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NCERT
CLASS 6
SCIENCE BOOK

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1

CHAPTER

FOOD

What is food? Is food only which is cooked in the kitchen? What is the food of a cow and what does a tiger eat? Who eats what in this living world and why? What makes food a basic requirement of every living organism and what should we eat? Let us explore the significance of food in living world which is an integral part of nature's larger design.



An Overview

NCERT Class VI Science textbook begins with the theme of food. Food is an essential requirement of every living organism all through its life span. This theme has been dealt within two chapters, namely:

- Food: where does it come from?
- Components of food.

(There is also some emphasis on cleaning of food which has been covered separately in the chapter on Separation of Substances).

Let us aim at developing the following abilities in our students:

- Learning from living experiences, observation and discussions with others.
- Conducting experiments.
- Organising data.

Chapter 1 talks about the variety of the sources of food that humans and animals eat. What are the ingredients that are used in the preparation of food items and what are the sources of these ingredients. This leads us to two major sources of food: Plants and Animals. Food is then seen in the context of the eating habits of different species and on that basis living species are classified into three categories of herbivores, carnivores and omnivores. Apart from what is food, Chapter 1 also talks about its importance, variety of sources and its components.

Chapter 2 notices the regional variety of food which exists in different parts of the country. This can be extended to the global

variety also. It talks about the various nutrients present in the food and their importance for the body. What is meant by 'balanced diet' and why it is important for us to take balanced diet? It ends with a discussion on deficiency diseases caused by improper intake of food.

From the field to the dining plate (thali) food takes a long journey. It has to be subjected to extensive cleaning processes to separate the undesirable components from the eatable part. The third sub-theme explains these cleaning processes.

What is Food?

By this standard, children are aware of what constitute their food but for many, food is what is cooked in the kitchen or is brought from the market to eat. What we need to do now is to develop their ideas of food into the general concept of food.

We would start by analysing what all we have been eating and the things our friends are eating. Children understand food better through the activities given in the text. They are also expected to make a list of food items they eat and also find out their ingredients and their sources.

Students may make collages on various themes related to food: "Save Plants", "Save Animals", "Food from Animals", "Food from Plants" etc.

As we talk of parts of the plant we need to draw the attention of our students to the fact that neither all the plants nor all parts of a plant are eaten by us. Different parts of different plants are eaten. Arranging them in a table would make students closely observe which part of the plant is being eaten by them. There are certain parts which are edible to us and while others are not. These parts may be eaten by some other species, e.g., we eat only the leafy part of spinach but a cow eats the whole of the plant.

Activity on sprouting of moong or chana focuses on food processing. Mostly, we do not eat raw food items. The preparation of the same item varies from place to place and people to people. And as the activities show there are many ways in which something can be processed to eat.

A child may wonder whether every living organism needs food. The fact that all organisms on earth from the smallest to the biggest; mosquito to whale, ant to elephant and also the plants need food, may at first surprise them. Do insects like butterflies

and mosquitoes take food? Do the micro-organisms, bacteria and the termite also need food? Even the microscopic amoeba needs food as do the whale, elephant, human beings and all the animals and plants. You can see animals eating food, but have you ever seen a plant taking food?

Sources of Food

As we look for the sources of our food, we find that both plants and animals provide us food. In the case of animals, some animals eat plants and certain others eat other animals for their food. If we explore further, it turns out that even those animals that are eaten by others, finally depend on plants for their food. Plants are thus the primary source of food. But, what is it that plants take for their food?

From where do we get our food and from where do animals and plants get their food?

Well some of your students may find it difficult to believe in the beginning that even plants are living species and require food. You may encourage your students to take up the assignment to prepare a presentation from books, encyclopaedias and the internet on this topic. They may also be encouraged to take specific examples of food taken by different species and then create food chains¹. This would help them realise that only plants are the ultimate producers of food. Details of how plants make their food may not be taken up here as it will be taken up in Class VII. But if your students are curious, you may briefly explain the process.

Students may be asked to collect pictures of animals, identify their names and what they feed on. If possible, arrange a visit to a zoo where students can collectively identify as many animals as possible and discuss their eating habits also. A discussion with the person who feeds the animals is also desirable. Subsequently, the students may prepare a table like the one given in the book to place animals in the three categories of herbivores, carnivores and omnivores.

As we discuss about forming categories based on the food habits, Paheli raises a question about where human beings should be placed in this classification. Here, it is important for you to remind your students about the distinction between the food habits of an individual and human beings as species.

¹. Teacher should simplify what food chain is.

Regional Variety

As we move to the Chapter 2, we start the discussion from the regional and community-based differences in food habits, preparations, ingredients used etc. Different plants grow in

You may ask your students to make a list of dishes/food items prepared and the crops grown in their areas.

different regions of our country. Lots of coconut trees grow in the coastal regions of South India, paddy and jowar grow in the Deccan plateau. Apple, plum and peach

Menus of regional restaurants may also be examined for dishes they prepare.

grow in Himachal Pradesh and Jammu and Kashmir, peas, carrot, wheat and bajra, grow in plenty in northern plains, mustard, daal, dates and amla grow in the western India. On account of this diversity, we come across a large variety of food items in our country with different kinds of preparations and varied eating habits among people. Apart from availability, temperature and living conditions in different areas also decide the preparation of different regions of India².

Some Common Food Items Eaten in Different Regions/States of the Country

Regions/States	Food Items
North kheer, meat etc.	Chapati, parantha, poori, dal, subzi, lassi
South	Upma, dosa, idli, rice, rasam, nariyal chatni etc.
East	Rice, fish curry
West	Poha, khichri, pav bhaji, roti, kadhi, khamman dhokla, subzi, dal etc.
Rajasthan	Dal, bati, choorma, kadhi, gatte
Punjab	Roti, parantha, subzi, chhole
Kashmir	Kahwa, meat preparations, rice, razma
Tamil Nadu	Idli, dosa, upma, rasam
Kerala	Aapam, puttu, payasam
Andhra Pradesh	Upma, dosa, rice, sambar
Gujarat	Dhokla, kadi, roti
Maharashtra	Poha, pav bhaji, vada pav
Bengal	Rice, fish curry, dal
Odisha	Rice, fish, dalma, pakhal

² Discussion can be initiated to respect the food habits of different places.

You should encourage your students to find out the preparations and ingredients of some of these food items.

In spite of this diversity, basic constituents of food are common. They are the essential nutrients. People in all parts of the country need them and, therefore, whatever is the staple diet of that region, it would definitely consist of carbohydrates, proteins, fats, vitamins and minerals.

Components of Food

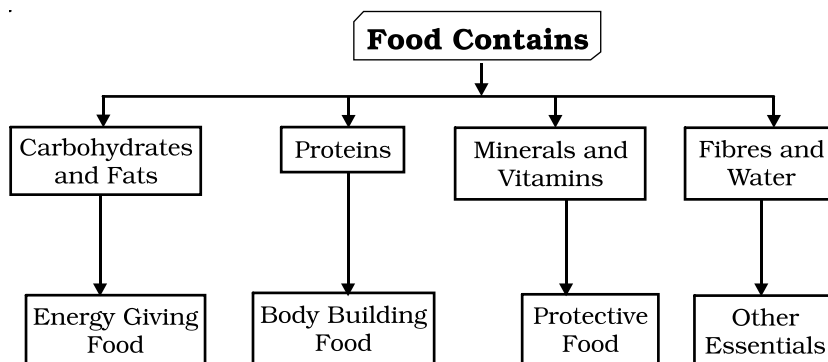
Do all food items taste alike? Food items vary in their taste for two reasons depending on the way they are cooked and what they contain. Fruit juices taste sweet because they contain sugar. Citrus juices taste sour (khatta) because it contains citric acid and Vitamin C.

During cooking, we add spices and salt in order to make food tasty.

Identifying Nutrients

The book has given elaborate tests for the presence of starch, proteins and fats. It would be good if these tests are not done just for demonstrating the presence of a particular nutrient but used by the students to explore the presence of these nutrients in various food items. The book has not provided any activity for the presence of water or fibre in the food items. You may think of some simple

Why most fruits taste sweet but most vegetables like ladyfinger, brinjal, potato, raw banana, etc., do not? This is because vegetables contain abundant starch, and fruits contain glucose and sugars that are sweet to taste. Fruits like gooseberry, grapes, orange also taste sour (khatta) as they contain certain acids and Vitamin C. Thus components of food decide its taste.



activities where they can be shown. You may ask your students to observe the rind (skin) of vegetables like ladyfinger (bhindi), radish, cucumber, etc. They may also break fresh French beans into two or more bits. They will notice a thread-like structure projecting from the sides of the fruits. This is dietary fibres (the roughage component of our food). And in order to show the existence of water in fresh vegetables and fruits, cut it or get your students to cut some of them on paper and they would observe the paper gets wet as the water oozes out of the vegetable/fruit.

Importance of all the Nutrients

Children often want to eat only those food items, which they like and this is an area of contention between the children and their parents all the time. Let us make them realise that all the nutrients have some specific roles to play in our body and thus we need to make our diet as balanced as possible. A discussion about deficiency disease may help achieve this goal.

Is it sufficient to eat only one type of food just because we like it? What happens if we drink only milk or eat rice or chapattis only?
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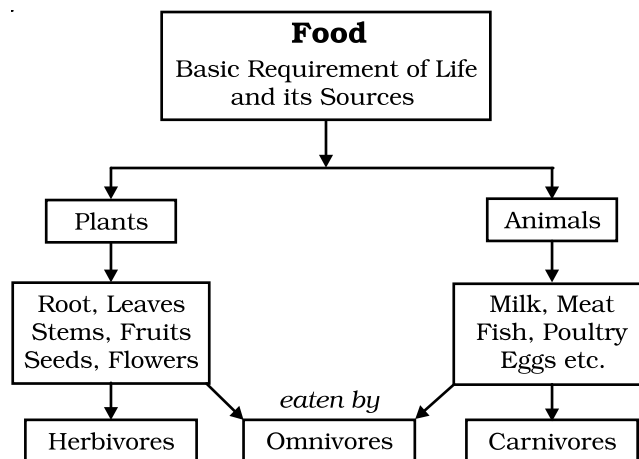
Most food items contain more than one nutrient. But no single food item provides all the nutrients that the body needs. Therefore, a combination of different food items in proper quantity and at appropriate time is necessary in order to ensure a continuous supply of all the nutrients to our body. It is also important to realise that food requirements depend on age, health status, level of activity and gender. Persons may suffer from under nutrition/malnutrition/deficiency disorders if they are not taking required amount of these components i.e., balanced diet.

At this stage you may ask them to go back to the table of food items they have eaten during the past few days. Let them try to see whether they have been taking all the required nutrients in the food items.

Balanced Diet

While talking about a balanced diet we need to be careful that it does not lead to misconceptions in the minds of the children. Some of the science textbooks describing a balanced diet tend to actually create misconceptions in the minds of the students. There may not be any uniformly applicable table for any age-group specifying quantities of various types of food items one must take daily in

order to take a balanced diet. It depends on the level of activity, status of health, age and gender. A balanced diet in respect of an obese person not doing much physical or mental work is different from a thin and hard-working person. Balanced diets for expecting women or lactating mothers are different from normal women even in the same age-group. Balanced diet is determined in respect of our requirements. Similarly, many illustrations of balanced diet in certain books indicate a number of food items in a plate (thali), creating an impression that one must take all those nutrients every time to make a balanced diet. It is actually not so. A plate may have only a few nutrition items at a time but those items must repeatedly change at regular intervals within a reasonable period of few days. Overnutrition (excess of nutrients) is not desirable. Overnutrition usually leads to obesity which enhances the risk of high blood pressure, diabetes and heart problems.



It is only a myth that expensive and non-vegetarian diet provides all the necessary nutrients for good health. Even low cost food items and plant products can fulfil all nutritional requirements of an individual. Pulses, groundnut, soyabean, sprouted seeds (moong and Bengal gram), fermented foods (idli, dhokla), a combination of flours (missi roti, thepla made from cereals and pulses), banana, spinach, sattu, gur (jaggery), vegetables and other such foods contain good amount of nutrition.

Values

A typical Indian meal consists of roti, chawal, dal, sambar, cooked vegetables, salads and fruits, milk and milk products. Many different kinds of snacks, juices, ice-creams, biscuits, candies, chats are relished by many people, especially children. Western, food items such as pizza, burger, garlic bread, cold drinks, carbonated beverages, chips etc., have also invaded our traditional culinary habits. Such a wide variety of multi-cultural foodstuff has upset our regular eating and dietary habits. We tend to eat a lot of food only for its taste e.g., potato chips, deep fried materials, pizza etc. These items must be eaten only occasionally and they must not be substituted for regular meals.

We must take food which contains such items in adequate quantity that provide necessary nutrition for good health. Each nutrient plays an important role in our growth and well-being, and only steady supply of all the nutrients ensures good health and normal growth. If any nutrient is in deficiency, our health suffers due to certain disorders and deficiency diseases.

Skills of Handling, Cooking and Eating Food Items

Eating the right kind of food is not the only rule. Food should also be cooked properly so that its nutrients are not lost. Are you aware that some nutrients are lost in the process of cooking and food preparations?

Washing vegetables and fruits after cutting or peeling may result in loss of some vitamins as the skin (rind) of many vegetables and fruits are rich in vitamins and minerals. Similarly, repeated washing of rice and pulses may remove some vitamins and minerals present in them.

We all know that cooking improves the taste of food and makes it easy to digest. But, cooking also results in the loss of certain nutrients. Many useful proteins and considerable amounts of minerals are lost if excess of water is used during cooking and is later thrown away. Vitamin C gets easily destroyed by heat during cooking. Hence, it is desirable to include some fruits and raw vegetables in our diet. But these have to be washed to clear the chemicals or microbes.

Care must also be taken to keep food items covered and well protected from insects, animals and other harmful contaminations. Food stored in cold temperature (refrigerator) does not get spoilt soon. Food should be stored as well as served in clean utensils. One must wash her/his hands before handling food items or eating. Unhygienic eating habits can cause various ailments.

Cleaning of Food

The process of cleaning or removing non-edible parts from the edible parts starts on the agriculture farm itself. The farmer separates the husk from the grains before they are sent to the market. They are further manually or mechanically cleaned in the godowns or shops. In our country, we use both traditional as well as modern methods of harvesting and cleaning of foodgrains. After the food materials are brought to the house, we remove small pieces of stones and other impurities from chawal (rice), dal (pulses), vegetables, dry fruits and foodgrains. We also wash the vegetables and fruits. Sufficient precautions are to be taken while cooking food. Pressure cookers and gas stoves are quite common in most urban homes these days but rural folk still use fire wood and chulha to cook their food. Most children would have seen these processes of cleaning. But, the names and the principle (in some cases) would be new for them.

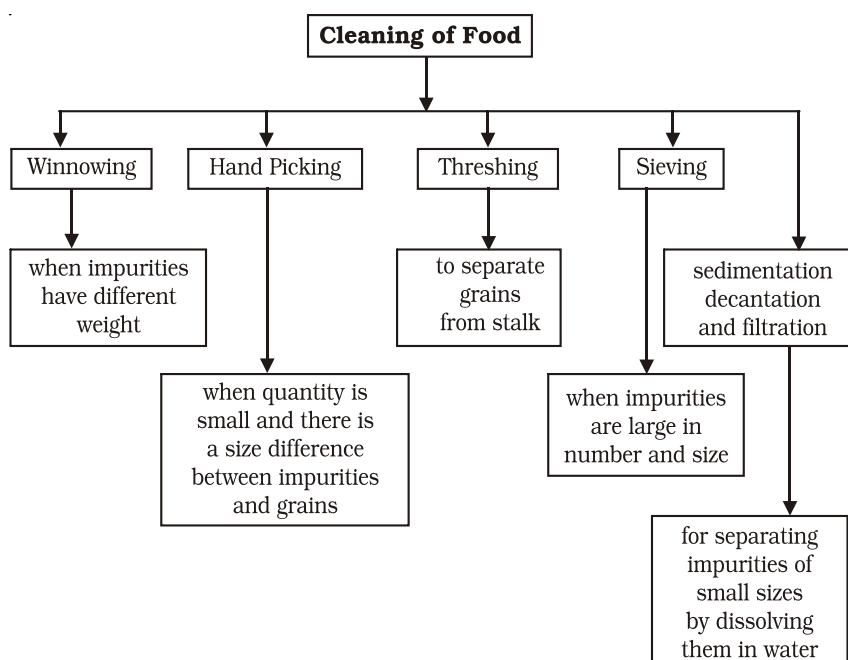
There is no better way to start off than to ask your students as to what are the processes of cleaning they observe at their home. You may need to give some examples like filtering of tea before drinking, washing vegetables etc. You may also ask them to make a list of cleaning processes they observe at home. And then ask them to find out what types of impurity are removed by these processes.

