, it bends very sharply. This makes the separated colours visible.
 6. When a Newton's disc spins, all the colours pass through a spot rapidly one after the other. The colours mix to produce white. Since the colours in the disc are not exactly the same as those that make up white light, the colour produced on spinning will be a pale colour close to white.
- C.**
1. An image that can be formed on a screen is called a real image. The image is formed by rays of light actually meeting at a point. A real image can be seen even without a screen. An image that cannot be formed on a screen is called a virtual image. Rays of light do not actually pass through a virtual image. The rays of light, after reflection, seem to come from a certain point. We can see an image at that point because we see things in the direction of the rays entering our eyes.
 2. The point where parallel rays of light actually meet or seem to come from after passing through a lens is called the focus of the lens. We can determine the focus of a convex lens through an activity. Take a magnifying glass or reading glasses. Turn the lens towards the sun. Move the lens away from the ground. When the lens is at a certain distance from the ground, we will see a sharp image of the sun at a point. This point is the focus of the lens.
 3. The bending of light when it travels from one medium to another is called refraction. When a refracted ray reaches our eyes, we see an image in the direction of the ray. The position and size of this image is usually different from those of the object.

For example, if we put a spoon in a glass of water, the part of the spoon in water looks bent. This is because light bends or refracts at the surface separating the two mediums—water and air.

- D.** 1. cannot 2. real 3. outwards 4. concave 5. convex
- E.** 1. (b), (c) 2. (a) 3. (c) 4. (a) 5. (b), (c)
- F.** 1. B, C, G, b 2. B, C, E, b 3. B, C, E, a 4. A, D, a 5. A, D, b 6. B, C, F, a



9

Obtaining and Utilising Food

LESSON PLAN 1

5 minutes	1. Ask the students why we need food.
30 minutes	2. Discuss autotrophic, saprophytic and parasitic nutrition. Complete the activities given on pages 82 and 84.
Closure: 5 minutes	Homework: A1, A2, A3, A6, A8, B1, C1

LESSON PLAN 2

15 minutes	1. Using Figures 9.6 and 9.7, discuss holozoic nutrition.
20 minutes	2. Discuss special types of nutrition using Figures 9.8 and 9.9.
Closure: 5 minutes	Homework: A5, A10, B3, B4, B5

LESSON PLAN 3

10 minutes	1. Complete the activities given on pages 86 and 87. Introduce the section on the human digestive system.
25 minutes	2. Demonstrate the second activity provided on page 87 and ask the students to record their inferences. 3. Using Figures 9.12, 9.13 and 9.14, discuss the role of the pharynx, oesophagus, stomach and the small intestine in digesting food in human beings. 4. Summarise what has been discussed.
Closure: 5 minutes	Homework: A4, B6 to B9, C2, C3, C4

LESSON PLAN 4

25 minutes	1. Discuss the role of the large intestine in human digestion. 2. Using Figure 9.17, discuss digestion in herbivores.
10 minutes	3. Summarise what has been discussed.
Closure: 5 minutes	Homework: A7, A9, B2, C5, D, E

Answers to Exercises

- A.
1. Nutrition, transport and respiration are the three life processes which help all living beings to procure energy from food.
 2. Organisms which prepare their own food are called autotrophs. An alga is an autotroph.
 3. Saprophytic, parasitic and holozoic nutrition are the three types of heterotrophic nutrition.
 4. Enzymes are special chemical substances produced by an organism. They help in digestion.
 5. Holozoic nutrition involves ingestion, digestion, absorption, assimilation and egestion.
 6. Carbon dioxide, water and sunlight are the three things a green plant needs in order to photosynthesise.
 7. The juice secreted by the liver is called bile. Bile helps to break down fat into small droplets.
 8. Dodder (*amarbel*) is a parasitic plant. Tapeworm is a parasite that lives in our intestine.
 9. Digestion is the process of breaking down food into simple, soluble molecules.
 10. The butterfly is not a herbivore, carnivore or omnivore.
- B.
1. Organisms which feed on dead and decaying organic matter are called saprophytes or saprotrophs. Most fungi are saprophytes. Parasites live inside or on another organism and draw nutrition from it. Lice and ticks are parasites.
 2. Herbivores live on plants. Most of their teeth are on the sides of the jaws, or the cheeks. Only the sharp-edged incisors, meant for cutting vegetable matter, are in front. The canines are absent and there is a big gap between the incisors and the premolars.
 3. The amoeba sticks out fingerlike projections called pseudopodia, which help it ingest food. When an amoeba senses the presence of suitable food in its surroundings, it sticks out pseudopodia and engulfs the food. Once the food is inside the cell, the amoeba digests it with the help of enzymes.
 4. Carnivorous plants trap insects to get their supply of nitrogenous compounds from which they make proteins. Pitcher plants have leaves that look like pitchers. The lid of the pitcher closes when an insect lands on the pitcher. The trapped insect slides down the wall of the pitcher and is digested inside it.
 5. Symbionts are organisms that live together for mutual benefit. For example, lichens are symbionts consisting of a fungus and algae that cooperate with each other to meet their food requirements. The fungus provides minerals and water to the alga. The alga supplies the fungus with food that it manufactures.
 6. The digestive juice in the mouth is called saliva. An enzyme called amylase is present in it. It acts on the starch present in food like roti, rice and bread, and changes it into sugar. This is why roti, bread or rice starts tasting sweet when you chew it for a while.
 7. Food is pushed down the oesophagus by a series of contractions. The part of the oesophagus just above the ball of food contracts and pushes it down. Then it relaxes and the next part of the oesophagus contracts. This wavelike movement, controlled by muscles, is called peristalsis.
No, peristalsis occurs all the way down the alimentary canal.
 8. Glands in the wall of the stomach secrete a digestive juice, which contains hydrochloric acid and an enzyme called pepsin. The food is churned gently in the stomach and mixes thoroughly with the digestive juice. The acid in the juice kills germs and pepsin helps break down proteins.
 9. The undigested food that remains in the small intestine passes into the large intestine. Some water is absorbed in the large intestine. The remaining semisolid waste is egested through the anus.
- C.
1. Place a leaf from a garden croton or coleus in a test tube of alcohol and heat the test tube in a water bath. Do not heat the test tube directly because then the alcohol will catch fire. Heating the leaf in alcohol removes all the pigment from it. When the alcohol has turned green and the leaf has lost its colour, take the leaf out of the test tube and wash off the alcohol with warm water. Use a dropper to put a few drops of iodine solution over the leaf. The parts which have starch will turn blue-black. Only those portions of the leaf which were green turn blue-black. This shows that plants cannot manufacture food without chlorophyll.

2. It is in the small intestine that most of the digestion of food takes place. Complex food molecules are broken down into simple, soluble molecules that the body can absorb. Many enzymes act on the food in the small intestine—some on carbohydrates, some on proteins and some on fats. Digestion, which starts in the mouth, is completed in the small intestine. The liquid food is then absorbed or passes into the blood, which carries it to all the cells. The process of absorption occurs in the small intestine. The inner wall of the small intestine has millions of fingerlike folds called villi. Digested food passes through the villi and enters the blood flowing in the fine capillaries in the villi.
3. An adult human being has 32 teeth. The two front teeth in each jaw are called incisors. They help in cutting food. So they are flat and bladelike. On either side of the incisors are the canines (four in all). They are pointed, to help in tearing food. Next to each canine are two premolars. These teeth have broad grinding surfaces to chew and grind food. Next to the premolars are the molars. They are larger than the premolars and have a larger grinding surface. These too help in grinding the food. There are three molars in each half of the upper and lower jaws, which means there are 12 molars in all.
4. Dr Beaumont treated a man called St Martin wounded by a bullet in 1822. Though the wound healed, there was a hole left in the stomach. He would push a tube through a hole in St Martin's stomach to take out food. The doctor experimented with the food for nine years and concluded that the stomach produces certain juices which help in the digestion of food. He came to this conclusion by mixing the juices from the stomach with food. He noticed that the food mixed with these juices dissolved after some time.
5. Ruminants have special stomachs to help them digest cellulose, which we cannot. The stomach of ruminants is divided into four compartments. Half-chewed grass travels from the mouth to the first chamber of the stomach, where it is acted upon by bacteria and other microorganisms. The half-digested grass then enters a second muscular chamber from where it is sent back to the mouth, to be chewed again. The rechewed food is swallowed again. This time, it bypasses the first two chambers and enters a third chamber. Here it is broken down into still smaller pieces. Finally, it enters the fourth chamber, where enzymes act upon it and digestion is completed.

- D. 1. proboscis 2. absorption 3. enzymes 4. alimentary canal 5. mouth 6. villi
- E. 1. (c) 2. (a) 3. (a) 4. (c) 5. (b) 6. (d)



10

Transport and Excretion

LESSON PLAN 1

15 minutes	1. Introduce transport in plants and complete the activity given on page 94.
20 minutes	2. Ask the students to do the first activity on page 95. Explain osmosis. 3. Do the second activity given on page 95 and discuss transpiration.
Closure: 5 minutes	Homework: A6, B1, B4, C1

LESSON PLAN 2

15 minutes	1. Complete the activity given on page 96 and discuss transport of food in plants.
20 minutes	2. Discuss blood plasma, red blood cells, white blood cells, platelets and blood vessels.
Closure: 5 minutes	Homework: A1

LESSON PLAN 3

25 minutes	1. Using Figures 10.9 and 10.10, discuss the working of the heart and how blood circulates in the human body. Complete the activity given on page 99.
10 minutes	2. Using Figures 10.12 and 10.13, discuss removal of waste in the human body. Explain the role of the human urinary system in excretion.
Closure: 5 minutes	Homework: A2 to A5, A7, B2, B3, C2

LESSON PLAN 4

25 minutes	1. Using Figure 10.14, discuss dialysis as a process of waste removal from human blood.
10 minutes	2. Summarise what has been discussed.
Closure: 5 minutes	Homework: C3, D, E, F

Answers to Exercises

- A. 1. The xylem carries the water absorbed by the root to the leaves of a plant.
2. A doctor can feel the throbbing arteries at the wrist when he checks our pulse. The pulse rate is the same as the rate at which our heart beats.
3. The wall prevents the oxygenated blood from mixing with the deoxygenated blood.

4. The urinary system consists of two kidneys, a urinary bladder, two ureters and the urethra.
 5. Water and wastes like urea and salt filter into the nephrons from the blood in the capillaries. The waste flows through the ureters and is collected in the bladder.
 6. When there are two solutions separated by a semipermeable membrane, substances pass from the region of their higher concentration to the region of their lower concentration.
 7. We excrete water, salt and a substance called urea in the process of sweating.
- B.**
1. Two forces—a pull and a push—help water move up the stem against the force of gravity. The absorption of water by the roots provides the push. And a much greater force is the pull provided by transpiration—loss of water from the leaves.
 2. The right side of the heart receives deoxygenated blood from all over the body. The heart pumps it into two arteries, which carry the blood to the lungs. Here, the blood gives up carbon dioxide and picks up oxygen. Oxygenated blood enters the left side of the heart, which pumps it into a big artery. Branches of this artery carry the oxygenated blood to the rest of the body.
 3. Sweating helps to keep us cool. The evaporation of sweat (water) requires heat. Our skin provides this heat, so we feel cool when sweat evaporates. This is why we sweat more when it is hot.
 4. When an egg is placed in water without its shell, it swells as water enters into the egg due to osmosis.
- C.**
1. Water from the soil enters the roots through tiny root hairs. This happens because the solution inside them is stronger than the solution of minerals and water in the soil. In other words, the concentration of water in the soil is higher than the concentration of water inside the root hairs. The process of transfer of a substance across a semipermeable membrane from a region where its concentration is higher to a region where its concentration is lower is called osmosis.
 2. Each kidney has millions of tiny filters called nephrons. A nephron looks like a small cup or funnel with a longish tube attached to it. There is a mesh of capillaries in each of these cups. Water and wastes like urea and salt filter into the cups from the blood in the capillaries. Blood cells and other large particles remain in the blood in the capillaries the way tea leaves remain in the strainer. The clean blood leaves the kidneys, while the wastes flow into the tubes of the nephrons. These tiny tubes join up to form bigger tubes, which in turn join the ureters. The wastes flow through the ureters and are collected in the bladder in the form of urine.
 3. Dialysis is the process of removing wastes from the blood artificially. The patient's blood is taken out of an artery and allowed to pass through a tube whose wall is semipermeable. The tube, which is dipped in a solution, acts like a sieve. It allows the smaller waste particles to pass out of the blood into the solution. But it does not allow the blood cells and proteins, which are larger, to pass through.
- D.** 1. phloem 2. sap 3. heartbeat 4. semipermeable 5. lower 6. atrium, ventricle
- E.** 1. (c) 2. (a) 3. (b) 4. (b)
- F.** (a) (v) (b) (iii) (c) (ii) (d) (vi) (e) (vii) (f) (iv) (g) (i)



11

Respiration in Plants and Animals

LESSON PLAN 1

25 minutes	1. Discuss external and internal respiration. With the help of Table 11.1, discuss the respiratory organs of various organisms. Complete the activity given on page 105.
10 minutes	2. Using Figure 11.2, talk about respiration in plants. 3. Do the activity given on page 106. Ask the students to write down their observations. Explain how this experiment proves that roots also breathe.
Closure: 5 minutes	Homework: A1, A2, A4, A5, B1, C1

LESSON PLAN 2

15 minutes	1. Demonstrate the activity given on page 107 and discuss the variation in the respiration rate in human beings.
20 minutes	2. Using Figures 11.4 and 11.5, discuss how we breathe. 3. Complete the activity given on page 108 to discuss how air enters the lungs.
Closure: 5 minutes	Homework: A3, A7, B2, B3, C2, C3, C4

LESSON PLAN 3

25 minutes	1. Discuss anaerobic respiration and its uses.
10 minutes	2. Summarise what has been discussed.
Closure: 5 minutes	Homework: A6, B4, D

Answers to Exercises

- A.
1. Earthworms breathe through their skin. Oxygen passes in and carbon dioxide passes out through their skin.
 2. Insects have small holes called spiracles on their sides. Air enters through these holes and reaches all parts of the body through a network of thin tubes called tracheae.
 3. The number of times we breathe in and out in a minute is called the rate of respiration.
 4. Plants breathe through small pores called stomata on their leaves. With the help of stomata, plants exchange gases with the atmosphere.
 5. Gardeners loosen the soil to create air spaces between the soil particles. This air is essential for the roots.
 6. The cells of our body produce energy by anaerobic respiration when we do something strenuous and there is not enough oxygen to meet our energy requirement.

7. Dust and other particles present in air get trapped by the mucus (secreted by the membrane) and hair present in the nasal cavity.
- B. 1. Fish and tadpoles use gills. Gills have filaments full of small capillaries carrying blood. Water entering through the mouth flows over the gills. The oxygen dissolved in the water enters the capillaries and carbon dioxide from the capillaries passes into the water.
2. The rate of respiration increases when we do some hard physical labour. This is because the more active the body is, the more energy does it require. To get this energy, it needs more oxygen.
3. Respiration involves two steps—external respiration and internal respiration. The process by which an organism takes in oxygen and gives out carbon dioxide is called external respiration. The process by which glucose combines with oxygen to release energy in the cells is called internal respiration.
4. The process by which food is broken down to release energy in the absence of oxygen is called anaerobic respiration. Yeast and many bacteria respire this way. Anaerobic respiration, also called fermentation, is used in making wine and bread.
- C. 1. We can show that exhaled air has carbon dioxide with the help of an experiment. Stir a few spoons of lime in a glass of water. Once the mixture has settled, decant the clear liquid into a small glass. Make a circular cover for the glass using stiff paper. Pierce two holes in the cover and insert straws into them. Breathe out through one straw. Soon, the limewater turns milky because of the carbon dioxide in the air we have exhaled.
2. We take in air through the nostrils, which lead to the nasal cavity. As the air passes through this cavity, it becomes warm and moistened by the mucus secreted by the membrane lining the nasal cavity. Dust and other particles present in air get trapped by the mucus and hair present in the cavity. From the nose, the air passes into the pharynx. From here, it goes into the trachea, or windpipe. The trachea branches into two tubes called the bronchi, which enter the lungs. After entering the lungs, the bronchi divide into bronchioles. Air passes through the bronchioles and finally, enters tiny sacs called alveoli. Each lung has millions of alveoli, which get filled with air when we inhale.
3. Our chest cavity is somewhat like a bottle. There is a sheet of muscle below the lungs, called the diaphragm. When we inhale, the chest muscles pull down the diaphragm. At the same time, the ribcage moves outwards. Both these movements increase the volume of the chest cavity, and makes air rush in to fill the alveoli.
4. Alveoli are tiny sacs in the lungs. There are millions of alveoli, which get filled with air when we inhale. There is a very fine mesh of blood vessels surrounding each alveolus. The oxygen of the air in the alveoli passes easily through the thin walls of these blood vessels. It combines with haemoglobin in the blood to form oxyhaemoglobin, which is carried to all the cells of the body.
- D. 1. oxyhaemoglobin 2. alveoli 3. water vapour 4. fermentation 5. speech 6. lenticels
7. anaerobic 8. guard



12

Reproduction in Plants

LESSON PLAN 1

15 minutes	1. Introduce the section on asexual reproduction. Complete the activity given on page 111.
20 minutes	2. Do the activity given on pages 112 and 113, and discuss spore formation in mushrooms and moulds. 3. Discuss fragmentation and vegetative reproduction.
Closure: 5 minutes	Homework: A1, B1

LESSON PLAN 2

15 minutes	1. Introduce the section on sexual reproduction in plants and discuss the parts of a flower.
20 minutes	2. Discuss self-pollination, cross-pollination and fertilisation.
Closure: 5 minutes	Homework: A2, A3, A4, B2, B3, B4, C1, C2

LESSON PLAN 3

25 minutes	1. Discuss the dispersal of seeds and complete the activity given on page 119.
10 minutes	2. Summarise what has been discussed.
Closure: 5 minutes	Homework: A5, C3, D, E

Answers to Exercises

- A.
1. Plants reproduce asexually by budding, spore formation, fragmentation and vegetative reproduction.
 2. The transfer of pollen grains from the anther to the stigma is called pollination.
 3. After fertilisation, the ovary develops into the fruit.
 4. Balsam
 5. Seeds need to be dispersed so that they do not have to compete with the parent plant for water, nutrients and sunlight.
- B.
1. Reproduction which takes place without the involvement of the sexual part of a plant is known as vegetative reproduction. Plants capable of vegetative reproduction are propagated (grown) by making use of the vegetative parts from which new plants can grow. This is why the terms vegetative reproduction and vegetative propagation are often used interchangeably.

2. The transference of pollen grains from the anther to the stigma is called pollination. When the anthers mature, they burst and release pollen grains that stick to the body of insects visiting a flower to gather nectar. When these insects visit another flower, some of the pollen grains get dusted off on to the stigma.
 3. The flowers of wind-pollinated plants are small and produce huge quantities of small, dry and light pollen grains that can be carried by winds. The stigmas of such flowers are long and feathery so that they can catch the pollen carried by the wind.
 4. A flower which lacks either stamens or carpels is called an incomplete flower or a unisexual flower. The flower of hemp (bhang) is, for example, a unisexual flower. Such a flower cannot self-pollinate, because it lacks either stamens or carpels.
- C. 1. Self-pollination is the transference of pollen from the stamens to the pistil of the same flower. It can occur only in bisexual flowers. Cross-pollination is the transference of pollen from the stamens of one flower to the pistil of another flower of the same kind of plant. All unisexual flowers are cross-pollinated.

For self-pollination to occur, the anthers and the ovules must mature at the same time. To prevent their stigmas from receiving the pollen of other flowers, some self-pollinated flowers, like the fig, remain closed until pollination occurs. Others, like peas, beans and snapdragons, are designed in such a way that pollen from other flowers cannot reach the stigma.

2. Upon reaching the stigma, a pollen grain germinates and grows a long, thin tube called pollen tube. This tube carries the male gamete produced by the pollen grain. The pollen tube pushes through the style, into the ovary. The male gamete then enters an ovule, which contains the female gamete, or egg. After the two gametes fuse, the ovary develops into the fruit and each ovule develops into a seed. Inside the seed lies the baby plant, which develops from the zygote.
3. The scattering or dispersal of fruits and seeds occurs in different ways.

By the wind: Some plants, like drumstick and maple, have winged seeds, which are carried by the wind. The seeds of other plants, like milkweed, silk cotton and devil's tree, have tufts of hair which help them ride on the wind.

By animals: Birds, monkeys and other animals eat the fruit of many plants and throw away the seeds. Some plants have fruit or seeds with hooks, bristles or spines. These get attached to the fur of animals or to our clothes. They are carried a long way before they fall off or are brushed off.

- D. 1. spore formation 2. fertilisation 3. gills 4. zygote 5. seed
- E. 1. (c) 2. (a) 3. (b) 4. (c) 5. (a)



13

Weather, Climate and Adaptations

LESSON PLAN 1

10 minutes	1. Ask the students how weather influences our lives. 2. Elicit from the students the meaning of weather by asking relevant questions.
25 minutes	3. Discuss maximum and minimum temperature. Use Figure 13.1 to explain the use of the maximum-minimum thermometer. 4. Discuss humidity and relative humidity. Ask the students to complete the activity given on page 122. 5. Elaborate on the formation of rain, snow, fog, etc. Explain the method of measuring rain and humidity.
Closure: 5 minutes	Homework: A1, A2, A3, B1, B2, C2

LESSON PLAN 2

35 minutes	1. Discuss different types of climate. Complete the activity given on page 124. 2. Explain the influence of climate on vegetation.
Closure: 5 minutes	Homework: A4, A5, A6

LESSON PLAN 3

25 minutes	1. Discuss how plants and animals adapt to various climatic patterns. Compare the adaptations of various animals to survive in the climate of their habitat.
10 minutes	2. Summarise what has been discussed.
Closure: 5 minutes	Homework: A7, B3 to B6, C1, D, E, F

Answers to Exercises

- A. 1. The weather of a place on a particular day comprises the atmospheric conditions (temperature, wind speed and rainfall) in that place on that day.
2. Latitude, closeness to the sea and rainfall are three things that determine the climate of a place.
3. Maximum and minimum temperatures are recorded using a maximum-minimum thermometer. It consists of a U-shaped tube with bulbs at the top of each arm. One arm records the maximum temperature and the other, the minimum temperature.
4. In cacti, the leaves are modified into spines and the spongy stems store water.

5. A simple rain gauge is a graduated cylinder with a collector fitted on top. A graduated cylinder is a jar with markings on its wall to measure the volume of a liquid.
 6. In the polar regions, the small, flowering plants complete their life cycle only during the short summer, when the snow melts.
 7. All elephants have large ears which help to radiate heat from the body. The large area of the body also helps the animal to lose heat.
- B.**
1. A city is warmer than the surrounding rural areas because concrete absorbs more heat than the ground does. It also retains heat for a longer period. Besides, urban areas lack the shade provided by trees and the cooling effect of transpiration from plants.
 2. Relative humidity is measured with the help of a hygrometer. A simple hygrometer consists of two thermometers. The bulb of one of the thermometers is wet. Since evaporation causes cooling, the wet-bulb thermometer records a lower reading than the dry-bulb thermometer. The difference between the two readings is used to calculate the relative humidity. There is more evaporation when the relative humidity is low, and the difference between the readings is higher.
 3. Animals which live in the polar regions have a very thick coat of fur to conserve heat. Some have a thick layer of fat under their skin that protects them from the cold. The conical shape of the coniferous trees helps the snow slide off, and their needlelike leaves reduce water loss through transpiration.
 4. Camels excrete very concentrated urine to reduce the loss of water. They can also tolerate changes in their body temperature, which helps them cope with the hot days and cold nights of the desert.
 5. The tiger has stripes on its body that help it hide among tall grasses. This type of pattern on the body is called disruptive coloration. It breaks up the shape of the body visually and confuses the prey.
 6. When moisture-laden winds meet a range of mountains, they get pushed up. As they climb, they cool, and the moisture condenses to bring rainfall. When the winds finally cross to the other side (leeward side) of the mountains, they do not have enough moisture to bring rainfall.
- C.**
1. In tropical forests, adaptations are related mostly to competition for food. There is plenty of food and there are also plenty of consumers. So the animals confine themselves to different layers of the forest. In the topmost sunlit canopy of the tallest trees live a great variety of insects, snakes, lizards, birds and monkeys. The middle layer of shorter trees has its own population of birds, monkeys, insects, snakes and lizards. Among the bigger animals that live in this layer is the jaguar. Gorillas, bears and other clumsy animals that cannot climb live on the forest floor.
 2. Relative humidity is the amount of water vapour present in the air expressed as a percentage of the maximum amount of water vapour it can hold at that temperature. Humidity means the dampness of the air or the amount of water vapour in it. Air can hold only a certain amount of water vapour at a particular temperature. When this amount of water is present in it, the air is said to be saturated. The capacity of the air to hold water vapour increases with temperature. When the air is close to being saturated and the temperature suddenly falls, some of the water vapour in the air condenses. Clouds form when condensation takes place high above the ground. And when the droplets join together and become heavy, they come down as rain.
- D.** 1. climate 2. millimetres 3. body 4. increases 5. claws 6. fish
- E.** (a) (iii) (b) (i) (c) (v) (d) (ii) (e) (iv)
- F.** 1. (b) 2. (c) 3. (a) 4. (d)



14

Soil

LESSON PLAN 1

15 minutes	1. Discuss how soil is formed. 2. Complete the activity given on page 131. Discuss the characteristics and components of soil.
20 minutes	3. Discuss the different layers of soil by using Figure 14.5.
Closure: 5 minutes	Homework: A1, A2, A3, B1 to B5, C2

LESSON PLAN 2

25 minutes	1. Discuss the different types of soil. Complete the activity given on page 134. 2. Do the activity given on page 135. Ask the students to note which type of soil remains moist for a longer time.
10 minutes	3. Explain the advantages and disadvantages of sandy and clayey soils. Discuss which plants grow well in these types of soil.
Closure: 5 minutes	Homework: A4, A5, C1

LESSON PLAN 3

25 minutes	1. Show the map of India given on page 136 to the students. Ask them to identify the different types of soil in different parts of India.
10 minutes	2. Summarise what has been discussed.
Closure: 5 minutes	Homework: D, E, F

Answers to Exercises

- A.
1. The oxygen present in air reacts with some minerals in rocks and makes the rocks crumble. This helps in the formation of soil.
 2. When rocks are heated, they expand. When they cool, they contract. This constant expansion and contraction weakens them and makes them break. The breaking down of rocks is called weathering.
 3. The various components of soil are minerals, water, air and humus. Soil also has bacteria, fungi, algae and tiny organisms called protozoans.
 4. Loamy soil is considered the best for the growth of plants.
 5. Clayey soil has a greater water-holding capacity.
- B.
1. Rainwater loosens pieces of rock and carries them with it. As the pieces tumble and knock against each other, they break into smaller pieces. The flowing water carries these pieces and deposits them over land when it slows down.

2. Soil contains minerals, water, air and humus. It also has bacteria, fungi, algae and tiny organisms called protozoans. These organisms help improve the fertility of soil by breaking down organic matter and converting the nitrogen of the air into nitrogenous compounds that plants can use.
 3. The topsoil supports the growth of plants. Its dark colour is due to the presence of humus. The particles of this layer are the finest and the action of decomposers makes this layer porous.
 4. The substratum consists of large pieces of broken rock and coarse soil particles called gravel. This layer is derived from the layer of hard rock that lies beneath. The topsoil is not always derived from the substratum.
 5. Rainwater seeping through the topsoil collects in the substratum as it cannot pass through the layer of hard rock underneath. The reservoir of rainwater in this layer is called groundwater. When there is sufficient rain, groundwater rises to the subsoil.
- C. 1. **Sandy soil:** It is light and easy to plough. The large particles are packed loosely, so there is a lot of air space between them. However, this type of soil does not hold water. So the soil dries out soon after the rain and plants are deprived of water. The dry soil also gets blown away easily.
- Clayey soil:** The fine particles in this type of soil are packed more closely than in sandy soil. Water clings to clayey soil and does not pass through easily. However, there is not enough space between the particles for air. This deprives roots of air. Clayey soil is heavy and difficult to plough. When it dries, it becomes really hard.
2. The organisms living in the soil are called biota. Soil contains bacteria, fungi, algae and tiny organisms called protozoans. These organisms help improve the fertility of soil by breaking down organic matter and converting the nitrogen of the air into nitrogenous compounds that plants can use. Worms and insects also live in the soil. One of the most useful of organisms living in the soil is the earthworm. It ingests soil, digests the organic matter present in the soil and excretes soil full of plant nutrients. Earthworms and other worms and insects also help by burrowing into the soil, and thus 'tilling' or aerating it.
- D. 1. weathering 2. humus 3. more easily 4. cotton and sugar cane
5. Western and Eastern Ghats
- E. 1. (a) 2. (c) 3. (c) 4. (a) 5. (b)
- F. 1. C, E, c, e 2. A, D, a 3. F, G, K, g 4. J, b 5. F, H, f 6. B, I, d



15

Wind, Storm and Rain

LESSON PLAN 1

15 minutes	1. Discuss in detail how winds are caused.
20 minutes	2. Using Figures 15.3, 15.4 and 15.5, discuss permanent wind systems.
Closure: 5 minutes	Homework: A1, A2, A6, B1, C5

LESSON PLAN 2

20 minutes	1. Discuss the origin and characteristics of thunderstorms, tornadoes and cyclones.
15 minutes	2. Divide the class into groups and ask the students to discuss the impact of storms. They could prepare presentations or charts on the topic. 3. Complete the first activity given on page 145 and show how roofs get blown off during a storm.
Closure: 5 minutes	Homework: A3, A4, A5, B2 to B4, C1, C2, C3

LESSON PLAN 3

25 minutes	1. Do the second activity given on page 145. 2. Do the activity on page 146 and discuss weather instruments.
10 minutes	3. Discuss safety measures to be taken during storms.
Closure: 5 minutes	Homework: A6, C4, D

Answers to Exercises

- A.
1. Winds are caused by the unequal heating of different parts of the earth. Hot air rises and cool air blows in to take its place.
 2. A barometer measures air pressure.
 3. When cyclones hit a coast, they bring heavy rainfall. Besides, they make the waters of the sea rise. This is called a storm surge.
 4. The low-pressure centre of a cyclone is called the eye of the storm, or storm centre.
 5. Winds swirl in the anticlockwise direction around the centre of a cyclone in the northern hemisphere.
 6. The unequal heating of the earth causes certain permanent winds to blow in different parts of the world. These winds are also called planetary winds.