Food Item	Cleaning Process	Impurity to be Removed
Pulses	Hand Picking Washing	Husk, Small Stones

You may take some rice or some other dal and then put some water in the container. Stir the grains with your hand. Allow the water to become stationary and then you can demonstrate your students the need for cleaning. Ask them to give more examples of cleaning of food materials from their daily lives.

Points to Ponder

- Do you know any living species which feed on products of non-living world?
- Why is it so that only living things provide food for other living species?



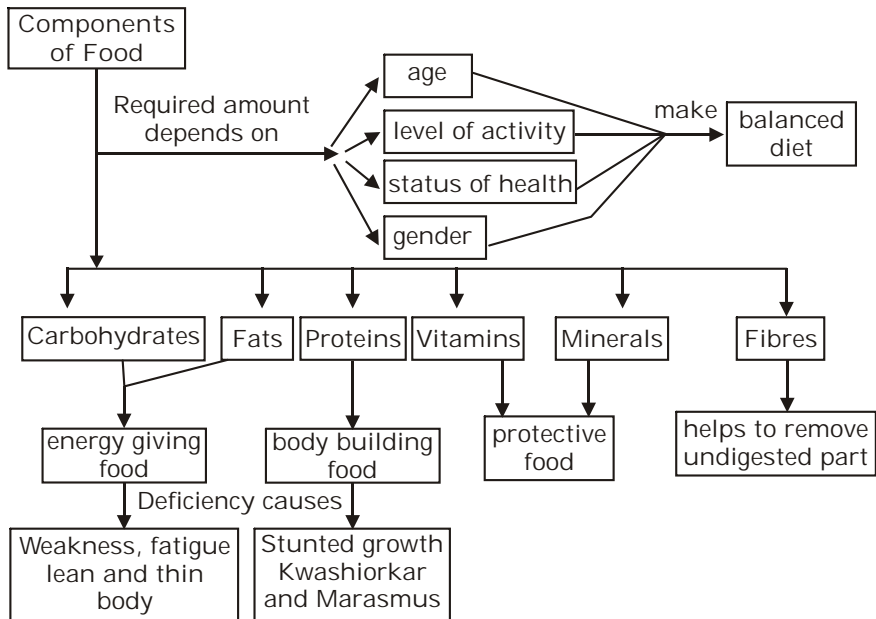
Unequitable Distribution

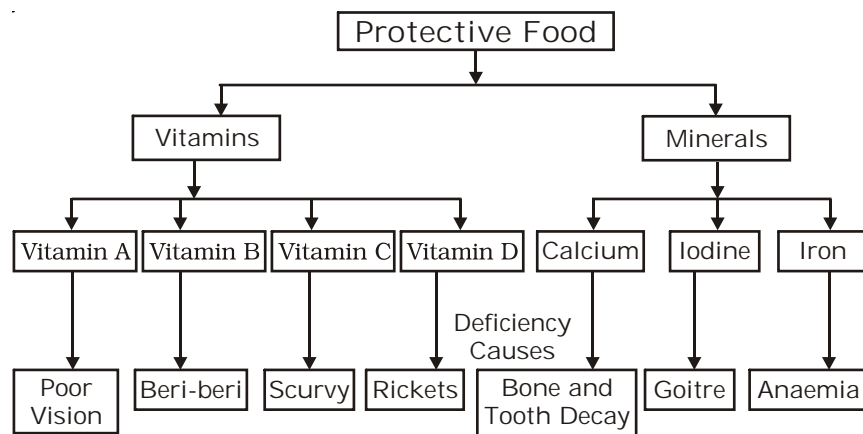
As we are talking about food, we should look into the problems of unequal distribution of food we face. Some people are suffering from the problem of excess nutrition, over-feeding and obesity and in some other parts of the world people suffer due to severe under nutrition and death due to hunger and disease. You may make some sketches or take some pictures (presented on page 11) from internet/World Health Organisation (WHO) reports/magazines/newspaper of some well fed, well grown and healthy children and also of some overfed and some suffering from malnutrition, disease and hunger. Ask your students to comment on the same and based on the comparison which you may have discussed in the class.



Summary

Let the students summarise their concepts in the form of a concept map or a flow chart of the processes and products with appropriate linkages like the one given below. Students may come up with different forms of presentation. The teacher may help them to organise their learning in their way. Alternatively, the teacher may give one of the box items or linkages and ask the students to fill the missing part.





Assignments

- Prepare a list of food items you commonly eat and find out (through tests, books, encyclopaedia or internet resources) major nutrients contained in them and check if you are missing on any essential nutrient.
- Prepare a food pyramid of the nutrient groups of commonly eaten food items showing nutrient group/food items and frequency of intake.
- Prepare a chart/diagrams showing the contents of common fruits, vegetables, beans, serials, milk, curd, meat, fish, paneer, ghee and butter.
- Adjust your diet according to the concepts of balanced diet for your level of activity and growth requirements.
- Make resolution for your food habits and exercise for good health.
- Show regional diversity of food on India's map.
- Ask students to visit a nearby zoo and let them identify animals on the basis of their eating habits.
- Ask the students to gather information about countries facing shortage of food, its causes and effects through newspapers, magazines and internet.
- Ask the students to observe the materials that their mothers discard while cleaning rice/wheat by hand-picking. Identify the impurities and try to find out their possible harmful effects if eaten.

Students may be asked to make presentation on their assignments, discuss them in the class for suggestions and improvement. These assignments not only make learning meaningful to them but can also be used in the teaching of the lessons. Children can be suggested further exploration and improvement in the techniques of investigations.

Evaluation

1. Multiple choice questions:

- (i) Which of the following statement is wrong?
 - (a) All living things need food.
 - (b) Food is necessary for life.
 - (c) Food should be taken to balance the diet.
 - (d) Plants don't need food.
- (ii) Which part of papaya tree do we eat?
 - (a) leaves
 - (b) stem
 - (c) fruit
 - (d) root
- (iii) Which of the following is not an animal product?
 - (a) milk
 - (b) soyabean
 - (c) paneer
 - (d) eggs
- (iv) The living beings eating plants as well as animals are known as
 - (a) herbivores
 - (b) carnivores
 - (c) omnivores
 - (d) none of the above
- (v) Deficiency of vitamin D causes
 - (a) scurvy
 - (b) goitre
 - (c) rickets
 - (d) Beri-beri

2. Fill in the blanks:

- (a) _____ deficiency causes Beri-beri.
- (b) Deficiency diseases can be prevented by taking _____
- (c) _____ is rich in carbohydrate.
- (d) Carbohydrates, vitamins, minerals, fats and _____ are the essential components of food.
- (e) _____ can be avoided by including sufficient roughage in food.

3. Answer the following:

- (i) What is balanced diet? What are the deciding factors of balanced diet?
- (ii) Why roughage is important for our body? Give two names of roughage containing food items?
- (iii) Why water is important for our body?
- (iv) Name three food items rich in protein.
- (v) Are carbohydrates and fats required in same proportion?

4. Match the terms in columns A and B:

Column A	Column B
Protein	Pulses (dal)
Sugar	Glucose
Carbohydrates	Energy
Vitamins	B ₁ , B ₂ , B ₆ , B ₁₂
Minerals	Calcium

5. Skills and application-based questions:

- (i) Ravi had weak eyesight. He had difficulty in reading and writing. He went to a doctor. The doctor asked him to increase the intake of green vegetables. Why do you think the doctor suggested him this?
- (ii) Separate the insects, dead worms and excreta of rodents in rice and wheat, husk and wheat grains, coffee powder from coffee seeds, mixture of cooking oil, sand and water.

Supplementary Resource Material

1. Acharya, K. T. Your Food and You. National Book Trust, New Delhi.
Acharya, K. T. Everyday Indian Processed Foods. National Book Trust, New Delhi.
Medha, S. Rajadhyaksha and Datta, Sukanya. The Secrets of Proteins. National Book Trust, New Delhi.
2. Encyclopaedia Britannica–2007. Ultimate Reference Suit: Britannica Student Library: Articles, Images and Multimedia on Food and Nutrition, Vitamin, Carbohydrates, Proteins, Starch, Malnutrition, Regional Food, Animals, Plant, Food from Plant, Ocean as Source of Food; Dietary Guidelines: Food Guide Pyramid. Encyclopaedia Britannica Library: Articles, Images and Multimedia on Food, Famine, Drought, Nutrition, Human: Carbohydrates, Proteins, Fat, Vitamins and Minerals; Herbivore, Carnivore, Omnivore.

3. Encyclopaedia Encarta (Microsoft), Reference Library–2007: Articles, Multimedia and Web Selection on Food Nutrition, Nutrition, Human, Agriculture, Food Hygiene, Food Web, Dietary Fibre, Nutrition Guidelines, Healthy Eating Pyramid.
4. Simon Schuster. New Millennium Encyclopaedia. Encyclopaedia of Science and Children. Encyclopaedia is also available as CD ROMs.
5. Online Encyclopaedia (free of cost)
<http://www.wikipedia.com>

Websites

- <http://school.discovery.com/lessonplans/programms/foodpyramid/>
(Lesson Plans Library—Life Science, Animals, Plants Ecology, Human Body, The Microscopic World.)
- www.sciencenetlinks.com/lesson.cfm
Science Net Links: Nutrition 2: Good Food, Good Health
- www.microsoft.com/Education/LessonPlans.mspx
(Search - Microsoft Lesson Plans for Students and Educators)
- [www.uq.edu.au/_school_science_lessons/websites.html/food photos](http://www.uq.edu.au/_school_science_lessons/websites.html/food_photos)
- <http://www.foodphotolibrary.com>
- <http://www.acephotos.com>
- WHO Report on Dietary Recommendation_ Nutritional Requirement.html – Child Growth and Development.

2

CHAPTER

MATERIALS

What are our clothes and other fabrics made of? A shirt, sari, dhoti, sweater, blanket, mat, are all of these made of the same fabric?

What are the threads, which come out of the fabrics after sometime?

What kind of clothes did people use in ancient times?

Why is a plate made of steel and shirt made of cloth?

What does a water filter do?



An Overview

This theme has been covered in four closely related chapters in the text, namely:

- Fibre to fabric;
- Sorting materials into groups;
- Separation of substances; and
- Changes around us.

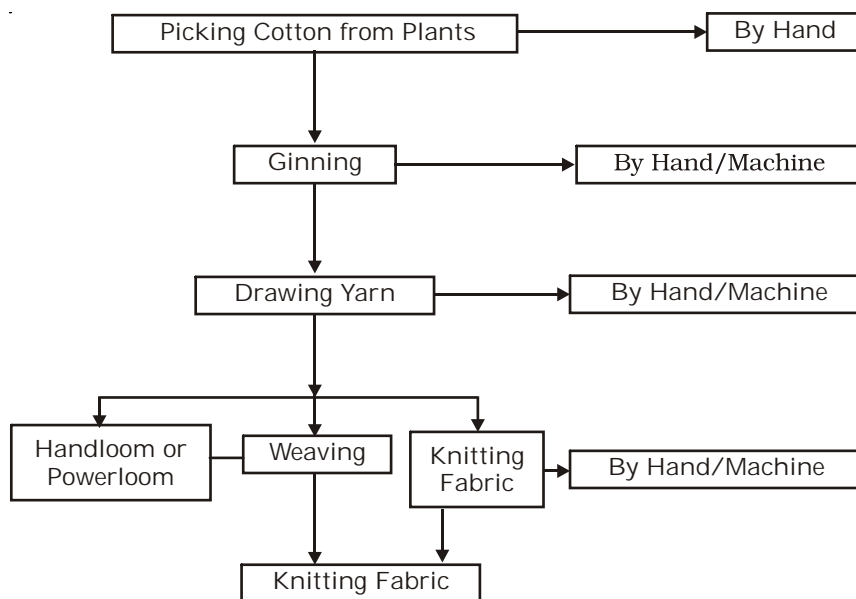
Can you draw a similar flow chart (process diagram) for woolen clothes, for clothes made from synthetic fibres?

Can one think of similar flow charts for making a cane-basket, for making a notebook, and so on? You may generate more such flow charts.

These chapters are aimed to help the child explore materials around him and develop an understanding of how to study them. The theme involves students to explore different kinds of materials, categorise them and understand the changes that can take place in the materials. In the process, they will have different experiences and develop many abilities, including the ability to observe closely, for instance, there is an exercise of observing a yarn carefully in the chapter of 'Fibre to Fabric'. There can be many other things

that you can ask children to observe. You can also ask them to look at the fibre (and other things) with a hand lens. They can be asked to develop small flow charts or put pictures of different processes involved in making fibre and then converting a fibre into a fabric and also for other processes of their daily life as well as many others indicated here. It may be useful to note that in the chapter on 'Separation of Substances' the reverse is being followed. Here, we are separating the components that constitute a material. Of course, there also a flow diagram of the processes needed for separation can be useful.

The basic point here is that there is the need for children to be able to extract processes and represent them. After seeing clear linkages between related processes and components you would be able to give children opportunities to explore and help them appreciate materials and changes in them. The overall theme adds up to give a notion of change as well as continuity in relation to a variety of materials. It also goes on to explore how materials are useful in daily life. One of the key sub-themes here is materials of daily use. The other sub-theme deals with analysis of different kinds of materials.



Now arrange the following pictures in the sequence of their stages in the process.



1. Weaving



2. Yarn



3. Clothes



4. Fabrics

Materials of Daily Use

The key thing here is exploring materials and their components. The process of understanding components in detail and going from components to the product has been explored through fibres and clothes.

The idea of students going out and exploring variety of a particular material can be taken up not only with clothes but also with other things that children use. If a specific observation schedule can be drawn with purpose, it would make the observation and its organisation richer. From here we go to the idea that the variety of the materials is due to the different components and that we can study the components to understand why there is a variety. Apart from this, students also study what a specific product is made of and find out the components of that material.

Exploring and
Observing Materials.

The categorisation of man-made and natural materials and then whether they are obtained from plants or other source has been indicated for fibres. The process how this happens is also discussed. Exploration can be done with other materials on similar lines. Students can develop presentations and projects on these aspects.

The Chapter 2 also deals with plant fibres and exploring how different kinds of fibres obtained from plants become available to us. What are the processes that are followed? It may be useful to

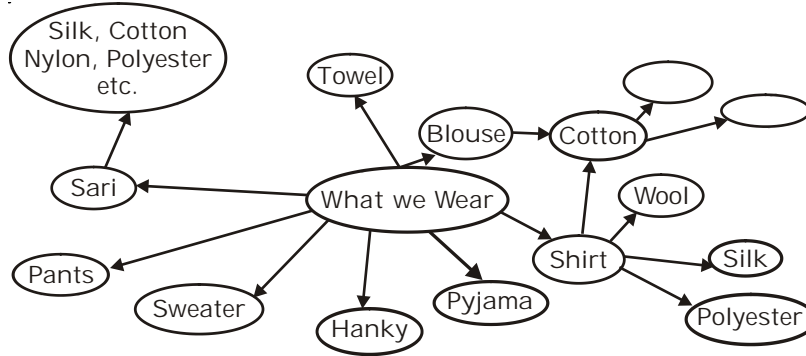
have children visit some spinning and/or weaving industries nearby or get some textile engineer or weaver to speak to them on the processes of spinning and weaving. This, of course, can also be done with other materials as well used by students. As we can see there are many possibilities of relating the key ideas and skills of this chapter to the living of the students and give them opportunity for exploring many other possibilities.