- B.
1. The air surrounding the earth exerts a pressure, known as air pressure, on the earth's surface. There is a close link between air pressure and winds. If the pressure at a place falls to a great extent, the chances are that high-speed winds will blow in from other areas where the pressure is higher.
 2. Cyclones in the western Atlantic and eastern Pacific are called hurricanes while those in the western Pacific are called typhoons. Scientists who study weather like to name cyclones so that they can study and refer to them more easily.
 3. When the air above the equator gets heated and rises, cooler, denser air from the tropical belts blow in towards the equator from the north and south. These permanent winds are called the north-east and south-east trade winds.
 4. When the speed of air increases, its pressure falls. During a storm, the pressure above the roof of a building is less than that below it. This causes an upthrust, which may blow off the roof.
- C.
1. The heat of the sun and the presence of moisture in air are necessary for the development of a thunderstorm. As the air near the land gets heated, it becomes light and rises. The upward movement of hot air and the downward movement of cold air lead to stormy winds, rain, lightning and thunder—in short, a thunderstorm.
 2. A tornado is a violently rotating column of air extending from the surface of the earth to a thundercloud. It forms when a rising column of hot air meets a horizontal current of cold air. Air gets sucked out of the centre of the column, and high-speed winds start spiralling around this low-pressure centre. Tornadoes are devastatingly destructive, and can blow off roofs and make houses collapse. However, they do not last long and they are not very wide. The winds that blow around the central low-pressure zone can have speeds up to 200–300 km/h.
 3. A cyclone is a storm that develops over the sea, characterised by high-speed winds swirling around a low-pressure centre. Cyclones develop over tropical seas. Air heated by the warm sun rises, creating a region of low pressure. Cold air rushes in, forcing up more hot air. This brings in more cold air, and so on, setting up a cycle or current of air. The rotation of the earth drags this air current around the region of low pressure. This is how the winds swirl around the centre. Hundreds of people are often killed and injured in a cyclone. Towns and villages get submerged. Buildings, bridges and other man-made structures get damaged.
 4. People living in cyclone-prone areas should always listen to the weather forecast. If there is a cyclone warning, they should move all their possessions indoors, stock up their houses with provisions (including medicines) to last for four or five days and stay indoors. Torches and battery-operated radios are a must because electric lines invariably snap during cyclones. In fact, the electric supply should be turned off. Fishermen should not go out to sea and should tether their boats securely. People living in low-lying areas should move to safer places.
 5. The seasonal winds that bring rain to India and other countries of South Asia between June and September were previously called monsoon. The term monsoon is now used generally to mean seasonal winds in the tropical and subtropical regions. The word was derived from *mausam*, which means weather. In summer, the landmass of northern India becomes much hotter than the surrounding seas. The hot air rises, and moist air blows in from the Arabian Sea and Bay of Bengal. These moisture-laden winds, which bring heavy rainfall in most parts of India, are called the summer monsoon.
- D.
- | | | | |
|-------------------|--|-------------------|---------------|
| 1. tornado | 2. the speed of wind | 3. calm weather | 4. waterspout |
| 5. meteorologists | 6. basement or an inner room on the ground floor | 7. winter monsoon | |



16

Water—Scarcity and Conservation

LESSON PLAN 1

15 minutes	1. Discuss the sources of water.
20 minutes	2. Talk about the various water resources in India.
Closure: 5 minutes	Homework: Activity on page 152; A1 to A4, B1, B2

LESSON PLAN 2

25 minutes	1. Discuss the reasons for the scarcity of water in India.
10 minutes	2. Discuss the role the pani panchayat started by Salunkhe played in making Naigaon prosperous.
Closure: 5 minutes	Homework: A5, B3, B4, C1, C2, D, E

Answers to Exercises

- A. 1. Rivers, lakes, tanks and ponds are surface water sources. Man-made bodies for storing rainwater also fall under this category.
2. Traditionally, groundwater has been utilised by digging wells. The modern way of tapping groundwater is to pump it out with the help of power-operated tubewells.
3. The southern and western parts of India use tanks for irrigation and domestic needs.
4. Excessive use of groundwater leads to scarcity of water.
5. Three causes of water scarcity are excessive runoff due to deforestation, overuse and pollution of rivers.
- B. 1. A part of the rain that falls over land enters the soil and fills up the spaces between the soil particles. This is called soil moisture. It sustains the plants growing on the soil. The roots of plants absorb this water and send it up to the leaves for photosynthesis. Plants would die without soil moisture.
2. After saturating the soil, rainwater moves downwards and gets collected above impervious rocks. This reservoir of water collected above impervious rocks is called groundwater. The depth at which groundwater is found under the ground is called the water table.
3. Though we get a lot of rainfall, it is mostly concentrated in the rainy season. Besides, rainfall is not even every year. Some years, it is far less than the average rainfall. These factors lead to a water shortage. Tamil Nadu and parts of Kerala get rainfall twice a year.
4. All the rain that falls over an area cannot be utilised. Some is lost due to evaporation and some due to runoff. Water going into streams and rivers is carried to the sea, unless we make dams, or embankments to trap the water.
- C. 1. Vilasrao Salunkhe, an engineer and the chairman of the Western Maharashtra Development Corporation, took 16 hectares of uncultivable land on a hillside on lease from the temple trust of Naigaon, a drought-prone village. He

and his family shifted from Pune to live in a hut on the land. With the help of engineering students and retired engineers, he raised bunds along the hillside to trap rainwater and stop soil erosion. He also constructed a percolation tank (a tank that allows water to seep into the soil and recharge groundwater) at the base of the hill and a well for drawing water further down. Water was pumped out of the well to irrigate the farm area on the hill slope.

2. The following steps can be taken to get over the scarcity of water.

- Gather information about water resources
- Take better care of the environment—prevent deforestation and pollution of water. Plant saplings every year to get more rainfall
- Take better care of tanks, ponds, and build embankments and wells
- Prevent overuse of water in cities
- Make rainwater harvesting compulsory

D. 1. permeable 2. groundwater 3. percolation 4. catchment 5. groundwater
6. southern and western

E. 1. False 2. True 3. False 4. False 5. False



17

Forests

LESSON PLAN 1

15 minutes	1. Discuss what forests provide us.
20 minutes	2. Ask the students to make a chart/presentation showing various forest products.
Closure: 5 minutes	Homework: A1, D

LESSON PLAN 2

15 minutes	1. Explain the role of forests in maintaining environmental balance.
20 minutes	2. Discuss forests as natural habitats. Complete the activity given on page 161.
Closure: 5 minutes	Homework: A2, A3, A5, B1 to B4, C1

LESSON PLAN 3

15 minutes	1. Discuss how deforestation affects life.
20 minutes	2. Ask the students to complete the activity given on page 162.
Closure: 5 minutes	Homework: A4, C2

LESSON PLAN 4

25 minutes	1. Using Figure 17.6, discuss the Delhi Ridge as a case study.
15 minutes	2. Summarise what has been discussed.

Answers to Exercises

- A.
1. Forests give us timber, paper, medicine, honey and rubber.
 2. Forests absorb thousands of tonnes of dust and other pollutants. They also absorb noise and protect us from noise pollution.
 3. The water vapour released by trees during transpiration helps to increase rainfall. The evaporation of water from the leaves also causes cooling.
 4. When a plant or an animal disappears from a country or stops existing altogether, we say that it has become extinct.

5. Forests maintain the natural balance of carbon dioxide and oxygen by using up carbon dioxide and releasing oxygen. They can help check the rise in the proportion of carbon dioxide in the air due to human activities like burning fuels.
- B.* 1. Tribals and people living near forests depend on forests for firewood and food. They collect honey, fruit, leaves, tubers and roots, and hunt animals and birds. They also make baskets, mats and other things of use and beauty from the bamboo, cane, leaves and grasses from forests.
2. When mountains lose their forest cover, rainwater rushes down very fast. This makes the rivers in the plains fill up suddenly. Unable to hold so much water, they overflow, causing floods. Forests slow down the flow of water, which helps control floods.
3. The water vapour released by trees during transpiration helps to increase rainfall. Since water is held by the forests, it gets a chance to seep into the soil and recharge groundwater. This prevents water scarcity after the monsoon.
4. The roots of trees bind the soil and save them from being washed away by water or blown away by the wind. The leaves of trees protect the soil beneath from the direct impact of rain pouring over them. And when the leaves fall, their decomposition makes the soil more fertile.
- C.* 1. A single tree in a forest helps many different types of organisms. Birds build their nests in it. Monkeys and squirrels also find shelter here. Birds, monkeys, squirrels and others feed on its fruit and seeds. Insects feed on the nectar of its flowers, its leaves, sap or roots. Grazing animals eat its leaves and twigs. And when its leaves fall on the ground below, soil organisms derive nutrition from them.
2. When we destroy forests, we deprive animals of food and shelter. Deprived of their natural food, they often enter villages neighbouring forests, destroying crops and threatening villagers. Elephants, jackals, hyenas, wolves, panthers and tigers prowl into villages, kill farm animals, and even attack people. Also, due to deforestation, certain plants and animals have become extinct.
- D.* (a) (v) (b) (ii) (c) (i) (d) (iii) (e) (iv)



18

Waste Management

LESSON PLAN 1

5 minutes	1. Ask the students why waste management is important.
30 minutes	2. Discuss the sources of liquid waste. Complete the activity given on page 166.
Closure: 5 minutes	Homework: A1, A2, A3, B1, B2

LESSON PLAN 2

10 minutes	1. Discuss the disposal of waste water. Use Figures 18.2 to 18.5 for explaining the topic.
25 minutes	2. Ask the students to form groups, and prepare group presentations on managing waste water. 3. Discuss other waste disposal systems.
Closure: 5 minutes	Homework: A4, A5, A6, B3 to B6, C

Answers to Exercises

- A.
1. Municipal sewage is the waste water carried by sewers, or underground pipes. This is the waste water from homes, offices, and so on.
 2. The waste water from toilets is often referred to as black water, while the waste water from kitchens and bathrooms is called grey water.
 3. Municipal sewage, industrial effluents and rainwater carrying waste washed off the land are the three sources of liquid waste.
 4. Treating waste water involves the separation of large solids, like rags and plastic, and the elimination of harmful chemicals and organic matter from waste water so that this water can be used for other purposes.
 5. Sludge from sewage treatment can be used to produce compost and biogas.
 6. Two things we can do to reduce the burden on the waste water disposal system are (i) to not throw solid waste into kitchen or bathroom drains and (ii) to not wash chemicals down the drain.
- B.
1. Rainwater drains get clogged not only by all the garbage washed into them by rainwater, but also by the garbage thrown into them deliberately. The clogging of rainwater drains is one of the causes of flooding during the monsoon. Open drains also provide an ideal breeding ground for mosquitoes.
 2. In the beginning of the 20th century, some countries realised that rivers, lakes and seas were getting polluted by waste water. That is when the idea of cleaning waste started gaining ground. Also, the growing human population has led to the generation of more and more harmful waste. We need to adopt methods of proper waste disposal to minimise the pollution of natural resources.
 3. Sewage is carried by sewers to a sewage treatment plant. Here, the large solids, like rags and plastic, are separated by strainers. Then the sewage may pass through settlement tanks, where most suspended solids sink to the bottom. These solids are called primary sludge, and can be used to produce compost and biogas.

4. The secondary treatment of waste water involves the removal of organic matter. This is done by breaking down organic matter by the action of bacteria in open tanks called aeration tanks. Aerobic bacteria, or bacteria that need oxygen, act on the sewage in these tanks.
5. Since sewage treatment facilities are expensive, allowing waste water to pass through a series of ponds is being considered as an alternative. Natural wetlands can also be used to process waste water. They have bacteria, worms and protozoans, which act on organic matter.
6. Sanitary toilets are being made available in Indian villages, where the waste from such toilets is fed into biogas plants. Microorganisms act on the excreta in the plant. The gas produced can be used as fuel. The sludge is used as manure.

- C. 1. sewers 2. nonbiodegradable 3. effluent 4. sewage
5. aerobic 6. biological or secondary



Basic Science for Class 8

1

Food Production

LESSON PLAN 1

10 minutes	1. Start the topic by asking the students the meaning of agriculture.
25 minutes	2. Discuss different types of crops and show the students samples of the types. 3. List the steps involved in the cultivation of crops.
Closure: 5 minutes	Homework: A1, A2, A3

LESSON PLAN 2

30 minutes	1. Explain how soil fertility can be improved. Do the activity on page 3. 2. Using Figure 1.7, discuss the nitrogen cycle.
5 minutes	3. Ask the students to note the role of nitrogen in plant growth.
Closure: 5 minutes	Homework: B1, B2, B4, C2

LESSON PLAN 3

15 minutes	1. Discuss biofertilisers, manure and chemical fertilisers.
20 minutes	2. Ask the students to differentiate between chemical fertilisers and manure. 3. Discuss irrigation and its sources. Use the map on page 7 to identify the major dams built in India. 4. Discuss the methods of irrigation used in India.
Closure: 5 minutes	Homework: B5, C1, C3

LESSON PLAN 4

15 minutes	1. Discuss crop protection.
20 minutes	2. Discuss harvesting and storage of crops. Explain the importance of a buffer stock.
Closure: 5 minutes	Homework: A4, A5, A6, A8, A10, B3

LESSON PLAN 5

20 minutes	1. Complete the activity on pages 11/12.
15 minutes	2. Divide the students into groups and ask them to make herbarium files.
Closure: 5 minutes	Homework: Read till page 11.

LESSON PLAN 6

15 minutes	1. Ask the students to list the types of food we get from animals. Compare plant proteins with animal proteins.
20 minutes	2. Discuss the various food products obtained from animals. 3. Summarise what has been discussed.
Closure: 5 minutes	Homework: A7, A9, D, E, F

Answers to Exercises

- A.
1. The practice of growing crops is called agriculture (*ager* means 'field' in Latin, while *culture* means cultivation).
 2. Rubber and coffee are two examples of plantation crops.
 3. The major activities involved in growing a crop are preparing the soil, which includes ploughing, levelling and manuring, sowing seeds, irrigating the fields and protecting the crops.
 4. The unwanted plants which grow along with crops are called weeds. They compete with the crops for light, water, space and minerals, and harm the growth and yield.
 5. Weeds can be removed manually or by using an implement like a trowel, hoe or rake. A third way of getting rid of weeds is by spraying chemicals called weedicides.
 6. Pests like rodents (rats) and insects often eat and damage crop plants and their produce. Rats eat grains and contaminate them with their excreta.
 7. Animal proteins are better than plant proteins as they are more completely digested by us. Also, they contain some essential amino acids that plant proteins lack.
 8. Kharif crops are sown during the monsoon.
 9. The rearing of animals is referred to as livestock farming or animal husbandry.
 10. Temperature and humidity are the two things that have to be controlled in a cold storage.
- B.
1. (a) Different crops have different nutrient requirements. If we grow the same crop in the same field season after season, the soil becomes deficient in the set of nutrients needed by the crop. So, it is better to grow one crop in one season and another crop in the next season. In other words, crop rotation is a good agricultural practice.
(b) Pulses are grown in alternation with nutrient-demanding crops such as wheat and paddy because they improve soil fertility.
 2. (a) Some plants (black gram, cluster bean, cowpea, etc.) are grown specially to produce manure. They are ploughed back into the soil and are referred to as green manure.
(b) Manure, or organic manure, is produced by the decomposition of crop residue, animal dung, the sludge from the treatment of sewage, and so on. When manure is produced by allowing microorganisms to act on the waste matter in covered pits or in the open, it is called compost. The process of decomposition can take place in the open too.
 3. (a) Scientists are trying to find natural or biological ways of controlling weeds and plant pests. One way is to use the natural enemies of weeds and pests to kill them. This is called the biological control of weeds and pests.
(b) Weedicides and pesticides are poisonous. They cause irritation of the human skin and respiratory system, and even cancer. Therefore, natural or biological ways of controlling weeds and plant pests is a better alternative.
 4. The swellings formed by the nitrogen-fixing bacteria in roots of leguminous plants are called root nodules. The bacteria convert nitrogen into ammonia, which the plant uses to make proteins.
 5. The modes of irrigation in which the water is allowed to run over the field fall under surface irrigation. In case of crops which do not need too much water, the crop is planted on ridges and water is allowed to run through

furrows between the ridges. This is called furrow irrigation. For crops like rice, which need a lot of water, the field is flooded with water by making bunds all around it. This is called basin irrigation.

- C. 1. The advantages and disadvantages of using chemical fertilisers are as follows.

Advantages

- (i) Provide nutrients which are either absent or not present in sufficient quantities in manure.
- (ii) Easy to store, transport and use because they are compact.
- (iii) Readily absorbed by plants because they are water soluble.

Disadvantages

- (i) They do not provide humus—they change the soil structure and make it prone to erosion.
 - (ii) Overuse can harm soil fertility by making it too acidic or alkaline.
 - (iii) Accumulation of fertilisers in water bodies causes eutrophication.
2. The bacteria living in the roots of legumes, many other bacteria and cyanobacteria (bacterialike microorganisms) convert atmospheric nitrogen into compounds that plants can use. When plants and animals die, the nitrogenous compounds locked in their body are converted into ammonia by microorganisms. The ammonia is ultimately converted into nitrates by bacteria.

There is a reverse process in nature which returns nitrogen to the air. Some bacteria living in the soil break down nitrogenous compounds to get energy. The nitrogen released in the process escapes into the air.

All these processes can be summed up as a continual cycling of nitrogen from the air to the soil and to the living world. Together they form the nitrogen cycle.