Presentation is Possible on:
Kinds of fibres, Man-made fibres, Process of obtaining fibre from plants, Process of converting fibre into cloth, Properties of fibres, Properties of clothes.

What Else can be Done?

The additional aspect that may be brought in this is the relationship of the type of cloth with the climate/weather and the purpose for which it is used. They can be encouraged to explore different kinds of cloth materials and to carry out some observations on each of them. These could include touching and feeling them, attempting to separate the fibres from the piece of cloth, testing the strength of the fibre and of the cloth piece, observing the luster, see what happens when it is dipped in the water and observe the difference in response. They can be asked to organise their observations in a table and see what inferences they can draw. As a project they can be asked to do some other studies with different materials that they use. These can be done in groups. We know that each word that the students come across is related to many others. Starting from one idea, our children after initial brain storming, can move on to make a complete chart, for instance, it may be useful to give students opportunity to complete the picture (presented on page 20).

You may desire children to make such networks on other topics also and recognise that children come up with very different ideas and different organisations. We must keep in mind that all these are correct and there is no one special and correct presentation. Children are aware of many kinds of clothes. They may be asked to explore ideas about different type of clothes they wear and what they are made of.



Different Kinds of Materials

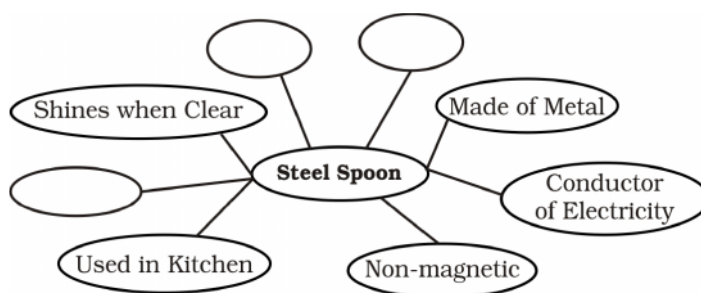
The next chapter in this theme is about different kinds of materials. Children see a variety of objects around them. They also know that these materials are used for different purposes at different times. They use that materials which can be put according to their properties. For example, to allow light to come in, windows have glasses. Similarly, chairs are not made up of glass as its properties are not suitable for seating people. You can ask children to list things around them and their primary purpose and try to infer the reason why a certain material is used for a certain purpose. Many of such examples can have more than one purpose and more than one reason that can be ascribed to a particular choice.

One of the key points in the exercise of classifying materials is to understand that each group has to be based on a specific property. For example, if you take a magnet and use its magnetic property you would find that some materials are attracted by the magnet while many others are not (materials made of wood are not attracted while those of iron are). For example, a table of wood would not be attracted while that of iron would be attracted. If you make a group of furniture then the iron table and the wooden table would both be a part of that group but if you group them according to magnetic attraction then they will belong to different items. There seems to be sufficient opportunities for children to appreciate this fact and generalise for themselves that different objects may belong to one group on the basis of one property but they will belong to different groups if sorted out on the basis of another property.

This is an easy idea to explore and many opportunities can be created. For example, you could give children a large list of objects, ask them to collect and identify properties on which they can be sorted. They can sort them in different categories and put each group as a list.

This clearly implies the need to have children cognise that each object can go into many groups. In order to facilitate understanding that one object can go into many groups, you could ask children to draw a picture showing the properties of one material.

It will be useful to help children explore materials that they can lay their hands-on to find out its properties and link it with



other objects they already know. It is necessary to give children opportunities to explore different properties of materials experimentally. Some of this kind of exploration can be done in the school and some at home to classify materials on the basis of those properties.

Separation of Substances

The sub-themes separation of substances are a natural extension of the idea that there are materials of different kinds. They have specific properties that can distinguish them from each other. Separation of substances requires identifying the property that is different in a specific respect and uses that property difference. For example, separating sand from water can be done on the basis of the difference in the weight or on the basis of difference between their ability to go through a filter paper. It would be important for students to explore different occasions where substances are

separated and identify the properties that are used in each of the processes.

You can ask students to think about situations in their daily life where they separate things. Some examples are given in the textbook but there are many others which students can think of. It is also important to think of examples where we cannot separate things from materials that are a mixture of substances.

Why Separation?

The process of separation requires resources and therefore, it is done only because it is useful. Separating salt from sea water, grains from the stalks, stones from grains before grinding, separating perfume from natural products, petrol from petroleum and many others are examples of processes where an effort is made to separate useful things from other materials. You can ask students to think of other examples where different processes are used to separate useful things.

Each of the processes given in the textbook for separation has many other examples which are useful in daily life and can be done without elaborate equipment. It would be interesting for students to observe situations around them where processes of separation are used and also do some of the activities themselves so that they can understand how separation happens. One more important use of separation is to obtain pure materials.

Solutions

Solutions are another important part of our life as well as of Science. A lot of work in Science particularly related to Chemistry, depends upon our understanding of solutions, their properties and how they are made. Separating solvent from the solute and vice versa is an important part of many industrial processes. We all know that in the process of laboratory and industrial extraction to separate a useful substance from others we need to make solutions in different solvent and extract appropriate substance from available mixtures.



It is, therefore, necessary that we make children interested in this by giving examples. They can also be asked to explore where such processes happen around them. Solution and separation is also a part of the natural process of cloud formation and rain and creation of fresh water from saline water. Not only does this sub-theme explore evaporation and condensation but also introduces the idea of saturated solutions. It may be useful for the students to explore different examples of saturated (and super saturated) solutions as well as of evaporation and condensation. They can also experiment with different things and make an attempt to reach the stage where further dissolution of solute is not possible. The solutes suggested in the textbook are salt and sugar, both easily available and the solvent is, of course, water. The exploration with other solutes may be extremely interesting for students and the recognition that they behave differently. Some such situations may be demonstrated.

It would be interesting for the students to sit down in small groups and try and think of mixtures that can be created. The condition is that it should be possible to separate these mixtures into their components using a combination of the suggested techniques and give them as a challenge to the other groups to unravel. They can also make a list of properties of different materials like metals, glass, wood etc., and try to see which property is utilised to separate such mixtures. None of these needs to be actually done as elaborate experiments and only the ideas and a little practice of how it can be done be explored.

The last sub-theme in this theme is changes around us. While the overarching purpose of this is to help children recognise changes around them and identify the variety of factors that cause changes. It is also expected that they will begin to appreciate some changes can be reversed and some cannot be. For example, putting tea leaves in water is different from putting salt in water. Once tea leaves are put in water, we cannot get the tea leaves back with all their components by evaporating water, while for salt it can be done. The examples given in the textbook have a variety of changes but you can ask students to list many more. Students can try and see which out of these can be reversed and which cannot be. Reversible change is also linked to separation of

substances as can be seen from the given example of separating salt from its solution in water. There are innumerable examples of changes when substances are mixed in such a way that they cannot be separated any longer. There are also many examples where separation is possible. Sorting out changes into these two categories would be of immense use. If you think useful, you may, repeat this discussion of changes as well as separation after explaining the chapters on magnetism and electricity. You could encourage children to see that those properties can also be used for sorting materials, separating them and for identifying how things change because of these properties.

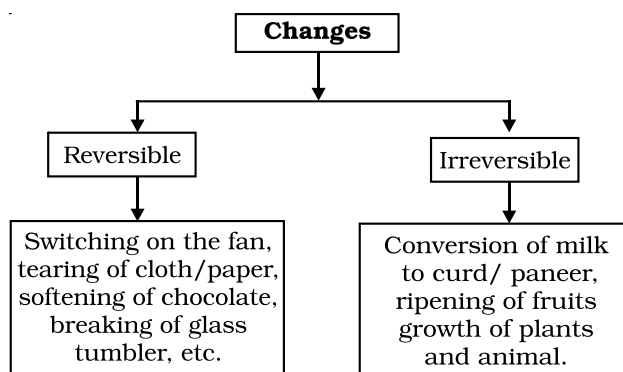
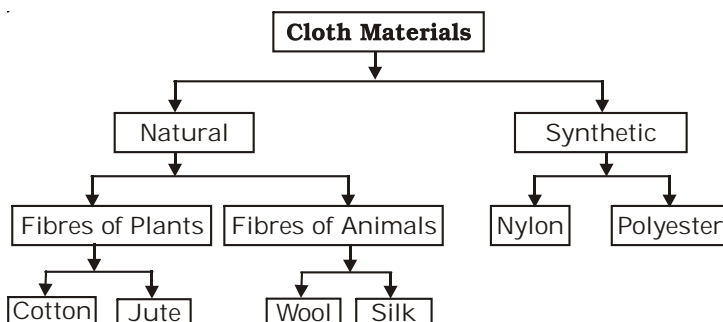
Apart from this it may be important sub-theme to discuss how some of the changes both reversible and non-reversible can be useful for us. This chapter gives one example of heating and cooling an iron wheel to fix it on a wooden wheel but there are many other instances that may be important and relevant for students to explore.

Summary

Students may be asked to summarise their learning. The teacher may give them diagrams to complete with either the box material or the linkage.

Assignments

- Think of a method, which is to be discussed with the teacher and apply the same to examine the strength of natural (cotton, wool and silk) and synthetic (nylon, polyester) fibres. Also examine which one of the fabrics– cotton, wool, silk or nylon or polyester, is most difficult to tear off.
- Think of a method, which is to be discussed with the teacher and apply the same to study the water absorption capacity of the above fabrics and arrange them in descending order. Also study water permeability (water passing through) of the above fabrics.
- Identify the fabrics by burning samples of the clothes which are used by you.
- Examine the fabrics and their fibres under a hand lens or microscope. Describe the characteristics of each.



- Take two fibres of a sample and intertwine (twist) them and study if twisting increases their combined strength.
- Take small amounts of different oils (mustard, groundnut, coconut) in glass tumblers or any other pot and add some water. Stir it up and see if oils are soluble in water.
- Which are combustible and incombustible substances out of the various things you use in your daily life? Which of these substances are most combustible?
- Group the objects in your surrounding in categories of transparent, translucent and opaque.

Evaluation

1. Write true or false:
 - (i) Cotton and wool are natural fibres.
 - (ii) Jute fibre is obtained from plant leaves.
 - (iii) Silk is obtained from fleece of animals.

- (iv) Yak hair is used to prepare woollen garments.
 - (v) Cotton fibre on burning does not shrink or melt.
 - (vi) Looking glass is transparent.
 - (vii) Milk and water mix with each other in all proportions.
 - (viii) Melting of Ice cream can be reversed.
2. Fill in the blanks:
- (i) Wool is obtained from _____ of sheep.
 - (ii) Separation of fibres from seeds of cotton balls is known as _____.
 - (iii) Sugar and common salt are _____ in water, whereas sand and saw dust are _____ in water.
 - (iv) Pure water is transparent, whereas muddy water is _____ and milk is _____.
 - (v) Process of changing water into water vapour is known as _____ whereas the reverse process is called _____.
3. Classify the changes that can be reversed and those that cannot be reversed:
- (i) Formation of clouds.
 - (ii) Formation of manure from cow dung and vegetations.
 - (iii) Burning of kerosene oil/LPG.
 - (iv) Preparation of cheese from milk.
 - (v) Dissolution of sugar in water.
 - (vi) Preparation of khadi yarn from cotton.
 - (vii) Growth of fruits.
 - (viii) Milking of cow.
4. Skills and application-based questions:
- (i) If a piece of cloth is burning how would you know whether it is cotton, silk, woolen or mixed?
 - (ii) What do you think which is the right type of cloth for people working near fire or gas?
 - (iii) Which of the following materials are lustrous and non-lustrous – jute fibre, cotton thread, diamond, gold ring, coal, polished ceramic tile, canvas shoe, silver fish, steel plate.
 - (iv) Show the states on map where jute and coconut plants are grown prominently.

Supplementary Resource Material

1. Textbook of Science, Class VI, NCERT, 2006.
2. Sharma, B.C. Books Like Material Marvels. National Book Trust, New Delhi.
3. Encyclopaedia Britannica–2007: Ultimate Reference Suite:
 - (i) Britannica Student Library: Articles and Illustrations, Images and Multimedia on Textile, Clothing Industry, Cotton, Wool, Characteristics of Woollen Clothes and Fibre, History (shearing, carding, combing), Man-made Fibres, Natural Fibre, Spinning and Weaving, Gins-separate Fibres from Seeds of Cotton and Manufacturing of Cotton.
 - (ii) Britannica Library: Articles on Textile, Development of Textile and Textile Industry from Pre-historic to the 19th Century, Textile Fibre, Textile in the New World, Textile Finishing Processes.
4. (i) Encyclopaedia Microsoft Encarta–2007: Reference Library: Clothing, Textile.
(ii) Children Encarta–2007: Textile, Fabrics.
5. Simon and Schuster. New Millennium Encyclopaedia.
6. Encyclopaedia of Science and Technology.
7. Online Encyclopaedia (free) – <http://www.wikipedia.com>
Also Provides Valuable Information on Clothes, Fibres and Textile Industry.

Websites

<http://library.thinkquest.org/C004179/textiles.html>
<http://www.relia.net/~thadane/textile.html>
http://www.encyclopedia.com/doc/1E1_textikle.html
http://www.bharat_textile.com/article/12.types-textiles.html
http://en.wikipedia.org/wiki/textile_manufacuring_terminology
<http://www.wikipedia.com.textile>
<http://www.costumegallery.com/textiles>
<http://textile-fabric.directory.alibaba.com>
<http://searchportal.information.com> (cloth/fabric)

3

CHAPTER

THE WORLD OF LIVING

We born, respire, take food, grow in size and develop, reproduce (multiply) and finally end up in death.... are certain characteristics of the living species.

But, is this all to the life or life has something more than this!



An Overview

This theme 'The World of Living' mainly deals with four major areas, namely, things around us, habitat of living, animal forms and functions and plants forms and functions.

These areas have been taken up in NCERT Class VI Science textbook in three chapters, namely, Getting to Know Plants (Chapter 7); Body Movements (Chapter 8); and The Living Organism and their Surroundings (Chapter 9).

The major skills to be developed at this level consists of (i) observation of forms, size, their variations and functions of animals' body parts and plants parts; (ii) identification of species, their forms, habitat, food etc. and (iii) classification of species (animals and plants) into categories of similar species.

Living and Non-living

Curiosity about the living world, especially animals, is very characteristic of early childhood. It tends to be the first love of young children all over the world. At early stage, well before they are admitted to school and are taught science, children begin to construct knowledge about living things around. A mere sight of a still butterfly or a lizard or a dog lying still on the roadside makes the child wonder, " Is it alive?" Surprisingly enough, every child has her/his own ways of a decision in such situations. Usually, children don't have any difficulty in concluding about living/non-living.

However, there is another side of the story. It can be easily noticed that while making such decisions, children often think of

one reason at a time. The reasons, firstly, are based on children's own experiences, and secondly, they keep on changing from case to case! "Oh, it can fly", "It bites" or "It barks" are just some of them. Another important feature of children's idea of animals also needs consideration. Ask a group of children to make a list of animals to whom they know. It can be easily noticed that it tends to be the list of four-legged creatures only! A mosquito, a crow, frog or snails are often not seen in such a list. 'It is an insect/bird, not an animal' is the usual response of children. Thirdly, as compared to children's treasure of observations and experiences related with animals, attention paid to the variety of plants, their features, etc., usually stands little lower.