3. Traditionally, farmers depended on rainfall for irrigation. Crops with a large requirement of water were grown in areas with moderate to high rainfall. Hardy crops, which can withstand a shortage of water, were grown in dry areas. Things have changed to a certain extent in modern times, with the construction of dams across rivers. Water from these dams is carried by canals to many areas which were deprived of water earlier. The dams bring water from different rivers and have made the cultivation of various crops possible. Inundation canals are used to divert rainwater from rivers and streams during the monsoon. The practice in southern India is to store rainwater in tanks.

Wells have been used to tap groundwater. Electrically-operated tubewells are used to pump out water for irrigation. Groundwater accounts for over 50% of the water used for irrigation.

- | | | | | | |
|----|-------------------------------------|------------------|-----------------|--------------|-------------|
| D. | 1. horticulture | 2. fumigation | 3. buffer stock | 4. symbiosis | 5. depth |
| | 6. The biological or natural method | 7. fallow | | | |
| E. | 1. (a) | 2. (d) | 3. (a) | 4. (b) | 5. (a) |
| | 6. (c) | 7. (a) | | | |
| F. | 1. (a), (d) | 2. (a), (b), (c) | 3. (a), (c) | 4. (b), (c) | 5. (a), (c) |



2

The Cell

LESSON PLAN 1

10 minutes	1. Discuss cells and their types. Complete the activities on pages 17 to 18.
25 minutes	2. Using Figures 2.3 to 2.7, ask the students to identify different types of cells.
Closure: 5 minutes	Homework: A1, A2, B1

LESSON PLAN 2

35 minutes	1. Discuss the structure of a cell and explain in detail the common features. 2. Using Table 2.1, discuss the differences between animal cells and plant cells.
Closure: 5 minutes	Homework: A4, A5, B2, B4, B5, C1

LESSON PLAN 3

25 minutes	1. Using Figures 2.9 and 2.10, discuss plant tissues and animal tissues.
10 minutes	2. Summarise what has been discussed.
Closure: 5 minutes	Homework: A3, B3, C2, D, E

Answers to Exercises

- A.
1. Organisms made up of a single cell are called unicellular organisms.
 2. Specimens are stained before being viewed under a microscope in order to highlight different parts so that they become distinguishable.
 3. The four types of animal tissue are epithelial tissue, connective tissue, muscular tissue and nervous tissue.
 4. The central part of most plant cells is occupied by a large vacuole. A vacuole is a saclike structure filled with fluid containing food, wastes, pigments and other substances dissolved in it. Some animal cells also have vacuoles, although much smaller.
 5. Chloroplasts are present in plant cells. Only green parts of plants have chloroplasts.
- B.
1. Since the cell is the building block of an organism, it may be called the smallest structural unit of life. In unicellular organisms, all life processes are carried out by the single cell. It is the cells that carry out all the functions even in multicellular organisms like us. This is why the cell is known as the functional unit of life.
 2. The different types of plastids are chloroplasts, chromoplasts and leucoplasts. Chloroplasts contain the green pigment chlorophyll and are responsible for photosynthesis. Chromoplasts contain pigments which give fruits and flowers their colours. Leucoplasts store food and are found in the storage organs of plants.

3. Vascular bundles are made up of two types of tissues, namely xylem and phloem. The xylem is responsible for transporting water and minerals from the root. The phloem is responsible for transporting food from the leaves to the rest of the plant.
4. The nucleus is the largest and the most important organelle of the cell. Inside it are chromosomes, which carry genes. The genes order the cell to perform all its functions. Thus, the nucleus is often called the control room of the cell.
5. The covering of the cell is called the cell membrane, or plasma membrane. It acts like a sentry, allowing only some things to enter and leave the cell and stopping others. For example, it allows oxygen and nutrients to pass into the cell and permits wastes to pass out of it. This is why it is called selectively permeable.

- C. 1. The basic differences between plant cells and animal cells are as follows.

	Plant Cells		Animal Cells
(i)	Plant cells have a cell wall in addition to the plasma membrane.	(i)	Animal cells do not have a cell wall.
(ii)	Plant cells have plastids.	(ii)	Animal cells do not have plastids.
(iii)	Most of the space in a plant cell is occupied by one or several large vacuoles.	(iii)	Even when vacuoles are present in animal cells, they are much smaller in size.

2. There are three distinct regions in the transverse section of a dicotyledonous stem. These are as follows.

(a) **Epidermis** The outermost region formed by a single row of closely fitting, flat, rectangular cells is called the epidermis. This is a protective tissue that covers stems, roots and leaves.

(b) **Ground tissue** This constitutes the rest of the stem except the distinct groups or bundles of cells arranged in a circle near the centre. It is divided into different zones and is actually a tissue system, consisting of different types of tissue, like the cortex and the pith. The thin-walled, oval or polygonal cells extending from the epidermis to the distinct bundles near the centre form the cortex. The central core of rounded cells forms the pith.

(c) **Vascular bundles** The distinct groups of cells arranged in a ring are called vascular bundles. They are made up of two types of tissue called the xylem and the phloem. The large, thick-walled cells form the xylem. The thin-walled, smaller cells lying more towards the outer side make up the phloem. The xylem is responsible for transporting water and minerals from the root. The phloem is responsible for transporting food from the leaves to the rest of the plant.

- D. 1. (a) 2. (c) 3. (d) 4. (b) 5. (a) 6. (d)
- E. 1. chromatin 2. genes 3. cortex 4. plasma 5. eyepiece



3

Microorganisms

LESSON PLAN 1

15 minutes	1. Introduce microorganisms in class. Do the activity on page 25. Classify microorganisms.
20 minutes	2. Discuss algae and their usefulness. 3. Discuss eutrophication and its harmful effects.
Closure: 5 minutes	Homework: A1, A2, A3, A8, B1, B2, C1

LESSON PLAN 2

15 minutes	1. Complete the activity on page 27.
20 minutes	2. Discuss the shapes of bacteria, and their nutrition, growth, reproduction and uses. 3. Discuss harmful bacteria.
Closure: 5 minutes	Homework: A4 to A7

LESSON PLAN 3

25 minutes	1. Using Figure 3.7, complete the activity on pages 29/30. Discuss fungi. 2. Do the activity on pages 30/31, and discuss moulds.
10 minutes	3. Discuss useful and harmful fungi.
Closure: 5 minutes	Homework: B5, C2

LESSON PLAN 4

25 minutes	1. Discuss protozoans using Figure 3.12. 2. Discuss useful and harmful protozoans.
10 minutes	3. Describe viruses. Talk about the AIDS virus using Figure 3.14.
Closure: 5 minutes	Homework: A9, A10, B3, B4, C3

LESSON PLAN 5

25 minutes	1. Discuss why we need to preserve food. Do the activity on page 34. 2. Using Figure 3.15, talk about the methods of preserving food.
10 minutes	3. Summarise what has been discussed.
Closure: 5 minutes	Homework: D, E

Answers to Exercises

- A. 1. The study of microorganisms is called microbiology.
2. Some microorganisms survive unfavourable conditions by forming spores. They remain inactive inside the spore and spring to life again when the conditions are favourable.

3. The Sargasso Sea owes its name to the brown alga *Sargassum*.
 4. Rod-shaped bacteria are called *bacilli*, spherical bacteria are called *cocci*, spiral bacteria are called *spirilla*, and comma-shaped bacteria are called *vibrios*.
 5. The major difference between a bacterial cell and the cells of other organisms is that the bacterial cell does not have a nucleus while the others have a nucleus.
 6. Bacteria reproduce by binary fission, a mode of asexual reproduction in which one cell divides into two.
 7. (i) Bacteria help us make yoghurt, cheese and vinegar.
(ii) They also help us produce some antibiotics.
 8. Yes, red and brown algae have additional pigments which mask the green colour of chlorophyll.
 9. The protozoan *Euglena* contains chlorophyll and can photosynthesise.
 10. The protozoan *Entamoeba histolytica* causes amoebic dysentery in human beings.
- B.
1. Diatoms are a group of algae. They are mostly unicellular and have cell walls made of silica. Shells of dead diatoms deposited on the beds of lakes and seas are used to make glass, porcelain and ceramics. They are also used to make toothpaste, polishes and filters.
 2. (i) A gummy substance called algin, obtained from kelp, is used to thicken ice creams, cosmetics and shaving cream.
(ii) Agar, a jellylike substance in which microorganisms and tissue are cultured, is made from certain red algae.
(iii) Certain red algae are eaten in China and Japan.
 3. *Paramoecium* is a freshwater protozoan found in ponds and ditches. Its hairlike projections called cilia help it to swim. They also help to direct food and water into the oral groove of this organism.
 4. Termites have protozoans living in their body, which digest the cellulose in the wood eaten by them and convert it into carbohydrates that the termites can use. Bacteria living in our intestines help in the absorption of food and protect us from some diseases.
 5. Moulds are a group of multicellular fungi. They spoil raw as well as cooked food.
Fungi cause infections of the skin, scalp and nails in human beings. These infections go by the general name 'ringworm'. Athlete's foot, barber's itch and dhobi's itch are also types of fungal infection.
- C.
1. Quite often, when sewage and fertilisers drain into water bodies, there is an unnaturally rapid growth of algae. The algae form a thick layer over the surface of the water body, and this is called an algal bloom. The dense layer of algae deprives other organisms of light and oxygen. Besides, when they die, the bacteria acting on them use up more oxygen. Slowly most other organisms living in the water body die.
 2. Yeast is a unicellular fungus which can be dried and stored for a long time. It is used to make bakery products. The carbon dioxide produced by yeast makes bread and buns rise and become fluffy. Idli and dosa are made with a fermented paste of rice and dal. The fermentation of the mixture is caused by the growth of yeast. Moulds are used to flavour processed cheeses. Pencillin and some other antibiotics are made from some moulds. Mushrooms are another type of fungi. Some of them are edible.
 3. Viruses are something in between the living and the nonliving. They are acellular, which means that they do not have any of the substances contained in a cell. They consist of a bit of nuclear material wrapped in a coat of protein. They cannot reproduce unless they enter the cell of a living organism; they do not use energy to grow; they do not respond to stimuli. Yet, when a virus enters the cell of a living organism, it is able to multiply and produce hundreds of viruses within the host cell. The nuclear material of the host cell gets destroyed and the nuclear material of the virus takes over, directing the host cell to produce copies of the virus.
- D.
- | | | | | | |
|-------------|------------------|---------------|-------------|------------|---------------|
| 1. mycelium | 2. cyanobacteria | 3. Protozoans | 4. Protozoa | 5. alcohol | 6. sporangium |
|-------------|------------------|---------------|-------------|------------|---------------|
- E.
- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (c) | 2. (a) | 3. (b) | 4. (d) | 5. (a) |
|--------|--------|--------|--------|--------|

4

Reproduction

LESSON PLAN 1

10 minutes	Ask the students what reproduction is. Differentiate between asexual and sexual reproduction.
25 minutes	Using Figures 4.2 and 4.3, discuss the male and female reproductive systems in human beings. Discuss fertilisation, pregnancy and childbirth.
Closure: 5 minutes	Homework: A1 to A8, B2

LESSON PLAN 2

35 minutes	1. Discuss the menstrual cycle and secondary sexual characters. 2. Discuss the role of the endocrine system in the development of secondary sexual characteristics and human reproduction.
Closure: 5 minutes	Homework: A9, B1, B3, C1

LESSON PLAN 3

20 minutes	1. Complete the activity on page 43. Discuss and differentiate between gender and sex.
15 minutes	2. Using Figure 4.8, discuss sex determination.
Closure: 5 minutes	Homework: B4, C2, C3, D, E, F

Answers to Exercises

- A.
1. In asexual reproduction, an individual produces offspring without the help of another individual.
 2. The male gamete is known as the sperm and the female gamete is known as the ovum in human beings.
 3. In frogs, reproduction takes place outside the body.
 4. The organs that form the male reproductive system are the testes, epididymis, vas deferens, penis and some glands.
 5. In human beings, fertilisation occurs inside the body of the female.
 6. The embryo receives nutrition from the mother through the placenta.
 7. The female reproductive system consists of the ovaries, Fallopian tubes, uterus and vagina.
 8. The zygote formed after fertilisation of the ovum divides repeatedly and travels to the uterus. It gets attached to the wall of the uterus and forms the embryo.
 9. The hormone that regulates secondary sexual characters in males is called testosterone.
- B.
1. When a girl attains puberty, either of the ovaries releases an ovum into the Fallopian tube once in every 28 days or so. This is called ovulation. If the ovum does not get fertilised, it is expelled through the vagina. And together with

it is expelled the lining of the uterus and blood. This is called menstruation. The entire process of ovulation, thickening of the uterine wall and menstruation is called the menstrual cycle.

2. When two mature ova are released at the same time and are fertilised by two sperms, this results in the birth of twins. Twins born this way are called fraternal or nonidentical twins. It can also happen that the fertilised egg divides into two. This leads to the birth of identical twins.
 3. The endocrine glands are different from other glands. They discharge the chemicals they produce directly into the blood. The chemicals produced by the endocrine glands are called hormones. Hormones act like chemical messengers. They are carried by the blood to specific organs or tissues with messages for them to function in particular ways.
 4. A taboo is a social or religious custom that prohibits or restricts a certain behaviour or practice. For example, Elizabeth Blackwell (the first woman doctor) had to overcome considerable resistance to study medicine. However, nowadays it is not uncommon for women to become doctors.
- C.
1. Physical and emotional changes that occur in boys and girls around the age when they attain puberty are known as secondary sexual characters. Generally, girls attain puberty between 11 and 14 years and boys, between 13 and 16 years. Puberty is marked by the onset of menstruation in girls and the production of sperms in boys. In the case of girls, the secondary sexual characters are enlargement of the breasts, widening of the pelvic girdle, and growth of hair in the pubic region and armpits. In the case of boys, the characters are deepening of the voice caused by enlargement of the larynx; growth of hair on the face, pubic region and armpits; enlargement of the penis and scrotum; and increase in muscle mass.
 2. Gender roles are functions that society sees as feminine or masculine. These roles are encouraged in children from a very early age. There is no law that binds a girl to behave in a particular way or compels a boy to perform certain functions. However, since most people in a society have certain ideas of what is feminine and what is masculine, boys and girls grow up performing these roles. For example, an Indian girl may be encouraged by her parents to learn cooking, while a boy may automatically help his father mend a fuse or fix a leaking tap. The idea of the roles men and women should perform is often reflected in their choice of profession. For example, women are associated with nurturing, caring for and looking after the old and the young. Thus, quite often, women become nurses, dietitians, counsellors or primary school teachers. Men are associated with protection, valour, physical stamina and the ability to put up with physical hardships. Thus, young boys often dream of joining the army, navy or airforce.
 3. The sex of a foetus in the mother's womb can be determined by testing its cells. The cells of the foetus are obtained by withdrawing amniotic fluid with the help of a special needle. There are other methods of determining the sex of a foetus, for example, by ultrasonography or taking a 'sound picture' of the mother's abdomen. Testing the mother's urine is yet another method.

Sex determination is prohibited by law. It is a punishable act. This is because people often want to know the sex of their child before birth since they do not want daughters. When they get to know that the unborn child is female, they try to kill the foetus. This is called foeticide.