On this background, at upper primary level, our role as science teachers is to shape children's thinking into a more systematic and scientific fashion. Providing glimpses of the tremendous variety in the world of living, and stimulating the students to look for similarities/differences in this variety is the first step in this direction. Revealing to the students the beauty in Nature's tricks and designs is the obvious next step. The theme 'The World of Living' should aim at these. Therefore, the major foci of discussions or sub-themes to be dealt with at this level are:

- Variety in animals and plants.
- Variety in their dwelling places (Habitat).
- Some types of difficulties to be faced in the given situations, and the features that help in overcoming these difficulties, appreciation of form and function (Adaptation, Modification).

Treasure of students' observations, and also their immense curiosity, are our assets. Let's use them for interesting open-ended discussions in classrooms and make students think. Better understanding in students, some freedom from the textbook, and the pleasure of teaching science will be the rewards. Students will take sometime to become familiar and friendly with terms like habitat, morphological structures, pistil, etc. Avoiding insistence on use of such terms at the initial stage can help in making classroom discussions interesting.

Let's Aim at

- Making our students keen observers – with eye for details, similarities and differences.
- Making them think of the tremendous variety in animals and plants, as well in terms of their body features, motion, food, reproduction methods, dwelling places, etc.
- Making them think about forms and functions of body parts of various organisms, e.g., mouth structure and food, type of locomotion and organs, special features, etc.
- Helping the students in appreciating tricks of nature that help in overcoming difficulties.
- Making students familiar and friendly with relevant technical terminology.

Things Around Us — Living/Non-Living

At elementary stage, students are certainly able to decide whether a given thing in the surrounding is living or non-living. They are familiar with a typical list of characters or the differences between the living and non-living, as given in the textbook. However, movements, respiration, need of food and water often remain the first considerations of students in decision-making. These are too obvious in animals like dog, bull, etc. They are not equally obvious in plants and students do have difficulties in perceiving movements or respiration in plants. Food of plants is yet another difficulty of students. At this stage, students need to have clear idea that certain characters of living are more important in making decisions. Starting with very familiar examples, we must raise some other slightly challenging examples and make students think and realise that even if some of the characters in the typical 'mugged up' list are not evident. It is possible to make a confident guess with proper reasoning. Compelling students to think of such situations will certainly help in real understanding.

In monsoon, a thin layer of greenish, slippery material spread on ground, cemented walls and tiles. Whether this material is living or non-living? How do we decide? Where does this material come from?

Are seeds like wheat or jowar grains stored in a gunny bag living or non-living?

Toward the end of summer a huge banyan tree was cut for the road widening. Its trunk and branches were cut down to smaller logs and they remained there in hot sun for several days. Are these logs living/ non-living? With the onset of monsoon, you noticed that some of these logs have started growing buds and soon the buds grew into leaves and branches. Now what is your opinion?

Elevating students thinking from very obvious points to slightly higher level of thinking and application is not very difficult. It calls for opportunities to do so and a teacher can certainly create them. Let students realise that amongst the list of characters of living: growth, respiration and reproduction are more important to look for. Movements or instant response to some stimuli may not be evident in every case.

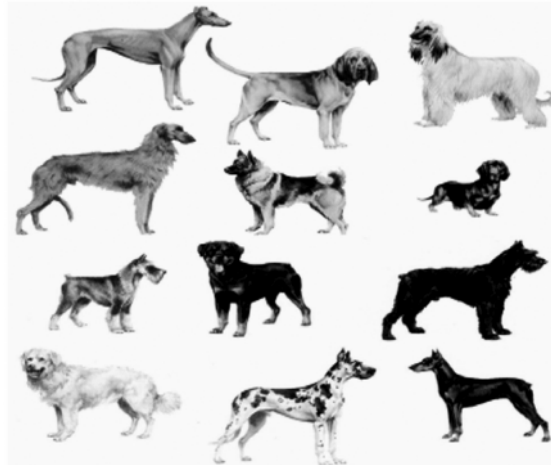
Variety in the World of Living

Snow clad mountains, vast deserts, thick forests and sediments lying at the ocean bottoms... are just some examples of situations at different places on the earth. One can add many more, like rocky/ marshy land, volcano craters, etc., to this list. Amongst all such places, there is no place to name where living organism is not found. Variety in geographical situations is one simple hint that can lead to thought of variety of plants and animals found there. Snails, insects, birds and snakes look very different from each other. So far scientists know about fourteen lakh different varieties of organisms and many of them have been studied in detail. However, many others still remain unknown to humans. Occasionally, we find reports of discovery of new animal published in science magazines. Recent discovery, by a youth from Kerala, of a variety of red frog that stays at the top of very tall trees, and that can glide to the branch of a nearby tree, is news of this kind. Many of our students might be aware of the TV programmes (e.g., Discovery, National Geographic and Animal Planet Channels) that show the adventures of scientists studying animal and plant life at the bottom of deep oceans. Encourage your students to watch such channels.

Will you buy a ticket to see a buffalo kept in a zoo? With so many buffalos around, this animal doesn't deserve a place in Indian zoo. However, in some other countries, people can see a buffalo only in zoo! Same is the case with kangaroos, giraffes and some other animals. Why does it happen? It needs to be brought to the notice of students that all the animals are not found at all the places on the earth. Some animals and plants require very specific conditions. Apple orchards, walnut plants or saffron farms are not seen everywhere in India.

Variety in plants and animals can be seen with one more angle. Dog is just one kind of animal. Do all the dogs in a locality appear alike? Forget their colour and health. A German shepherd, Pomeranian, Bulldog and Doberman are some breeds of dogs we have seen.

How many other breeds of dogs do we know? The Federation Cynologique Internationale, an organisation with 65 member countries, lists 335 different breeds of dogs. Usually Kennel clubs group them as sporting dogs, working dogs, terriers, sheep dogs and so on. This is a variety within the variety. Similar is the case with almost every other plant/animal type. Think of bears, foxes, and butterflies...or, varieties of rice, wheat and many other plants. Discussions on shells on seashore, snails you have seen or



Some breeds of dogs. Try how many of them can your students identify?

differences between a polar bear and bears in our forests, etc., do provide opportunities for students to share their knowledge. The number of varieties of insects on the earth is much more than the varieties of all other types of animals put together!

Activities

Ask a small group of students to stand under a big shady tree and list the following:

- All animals seen on the branches and foliage of that tree (e.g., squirrels, honeybees, various birds, etc.).
- Animals on the ground under that tree.
- Animals on, and little under the bark of the trunk/ branches.
- Animals seen inside/nearby the flowers and fruits of that tree.
- Animals little under the soil around that tree.

Students can identify some of the organisms seen in this activity. Some others may not be identified, but their features can be noticed. Students can be asked to make their drawings with brief descriptions of size, colour etc. Identification of at least some of these with the help from persons in the surrounding will be yet another pleasure for students. Variety in ants, different larvae, butterflies, etc., will not be missed by the students. This activity performed by different groups at different places in the surrounding, followed by a discussion of their observations will certainly prove an enjoyable and enriching experience to students.

Encourage your students to observe plants around to look for the variety in their sizes, characters of stems, leaves, branching, etc. Students may list them by visiting a nearby garden or a nursery. They can add those plants to the list which they have seen around their homes. Special features of creepers, climbers, etc., should not be missed in the observations. Making drawings of different varieties of cactus plants can be a part of such activity.

Habitat

There are forests in India where enough water is available. Yet we don't have giraffes roaming in these forests. Nor do we have

kangaroos. In spite of fertile soil and water available in many parts of the country, alphonso mangoes, apples and several other fruits remain the speciality of certain regions only.

Panda is a rare and beautiful animal found in between the elevations of 1,800 to 4,000 metres. It is found in great Himalayans heights and Central China only. Lush green, young leaves and pencil thin stains of bamboo are panda's main diet. It provides panda all the needed digestible



carbohydrates, proteins and minerals. Will it be possible to have a panda in a zoo situated in the other regions of the country?

Facts like these clearly indicate the importance of some factors, other than mere availability of food and water, in dwelling places of animals and plants as well. Factors like moisture, temperature and availability of certain minerals in the soil are obviously non-living (abiotic). Presence of other animals/plants – enemies and friends– is biotic facet of the story. Discussion on roles of insects, pests, weeds can highlight this issue in the context of plants. Many students can understand the idea of habitat in the context of animals, however, they have difficulty with the habitat of plants.

Very often children have confusion in labelling habitat of certain animals. At one time it is described as terrestrial and at some other point it is set to be desert. Children have a doubt that which of these two is the final or correct. It needs to be made clear that the general habitat can be, land, water or air. However, it can be further thought of about the specifics like marshy land, desert or mountain. Accordingly, while describing the habitat of a given organism, these details are described. They are not totally two different habitats. Same will be true for aquatic organisms—marine water, river, stagnant water or even shallow seashores.

Children love interesting information about unfamiliar animals. A collection of pictures/photographs and relevant information is something that students can start and continue on their own. Regular display of such material, encouraged by the teacher, can certainly build a valuable resource. Why not initiate wallpaper by students on such theme? Quoting the source of information can inspire many others.

Think about it

- Do all animals, big or small, have mouth and teeth?
- Can a butterfly bite, or eat a fruit? If not, why?
- Do all plants have fruits and seeds?

Forms and Functions – Plants

A carpenter always fixes a pointed nail and hammers on its flat head. A blunt nail and pointed hammer are certainly difficult to use. These serve the purpose. Appropriateness of shape, size, design, material etc., in the context of their role and purpose is very important in engineering. This, in fact, is the consideration of form and function principle. Numerous examples of this principle can be easily seen in nature.

At the upper elementary level, in depth discussion of such examples in nature is certainly not our goal. At the same time, it will not be difficult to draw students' attention to the variety in organs/body parts of some creatures seen in the form of organs and their functions. This is the objective of this sub-theme.

Morphological Structures

The terms morphology or morphological structure are new to students. Morphology implies study of external features. In other words, it is the description of the body of organism. Morphological structure, therefore, means the description of body parts. It is important to make it clear to students that it needs to be a description with observable details, like the shape, texture, arrangement, etc.

Morphological Structures of Plants

Students are very much familiar with organs of a typical plant and they are also familiar with functions of these organs. Students

are aware of the importance and functions of plant parts, like the roots, stem, leaves, etc. But they are not aware of the fact that these parts are not similar in all the plants or kind of variety present in such parts. Our efforts at this level need to be aimed at highlighting such variety and grouping based on it.

Variety in the size of fully-grown plants can be a point to begin with. Plants of Tulsi, Rose, Datura, Banyan don't grow to same size. Nature of the stem will decide whether it can grow to become a huge tree or a bush. Grouping like herbs, shrubs and trees is based on this aspect. Features of stem are more important to look at and need to be clear to students than a mere consideration of height of that plant. Green and tender stem (not very thick and wooden), hard stem and hard, thick, wooden stem are the three commonly seen categories. Number of branches and whether branching is seen close to ground or at height also depends on the kind of stem. Importance of these features in grouping plants, as herbs, shrubs and trees needs to be emphasised.

Roots of huge trees like tamarind, mango and banyan, etc., can be traced underground very far away from the tree. Damage of walls caused by the roots of nearby tree can be seen at many places. But roots of a coconut tree growing close to a building usually don't show such effects. Why should it be so? Students can easily guess it. Similarity in the function and differences in their structure, arrangements, etc., remains the important issue to discuss and highlight.

Tendrils or hooks that help climbers in holding a support are morphological structures on their stems.

Try to tear a peepal or banyan leaf and observe the torn edges. Are they straight and smooth like a razor cut?

Try to tear a banana leaf to get a zigzag cut. Every time, torn edge of leaves of some plants remains zigzag, while that of a banana leaf remains like straight cut. A discussion on what causes this difference can easily bring out the difference in their venation.

Association in between the leaf type, i.e., the venation and the root type will not be obvious to many students. Parallel venation is seen in leaves of banana, coconut, etc. These are monocots.

Roots of all such plants look like a bunch of fibres, without branching. This fact needs to be highlighted by the teacher.

Parts of flower and details of their arrangements need to be discussed at this level. It has not been discussed in earlier classes. Terms like stamens, carpel, pistil, whorl, ovary and ovule are not very familiar to students. Practically showing these parts in some flowers and introducing the terms compelling students to observe some other flowers and drawing labelled diagrams will help in developing familiarity with such terms. Similar care will be needed for other terms like lamina, petiole, margin, etc.

Think about it

- What are the differences between the morphological structures of palms (like coconut/dates) and a typical tree?
- What is the importance of the axial bud in determining leaves as simple or compound?
- Without observing seeds how will you decide whether tulasi is a dicot or monocot?
- Some papaya flowers don't grow into fruits at all. Why does it happen?

Activities

- Observe different varieties of rose plants, like miniature roses, wild or desi roses etc.
- List the differences seen in their stems.
- Visit a nearby garden or a nursery and observe the plants there. Group them as herbs, trees and shrubs. Observe the variety in shapes, petioles and margins of leaves.

Forms and Functions – Animals

Body of a cockroach looks very different from that of fish and fish is very different from a dog. The differences are not merely in size and shape. External organs, their structures and even the type of covering on the body are different. Style of moving from one place to other (locomotion) also differs in these animals. What is the difference between walking, hopping and crawling?

Importance of Skeleton

On crushing a mosquito or a housefly, we don't feel any hard bones in their body. So is the case with an earthworm and snail. They are without any bones. Some fishes don't have bones, but they do have certain kind of structures made up of slightly tough material – cartilage. Some others, like whales, have a skeleton made of huge, strong bones. Cockroach, butterfly and birds, all the three have wings. But their wings are not similar; they are made of different materials. Opportunities to children to look for such differences can make them think and understand the idea of morphological structures. It also helps in developing their observation skills.

One can easily make a small toy from mud. Pose questions such as: Is it possible to make a huge idol from only mud? Can we pile butter to make a tall column of it? Beyond a certain limit, materials like mud or butter begin to flatten. They cannot withstand the weight above. It is applicable to bodies of organisms too. Animals cannot grow big without sufficiently strong support inside the body.

Providing certain shapes is another important aspect. To make an umbrella or a kite, certain type of frame is necessary. Same is true with shaping bodies of animals. Variety in shapes of bones in different parts of human skeleton, like bones, ribs, digits, pelvis is important to highlight.

Types of Skeletons

Skeleton is often thought of as inner framework of the body. Students have difficulty in perceiving outside skeleton i.e., exoskeleton. Such skeletons cannot be made of bones, nor do they resemble skeleton of animals like snakes and birds. Even then, thin protective coverings on the soft bodies of animals, like snails, oysters, etc., are considered as their skeletons. They are part of the body and not mere shelters of such animals. Details of exoskeletons are not expected at this level, but the realisation that some animals do have this kind of skeleton is important.

Human Skeleton

Human body is an important topic in school syllabus. The ideas of skeleton, its importance and types are dealt within elementary

fashion. Examples of variety are introduced in this context. Human skeleton, on the other hand, needs to be discussed in more details. Students are familiar with sketch of human skull as 'danger sign'. They have not thought of it as a structure made of many bones. Features of these bones, their joints will require a little more discussion in the class. Certain observations, like the precautions taken in handling very young babies will be meaningful to recall and talk about. Similarities and differences between human skeleton and skeletons of some other organisms is another point of interest to children. The answer to questions like 'why the wings of birds are called modified limbs?' can be easily traced in such similarities.

Number of bones in the body of a newly-born baby and in adult human is important to highlight. The less number of bones in adult does not mean disappearing/disintegration of some bones. Actually it is number that we are considering. Certain bones in the lowermost of the vertebral column are separate bones in the beginning. Slowly, some of them fuse together and appear as one bone. This makes the difference in their count.

Students can be asked to feel the bones of their fingers or ribs and count the number, size, etc.