- D. 1. umbilical cord 2. fraternal 3. oestrogen 4. pituitary 5. kidneys
6. semen
- E. 1. (a) 2. (c) 3. (b) 4. (c) 5. (a)
- F. (a) urinary bladder, vas deferens, urethra, skin of penis, epididymis, testis, scrotum
(b) funnel of Fallopian tube, Fallopian tube, ovary, uterus, cervix, vagina



5

Synthetic Materials

LESSON PLAN 1

10 minutes	1. Discuss monomers and polymers. Use Figure 5.1 to explain polymerisation.
25 minutes	2. Bring different types of fibres to class and ask the students to differentiate between natural and synthetic fibres. 3. Discuss the characteristics of rayon. Use Figure 5.2 to explain how viscose is forced through a spinneret.
Closure: 5 minutes	Homework: A1, A2, A3

LESSON PLAN 2

25 minutes	1. Divide the class into groups. Ask them to discuss polyesters, nylons, acrylics, and the advantages and disadvantages of synthetic fibres.
10 minutes	2. Discuss how blends make for comfortable clothing. List the other uses of synthetic fibres.
Closure: 5 minutes	Homework: A4, A9, B1, C2

LESSON PLAN 3

25 minutes	1. Using Figure 5.3, Table 5.1 and the flowchart given on page 51, discuss other useful synthetic polymers.
10 minutes	2. Ask the students to collect specimens of synthetic fabrics. You could also ask them to get things made of synthetic polymers other than fabrics. Discuss their various uses in our daily life.
Closure: 5 minutes	Homework: A5, A6, A7, B2, B3, C1

LESSON PLAN 4

25 minutes	1. Complete the activity on page 52 and discuss the tensile strength of fibres. 2. Do the first activity on page 53 and discuss the capacity of different fabrics to absorb moisture.
10 minutes	3. Complete the second activity on page 53 and discuss the action of heat and flame on fibres.
Closure: 5 minutes	Homework: A8, C3

LESSON PLAN 5

25 minutes	1. Complete the activities on page 54, and discuss the thermal and electrical conductivities of different materials. 2. Compare the properties of natural and synthetic fibres using Table 5.2.
Closure: 5 minutes	Homework: D, E, F

Answers to Exercises

- A.
1. A polymer is a substance formed by many small units, called monomers, combining end to end.
 2. The process by which monomers combine end-to-end to form a polymer is called polymerisation.
 3. Viscose rayon, cuprammonium rayon and acetate rayon are the three types of rayon.
 4. Apart from making clothes, synthetic fibres are used for making bedspreads, curtains, bandages, mosquito nets, insulation for electric wires, etc.
 5. Plastics are synthetic materials that can be moulded into a permanent shape.
 6. The polymer used in bubblegums is poly(styrene-butadiene), in Thermocol it is polystyrene, and in synthetic erasers, it is vinyl rubber.
 7. Three polymers that can be obtained by using chemicals derived from natural gas are polythene, acrylics and bakelite.
 8. The pulling stress required to break a material is called its tensile strength. The greater the tensile strength of a fibre, the greater is the load its yarn can bear.
 9. (a) Natural fibres are hydrophilic, i.e., they absorb moisture.
(b) Synthetic fibres are hydrophobic, i.e., they repel moisture.
- B.
1. Acrylic fibres decompose without melting. So, they are dissolved in a suitable solvent and the solution is forced through spinnerets to obtain filaments. The filaments can be cut into staples and the staples spun into yarns.
 2. Thermoplastics retain their plasticity even after repeated heating and cooling. So they can be moulded over and over again. But thermosetting plastics, once set after being melted, cannot be moulded again.
 3. Acetylene is used for making polythene, polyvinyl chloride (PVC), and acrylics. Propylene is used to make polypropylene (a plastic). Of these, polythene is used to make packaging materials, bottles, etc., and PVC is used to make pipes and insulation.
- C.
1. Polymers are classified into three types—natural, semisynthetic and synthetic. Many substances in living organisms are polymers. Cellulose, a polymer of glucose, is a natural polymer. Semisynthetic polymers, like rayons, are made by using natural polymers as the starting material. Purely synthetic polymers are made from chemicals. The chemical raw materials used to manufacture synthetic polymers are obtained directly or indirectly from natural gas and petroleum.

Natural gas contains mainly methane. Methane can be converted into acetylene and formaldehyde. Acetylene is used for making polythene, polyvinyl chloride (PVC), and acrylics, while formaldehyde is used for making bakelite.

By the fractional distillation of petroleum and cracking of the fractions, we get acetylene, propylene, benzene, naphthalene, etc. Propylene is used to make polypropylene (a plastic). Benzene is used for making nylon. Naphthalene is converted into phthalic acid, which is used for making polyester.

2. Advantages

- (i) Synthetic fibres do not depend either on an agricultural crop as cotton, flax and jute do, or on animal farming as silk and wool do.
- (ii) They are much stronger and hence more durable than natural fibres.
- (iii) They are not easily acted upon by moisture, chemicals or bacteria.

Disadvantages

- (i) Synthetic fibres do not absorb water easily. So clothes made of such fibres are not comfortable to wear.
- (ii) Synthetic fibres melt before burning. So clothes made of such fibres stick to the skin when they come in contact with a flame, causing burns.
- (iii) Some electrical charges accumulate on synthetic fibres due to which they cling together as well as to the skin. The electrical charges irritate the skin.

3. The greater the tensile strength of a fibre, the greater is the load its yarn can bear. In respect of fibres, tensile strength is expressed in g/tex, where tex is the mass in grams of 1000 m of the fibre or its yarn. The tensile strengths of different fibres can be compared in the following way. Tie one end of a cotton thread to a hook fixed to a rigid body and the other end to a pan of a balance. Put some weights on the pan and increase the weight in small steps, till the thread breaks. Note the total weight, including that of the pan, required to break the thread. Repeat the activity with other kinds of fibres, e.g., wool, silk, nylon and polyester, of similar thickness and the same length. The different weights required to break the threads will give comparative values of their tensile strength.

- | | | | | | | |
|-----------|------------|----------|------------------|------------|-----------|---------|
| <i>D.</i> | 1. Acrylic | 2. block | 3. nondegradable | 4. harmful | 5. higher | 6. melt |
| <i>E.</i> | 1. (c) | 2. (a) | 3. (d) | 4. (c) | 5. (a) | |
| <i>F.</i> | (a) (v) | (b) (iv) | (c) (i) | (d) (ii) | (e) (iii) | |



6

Metals and Nonmetals

LESSON PLAN 1

15 minutes	1. Discuss the physical properties of metals and nonmetals.
20 minutes	2. Do the activity on page 58.
Closure: 5 minutes	Homework: A1, A2, A3, B1, B2

LESSON PLAN 2

35 minutes	1. Discuss the action of air on metals. 2. Do the first activity on page 60 and discuss the displacement of one metal by another. 3. Complete the second activity on the same page and discuss the displacement of hydrogen from water.
Closure: 5 minutes	Homework: A5, C2

LESSON PLAN 3

20 minutes	1. Do the experiment based on Figure 6.10 on page 61 and discuss the displacement of hydrogen from acids.
15 minutes	2. Talk about the chemical behaviour of nonmetals.
Closure: 5 minutes	Homework: B3, C1

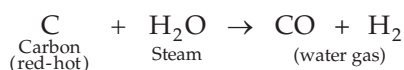
LESSON PLAN 4

35 minutes	1. Discuss the uses of metals and nonmetals.
Closure: 5 minutes	Homework: A4 to A8, B4, B5, D, E, F

Answers to Exercises

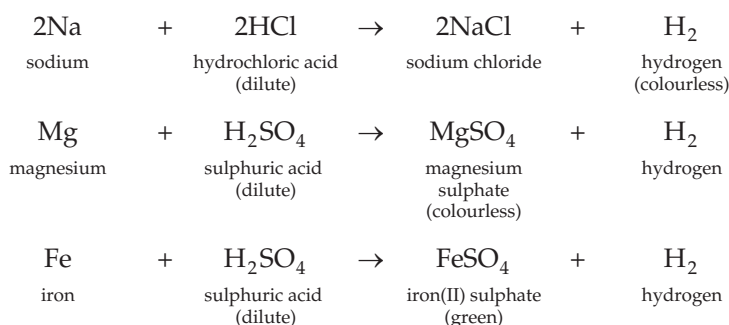
- A. 1. Potassium (K), calcium (Ca), sodium (Na), magnesium (Mg), iron (Fe), aluminum (Al), zinc (Zn), copper (Cu), tin (Sn) and mercury (Hg)
2. Metals are generally hard, strong solids, for example, aluminum, iron, zinc, tin and copper. They are strong enough to bear heavy loads. Steel cables, for example, are used to carry heavy loads.
3. (a) We cannot draw wires from a piece of wood or coal because wood and coal are brittle, not flexible.
(b) We cannot use nylon or jute ropes for electrical transmission because they are bad conductors of electricity.
(c) We cannot use a cooking utensil made of cardboard because it is a bad conductor of heat.
4. Hydrogen, nitrogen, oxygen, fluorine and chlorine

5. Potassium and sodium react vigorously even with cold water, while magnesium continues to burn in steam if ignited.
 6. (a) All combustion processes need oxygen.
(b) Oxygen is used in the manufacture of sulphuric and nitric acids.
(c) Liquid oxygen is used to burn rocket fuel.
 7. (a) Plants use nitrogen to manufacture proteins.
(b) Liquid nitrogen is used to preserve blood, corneas or other donated organs.
(c) Nitrogen is used in the manufacture of ammonia and urea.
 8. Alloys are homogeneous solid mixtures of metals or of metals and nonmetals. Alloying is done to make the parent metal stronger. Steel, brass and bronze are alloys.
- B.
1. Metals have lustre, known as metallic lustre. They are sonorous. When struck, they produce a sound called a metallic sound. Metals are also malleable, i.e., they can be beaten or rolled into sheets. They are ductile, i.e., they are flexible and can be drawn into wires. Metals are good conductors of electricity.
 2. In contrast to metals, nonmetals are not known for strength. They are usually lustreless (dull), except graphite and iodine, brittle (if solid), bad conductors of heat, bad conductors of electricity (except graphite) and nonsonorous (i.e., they do not produce a metallic clink).
 3. Carbon, when red-hot, reacts with steam. When steam is passed over red-hot coke (carbon), a gaseous mixture of carbon monoxide and hydrogen is formed. This mixture, called water gas, has many industrial uses.



4. Copper wires are generally used for domestic wiring and aluminum wires for long-distance electrical transmission. Aluminium is lighter and cheaper than copper. Iron is a very useful metal as it is tough, strong and cheap. It is used for making tools, machines and agricultural equipment. Mercury does not stick to glass. It is also a good conductor of heat. So it is used in thermometers.
 5. Carbon is found in two crystalline forms—diamond and graphite. Diamond is used as a gem and also for cutting rocks or glass. Since graphite is a good conductor of electricity, it is used as an electrode. Graphite is a good lubricant. Since its melting point is high, it can be used as a lubricant in machines that acquire high temperatures while being operated.
- C.
1. Metals along with hydrogen (a nonmetal) are arranged in order of their activity in a series, called the activity series. This series helps us understand the reactions of metals. Metals higher than hydrogen in the activity series displace hydrogen from dilute hydrochloric and sulphuric acids, but those below hydrogen do not. Also, the reactivity of the metal decreases down the series.

For example, (a) iron displaces hydrogen from dilute sulphuric acid, and (b) magnesium reacts more vigorously with an acid than iron does.



Copper or silver do not liberate hydrogen from dilute acids because they are less active than hydrogen.

2. Using an electrical circuit, we can easily test whether or not something conducts electricity. Sharpen a small pencil at both ends, and connect the two naked ends of the 'lead' to the circuit. The bulb will glow, showing that the 'lead' of the pencil conducts electricity. The 'lead' of a pencil is made of a mixture of clay and graphite, and graphite (a form of carbon) is a good conductor of electricity. Replace the pencil by some sulphur. The bulb does not glow, showing that sulphur is a bad conductor of electricity.

- | | | | | | | |
|-----------|--------------------|---------------------|-------------------|----------------------|----------|-------------|
| <i>D.</i> | 1. iodine | 2. metals | 3. clay, graphite | 4. liquid | 5. Argon | 6. nitrogen |
| <i>E.</i> | 1. (d) | 2. (d) | 3. (a) | 4. (d) | 5. (d) | |
| <i>F.</i> | 1. Neon-B, s | 2. Graphite-B, C, u | 3. Iodine-B, C, r | 4. Aluminium-A, C, p | | |
| | 5. Diamond-B, C, t | 6. Mercury-A, D, u | | | | |



7

Combustion and Fuels

LESSON PLAN 1

35 minutes	1. Introduce thermal energy. Do the activities on pages 68 and 69 (Figures 7.1 and 7.2). 2. Complete the activity on page 69 (Figure 7.3). Discuss ignition temperature.
Closure: 5 minutes	Homework: A1, A2, A3

LESSON PLAN 2

20 minutes	1. Discuss the concept of calorific value. Also refer to Table 7.1. 2. Discuss the method by which biogas is produced. Use Figure 7.5.
15 minutes	3. Discuss coal as a fuel.
Closure: 5 minutes	Homework: A4, B1, B2

LESSON PLAN 3

35 minutes	1. Discuss the fractional distillation of petroleum. 2. Talk about the factors to be considered while choosing a fuel.
Closure: 5 minutes	Homework: A5, A6, A7, B3, C3

35 minutes	1. Discuss the four regions of a candle flame. 2. Do the activity on page 74. Ask the students to write what they observed during the activity. Summarise the topics discussed.
Closure: 5 minutes	Homework: C1, C2, D, E, F

Answers to Exercises

- A. 1. (a) Combustion
(b) A supporter of combustion
(c) A fuel
2. The temperature to which a substance must be heated before combustion takes place is known as its ignition temperature.
3. When placed over a flame, a paper cup containing water does not burn because the water takes away the heat from the cup and does not allow it to reach its ignition temperature.
4. The amount of heat given out by a unit mass of a fuel on complete combustion in air or oxygen is known as the calorific value of the fuel.
5. In order of increasing boiling range, petrol, diesel and kerosene may be arranged as petrol < kerosene < diesel.

6. Natural gas, liquid petroleum gas (LPG) and biogas are three gaseous fuels. Natural gas collects over petroleum found inside the earth. Wells are sunk to extract it. LPG is obtained by the liquefaction of petroleum gas, and biogas is obtained from the anaerobic fermentation of cattle dung and domestic sewage.
7. The ignition point of a fuel should not be lower than room temperature. Otherwise, it would catch fire at room temperature.

- B.
1. Coal contains compounds of nitrogen and sulphur as impurities, which also burn to form the oxides of these elements. These oxides are poisonous and pollute the atmosphere. In an insufficient supply of air, coal burns to form carbon monoxide, which, too, is poisonous and pollutes the air. A lot of soot is formed when coal is burnt.
 2. Biogas is obtained by the anaerobic fermentation (fermentation in the absence of air) of cattle dung and domestic sewage. A mixture of methane (CH_4), carbon dioxide (CO_2), hydrogen (H_2), and hydrogen sulphide (H_2S) is thus obtained, methane being the main constituent. Methane burns completely to give carbon dioxide and water vapour. No soot and carbon monoxide are formed.



3. Refer to Figure 7.6 on page 72.

- C.
1. Light a candle and wait for a while. Some wax near the wick melts, trickles down and resolidifies. Place a glass tube bent at right angles at a distance of 10–12 cm. One arm of the tube should be smaller than the other. Place the mouth of the shorter arm just over the wick and introduce the longer arm into a transparent bottle. Now raise the shorter arm such that its mouth is just above the flame. Test the gases coming out of the longer arm as follows.
 - (a) Pass the gas over anhydrous copper (II) sulphate (white) kept in a watch glass. The anhydrous copper (II) sulphate turns blue, indicating that the gases contain water vapour.
 - (b) Insert the longer arm of the tube into a test tube containing limewater. Place another tube in the same test tube. Suck through tube B. [See Figure 7.10 (c)]. The limewater will turn milky as gases get drawn in through tube A. This indicates that the gases contain carbon dioxide.
 - (c) Hold a stainless-steel dish above the flame for a while. A black solid deposits on the underside. This solid is soot.
 2. A candle flame consists of the following four regions.
 - (a) A bright blue region near the wick, where the wax burns completely
 - (b) The dark inner cone containing unburnt vapours of wax
 - (c) The luminous region containing unburnt carbon particles
 - (d) An outer mantle (not prominently visible) surrounding the entire flame
 3. A good fuel should have the following characteristics.
 - (a) It should have a high calorific value.
 - (b) It should have a low ignition point, but not lower than room temperature (so that it does not catch fire at room temperature).
 - (c) It should not burn too fast or too slowly.
 - (d) The combustion of the substance should not produce harmful substances like soot and poisonous gases.
 - (e) No residues should be left on combustion.
 - (f) It should be safe to store, handle and transport.
- D.
- | | | |
|-----------------|---------------|---|
| 1. slower | 2. spacecraft | 3. A – unsuitable, B – best, C – better, D – good |
| 4. neither, nor | 5. better | |
- E.
- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (c) | 2. (d) | 3. (d) | 4. (a) | 5. (a) |
|--------|--------|--------|--------|--------|
- F.
- | | | | |
|----------|-----------|----------|---------|
| (a) (iv) | (b) (iii) | (c) (ii) | (d) (i) |
|----------|-----------|----------|---------|

8

Force and Pressure

LESSON PLAN 1

20 minutes	1. Define force and give examples. Using Figures 8.1 to 8.4, discuss what a force does.
15 minutes	2. Discuss types of force broadly. Do the activity on page 80.
Closure: 5 minutes	Homework: A1 to A4

LESSON PLAN 2

35 minutes	1. Do the activities on page 81 and 83. Discuss friction in detail.
Closure: 5 minutes	Homework: A5, B1 to B4, C3

LESSON PLAN 3

35 minutes	1. Discuss magnetic force, electrostatic force and gravitational force. 2. Explain weight. Complete the activity on page 85 and discuss the findings.
Closure: 5 minutes	Homework: A9, B5, B6, C1

LESSON PLAN 4

35 minutes	1. Do the activity on page 86 and discuss pressure. 2. Demonstrate the activity on page 87 and discuss pressure exerted by liquids.
Closure: 5 minutes	Homework: A6 to A8, C2

LESSON PLAN 5

35 minutes	1. Complete the first activity on page 88 and discuss how to measure the pressure exerted by a liquid. 2. Do the second activity on page 88. Complete the activity on page 89. 3. Complete the activity on page 90. Ask the children to look at the hints given in the figures, and write their observations.
Closure: 5 minutes	Homework: D, E, F

Answers to Exercises

- A. 1. We apply a force on a moving body to change its speed or direction.
2. Frictional force makes a moving ball come to rest even if no other force is applied.
3. Everything on or near the earth is attracted towards it by the force of gravity. This makes a ball thrown up into the air fall back to the ground.

4. Magnetic, electrostatic and gravitational forces can act from a distance.
 5. (a) Friction makes surfaces wear down.
(b) It wastes energy.
(c) Friction generates heat, damaging machine parts.
 6. Pressure is the force acting over a unit area of a surface. Pressure = force/area. The SI unit of pressure is N/m^2 .
 7. The cutting edge of a knife is made sharp in order to reduce the surface area of the edge. This means that we can exert a large pressure even by applying little force (pressure = force/area).
 8. The atmospheric pressure acting on the coaster after the glass of water is inverted helps balance the pressure of the water (acting downwards). So the coaster sticks to the glass.
 9. The SI unit of force is the newton (N).
- B.
1. When there is very little friction, as on a smooth floor, it is difficult to walk. Also, vehicles would skid on too smooth a road as they sometimes do after it rains. The soles of our shoes and the tyres of vehicles, for example, have grooves to increase friction.
 2. Air and water offer resistance to movement. A streamlined body has smooth outlines. When such a body moves through water or air, it disturbs the natural flow of water or air as little as possible. This reduces the resistance offered by air or water to its movement. For example, nature's fliers (birds) and swimmers (fish) have streamlined bodies. Cars, planes and ships are designed to have streamlined bodies.
 3. (a) Oil reduces friction by filling up the dents on the surfaces that move against each other in a machine. It also prevents direct contact between the surfaces by forming a film between them.
(b) Ball bearings are used to reduce friction especially when a rod rotates inside a hole, as in a bicycle wheel. The ones used between the wheel hub and the axle of a bicycle are small steel balls.
 4. When a force is applied to move a body, frictional force resists the movement. As the force increases, the frictional force also increases, until the force applied becomes greater than the frictional force. Just as the force applied becomes greater than the frictional force, the body starts moving. And as the body starts moving, the frictional force decreases.
 5. (a) The common characteristic in the magnetic, electrostatic and gravitational forces is that they can act from a distance.
(b) When a body leaves the earth's gravitational field, it is no longer pulled back to the earth. For example, a spacecraft sent into space is not attracted by the earth.
 6. (a) Everything in the universe attracts everything else with a force called the force of gravitation, which depends on the masses of the two bodies concerned. Unless one of the bodies is massive, the force of gravitation cannot be felt. So we do not attract each other.
(b) The moon's mass, and therefore its force of gravity, is much less than that of the earth.
- C.
1. A spring balance is a device used to measure the weight of a body. Let us see how it works. Hang a spring from a nail and note its length. Hang a small stone from the other end of the spring and note the increase in its length. Hang a bigger stone and note the change in the length of the spring again. We will notice that the bigger the stone, the more the spring gets extended. This is because a bigger stone has a greater mass, so it is pulled by the earth with a greater force (gravitational force depends on mass). This is the principle on which a spring balance works. Refer to Figure 8.10 on page 85.
 2. Pressure increases with the depth of a liquid. Let us see how. Make a manometer (an instrument used to measure pressure differences) by fixing a U-tube on a board and filling half of it with water. The water level is the same in both arms of the U-tube. Slip one end of a 1-m rubber tube over one end of the U-tube and attach a funnel to the other end of the rubber tube. Stretch a thin balloon over the mouth of the funnel and fix it with thread or a rubber band. Lower the funnel slowly into a bucket of water. The difference between the heights of water in the two arms (which indicates the pressure at a certain depth) will increase as the funnel goes deeper into the bucket of water.

3. Problematic friction

- (a) Air resistance wastes energy.
- (b) Friction between moving parts wastes energy, causes wearing down.

Helpful friction

- (a) Helps us to sit on the saddle
- (b) Helps us to grip the handlebar
- (c) Helps us to apply brakes
- (d) Keeps our feet on the pedals
- (e) Helps the cycle move

- D.* 1. less 2. gravitational 3. frictional 4. less 5. smaller
 6. less 7. the same
- E.* 1. (c) 2. (c) 3. (b) 4. (d) 5. (c)
- F.* 1. Gravitational force - B, n, r, t 2. Frictional force - A, m, o, s
 3. Magnetic force - B, p 4. Electrostatic force - B, q



9

Sound

LESSON PLAN 1

10 minutes	1. Do the activity on page 93 and discuss how sound is produced.
25 minutes	2. Complete the activities on pages 94 and 95, and discuss the characteristics of sound.
Closure: 5 minutes	Homework: A1 to A6, B1

LESSON PLAN 2

35 minutes	1. Explain the difference between music and noise. Ask the students to complete the first activity on page 97. 2. Use Figure 9.7 to discuss how sound travels through air. Complete the second activity on page 97 to show that sound needs a medium to travel. 3. Complete the activities on page 98 and discuss the speed of sound, and how telephones carry sound over a distance.
Closure: 5 minutes	Homework: A7, B2 to B4, C1

LESSON PLAN 3

35 minutes	1. Using Figures 9.11 and 9.12, talk about how we speak and how we hear. 2. Using Figure 9.13, discuss what we and other animals hear. 3. Discuss the reflection of sound and its applications.
Closure: 5 minutes	Homework: A8, A9, B5, B6, B7, C2, D, E

Answers to Exercises

- A.
1. The three characteristics that help us distinguish between one sound and another are a sound's loudness, pitch and quality.
 2. The loudness of a sound depends on the amplitude of the vibrations that produce it.
 3. The pitch of a sound has to do with how shrill or bass it is. The pitch of a sound depends on the rapidity of its vibrations.
 4. When we increase the tautness of a stretched string, the string vibrates faster and produces a shriller sound.
 5. The tautness of the membrane and its area in percussion instruments determine the pitch of the sound produced. Smaller areas and tauter membranes produce shriller sounds.
 6. When we strike a glass as we increase the level of water in it, the pitch of the sound produced by it changes.
 7. Infrasonics are sounds of a frequency below 20 Hz.
 8. Porpoises and bats are two animals that can hear sounds we cannot hear.

9. Bats use echoes to locate their prey. They emit ultrasonic vibrations and can judge the distance of the prey from the time taken by the echo to return.
- B. 1. The loudest, basic sound produced by a musical instrument is called the fundamental. The other sounds mixed with it, called harmonics, are softer and of varying loudness. When the same note is played on different instruments, the fundamental is the same. However the harmonics are different. Generally, the quality of a sound is better if more harmonics are present.
2. Music is produced by regular vibrations, or vibrations whose frequencies have a definite relation with each other. Noise is produced by irregular vibrations.
3. The loudness of noise determines how much it can harm our health. Noise can cause stress, anxiety, sleep disturbance and permanent damage to hearing. Very loud noise, like that produced when a jet plane takes off, can burst the ear drum. The noise level in a rock concert can hurt the ears.
4. Light travels faster than sound. So we see a flash of lightning before hearing the peal of thunder. The louder the sound or the greater the amplitude of the vibrations, the greater is the distance travelled by them before they die out.
5. The larynx helps us speak. When exhaled air passes through the larynx, the vocal cords vibrate, producing sound. The vocal cords also control the size of the opening of the larynx. When the vocal cords become taut and thin, and the opening of the larynx becomes narrow, the frequency of the sound produced increases.
6. Echoes are reflected sounds. We can distinguish between two sounds only if there is a time lapse of $\frac{1}{15}$ s between them. Since the speed of sound is 340 m/s, it travels 22.6 m (approximately) in $\frac{1}{15}$ s. This means the reflecting surface must be at least $22\frac{1}{2}$ m, or 11.3 m, away for us to distinguish between the echo and the original sound.
7. Doctors use echoes to get a 'picture' of internal organs of the body. Ultrasonic vibrations reflected by different parts of an organ help to create an image of the organ. The technique is called echocardiography in the case of the heart. The term ultrasonography is generally used in the case of other organs.
- C. 1. The sound produced by a vibrating body is a form of energy. The vibrating body transfers this energy to the surrounding air molecules, which then start vibrating with the same frequency. These molecules pass on the vibrations to the neighbouring molecules, and so on. This is how sound travels in all directions from the sound-producing body.
- Sound travels much faster through solids than through air because molecules are packed much more closely in solids. Since molecules carry the vibrations, they do so more efficiently when they are closer together.
2. The vibrations of any sound-producing body are transmitted to our ears by the vibrating molecules of air. They first reach the outer ear, which consists of the pinna and the ear canal. When this happens, the air molecules inside the canal start vibrating and strike the eardrum.
- The eardrum separates the outer ear from the middle ear, which has three delicate, interlocked bones called the hammer, anvil and stirrup. The vibrations of the eardrum make these bones vibrate. The bones pass on the vibrations to the inner ear, which has a coiled tube called the cochlea. Tiny hairs inside the cochlea pick up the vibrations transmitted from the middle ear. They send a signal to the brain via the auditory nerve, and the brain interprets it to make us hear sounds.
- D. 1. hertz (Hz) 2. amplitude 3. more 4. energy 5. medium
6. proper maintenance of machines 7. 11.3 m
- E. 1. (c) 2. (c) 3. (d) 4. (a) 5. (b) 6. (b)



10

Electricity and Lightning

LESSON PLAN 1

10 minutes	1. Explain to the class what electrical charges are. Ask the students to do the activity on page 104.
25 minutes	2. Complete the activity on page 105 and discuss electrostatic forces. 3. Do the activity on page 106 and broadly discuss how an object gets charged.
Closure: 5 minutes	Homework: Read the chapter up to page 106

LESSON PLAN 2

25 minutes	1. Do the activities on page 107 and discuss charging an object by conduction and induction. 2. Do the activity on page 108 and elaborate on detecting and measuring charges. 3. Using Figures 10.9 and 10.10, discuss the gold-leaf electroscope.
10 minutes	4. Summarise the topics discussed.
Closure: 5 minutes	Homework: A, B1 to B4, C1, C2, C3

LESSON PLAN 3

25 minutes	1. Do the first activity on page 110 and discuss the flow of charge from one object to another. 2. Do the second activity on page 110. Explain how sparks and lightning are generated.
10 minutes	4. Summarise what has been discussed by asking the students to write down the main points.
Closure: 5 minutes	Homework: B5, C4, D, E, F

Answers to Exercises

- A. 1. (a) On rubbing a plastic ruler with a woollen cloth, the ruler gets negatively charged and the cloth gets positively charged.
- (b) The glass rod gets positively charged. If we bring it near a negatively charged paper cylinder, it will attract the cylinder.
- (c) When a positively charged rod is moved slowly towards an uncharged paper cylinder, the cylinder will be attracted to it. Once the rod touches the cylinder, the cylinder will move away with a jerk.
- (d) A negatively charged body reduces the positive charge on the leaves of the electroscope and reduces the divergence.
- (e) It gets discharged through our body, or the charge gets earthed.

- B.
1. On rubbing Styrofoam with paper, some negative charges from the paper travel to the Styrofoam. Thus, the Styrofoam piece has an excess of negative charges, or acquires a net negative charge. The paper, which loses negative charges, has an excess of positive charges, or acquires a net positive charge.
 2. Suppose the rod is negatively charged. When we bring it close to an uncharged paper cylinder suspended by a string, the negative charges in the cylinder move away from the rod, leaving positive charges near the rod. This is why the cylinder moves towards the rod. When the rod touches the cylinder, some of the excess negative charges on the rod get transferred to the cylinder. The cylinder then acquires a net negative charge and is repelled by the rod.
 3. When a charged body is brought in contact with the metal disc of an electroscope, the gold leaves get charged by conduction. They then diverge (repel each other) since they carry like charges. The extent to which they diverge is not always the same and gives an idea of the magnitude of the charge on the body.
 4. When the electroscopes are connected by a conductor, charge flows from the first electroscope to the other, until they both carry the same charge. The leaves of the second electroscope will diverge and the divergence of the leaves of the first electroscope will decrease, until the divergence of both is the same.
 5. A lightning conductor is a tall metal rod, which is fixed to buildings to protect them from being damaged by lightning. The top of the rod ends in spikes. The lower end of the rod is connected to a metal plate, which is buried underground. If lightning happens to strike a building which has a lightning conductor, the charge passes harmlessly through the metal rod into the earth, or gets earthed.

- C.
1. A body can be charged by friction (rubbing it with another body), conduction or induction.

Let us do an activity to show charging by induction. Make two metal spheres (say A and B) using aluminium foil. Attach them to sticks, and stand them up on a table with the help of modelling clay. Let the spheres touch each other. Bring a negatively charged ruler close to sphere A and then move sphere B away from it. Now move the ruler away. If we test spheres A and B, we will see that the first is positively charged, while the second is negatively charged.

If we had moved the ruler away before moving sphere B, the charges inside the spheres would have rearranged themselves, and the two spheres would have remained electrically neutral.

2. The gold-leaf electroscope is used to detect, measure and find the nature of a charge. It consists of two thin strips (leaves) of gold attached to a metal rod, which is suspended inside a glass jar. The mouth of the jar is fitted with a rubber stopper, through which the rod passes. The other end of the rod is attached to a metal disc. Some electroscopes have strips of silver, copper or brass instead of gold.

When a charged body is brought in contact with the metal disc of an electroscope, the gold leaves get charged by conduction. They then diverge, indicating the presence of a charge. And the amount by which they diverge gives an idea of the magnitude of the charge on the body. Refer to Figure 10.9 on page 109.

3. The leaves of the electroscope will diverge whether the body being tested has a positive or negative charge. To determine the nature of the charge, we have to first charge the electroscope with a known charge. Suppose we charge it with a positively charged glass rod. The leaves will get positively charged and move apart. Then touch the disc of the electroscope with the body we want to test. If the distance between the leaves increases, it means that the body we are testing is positively charged. In case the distance between the leaves decreases, it would mean that the body we are testing is negatively charged.
4. Clouds contain tiny crystals of ice and droplets of water, which move against each other. This can cause huge amounts of charge to build up. Ordinarily nothing happens due to this charge build-up, because air does not conduct the charge from the clouds. But when the accumulation of the charge is great enough and the wind brings the clouds close together, the charge can jump from one cloud to another through the air. This electric discharge is called lightning. During this process, a huge amount of energy is released in the form of light and sound.

- D.* 1. (a) 2. (c) 3. (b) 4. (d) 5. (b) 6. (a) 7. (b)
- E.* 1. negative 2. repulsion 3. amount 4. electric discharge 5. earth
- F.* (a) The leaves will come closer/collapse.
(b) The leaves of the first electroscope will remain as they were and those of the second will not move.
(c) The leaves of the second electroscope will diverge and those of the first will come closer till the divergence in both is the same.
(d) The leaves will collapse.