Skeletal System, Cartilage

Need of skeleton and general idea about skeleton is one concept. Viewing skeleton as skeletal system has something more in it. The terms digestive system, respiratory system, etc., indicate that there are various parts contributing to or participating in that function. Together, they are named as system. Highlighting functions of different parts of skeleton, role played by cartilages and their function in joints will help in seeing as a complete system. Feeling the difference between the bones in hand and head and the cartilage in the lobe of ear is necessary to understand cartilage.

At this level, it will be enough to explain ideas, like vertebral column, rib cage, skull etc. Names or exact number of bones in each or such parts need not be insisted on.

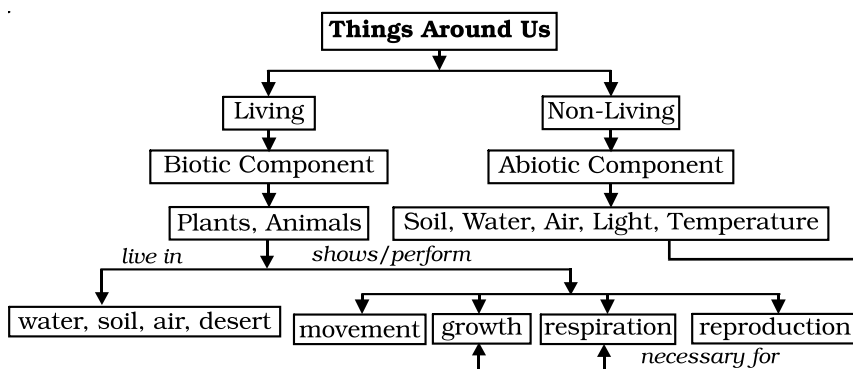
All human beings have same type of skeleton. However, due to certain requirements, some features of certain bones show certain characters. For example, just by observing pelvic bone, an expert can easily conclude whether it is bone of a man or of a woman. Similarly by studying some features or certain bones, it is possible to guess the age of the victim. Such skills prove very important in crime detection and biology related studies of historical events.

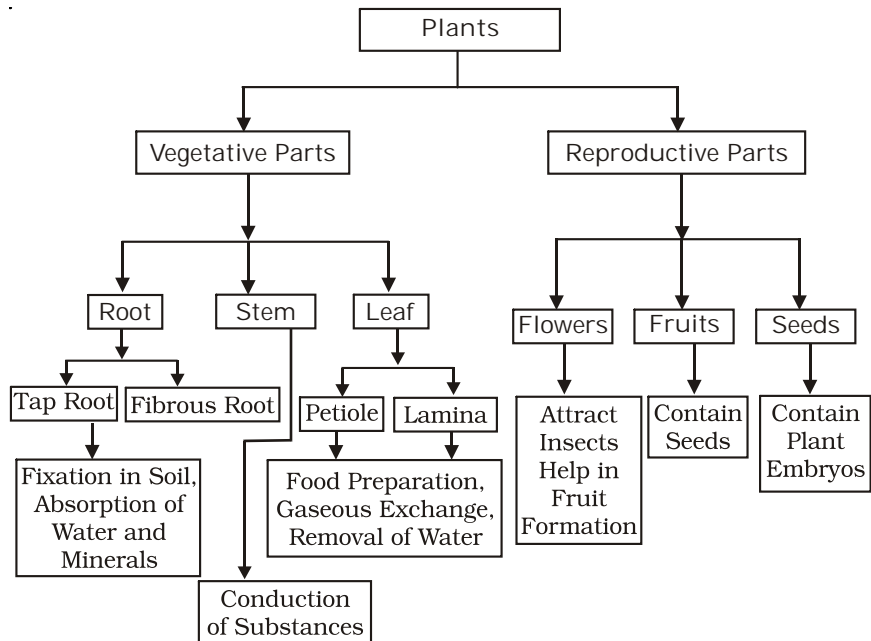
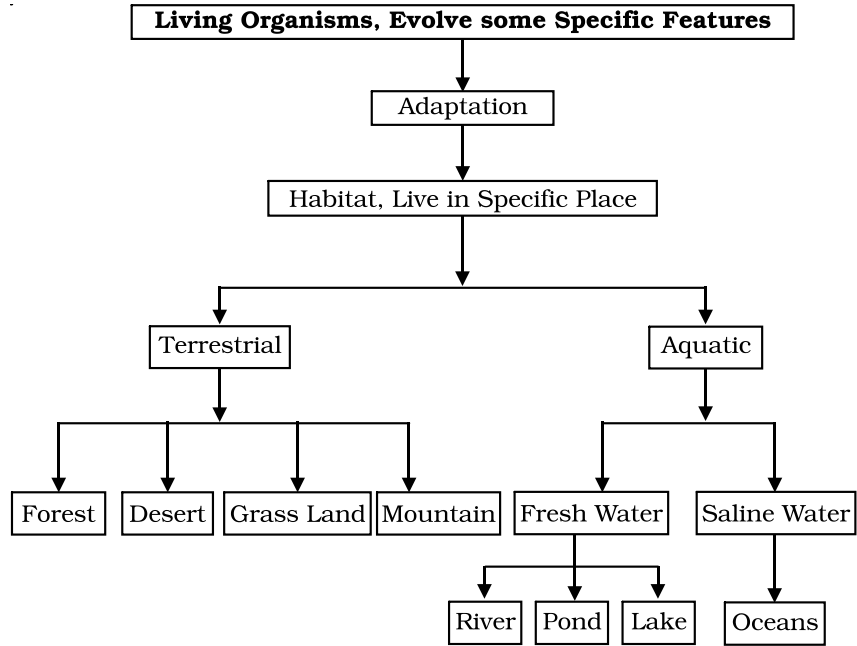
Now Reason about

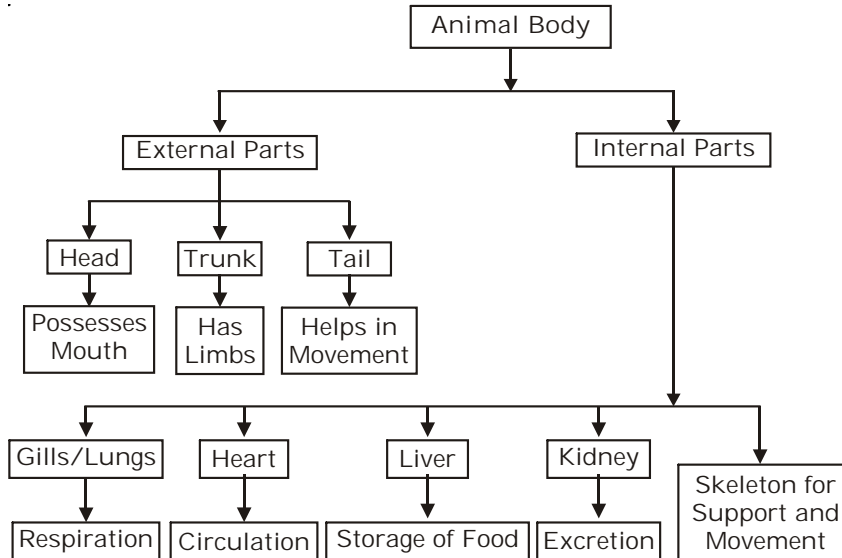
- Why do earthworms live in burrows?
- What would happen to the seedlings, kept in the refrigerator?
- In which of the following places, plants exhibit luxuriant growth – on the roadside of a crowded city or in a forest? Why?
- If a potted plant is covered with a polythene for a few days, what will happen? Give reasons.
- A tree does not move from one place to another. Still it is considered as living. Why?
- If all green plants are removed from earth, what will happen?
- If we take a fish out of water and keep it on a plate. Will it survive? If not why?

Summary

Students may be asked to summarise their learning. The teacher may give them diagrams such as given below to complete with either the box material or the linkage.







Assignments

- How does a fish move?
- What will happen if tail fin of a fish is removed?
- What will happen if the wings of a bird are removed?
- How do snakes and earthworms move?
- What will happen if beaks of birds get injured?
- How do the plants and animals living in water get oxygen?
- In cold countries, the surface water or rivers and lakes freeze. What happens to the fishes living there?
- What happens to a cactus when it is planted in a pond?
- Why roots are continuously cut in Bonsai plants?
- Which part of the plant is equivalent to the kitchen of the plant.
- Why are the leaves green in colour?
- In desert plants, leaves either fall off very early or are absent. How do these plants respire?
- If plants and flowers are dull coloured and without any fragrance, how does reproduction take place in them?

Evaluation

1. Answer the following:

- (i) A motorcycle moves, consumes fuel, takes in air and gives out gases. Is it living? If not, then, why?
- (ii) Mention two ways in which living and non-living things are alike.
- (iii) Identify living and non-living components of your food.
- (iv) Which are living things in the following: wool, rubber, apple, ghee, leather, pulses, vegetables and rice.
- (v) Name the sleep that extends throughout the winter. Name, which animals go in long winter sleep.
- (vi) How are the following adapted to their respective environments? Polar bear, fish, penguin, camel, birds, cactus, water lily and lotus.

2. Fill in the blanks:

- (i) Onion is a modified_____.
- (ii) Ginger is a modified_____.
- (iii) _____ is a fibrous root.
- (iv) Leaves are green due to the presence of_____.
- (v) The pores on a leaf are called_____.
- (vi) The male reproductive organ of a flower is called_____.

3. Mark true or false:

- (i) Bones and cartilages are parts of skeleton system.
- (ii) Exoskeleton belongs to human.
- (iii) Endoskeleton is present in invertebrate animals.
- (iv) Sweet potato is a stem.
- (v) Potato is a root.
- (vi) Plant stores food in fruits only.
- (vii) Leaves are attached to the stem at nodes.
- (viii) The root of wheat plant is fibrous.

4. Match the terms in columns A and B

Column A	Column B
Air	Movement of parts of body
Locomotion	Respiration

Birds	Development of certain features
Adaptation	Supports body forms
Skeleton system	Organisms live, reproduce and fulfils its needs
Habitat	Modified limbs

5. Multiple choice questions:

Mark the one with correct relationship

- (i) Tap root
 - (a) maize
 - (b) pea
 - (c) rice
 - (d) wheat
- (ii) Modified stem
 - (a) beet
 - (b) turmeric
 - (c) sweet potato
 - (d) radish
- (iii) Veins
 - (a) seeds
 - (b) fruits
 - (c) stem
 - (d) leaf
- (iv) A modified leaf
 - (a) sugarcane
 - (b) spines of cactus
 - (c) maize
 - (d) banyan
- (v) Pollens
 - (a) ovaries
 - (b) fruits
 - (c) flower
 - (d) anther

6. Skills and application-based questions:

- (i) Give students some roots or their picture and ask them to observe carefully and write down the differences.
- (ii) What is the difference between the stem of a rose plant, mango tree and tulsi?
- (iii) Snake and snail have very different style of movements. Why is it so?
- (iv) What difficulties would we face if our bodies did not have muscles in it?
- (v) Twist your ear. It's flexible. What do you think it is made of? What other parts of our body are made of similar stuff?

Supplementary Resource Material

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Nair, S.M. Endangered Animals of India and Conservation. National Book Trust, New Delhi.
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2. David, A. and Shivakumar. Animal World. Children Book Trust, New Delhi.
Majumdar, N.N. and Chakravarti, Pranab. Wild Life: Some Indian Birds. Children Book Trust, New Delhi.
Lois Hamilton Fuller. Little Tigers, Big Tigers, Children Book Trust, New Delhi.
Majumdar, N.N. Indian Birds. Children Book Trust, New Delhi.
Rastogi, Rekha. Let Us Identify the Useful Trees. Children Book Trust, New Delhi.

3. Encyclopaedia of Animal Kingdom.
4. Programmes on Discovery Channel, National Geographic and Animal Planet Channels of TV Show Habitats, Adaptations and Lifestyles of Various Animals in Wild.
5. Encyclopaedia Britannica–2007: Ultimate Reference Suite:
 - (i) Britannica Student Library: Articles and Illustrations, Images and Multimedia on Animals, Covering Various Facets of Animal Behaviour, Animals; Domesticated, Pre-historic (sea animals, land animals, birds and mammals), Legendary and Animal Migration, etc. Plants: Plants Uses (food, clothing, paper, fuel, shelter, medicine), Plants and Balance of Nature, Distinction of Plants from other Living Things, Plant Structures.
 - (ii) Britannica Library: Animals; Habitat, Adaptation, Animal Behaviour, etc. Plants: Structure, Adaptation, Uses, Variety etc.
6. Microsoft. Encarta Reference Library–2007 and Children Encarta–2007.
7. CDs of Discovery Channel. School on Various Categories of Animal and Plant Related Aspects of Living World; Habitats of the World, Birds, Fish, Amphibians, Reptiles, Evolution, Plants, etc. The CDs Contain Teacher Guide, Library, Laboratory and Theatre.

Websites

- <http://animal.discovery.com>
- <http://www.national-geographic.com>
- <http://www.animalinfo.org>.
- <http://www.school.discovery.com/lesson-plan/plants.html>
- <http://www.school.discovery.com/lesson-plans/animals.html>
- <http://www.discovery.com>

4

CHAPTER

MOVING THINGS PEOPLE AND IDEAS

How far is Radha's house from mine?
Is my brother taller than me?
Is the car stationary or moving?
How some Sabzi Wallahs use stones for weights?



The theme of Moving Things, People and Ideas in Class VI deals with Transportation, Motion and Measurement of Distances. The three important concepts taken up in this chapter are:

- (i) Transportation
 - Various modes of transportation
 - History of transportation
- (ii) Measurement of length
 - Non-standard units
 - Standard units
 - Use of scale
 - Measuring a curved length
- (iii) Motion
 - Rest
 - Types of motion
 - Translatory motion
 - Rotational motion
 - Oscillatory motion
 - Repetitive and non-repetitive motion
 - Periodic and non-periodic motion.

Following skills can be developed in the students

- Observation
- Estimation
- Measurement of length (using a scale and other means).

A good way to start could be to take them to the road side, if possible, to observe various means of transport that exists today

and possibly count how many scooters, buses, cycles, trucks, cars and even tonga, rikshaw, bullockcarts etc., they see. You may also ask them to do the same while they are coming to school. You may also ask them to collect pictures of various means of transportation that existed in the past. Any activity which is making them conscious of all the vehicles that they see around them everyday would set the stage for you to have discussions about the choice of the means of transport based on speed, cost and need.

Some questions your students may be wondering about.

How did the kings and monarchs travel in the ancient times? How did they move over land, river and sea? How did British come to India and how do we travel to different places today?

Development of Means of Transport

People have been moving to various places, villages and cities or even to different countries for various activities from pre-historic times. They employed different means of transport. The means of transport kept changing through the ages. Students may find it interesting to know about the means of transport used in the historic and pre-historic times. This can also be dealt within the form of stories. This way it also develops linkages with historical development of concepts.

When we are talking of movement from one place to another, the measurement of distance is logically the next step. This linkage is to be made evident to the child. You would probably need to arouse the curiosity of the child in knowing and measuring various distances and lengths. The distance of a place where we intend to go, the length of a cricket pitch and length of the race track in the school etc.

Need for Measurement

I want to know how tall am I? How long can I jump? I want to compare the size of things. Will the cupboard that I wish to buy go through the door of my home? What should be the height of the mirror so that everybody in the house can see his or her full image?

Sometimes optical illusions create need for measurement, for instance, look at the following figures and say which is longer



Encourage the children to measure the length of the classroom in terms of their foot steps, hand span, arm's length, foot length etc., and record this in the following table:

Students	Length of Classroom		
	Hand Spans	Foot Steps	Arm's Length
Ram	20		
Mohan	19		
Razia	18		
Meena	17		
Nasreen	21		

You can modify the table in as many ways as you want. Another example would be:

What am I measuring?	Non-standard Estimate	Standard Measurement

The structure of the table would depend on what you intend to do. We should provide them opportunity to develop the ability to present data according to what they want to focus on. Let us just try and understand how a small variation in the activity can change the focus to our benefit. In one activity your objective may be to make students conscious of how each person would get a different answer when you are using a non-standard unit for measurement. On the other hand, in the second activity, you could use standard units for measurement and see the difference between the estimates using non-standard means on one hand, and the precise, standard measurements on the other.

Why do we emphasise on estimation then?

It is important as a practical skill, which one should develop. How many people would come in a party organised at my home? How much food should be cooked? What size of carpet would fit this room? How much cloth would be needed for my shirt? How much water should be stored when there would be no water supply tomorrow?

Need for Standard Units

You may ask your students to measure everybody's pencil in the class, which would definitely be different for each child and then record them in a table in the notebook. Measurements done by students using both non-standard means such as, anguls, palm lengths, etc., and some standard scales lead students to appreciate the need for standard units. This may be better done through some interesting story. You may find your own story to be told.

Whenever we discuss non-standard units, it is always to make students realise the need of standard units. But, the contexts of non-standard units are not entirely out of place. Non-standard units are being used, even today in many cases without any serious problems, for example, estimation by means of anguls of length and width of a sweater being knitted and ingredients put in a recipe at home. This may be brought in the realm of the classroom discussions.

An exploratory activity that could be given to the students when they are dealing with the concepts of scales and units, both standard and non-standard, is to ask them to collect information about the different scales used in different professions, may be directly from the professionals, encyclopaedias, texts and websites.

Group Task: You may ask your students to make a play on "Why Standard Units are needed?"

Giving students lots of opportunities to measure and then to record is crucial as precise and accurate measurements and its faithful reporting is a very important value of science. This also forms the basis of further scientific researches and has led to several remarkable discoveries in the past. Precise measurements bring precision in communication and comparison. This should be encouraged in action.

Skills of Measurement

As students use scales, we should take care to develop proper skills of measurement in them which requires:

Incorrect Ways: 15 metres, 15 metre
 15 m, 3 centimetres
 3 centimetre, 3 cm, 8 millimetres
 8 millimetre, 8 mm, etc.

While children use scale, you need to draw their attention to the smaller marks on the scale and their use to improve precision in measurements. You would encourage students to estimate the least count of the scale and appreciate its role. Least count of the scale almost always limits accuracy of measurement.

Here are some interesting facts that you may want to share with your students. These facts may excite the students and they will get interested in the subject. You can only judge what would interest your students most. Here is an example:

How Long is a Metre?

Long ago Paris Academy of Sciences defined a metre as ten millionth ($1/10,000,000$) part of the distance from the equator to the North Pole along the meridian passing through Paris. International conference on weight and measures (1899) standardised the metre as the distance between two lines marked on a specially prepared metallic rod kept under a constant temperature at International Bureau of Weights and Measures at Paris in France. A replica of this rod is used as standard of a metre elsewhere. National Physical Laboratory, Delhi maintains the standard of measurements in our country.

Measurement of Curved Lines

Measurement of length is not only about measuring straight lines. As you would have seen in the chapter, the skill of measuring a curved line using thread has been given in an activity. You may remind your students how a tailor takes various measurements of your body with the help of a graduated flexible tape. It would be good to give students practice in such skills and you may do this in various ways not just the one suggested in the book. You may ask your students to measure the circumference of a pipe or bangle, the circumference of their head or the perimeter of their playfield.

When we are talking of measuring distances, a question may come up: how does an automobile metre know how much distance has been covered? A simple activity may help your students understand this. Ask them to bring a cycle tyre to the class. Tie a piece of cotton soaked in some colour at one point on the tyre. Now move this tyre on the floor. Ask your students to measure the distance between one colour spot and the next. This measures the circumference of the tyre even without a flexible scale!

A farmer wants to put barbed wire fence around his farm. How can you help him to estimate how much wire is needed?

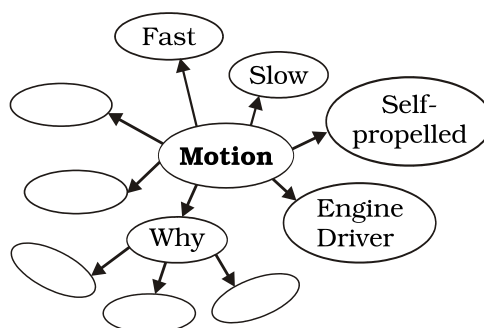
Motion and Rest

As one looks around and makes a list of objects which can be identified as objects in motion or at rest, it would be a good starting point to take their attention to a hill, an electric pole, road, a well, a hand pump or just another building in front of our house which remain at the same place from morning to evening, from days to years and so on, and also on the other hand, notice things like flying birds, moving trains, aeroplane, kites, cow, dog, car, motorbike, bullockcart etc. Children at this stage are aware of stationary and moving things from the observation of their surroundings. They can identify stationary and moving things. You may ask students to list things from their surrounding into two categories, i.e., stationary and moving and also objects like a fan, motor, hands and pendulum of a clock, which also move but in different manners. May be special attention will have to be given to these motions. Identifying examples and the abstract level understanding of a concept are two separate things. Wouldn't it be a good idea to have a discussion at this stage with your students about what are the common characteristics in all the stationary things and in all the moving objects?

Another concept where you would need to put special attention is that motion and rest are observed in context of the observer. They are relative phenomena.

You may have a discussion about the difference in time taken in covering a distance by walking on foot or on a bicycle or on a

motorbike. If not, then why not have it right now and also ask them to compare the time taken in travelling by an aeroplane and by a train. You may also ask students to arrange moving things in order of increasing fastness and slowness. How about initiating a discussion in the class, on the criterion for slow and fast motion based on the time taken to cover a definite distance?



Get students to work on this and complete it according to their ideas. Let them modify, add or delete in this

How do you decide whether a fan is moving faster or slower?
 A swing is moving faster or slower?
 An object is rolling faster than another object?

Types of Motion

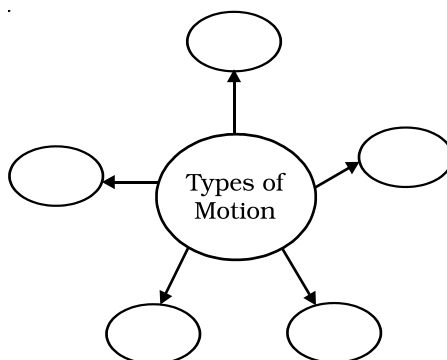
As the diagrammatic representation shows the chapter introduces the students with different types of motions. Let your students observe the details and point out similarities and differences between the motions of:

- A motorbike/car/train/plane and a fan or motor.
- A fan and a swing.
- Needles (hands) of a clock and its pendulum.
- A wheel or cylinder rolling along a plane and a fan.
- A fan and the needle of a tailor's sewing machine.

You may divide the class into small groups and allot each group an exercise from the above. Students may discuss within their groups and list the similarities and differences in respect of each category. The students may need your help in observing the details of the motion and describe its features and its distinction

from other motions. You may then arrange a quiz session between different groups of students on different types of motion.

Take different examples and ask them to find other examples around them for the various motions talked about in the book: rotational motion (motion of a fan, hands of a clock), oscillatory motion (swing, pendulum of a clock), translatory motion.



Some objects as we know show two types of motion at the same time. You may ask your students to move a wheel or drive a screw and focus on its motion. A wheel rolling along a road/ plane performs two types of motion. It rotates about a central position (rotational motion) as well as it moves from one point to another as one object in translatory motion along a path.

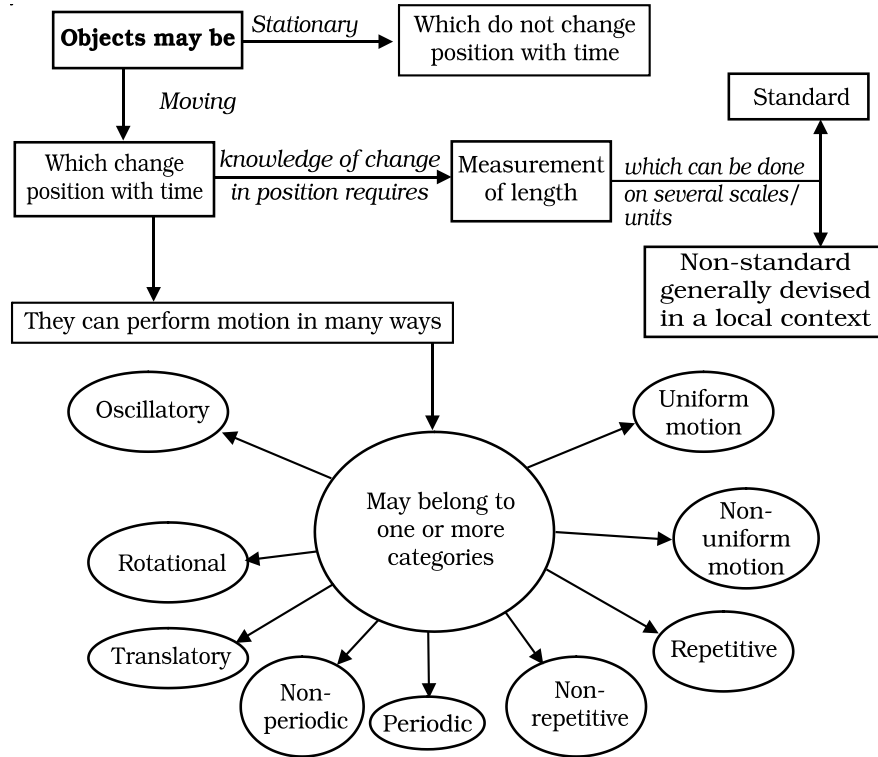
Then the book deals with the concept of periodic motion. As you elicit examples of repetitive motion, it would be important to talk of some motions which sometime look like repetitive motion like the motion of a bee when it is hovering near the hive or a fly circling around some eatables. How would you like to answer these? What about the movement of your pulse, movement of air through your nostrils etc?

Summary

Students may be given the exercise to prepare a summary in the form of process – product/concept map with appropriate linkages.

Assignments

- Observe the motion of the things in your surroundings and categorise their motion.
- Measure the length of various objects in your house and study room.



- Make a presentation on various kinds of scales used by people in different professions and why.

Evaluation

1. What kind of the motion is:
 - (i) movement of branches of trees?
 - (ii) motion of potter's wheel?
 - (iii) motion of a takali?
 - (iv) chain of a bicycle?
2. Mark true or false:
 - (i) Measuring tapes are used for measuring length more than 1 km.
 - (ii) The motion, which appears again and again, is called non-repetitive motion.
 - (iii) 1cm is 1/10 part of a metre.

- (iv) The motion of the wire in a sitar is vibratory motion.
- (v) 1/1000 part of a metre is called 1km.

3. Fill the blanks:

- (i) A moving carom board coin is_____motion.
- (ii) 1km distance is equal to_____cm.
- (iii) To and fro motion of a body is called_____.
- (iv) 1m is equal to_____of distance from equator to pole_____.

4. Skills and application-based questions:

Rafat and Rajni were asked to measure the given leaf. Rafat gave the answer as 6 cm and Rajni gets the answer as 5 cm. Whose answer is right? Why is one of them getting a wrong answer? Find out what was wrong with whom.

Supplementary Resource Material

1. Science, Class VI, NCERT – 2006. Also available on internet website <http://www.ncert.nic.in>
2. Encyclopaedia Britannica – 2007. Ultimate Reference Suite
Encyclopaedia Britannica Library: Articles on Transportation, History of Transportation, Measurement and Measurement System from Early Elementary to Modern Measurement System and Related Aspects.
Britannica Students Library: Articles on Measurement of different Phenomena (Earthquake, Electricity, Length, Instruments etc.). Early History of Transportation, History of Navigation, History of Bicycle, History of Buses.
3. Microsoft Encarta Reference Library – 2007: Articles on Measurement, Units and Basic Standards, Metric System, Weights and Measures and Related Articles.
Encarta Children: Length: Measurement Units, Dictionary of Units, Relation between Different Units.

Websites

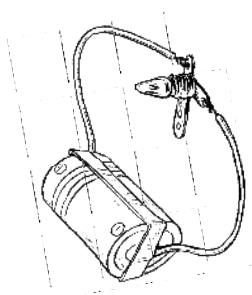
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- <http://www.sciencenetlinks.com/lessons>
- <http://www.google.co.uk> (google search-length + metre)

- <http://www.reference.com/browse/wiki/>
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- http://en.wikipedia.org/wiki/system_of_measurement
- <http://www.ask.com> (Get all the Historical Facts you need from ask.com)
- <http://www.google.co.uk> (google search ancient +means + transport)
- <http://www..Amazon.com/Alexendere-Great-Logistics-Macedonian-Army/dp/>
(An Account of how Army of Alexander the Great Moved).

5

CHAPTER

HOW THINGS WORK



What makes an electric bulb glow? What makes a fan rotate when we put a switch on? What is it that attracts iron?



An Overview

This question 'how things work' opens unlimited potential for arousing curiosity about principles of science and related gadgets. A variety of questions can be asked concerning scientific phenomena and their applications. How is electricity generated in a cell, a battery and a generator? How does a torch work, what makes an electrical bell sound and how does telephone, radio, television and computer work? How is a magnet used to find direction and see how two magnets sometime attract and sometime repel each other? You can take such opportunities to inspire children into exploring scientific principles in various appliances and scientific phenomena of daily life in an interesting manner.

The movement from concrete examples to scientific principles is slow and you would need to be patient in this process.

This theme has been dealt within two chapters in NCERT Class VI Science textbook: (i) Electricity and Circuits (Chapter 12); and (ii) Fun with Magnets (Chapter 13).

Electricity

Children by this time have experienced some electrical devices. Students living in cities may have seen an electric geyser, mixer-grinder, computer, TV and many more items apart from bulb, fan etc. Village children may have a little less exposure but they would also know about a water submersible pump, television etc.

Teacher may initiate a conversation about where electricity is used based on their living experience at home, school or elsewhere. When the electric supply is interrupted, some of us use torch at home. How does a torch work? How does electricity make it possible to light our homes, roads, offices, markets, etc.? We use electricity to operate various other gadgets like room heaters, fans, water coolers, electric irons, pumps for lifting water from tanks/wells and other machines. This theme explores basic principles behind such applications.

The textbook deals with the following concepts in this theme:

- Electric Circuit in which includes a source of electrical power, some device to consume the electric power, a key/switch and connecting wires.
- Open and closed circuits.
- Key/switch and its role.
- Conductors and insulators.
- Proper way of connecting a bulb with a cell which makes it glow.

Just probe or explore students existing ideas about electricity and electric current.

Skills to Develop

- To connect cell, key, bulb and other things with the help of connecting wires.
- To make proper electric circuits.

You may give the basic materials (cell/cells, connecting wires, key/switch, torch bulb etc.) and ask your students to explore ways to connect them such that the torch bulb glows. They may need your help in this exercise, allow them to explore and try various possible ways. Please encourage your students to investigate the following:

- Does the bulb glow if any wire is not connected at any place i.e., if any of the connecting wires has a free end?
- Does the bulb glow if both the wires are connected to only one end of the cell?
- Does the bulb glow if the two ends of the cell are connected to only one point of the bulb? (There is a chance of damaging cell if this way of connection lasts for sometime connecting

wires may heat up find out why it so happens? This may then be introduced as precaution).

- What is the difference in electric connections in the torches with plastic body and metallic body?
- Why are electric wires covered with rubber?

Since we are talking about closely observing and understanding how electricity makes things work, it would be good to ask your students to carefully observe the bulb and then draw it. Also ask them to observe where the light comes from in the bulb. Does the bulb also heat up?

Can they make a guess of what is happening? Encourage them to guess the phenomenon by observation.

Electric Conductors and Insulators

Ask your students to collect the material given in the table below. Ask students to investigate whether it is a good conductor or a bad conductor by putting it in the place of a switch/key in a closed circuit and see whether it conducts current or not?