11

Chemical Effects of Electric Current

LESSON PLAN 1

10 minutes	1. Do the activity on page 116 and discuss how different liquids conduct electricity.
25 minutes	2. Using Figure 11.3, discuss conduction in solids. Talk about conduction in liquids and the formation of ionic compounds.
Closure: 5 minutes	Homework: A1, A2, A3, B1

LESSON PLAN 2

30 minutes	1. Explain electrolysis. Complete the activity on page 119. 2. Do the activity on page 120 and discuss how to use electrolysis to make an electric pen.
5 minutes	3. Ask the students relevant questions on the topics discussed.
Closure: 5 minutes	Homework: A4, A5, B2, B3, C1

LESSON PLAN 3

25 minutes	1. Illustrate electroplating by completing the activity on page 121. 2. Discuss the uses of electrolysis.
10 minutes	3. Summarise the topics discussed.
Closure: 5 minutes	Homework: C2, C3, D

Answers to Exercises

- A.
1. In a circuit, an electrode is a conductor that is in contact with nonmetallic things like a liquid or gas.
 2. When an atom or a radical becomes charged by losing or gaining one or more electrons, it is called an ion.
 3. The current through it is constituted by the flow of electrons.
 4. The metal released in the electrolysis of a salt is deposited at the cathode.
 5. In the electrolysis of water, an acid or an ionic salt is added to water because this will make the solution conduct electricity.
- B.
1. In metals, some electrons are not very tightly bound to the atoms. They move about randomly in different directions within the metal. When a voltage is applied across a piece of a metal, these electrons move in an orderly fashion in one direction. This flow of electrons constitutes the current in the metal.
 2. A liquid or a moist paste that has ions in it is called an electrolyte. When common salt is dissolved in water, it splits into Na^+ and Cl^- ions. A solution of salt is therefore an example of an electrolyte. In general, acids and solutions of salts and bases are electrolytes.

3. Ions are free to move about in an electrolyte. When a voltage is applied across the electrodes placed in the electrolyte, the ions start moving in an orderly fashion. The positive ions move towards the cathode (negative electrode) and the negative ions move towards the anode (positive electrode). Their flow constitutes a current through the electrolyte.

- C. 1. When electricity passes through an electrolyte, the positive ions of the electrolyte move towards the cathode (negative electrode), where they gain electrons to become neutral. The negative ions move towards the anode (positive electrode) and give up electrons to become neutral. With the formation of neutral substances, the electrolyte is decomposed. The decomposition of an electrolyte when electricity is passed through it is called electrolysis.

When water is electrolysed, it decomposes into hydrogen and oxygen. First, water splits into hydrogen (H^+) and hydroxide (OH^-) ions. These lose charge to form hydrogen and oxygen at the cathode and anode respectively. The volume of hydrogen liberated is twice that of oxygen. So we see more bubbles at the cathode.

2. The following are some uses of electrolysis.

(a) Metals are extracted from their ores by electrolysis. For example, when a current is passed through molten sodium chloride, sodium is deposited at the cathode and chlorine gas is evolved at the anode. Aluminium and potassium are also extracted by electrolysis.

(b) It is used for refining certain metals such as copper and zinc.

(c) In submarines, oxygen produced by the electrolysis of water is used for breathing.

(d) Electrolysis is used for electroplating many things we use every day.

3. The electrical process of coating an inexpensive conductor with a metal is called electroplating. Electroplating is done for protection or decoration. For example, the bumpers of cars are chromium-plated to protect them from corrosion.

For electroplating a steel spoon with silver, a solution of a silver salt is taken as the electrolyte. The spoon and a silver bar are dipped into the electrolyte and connected to the negative and positive terminals of a battery respectively. The positively charged silver ions move to the negative electrode (spoon) and form a deposit of silver on it.

- D. 1. cathode 2. cathode 3. anode 4. ionic 5. electrolytic cell



12

Light and Vision

LESSON PLAN 1

5 minutes	1. Ask the students what they know about light.
25 minutes	2. Using Figures 12.1, 12.2 and 12.3, discuss reflection. 3. Discuss the laws of reflection. Do the activity on page 124.
Closure: 5 minutes	Homework: A1, B1, B2, C1

LESSON PLAN 2

30 minutes	1. Do the activity on page 125 and discuss the characteristics of images formed by a plane mirror. 2. Using Figure 12.7, discuss lateral inversion. 3. Complete the activity on page 127 and discuss multiple reflections.
5 minutes	4. Ask the students relevant questions from the topics discussed.
Closure: 5 minutes	Homework: A2, A3, A4, B3, B4, B5

LESSON PLAN 3

35 minutes	1. Do the activity on pages 128–129, and explain how a kaleidoscope is made. 2. Explain dispersion of light. Do the activity on page 130.
Closure: 5 minutes	Homework: A5

LESSON PLAN 4

35 minutes	1. Talk about the structure and functions of the human eye. 2. Discuss various problems of vision. 3. Sensitise the students to the problems blind people face. 4. Summarise what has been discussed.
Closure: 5 minutes	Homework: A6, A7, A8, B6 to B9, C2, C3, D, E, F

Answers to Exercises

- A. 1. In case of diffuse reflection, the rays are reflected in different directions, and we see a hazy image or no image at all. This happens when a beam of light falls on an uneven surface.
2. The image is formed 10 cm behind the mirror. In other words, the distances of the image and the object from the mirror are equal.

3. Three images are formed. Each of the mirrors forms an image due to reflection. In addition, an image is formed at the edge where the mirrors meet.
 4. When lights of all colours are mixed in a certain proportion, the result is a colourless light, called white light. Sunlight is an example of white light. It is a mixture of lights of seven main colours.
 5. The splitting of light into its component colours on refraction is called dispersion of light.
 6. Light falling on the eye is refracted as it passes through the cornea, the lens of the eye and the fluids in the eye. These make up the converging lens system of the eye.
 7. A person with myopia, or near sightedness, is unable to see distant objects clearly, but has no difficulty in seeing nearby objects.
 8. In the first stage of nutritional blindness, a person is unable to see properly at night or in dim light. This condition is called night blindness.
- B.
1. Since the surface of a shiny metal utensil is not as smooth as that of a mirror, the rays reflected from it get diffused. Therefore, the image formed is not as clear and bright as that formed by a mirror.
 2. Reflection of light follows two laws.
 - (a) The angle of incidence is equal to the angle of reflection.
 - (b) The incident ray, the reflected ray and the normal at the point of incidence lie in the same plane.
 3. The image formed by a plane mirror is virtual, erect, laterally inverted, of the same size as the object, and at the same distance behind the mirror as the object is in front of it.
 4. In the image formed by a plane mirror, the left and right sides get reversed. This sideways (lateral) change is called lateral inversion.
 5. Each of the mirrors will form an image due to reflection. Each of these images is formed by a single reflection. These images are laterally inverted. In addition, an image is formed at the edge where the mirrors meet. This image is formed by rays that get reflected twice. As a result, this image is not laterally inverted.
 6. The iris controls the amount of light entering the inner part of the eye to ensure the best possible brightness of the image. In dim light, the iris automatically widens the pupil to let in more light. And in bright light, the iris contracts the pupil to keep out excess light.
 7. There are no sense receptors at the spot where the optic nerve leaves the eye. When an image is formed at this spot, information about it cannot be picked up. So, we cannot see the image formed there. This spot is, therefore, called the blind spot.
 8. The process by which the focal length of the lens of the eye is changed to ensure the formation of sharp images of objects at different distances is called accommodation. To ensure that images of objects at different distances are equally sharp, the ciliary muscles contract and relax to change the curvature, and thus the focal length, of the lens.
 9. Braille is a system of representing characters by raised dots. Combinations of raised dots in a six-dot 'cell' make up different characters. The characters are read by touching them with fingers. This system was invented by Louis Braille, who lost his sight as a child.
- C.
1. Draw a straight line XY on a sheet of paper. Stand a mirror upright, with its reflecting surface on the line. Let a ray of light from a ray box fall on the mirror. It will get reflected. Trace the incident and reflected rays, and remove the mirror. Draw a normal to XY at the point where the rays meet (O), and measure the angles of incidence ($\angle i$) and reflection ($\angle r$). Repeat this experiment a number of times, changing $\angle i$ every time by rotating the sheet with the mirror on it. In each case, $\angle i = \angle r$.
- In this case, the incident ray, the reflected ray and the normal at the point of incidence lie on the plane of the sheet of paper. Now put the sheet at the edge of a table and fold down the sheet near O. This time the reflected ray will not fall on the folded part, because it is in a different plane.
2. The eye is enclosed in a nearly spherical eyeball. A white membrane called the sclera covers most of the eyeball. The eyeball has a small bulge at the front, with a transparent membrane over it called the cornea. Behind the

cornea lies the iris, which has a small opening called the pupil. Light entering through the pupil falls on a flexible lens attached to a set of ciliary muscles. The space in front of the lens is filled with a watery fluid called aqueous humour. And that behind the lens is filled with a jellylike fluid called vitreous humour. Light entering the eye finally falls on the retina, which is at the back of the eyeball. There an image is formed.

Refer to Figure 12.16 on page 131.

3. Vitamin A is essential for good vision. When the diet lacks this vitamin, a series of eye problems occur. In the beginning, the patient is unable to see properly at night or in dim light. This condition is called night blindness. This is followed by extreme dryness of the eye, the softening and clouding of the cornea and other problems. These conditions finally lead to blindness.

- | | | | | | |
|-----------|------------------|----------------|-------------|------------------|-------------|
| <i>D.</i> | 1. parallel | 2. reflections | 3. iris | 4. hypermetropia | 5. cataract |
| | 6. spectrum | | | | |
| <i>E.</i> | 1. (b), (c), (d) | 2. (b), (d) | 3. (b), (d) | 4. (b) | |
| <i>F.</i> | 1. B, o | 2. B, m, q, r, | 3. A, n, p | | |



13

Our Universe

LESSON PLAN 1

5 minutes	1. Ask the students what they know about celestial bodies.
30 minutes	2. Using Figures 13.1, 13.2, 13.3 and 13.4 discuss stars, galaxies and constellations. 3. Discuss the solar system and the characteristics of planets. Refer to Table 13.1.
Closure: 5 minutes	Homework: A1 to A7, B1, B2, B3, C1

LESSON PLAN 2

35 minutes	1. Do the activity on page 143 and discuss the moons of planets. 2. Discuss the characteristics of dwarf planets, asteroids, meteoroids and comets.
Closure: 5 minutes	Homework: A8, A9, B4, B5, B6, C2, D

Answers to Exercises

- A.
1. The light year is a unit of distance. It is the distance travelled by light in one year.
 2. All stars are huge balls of hydrogen and helium gases. In a star, hydrogen gets converted into helium. In this reaction, a large amount of energy is liberated. This is the source of the heat and light of a star.
 3. The distribution of the stars in a galaxy can give it a shape. Galaxies can have different shapes such as spiral, elliptical and ring.
 4. The seven brightest stars in the Great Bear form the shape of a dipper (a long-handled spoon used for drawing out water). Together, these stars are called the Big Dipper or Saptarshi.
 5. The four planets closest to the sun—Mercury, Venus, Earth and Mars—are called terrestrial (earthlike) planets because they are small and rocky, like the earth.
 6. Jupiter, Saturn, Uranus and Neptune have rings around them.
 7. The huge spot on Jupiter is actually a huge storm, which has been raging on Jupiter for more than 300 years. It can only be seen through a powerful telescope.
 8. Pluto, which was previously thought to be a planet, is now considered a dwarf planet. Ceres is another dwarf planet.
 9. At the time of its formation, a dwarf planet could not pull in all other objects near its orbit. So it is not considered a planet.
- B.
1. Stars are celestial bodies that produce their own heat and light. Planets and their moons shine by reflecting the light of a star such as our sun. A planet is a round body that orbits the sun. While stars twinkle, planets shine with a steady light.
 2. Constellations are imaginary. A group of stars which seem to form a pattern is called a constellation. On the other hand, galaxies are real things in which stars and other celestial bodies are held together by gravitational force.

3. The pattern of stars shown in Figure 13.3 (b) belongs to the Big Dipper in the Great Bear (Ursa Major) constellation. The two brightest stars of the Big Dipper are called 'pointers' because they point towards the pole star, which seems fixed above the north pole.
 4. Asteroids are small, irregular, rocky bodies which revolve around the sun in a belt between the orbits of Mars and Jupiter. This belt is called the asteroid belt. Asteroids are also called minor planets. They can measure a few metres to hundreds of kilometres in width. Some asteroids even have moons.
 5. Meteoroids are rocks which orbit around the sun. When they enter the earth's atmosphere, they get heated because of friction with the air, and start burning. Meteoroids which fall on a planet or a moon are called meteorites. Meteorite hits are more common on those planets and moons which have little or no atmosphere to burn off the falling rock. The craters on our moon have resulted from meteorite hits.
 6. A comet is a small body of ice and dust that moves around the sun in an elongated orbit. As a comet approaches the sun, it heats up and leaves behind a stream of hot, glowing gases and dust particles. We see this as the 'tail' of the comet.
- C.
1. The earth is the only planet on which life is known to exist. The planet's distance from the sun, the composition of its atmosphere and the fact that liquid water is found on it make life possible here. Were it nearer the sun, the water on it would have evaporated. Were it farther away, all our oceans, rivers and lakes would have frozen. The carbon dioxide in the earth's atmosphere plays two important roles. Plants use it to make food, which feeds, directly or indirectly, all animals. It also traps just enough heat to ensure that the nights on earth do not become freezing cold.
 2. Sunlight lights up half of the moon. As the moon revolves around the earth, we see different parts of the sunlit half. When the entire side facing the earth is sunlit, the moon appears as a full disc. We call this the full moon or *purnima*. And when the side of the moon facing us gets no sunlight, we do not see the moon. This is called the new moon or *amavasya*. After the new moon, the moon appears as a crescent. As days pass, we see larger portions of the moon till the full moon appears. After this, the size of the moon visible to us gradually decreases till we once again have the new moon. The whole cycle of one new moon to the next takes 29.5 days.
- D.
- | | | | | |
|-------------|-------------------|-----------------|-----------|---------------|
| 1. big bang | 2. 100 | 3. east to west | 4. spiral | 5. great mass |
| 6. gases | 7. carbon dioxide | 8. Mercury | | |



14

Earthquakes

LESSON PLAN 1

5 minutes	1. Ask the students what they know about earthquakes.
30 minutes	2. Discuss the composition of the earth using Figure 14.1. 3. Use Figure 14.2 to discuss how the tectonic plates move to cause earthquakes. Also discuss other causes of earthquakes. 4. Talk about earthquake-prone zones, using Figures 14.3 and 14.4.
Closure: 5 minutes	Homework: A1 to A3, A5, C1

LESSON PLAN 2

30 minutes	1. Discuss the methods of measuring an earthquake. Use Table 14.1. 2. Discuss the impact of earthquakes. 3. Do the activity on page 152. Using Figures 14.7 and 14.9, discuss how we can protect ourselves from earthquakes.
5 minutes	4. Summarise what has been discussed by asking relevant questions.
Closure: 5 minutes	Homework: A4, B1, B2, C2, D, E

Answers to Exercises

- A.
1. Volcanic activity and nuclear explosions carried out underground may cause earthquakes.
 2. The point of origin of an earthquake is called the seismic focus, or hypocentre.
 3. The extent of damage depends on the strength of the vibrations or the energy associated with them, density of population, the way buildings are constructed and the nature of the soil.
 4. Earthquakes below the sea can cause tsunamis. The waves are usually not very high in the deep sea, where they originate. But when they reach the coast, they rise high like massive walls of water. They sweep over the land, submerging everything in sight within a very short time.
 5. Two earthquake-prone regions in India are the Himalayan region and the Ganga–Brahmaputra basin.
- B.
1. There are two ways of protecting buildings—strengthening them or allowing them to move with the vibrations of the ground. One way of strengthening buildings is to divide the walls into rectangular areas and insert diagonal pieces in them. This stops the walls from getting ‘squashed’ when a sideways force acts on them. The best way to allow buildings to move is to place bearings between the foundation and the bottom of a building.
 2. When indoors during an earthquake, one should stay away from windows, glass objects, mirrors and things that can fall, like book cases and cabinets. Crawl under a table or bed or crouch near an inner wall or doorway and protect your head and face with your arms. Hold on to something that is unlikely to fall.