Sl. No.	Material	Observation: Bulb Glows or Not	Inference
1.	A piece of plastic		
2.	Glass		
3.	A piece of leather		
4.	Chalk		
5.	Cloth		
6.	Flower petal		
7.	Iron nail		
8.	A piece of brass		
9.	A pencil sharpened on both ends		
10.	Outer cover of the pencil (wooden)		
11.	Paper		
12.	Coin		

We have already talked about where electricity is being used. It is, therefore, not difficult to see all those things that we would not be able to do when electric supply is disrupted.

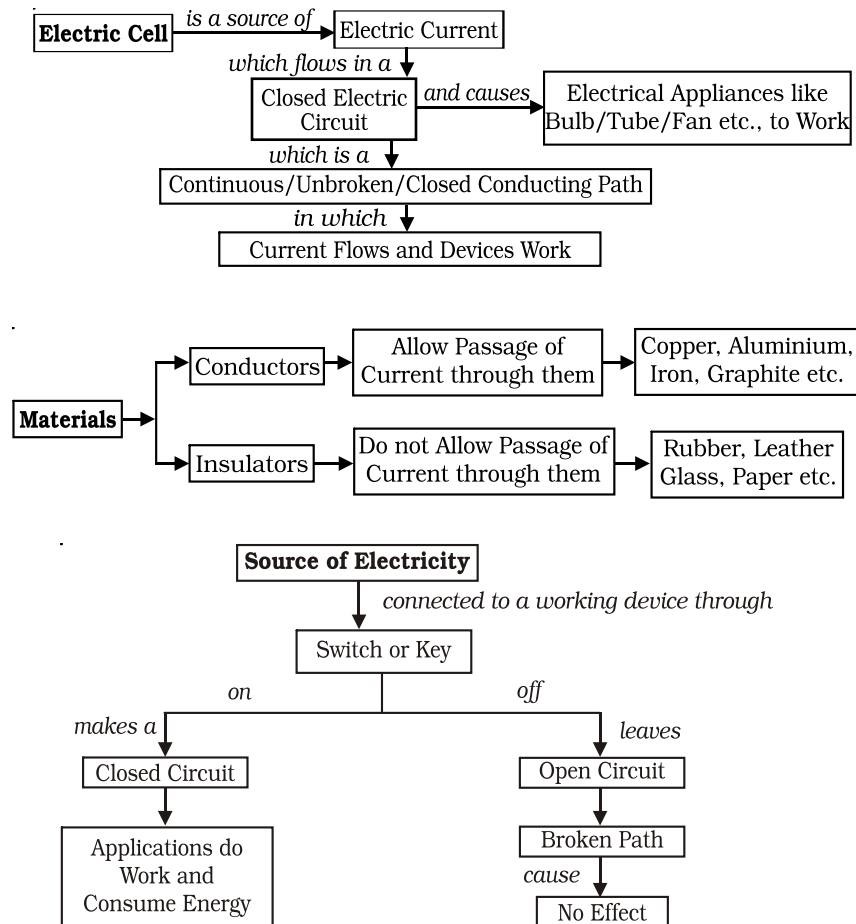
We should spend some time on making students aware about the need to save electric energy.

- Turn off all electrical appliances when they are not in use.
- Create posters, slogans, organise campaigns to create awareness to save electricity.

Place some posters on this theme in the class.

Summary

Students may be given the exercise to prepare a summary in the form of process-product or concept map with appropriate linkage.



Magnet

The next sub-theme in the text deals with magnets and their properties a little more. Children by this time are familiar with some magnetic behaviour through toys, magnetic stick etc., magnets are interesting to play with. You may begin a classroom discussion on where magnets are utilised in our life.

Magnets have got a wide range of applications in motors, fans, TVs, loudspeakers.

Skills that the theme attempts to develop

- Observation: magnetic effects.
- Classification: magnetic and non-magnetic substances.
- Experimentation.

The textbook gives an interesting story of the shepherd boy who, by chance, discovered magnet. Wherever such historical anecdotes are presented they are to make the teaching of science interesting, so use it in that spirit. Draw on this story and asks students to go on a 'Magnet walk'. Accompany them in this walk and let them collect a few things. Later these things can be used for activities in the class. The students may be asked to identify objects which get attracted by magnet. They may also look for particles present in the soil or sand which get attracted by magnet. You may want to take this exploration a little further. If you have some magnet in your class then distribute them amongst the students and if that is not possible then you may help them in identifying some magnetic items in their household material. The students may then be asked to find out which of the articles in their homes are attracted by magnet and which are not. They may arrange their observations in the following table:

Sl. No.	Magnetic Materials (which are attracted towards a magnet)	Non-Magnetic Materials (which are not attracted towards a magnet)
1.		
2.		
3.		
4.		
5.		
6.		

Interestingly, a piece of magnet consists of the same material throughout but still the force of attraction/repulsion is maximum at the poles. An activity depicting this has been given in the book. You may ask them to do similar activity with

You must have seen some trash collectors/rag pickers with a stick in hand. Well they are also on a kind of magnet walk, their stick has a magnet attached to it and with its help they collect small pieces of iron.

pins. You may also ask your students to take a bar magnet and an iron rod. Place the magnet on the table and touch the iron rod at various points of the bar magnets along its length. They will observe maximum attraction at the ends called poles and no attraction at the centre.

A magnet has two poles, and if it gets broken in two pieces, each piece would again have two poles. Breaking a magnet into two pieces to show this may not be practical but here is some thing which can be easily done. Let the students combine a few

small magnets; join N-S poles of small magnets together to form a big magnet and find where the iron powder concentrates on the combined magnet? It is at the ends. Break this combination (dismantle) to separate them back into smaller magnets,

You may ask your students to bring two bar magnets close to each other and see they get attached at the poles only.

each magnet will again behave like an independent magnet having two regions of highest magnetic strength – the poles.

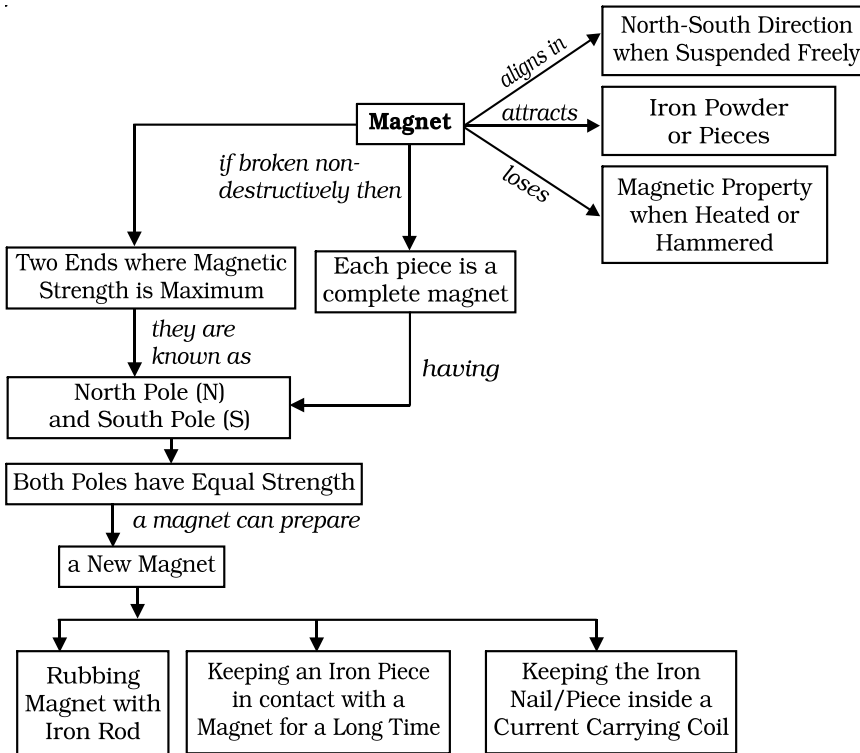
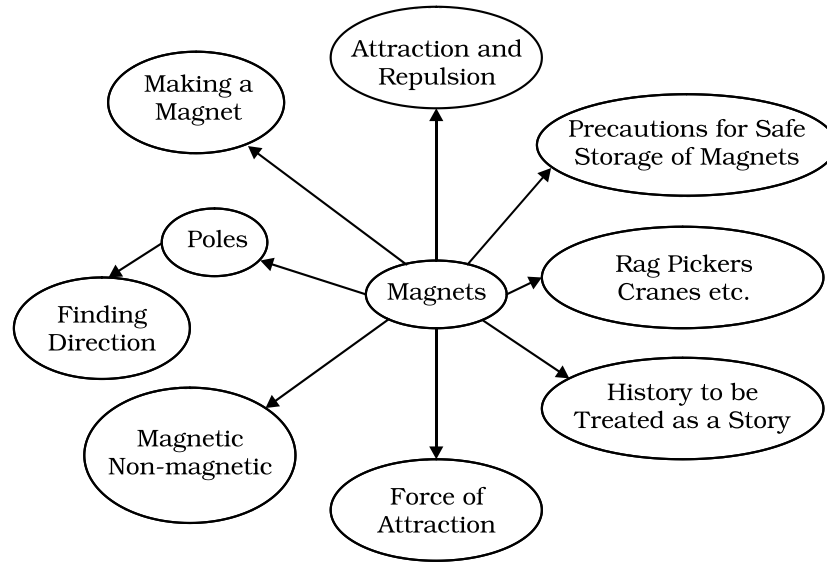
Magnets from ancient times have been used to find direction. A compass is a simple device used for this purpose. The textbook gives one way of making a magnetic compass. Encourage your students to be creative and make different types of compasses. You may also ask your students to find out directions at various points in the school using compass.

As we said earlier, magnets fascinate students and the best way to give them opportunities to explore forces of attraction and repulsion are through play. One such game is given in the textbook; you may also evolve some of your own.

Summary

This can actually be drawn by the students as exercise in different ways.

Understand the Linkage



Assignments

- Identify two objects in your house where you can stick a magnetic sticker.
- Identify magnetic and non-magnetic objects in your house and prepare a list.
- Find where magnets are being used in your house and surrounding.
- Find out types of magnets (shape, size and kind) you come across in different gadgets e.g., loudspeaker, TV, radio, telephone, electric bell, door holder, refrigerator, almirah etc.
- Collect information on magnetic therapy (magnets are used in the treatment of some magneto therapy).
- Find out if earth shows any magnetic behaviour as it is said, earth behaves like a huge magnet. (Search encyclopaedias and internet sites for the required information).
- Imagine and write your views on quality of life without electricity.

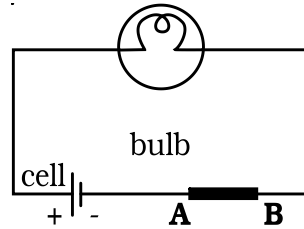
Evaluation

1. Fill in the blanks:
 - (i) Electric cell converts _____ energy into _____ energy.
 - (ii) An electric bulb converts _____ into _____ energy.
 - (iii) An electric _____ is a _____ path in which current flows.
 - (iv) A device used to put circuit on/off is called _____.
 - (v) Materials that allow the electric current to flow through them are called _____.
 - (vi) Electric current flows only in a close circuit from _____ terminal to _____.
 - (vii) In a torch _____ energy of cells is used to produce light.
 - (viii) A freely suspended magnet always points in the _____ direction.
 - (ix) Unlike poles of a magnet _____ each other.
 - (x) Materials attracted by a magnet are called _____.
 - (xi) There is no magnetism at _____ of a bar magnet.

- (xii) A magnetic compass is used for finding _____ .
- (xiii) When a magnet is broken, then each broken piece is a _____.
- (xiv) The poles of a bar magnet are located at _____ .

2. Short answer type questions:

- (i) Look at the following circuit, point out what type of material AB is if the bulb glows?
- (ii) Name two sources of electrical energy other than electrical cell.
- (iii) Give suggestions to reduce misuse of electricity.
- (iv) Explain why an electrical appliance stops working when switch is put off.
- (v) In an electric circuit, when glowing bulb gets fused, the circuit becomes an open circuit. Explain how?
- (vi) Name electrical appliances where electricity is used for heating, cooling, listening to music.
- (vii) If you bring a magnet near the following devices which device may not be affected and why?
 - (a) audio tape
 - (b) video tape
 - (c) floppy
 - (d) CD.



3. Match the items in columns A and B:

Column A	Column B
Bulb	Insulator
Cell	Switch
Key	Filament
Connecting wire	Source of energy
Plastic scale	Conductor
Poles	A device that attracts iron
Magnetite	Materials not attracted by a magnet
Magnet	ends of magnet
Non-magnetic materials	Natural magnet

4. Write true or false:

- (i) Electric current does not flow through glass.
- (ii) Thread can be used in place of metallic wire to make an electrical circuit.

- (iii) There is a similarity between a Cell and a Battery.
 - (iv) We can make open and closed circuit by putting the key off and on.
 - (v) Two terminals of an electric cell should not be connected together directly.
 - (vi) Materials that are attracted towards magnet are called non-magnetic.
 - (vii) A freely suspended bar magnet always aligns in East-West directions.
5. Skills and application-based questions:
- (i) Describe do's and don't with electricity.
 - (ii) Why are electrical wires made of metal? Why are they not made of glass?
 - (iii) Why electric wires have plastic covers on them?
 - (iv) Teacher may draw wrong electric circuit diagram and ask students to point out the mistake and make the circuit diagram correct.
 - (v) Suggest means of conservation of electricity.

Supplementary Resource Material

1. How it Works, Children's Book Trust, New Delhi.
A series which introduces and explains to the child, the working of things he is familiar with. Scientific principles are explained with simple diagrams enriched with anecdotes and cartoons. Roy, Navkala. The Aeroplane, The Railway Train, The Motor Car, The Ship, The Telephone and The Television. Hallen, Rakesh Mohan. The Computer. Raghavan, Neeraja. I Wonder How and I Wonder Why.
2. Ali, Mir Najabat. Inventions that Changed the World: Part I and II. National Book Trust, New Delhi.
3. Discovery Channel. School CDs (Physical Science, Grade-VI-XII).
 - Electricity (Teacher Guide, Theatre, Library, Laboratory, Studio, Simulations).
 - Magnetism (Teacher Guide, Theatre, Library, Laboratory, Studio, Simulations).
4. Encyclopaedia Britannica – 2007: Ultimate Reference Suite, Articles on: The Study of Electricity and Magnetism, Emergence of Modern Sciences of Electricity and Magnetism, Early Observation and Application and Many Interesting Related Articles (Electricity and Magnetism), Magnets and Related Aspects of Magnets.

Britannica Student Library – 2007: Articles Images, Video on Measurements from Electricity, History, Battery and Fuel Cells, Magnetic Fields, Magnets and Magnetism, Magnetism and Electricity, Earth as a Magnet.

5. Microsoft Encarta – 2007: Reference Library: Articles on Magnetism, Magnetite, Magnetic Field, Earth's Magnetic Field, Magneto Therapy and Many Related Links.

Microsoft Children Encarta – 2007: Articles on Electricity on the Move, Conductor, Resistance, Electric Charge, Electricity created for Use in Home. How does Electricity get to our Home, Pollution Relation Points, Window of History (Did you Know? Multimedia, Web Selection, Dictionary).

Websites

- <http://www.google.co.in/search/?-electricity+current+cell>
- http://en.wikipedia.org/wiki/Galvanic_cell
- <http://www.scienceteacherprogramme.org/physical/collier>
(how does an electric charge move)?
- <http://www.wikipedia.com>.
(Free online and encyclopedia-battery, electricity)
- <http://www.electricmuseum.com>
- <http://www.tpt.org/Newton/12/electric/htm> (web link to electricity)
- <http://pbs.org/wgbh/amex/edison>
(An interesting account of Edison's miracle of light)
- <http://www.school-for-champions.com/science/magnetism.htm>
- <http://canadaonline.about.com/od/magnets/magnets-lesson-plans>.

6

CHAPTER

NATURAL PHENOMENA

What is light? How do you see things? You have seen your shadow. How is your shadow formed? What are shadows?