- C. 1. The crust of the earth consists of large blocks called tectonic plates which float on the pastelike mantle. The heat inside the earth sets up a current in the mantle, keeping it in constant motion. This makes the plates of the crust move continually, like rafts on a gentle ocean. The movement sometimes causes the edges of the plates to grind against each other with a lot of force. They may then get deformed, displaced, crushed or fractured. They may also slide under each other or move apart. Such changes in the plates send a tremor or set up vibrations through the crust, causing an earthquake.
2. Most earthquakes last less than a minute, but they can bring down entire cities and kill thousands in a matter of moments. The tremors during an earthquake can make buildings collapse. They can twist railway tracks, destroy bridges, open up cracks in the ground and damage dams. They can start up fires and cause floods and landslides. The collapse of buildings is usually the cause of death and injuries, though floods and fires (caused by earthquakes) have also been known to cause great human suffering.

- D. 1. tectonic 2. mantle 3. faults 4. seismograph 5. Richter 6. epicentre
- E. 1. (b) 2. (a) 3. (c) 4. (b) 5. (c)



15

Natural Resources

LESSON PLAN 1

5 minutes	1. Ask the students what they know about natural resources.
30 minutes	2. Broadly discuss forests. Also introduce deforestation. Talk about the impact of commercial logging on the environment. 3. Discuss production of paper. Ask the students to do the activity on page 157, and discuss the recycling of paper.
Closure: 5 minutes	Homework: A1 to A5, B1

LESSON PLAN 2

35 minutes	1. Discuss the use of fuelwood and other reasons for the destruction of forests (shifting cultivation, conversion into pasture land, etc.). 2. Discuss the impact of deforestation in detail (soil erosion, floods and droughts, climate change, etc.)
Closure: 5 minutes	Homework: A6, A7, B2, C1, C2, C3

LESSON PLAN 3

35 minutes	1. Discuss the formation of coal, petroleum and natural gas. 2. Talk about the utilisation of fossil fuels. 3. Discuss the problems associated with the overutilisation of fossil fuels. 4. Discuss the importance of alternative energy sources.
Closure: 5 minutes	Homework: A8, A9, A10, B3, C4, D, E

Answers to Exercises

- A.
1. Natural resources that cannot be easily renewed or renewed fast enough to be of use to us are called nonrenewable resources. Minerals and fossil fuels (coal, petroleum and natural gas) are nonrenewable resources.
 2. Plantations cannot make up for the loss of primary forests as the latter have evolved over centuries and have a variety of organisms that modified or man-made forests do not have.
 3. The natural causes of deforestation are droughts, floods, storms and forest fires. However, even these can be caused or triggered by human activities.
 4. Logging for timber and production of paper cause large-scale destruction of forests. Shifting cultivation and the conversion of forests into pastures and plantations also lead to deforestation.
 5. Forests protect the soil in two ways. The cover of leaves protects the soil from the direct impact of rain and the roots keep the soil in place.

6. Deforestation leads to soil erosion, floods and droughts, climate change and habitat destruction. It may also cause shortage of timber and fuelwood, and take away the means of survival of people dependent on forests.
 7. Coal, petroleum and natural gas are called fossil fuels because they are formed by the fossilisation of plant and animal remains.
 8. More than 75% of the world's energy requirements are met by fossil fuels. The energy that is bought or sold, and not the energy from crop residue, cattle dung, etc., that is used by the poor, is called commercial energy.
 9. Coal tar, coal gas, coke and ammoniacal liquor are produced by the destructive distillation of coal. Ammoniacal liquor is used for the production of fertilisers.
 10. Solar energy, wind energy and the energy of flowing water (hydroelectricity) are some alternative sources being tapped for the generation of electricity.
- B.**
1. Cutting down on wasteful consumption of paper could help save trees. Most of the paper is used to make disposable diapers, tissues and towels. We could go back to the era of cloth diapers and handkerchiefs in order to save trees. Another way to save trees is to make recycled paper, or use waste paper to make new paper.
 2. Trees absorb carbon dioxide from the air. Deforestation means an increase in carbon dioxide in the environment. Trees release most of the water absorbed from the soil, leading to an increase in rainfall. When a large area is deforested, the percentage of rainfall in that area lessens.
 3. Petroleum is found deep under the earth between layers of rock. Natural gas is often found in association with petroleum. Both were formed from the remains of marine organisms that died and collected on the floor of the seas millions of years ago.
- C.**
1. Shifting cultivation is a traditional agricultural practice followed in many parts of Asia, Africa and South America. The practice consists of clearing a part of a forest by cutting down and burning the vegetation and growing crops on the cleared land, and then moving on to another part of the forest when the soil gets exhausted. Earlier, people would leave the exhausted soil fallow for 20–25 years. During this time, the vegetation would grow back and the fertility of the soil would be restored. With growth in population, people are returning to the original piece of land much earlier. They are also clearing larger and larger parts of the forest. This has led to a large-scale destruction of forests.
 2. Commercial logging, or cutting down trees with electrically powered machines for industrial use, destroys forests in many ways. First of all, for every cubic metre of timber extracted, about double that quantity is destroyed. Nontimber trees and plants are also destroyed. The process of making roads and other facilities needed for commercial logging destroys more trees. Besides, roads made through forests encourage hunters, poachers and settlers to damage the forest further. Soon, a dense forest is reduced to small islands of green, which are more prone to soil erosion, winds, pests, and so on.
 3. Trees check the flow of rainwater. When mountain slopes and uplands are deforested, the water rushes down and causes rivers to overflow and flood lower lands. The silt carried by the water from denuded slopes chokes rivers and aggravates the problem of flooding.

Deforestation can lead to droughts as well. Forests hold water and release it slowly. When they are cut down, the water rushes down very fast, and the uplands, especially, are deprived of water soon after the rains. By holding water and improving the water-retaining capacity of the soil, forests also help recharge groundwater. In India, deforestation of the Himalayas has changed perennial streams into seasonal streams, which run out of water soon after the monsoon.

4. Peat, the first stage in the formation of coal, has the lowest carbon content and is the most inferior type of coal. It was formed by the action of anaerobic bacteria on plant remains buried under swamps. Earthquakes and volcanic eruptions pushed the decomposed remains of plants under the ground. As they sank, they experienced tremendous pressure and temperature, which drove out gaseous products from the remains. This increased their carbon content. The lower the remains sank, the more their carbon content increased. The best-quality coal, known as anthracite, is thus found at greater depths than bituminous coal and lignite, which have a lower carbon content.

- | | | | | | | |
|-----------|---------|------------------|------------|-----------|-----------|--------------|
| <i>D.</i> | 1. wood | 2. carbonisation | 3. biomass | 4. geyser | 5. global | 6. synthetic |
| <i>E.</i> | 1. (a) | 2. (a) | 3. (c) | 4. (b) | 5. (c) | |



16

Pollution of Air and Water

LESSON PLAN 1

35 minutes	1. Using Table 16.1, discuss the common pollutants of air and their sources. 2. Discuss the effects of air pollution in detail. 3. Explain the methods of reducing air pollution.
Closure: 5 minutes	Homework: A1, B1, B2, C1

LESSON PLAN 2

35 minutes	1. Talk about what indicates water pollution. 2. Discuss the six important types of chemical pollution of water. 3. Talk about the biological pollution of water. 4. Discuss the effects of polluted water on soil and how water pollution can be reduced or prevented.
Closure: 5 minutes	Homework: A2 to A5, B3, C2

LESSON PLAN 3

35 minutes	1. Using Table 16.4, discuss some polluted rivers in India. Ask the students to find out how these rivers got polluted. 2. Discuss the importance of clean water. 3. Talk about purification of water using Figure 16.12.
Closure: 5 minutes	Homework: A6

LESSON PLAN 4

35 minutes	1. Do the activity on page 176 and discuss the action of alum on muddy water. 2. Talk about purification of water at home using Figures 16.14 and 16.15.
Closure: 5 minutes	Homework: A7, A8, C3, D, E, F

Answers to Exercises

- A.
 1. Air or water containing substances that are harmful to us and our environment is said to be polluted.
 2. A given sample of water is polluted if it tastes bad, it smells bad, and there has been a decrease in the population of fish in the water body from which it has been taken.
 3. Chemical pollution of water is caused by the discharge of harmful chemical substances into water bodies. Pesticides and fertilisers, mineral acids, oils and grease, etc., are examples of chemical pollutants.

4. Chemical pollutants can be one or more of the following substances.
 - (a) Pesticides and fertilisers
 - (b) Synthetic chemicals
 - (c) Oils and grease
 - (d) Mineral acids
 - (e) Metals and their compounds
 - (f) Phosphates from detergents
 5. Typhoid, dysentery, cholera and hepatitis are water-borne diseases.
 6. Water fit for drinking is called potable water. It should be free from suspended particles like mud and sand, excess of soluble salts, harmful chemicals and harmful bacteria.
 7. Activated charcoal is a special type of charcoal made by heating ordinary charcoal in vacuum. Water can be filtered using activated charcoal, which holds the impurities strongly.
 8. Bleaching powder slowly reacts with water to form chlorine, which kills the germs present in water. It is generally used to purify well water in villages.
- B.**
1. The affinity of CO for haemoglobin is much greater than that of oxygen. So the inhalation of CO cuts off oxygen supply to cells. It can cause disorientation, loss of consciousness, and even death, depending upon the degree of exposure.
 2. One of the methods of reducing air pollution is using compressed natural gas (CNG). Nowadays, CNG is preferred over petrol or diesel in trucks, buses and other vehicles. It contains methane (CH_4), which, on burning, produces much less pollutants than do petrol and diesel.
 3.
 - (a) Sewage should be treated in sewage-treatment plants, which allow only clean water to be discharged into a river or lake.
 - (b) Industrial wastes must be treated to remove harmful substances.
 - (c) Pesticides and fertilisers must be used in limited quantities.
- C.**
1. The common pollutants of air and their sources are mentioned in the following table.

Pollutant	Source
(a) Carbon monoxide	(i) The incomplete combustion of fuels in vehicles (ii) The incomplete combustion of coal in thermal power plants
(b) Oxides of sulphur	(i) Volcanic eruptions (ii) The burning of sulphur and fossil fuels (iii) The extraction of metals from minerals containing sulphides
(c) Oxides of nitrogen	The combustion of fuels like petrol, diesel, kerosene or coal

2. Fertilisers are discharged into water bodies by run-off from agricultural land. They help aquatic weeds to grow fast. The unchecked growth of weeds makes the water body extremely deficient in dissolved oxygen, badly affecting aquatic life. This process is called eutrophication.
In Delhi, along a stretch, the Yamuna is choked by water hyacinth—a weed. This is an example of eutrophication. Dead fish are also found in the river as soon as the monsoon begins.
3. Take two similar glasses containing equal volumes of muddy water and label them A and B. (You can prepare muddy water by mixing a teaspoonful of mud from your garden with the water in the glass.) Crush a small crystal of alum (which you can obtain from a store) between the folds of a paper and add it to glass A. Stir the water in the two glasses and allow them to stand side by side. Within a short while, you will find that the mud has settled down with clear water above it in glass A, but the water is still not clear in glass B.

- | | | | |
|-----------|--------------------------------------|---------------------------|------------------------------------|
| <i>D.</i> | 1. Carbon dioxide (CO ₂) | 2. sulphuric and nitric | 3. greenhouse |
| | 4. eroded | 5. microorganisms, oxygen | |
| <i>E.</i> | 1. (b) | 2. (a) | 3. (d) 4. (d) 5. (b) |
| <i>F.</i> | (a) (iii) | (b) (iv) | (c) (i) (d) (v) (e) (ii) |



17

Conservation

LESSON PLAN 1

5 minutes	1. Ask the students if they know what wildlife is, and why we need to conserve it.
30 minutes	2. Discuss the importance of biodiversity and how animals have become endangered. Refer to Table 17.1.
Closure: 5 minutes	Homework: A1, A3, B1, B2, C1, C2

LESSON PLAN 2

35 minutes	1. Discuss the impact of biodiversity loss on the environment. 2. Talk about the <i>Red Data Book</i> . Discuss India's biodiversity and also the threat to it.
Closure: 5 minutes	Homework: A2, A4, A5, A6, B3

LESSON PLAN 3

35 minutes	1. Broadly discuss protecting diversity, and conservation in India. 2. Do the activity on page 186 and discuss people's participation in the conservation of plants and animals in India.
Closure: 5 minutes	Homework: A7, A8, C3, D, E

Answers to Exercises

- A.
1. Plants and animals in their natural habitat are referred to as wildlife.
 2. The five categories of threatened species listed in the *Red Data Book* are critical, endangered, vulnerable, rare and indeterminate.
 3. Development, practising monoculture, introduction of exotic species, hunting and fishing, and pollution are some of the factors that cause loss or depletion of biodiversity.
 4. Three international organisations involved in the conservation of biodiversity are the International Union for Conservation of Nature (IUCN), the World Wide Fund for Nature (WWF), and the United Nations Environment Programme (UNEP).
 5. The UNESCO's Man and the Biosphere Programme is aimed at establishing and maintaining at least one biosphere reserve in the 193 bio-geographical zones of the world. The idea is to protect the plants and animals that characterise each bio-geographical zone in their natural setting.
 6. The Joint Forest Management Programme launched by the government aims at regenerating and protecting degraded forests with people's participation.
 7. Three special projects launched to protect endangered species in their natural habitat are Project Tiger, Project Elephant and Project Crocodile.

8. Sustainable utilisation of natural resources means making use of natural resources to meet the needs of the present generation, while ensuring that future generations are not deprived of the use of natural resources for their needs.
- B.
1. A plant or an animal that no longer exists in the world or a country is said to be extinct. For example, the dodo has become extinct in the world, while the cheetah and the pink-headed duck have become extinct in India.
 2. The practice of planting one type of plants in an area is called monoculture. Replacing natural forests, rich in biodiversity, with monoculture plantations leads to the loss of biodiversity. Not only are the plants endangered, but all the organisms dependent on the various types of plants in a forest are affected.
 3. The Botanical Survey of India keeps track of the plant species in the country, while the Zoological Survey of India keeps track of animals. The Forest Survey of India conducts surveys of our forest resources. It uses satellite pictures and ground surveys, in which different parts of forests are surveyed and their condition studied.
- C.
1. Biodiversity means the variety and variability of organisms in the world. Depletion or loss of biodiversity is extremely grave because we can never get back the species we have lost. In a short-term way, the wiping out of a species or a drastic decrease in its numbers can affect the livelihoods of people, for example, those directly dependent on forests. It can cause economic loss for an industry or a country.
In the long run, the loss or depletion of biodiversity can threaten our very existence. For example, most of the world's food comes from about 20 species of plants. If any one or more of these plants are affected by some killer disease, it would be necessary to develop new varieties with the help of their relatives in the wild.
 2. Animals and plants that do not belong to a place originally and are introduced from elsewhere are called exotic. An exotic plant or animal often proliferates (increases in number) at the cost of the native species. The eucalyptus, for example, is not native to India. It grows fast and spreads, depriving native species of space and nutrition. The spotted deer introduced in the Andaman and Nicobar Islands has proliferated because it does not have natural predators. The deer are not only harming forest plants, but also damaging crop plants.
 3. The Chipko Andolan, a people's movement to save trees, spread over the Himalayan region under the leadership of activists like Sunderlal Bahuguna and Chandi Prasad Bhat. It was started in 1973, in the village of Gopeshwar in Chamoli district (Uttarakhand). The villagers rebuffed the attempt of a contractor to cut down trees for a sports goods factory by hugging the trees. When the contractor arrived at Rani village in the Garhwal district, the women of the village, led by the 50-year-old Gauri Devi, forced the contractor and his men to leave. The resistance offered by the villagers to stop deforestation of their land inspired environmentalists all over the world.
- D.
1. *in-situ*
 2. IUCN
 3. Bishnoi
 4. environment
 5. national parks
- E.
1. (a)
 2. (d)
 3. (c)
 4. (d)
 5. (b)