What causes rains? Where from the clouds bring water? Can you drink rainwater? What, if it doesn't rain for long?



An Overview

Children are basically curious about natural phenomena occurring around them. Under this theme of Natural Phenomena in Class VI, children shall explore rain and light. We should encourage them to explore these phenomena; experiment with them, organise their experiences, express them, articulate their questions and look for their answers. Such explorations can be taken in the class or at home. Rain, thunder and lightening are wonderful experiences in everyone's life. Moments of such phenomena are pleasant to watch and they also inspire awe for nature. Nature has more deep-rooted reasons than its artistry for such phenomena. We shall see what it means to the whole living world and the environment (beyond the pleasant dance of a peacock in a rainy season!). Let children learn how it rains, what is lightening and what causes thunder.

Light

Light is a miraculous entity. Spectacular is life with light. Simply fantastic are the myriad of phenomena it shows! Light makes things visible, light travels in straight line, it causes shadows, eclipses and forms images. It is reflected, it is absorbed wholly or partially and it also produces amusing colour patterns. Phenomenon of light is closely linked to living experiences. What makes us see things? What are the sources that give light? Are there strong and weak sources? Children have many questions and observations. We need to make children articulate their experiences and explore them besides the questions in the textbook.

The chapter starts with a discussion about what makes things visible or would they be able to see things in dark? You should facilitate this discussion and you may ask questions like how do we see? A question like what makes things visible would probably help you to know what the children already know and expose you to some of the alternative frameworks of the students. We need not label their responses as right or wrong but allow the flow of responses without putting the filter of correctness. They can suggest ways of verifying their views and what the other person is saying. The following section is about shadows.

How are Shadows Formed?

Shadows are observed by children all the time. Sometimes shadows scare them and sometimes they are their playful partners. What is it that causes the formation of shadows? Students may have themselves observed that a light source is essential for the formation of the shadows or you may lead students to make this observation. An activity in their book asks students to hold different objects in the sun and then see their images. An opaque object is another requisite for the shadows to be formed. Another essential requirement is the need of a surface on which the shadow will be formed. A shadow results due to an obstruction placed in the path of light causing its absence on the part of the surface. You may also do some other activities to show the necessity of these three things, namely, source of light, opaque object and a surface.

Ask your students to vary the distance between the object and the surface where the shadow is being formed and note the difference.

What is the difference between the shadows of a bangle, disc and a ball?

You may ask your students to observe their shadows at different times of a day. You may ask them to fix a place where a child would stand and a friend would make a sketch of his shadow. This can be repeated at different times of the day. You may then talk about how the direction of the source of light decides, how and where the shadow is formed. The students may be asked to

repeat similar activity with a torch at their homes. Here they would be able to vary the position of the source light, distance between source, object and the surface on which the shadow is being formed and the angle at which the light is falling on the object.

The shadow cast by sun changes with time. This was used in earlier times to find time.

Thus, an opaque object which obstructs the path of light casts shadow. Similarly we can define transparent and translucent objects. You can raise an interesting question here. Ask your students to hold a transparent object, say a glass sheet in the sun; is there any shadow at all? You would draw the attention of your students to the fact that since absolute transparent object is something one would not find in the real world, partially dark patch that you observe on the surface is due to the small amounts of light obstructed by the glass.

Shadows and Reflections

Like shadows, children also observe reflection of light from mirrors, water surfaces, polished metal sheets and new utensils etc. They also observe their images formed in them and similarly images of many other things in them. This you can use to make your students look for the difference in a shadow and image and/or reflection of light evident to them. They may wonder why is this difference. You may ask your students to compare their shadows on the floor caused by sunlight to their image formed by the mirror and then encourage them to look for the answer of this difference. They now know how a shadow is formed and on what factors it depends. At this age, it is not expected that they would be able to understand how an image is formed by reflection. But, an intuitive understanding of the fact that all smooth and shiny surfaces reflect light and form images would be enough for them. A question which some students may ask pertains to glasses where one is able to see through it and also, sometimes see an image in it (especially when there is some dark surface behind it). Well children should explore it. There are no absolutely transparent surface and none which reflects light completely.

Now, you should encourage your students to make a pinhole camera of their own, may be in groups. Ask them to observe various things, like an electric bulb, a tube light, candle light, a scene in bright sunlight etc. Why is the image in a pinhole camera inverted or upside down? The observation of these images would definitely be an exciting thing for them. The textbook asks them to adjust the camera and the screen at various distances and then observe what difference does this make? Whether this affects clarity of the image formed?

Well, we leave it for your exploration. You may want to discover it in the class with your students. Or, you may find it better to do such experiment beforehand and raise some questions to yourself.

It will be a good idea to decorate your classroom and laboratory with diagrams/charts/photos depicting a pinhole camera and how image is formed in it. This gives a good feeling to the classroom and laboratory environment and are also handy to understand/explain the phenomena. Similarly, photos taken from a pinhole camera may also be placed on the walls. Even students can be involved to prepare such a material as their project work. It can also be purchased from the market or taken from encyclopaedia/photo libraries and internet.

Light Travels in a Straight Line!

A common observation would be while you are talking to a friend across the road and a bus or car happens to pass in between, you do not see each other till that bus or car is there in between you and your friend. This observation along with many others which

Light travels in a straight line! How do we know this? Can we see light travelling? Is it visible?

your students may come across in their day-to-day living like seeing a thing through a straight pipe or a bent tube may be used to demonstrate the fact that light travels in a straight line. Once your students have internalised the concept that light travels in a straight line, you can connect the concept to the formation of shadows and also to the formation of Umbra and Penumbra in the shadows.

This sub-theme of light tries to, and should be dealt in a manner that provides students opportunities of guided exploration in understanding the everyday observation of shadows and images

and how they are related with straight line propagation of light and reflection.

How about making your students curious to discover how light could be used in ancient times to communicate messages?

Water

Water is a sub-theme in natural phenomena (Chapter 14 of the textbook).

Start with questions related to daily activities. When you wash your clothes they are wet. You put them in open to dry. When you paint with water colours on paper, house walls, it is wet but later it dries. You might have also observed small lakes and ponds and other water bodies drying in summer. Why? What do they observe when they throw a few drops of water on

Why is the water on the iron railing in winters? Where from the water comes on the inner surface of any utensil containing hot food?

a hot tawa which has just been used to make chapattis? These are all daily life experiences where we see the process of evaporation, in some cases it is fast and is clearly visible and in some cases it is very slow. You notice it only after sometime when substantial change has taken place.

You may have to deal with certain activities carefully. You have a glass containing cold water and after some time you see some droplets of water on the outer surface of the glass. Contrast it with a glass containing water at normal temperature. Children may sometimes wonder from where this water has appeared on the cold glass. Children may come up with a number of answers.

Do not discourage them from exploring possibilities. When you tell them it is the water vapour, present in the air which is condensed, it may seem untrue to some of your students. You may here take various other examples of water drops appearing on cold surfaces e.g., seat of your scooter or motorbike in a cold night in winter or dew drops forming on many bodies in cold. Repeat the experiment so that they see the water droplets on surfaces which are not in touch with water anywhere then they would be able to understand the fact that it is the water present in the air which condenses on the cold surfaces.

When we talk of evaporation from different water bodies and from a pan on the gas stove, they are two very different things for a child to understand. In one the source of heat is evident and in the other it is not. The idea of sun providing the requisite heat to water for evaporation would need special attention. How about the evaporation from a cloth lying inside the house? Is it sun's heat? If so, how?

Sometimes it is not a bad idea to raise a question in the class for which we are sure the students at that age have no answer, but it may be very interesting, it may stay with them and encourage them to seek an answer. The Mpemba effect is one such area.

Is it possible to freeze hot water before cold water? If your students know about changing state of water to another then the answer should be no. You must tell them about the following and leave it there.

The effect is named after the Tanzanian high-school student Erasto B. Mpemba. Mpemba first encountered the phenomenon in 1963 while freezing hot ice cream mix in cookery classes where he noticed that hot mixes froze before the cold mixes. Many years later his headmaster invited Dr Denis G. Osborne from the University College in Dar-E-Salaam to give a lecture. After the lecture, Erasto Mpemba asked him the question "If you take two similar containers with equal volumes of water, one at 35°C and the other at 100°C, and put them into a refrigerator, the one that started at 100°C freezes first. "Why?" This was only ridiculed by his classmates. After initial consternation, Dr Osborne confirmed Erasto's finding and they published the results together in 1969.

A story like this may also excite students in the spirit of discovery. All of us and definitely the children have a hidden Mpemba inside. But, we do not allow ourselves to struggle with explorations and ideas. It is important to trust ones own observation and look for its reasons.

Formation of cloud is an area which most students find difficult to understand at this age. They may understand condensation and take the idea that as we go higher from the surface of the earth, it gets cooler. Hot air moves up and as it goes up, it gets cooler.

At sufficient height the air becomes so cool that its water vapour condenses to form small droplets of water. But how is that these

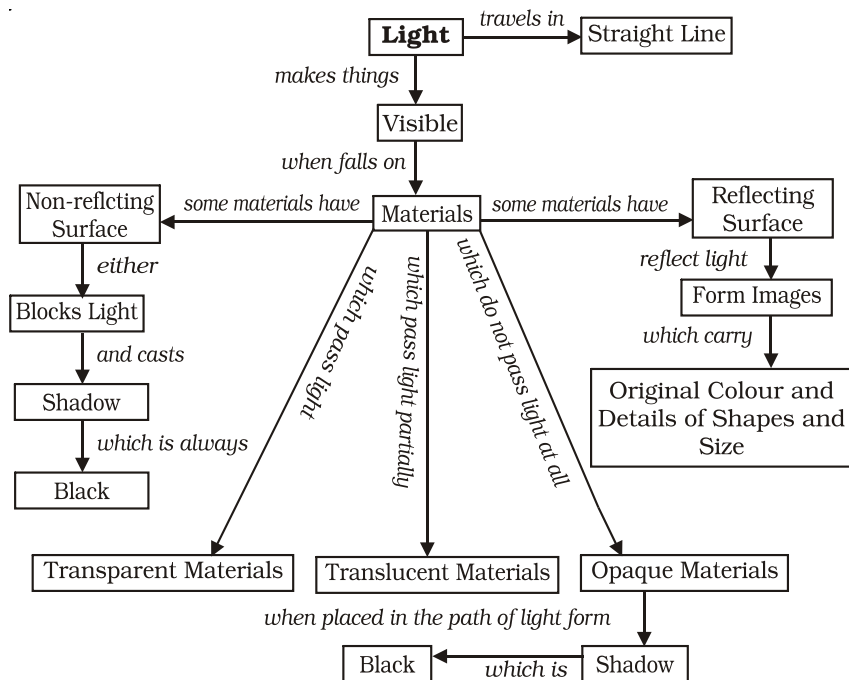
water droplets do not fall down immediately? We need to make the students understand that the droplets, which are formed are really tiny and they remain suspended in the air. Several tiny droplets then combine to form bigger drops.

The drops which fall in rain are much larger as they are formed by fusion of many small droplets.

Summary

Let the students create concept map/summary of their learning through this chapter as an exercise.

It will be a good thing to place some charts and eye-catching photographs in the laboratory and classroom of natural phenomena like rain and lightening along with posters explaining the cycle how clouds are formed, how rains fall and how lightening take place. This can be given to students as project work and it can also be arranged from the market or from internet sites/encyclopaedia.



Assignments

- Identify materials found in your house as transparent, translucent and opaque and prepare a list accordingly.
- Enlist reflecting and non-reflecting materials found in your house.
- Compare the sizes of the shadows of object placed at different distances from the candle.
- Comment on the size of the shadow of a tree in your school/surroundings in morning, evening and at noon. Try to find out the reason.
- Investigate the shadow of an object smaller in size than the source of light. Identify regions of different light intensities. Try to find out the reasons for this variation of light intensity in shadow and around it.

Evaluation

1. Fill in the blanks:
 - (i) The colour of the shadow is always_____.
 - (ii) Shadows are formed only when an _____material acts as obstacle in the path of light.
 - (iii) Moon is visible to us due to _____of sun light.
 - (iv) Wood is an_____material.
 - (v) Window glass pane is a _____material.
 - (vi) A tracing paper is a_____material.
2. Write true or false:
 - (i) Images are also known as shadows.
 - (ii) Shadows are formed when opaque materials come in the path of light.
 - (iii) Skin is an opaque material.
 - (iv) When an orange beam of light falls on a black object, its shadow turns orange.
 - (v) Shadows are formed only in the presence of light.
3. Choose the correct statement from the following:
 - (i) The shape of a shadow depends on
 - (a) the shape of the object

- (b) the rotation of the object
 - (c) the position of the source of light
 - (d) all of them []
 - (ii) Light is
 - (a) visible and also makes other objects visible on which it falls.
 - (b) invisible but visible when it falls on an object.
 - (c) invisible but makes objects visible on which it falls.
 - (d) sometime visible and sometime invisible. []
 - (iii) Objects through which we can see but not very clearly
 - (a) Transparent (c) Opaque
 - (b) Translucent (d) None of the above []
 - (iv) Objects that cast shadow are called
 - (a) Transparent (c) Opaque
 - (b) Translucent (d) None of the above []
4. Skills and application based-questions:
- (i) What is the process by which wet clothes dry up? Give three examples from your surroundings where you see this process.
 - (ii) A balloon which is filled with hydrogen gas always goes up whereas the one filled by us (by blowing air in it) does not. Can you think of a reason for this?
 - (iii) Which type of surface do you use to see your image?
 - (iv) Is your image affected by the colour of light?
 - (v) Why is the shadow of any object always black?
 - (vi) What is the difference between a glass plate and a mirror?
 - (vii) Why are objects in a classroom visible even when no direct sunlight enters it?
 - (viii) What makes images different from shadows.
 - (ix) Will you be able to see your image in a mirror in dark room?
 - (x) Have you noticed more than one shadow of cricket player on your TV screen? If yes, explain why?

Supplementary Resource Material

1. Murti, R.K. The World of Shadows. National Book Trust, New Delhi.
2. Discovery Channel. School-CD ROMs, Physical Science, Grade VI-XII.

- Weather and Climate – Interactive CD ROM, Enriched with Theatre, Library, Graphics and Other Visual Aids and Teacher Guide.
 - Light-CD ROMs containing Laboratory, Library and Studio Section and Teacher Guide.
3. Encyclopaedias: Very Useful, Interesting and Enriching Articles on Clouds, Rain, Water Cycle, Lightening, Thunder and Light can be studied from the Following Encyclopaedias.
- (i) Britannica – 2007: Ultimate Reference Suite:
 - Encyclopaedia Britannica Library;
 - Britannica Student Library.
 - (ii) Microsoft Encarta-2007:
 - Microsoft Encarta Reference Library-2007;
 - Children's Encarta-2007.
 - (iii) Simon and Schuster Millennium Encyclopaedia.

Websites

- <http://www.school.discovery.com/lessonplans>
- <http://www.firstschool.ws/activities/science/drippy.htm>
- <http://www.reachoutmichigan.org/funexperiments/agesubject/middleschool.html>
- <http://www.reachoutmichigan.org/funexperiments/agesubject/lessons/newton/lightning.html>
- http://www.viterbi.usc.edu/news/news/2004/2004_08_02_light.htm
- [http://www.School.discovery.com/lessonplans/physci.html#6-8\(Sight-Light\)](http://www.School.discovery.com/lessonplans/physci.html#6-8(Sight-Light))
- <http://www.proteacher.com/110017.shtml>
- <http://www.school-for-champions.com/science/light.htm>
- <http://www.iit.edu/~smile/ph9707.html>

7

CHAPTER

NATURAL RESOURCES

- What do we mean by resources?
- What are natural resources?
- Where do we get our food from?
- Would we survive if there is no usable water on earth?
- What happens if there is no fresh air?



An Overview

By resources we mean everything and anything which is required by us for some use or to do some work. All those resources (things) which are available to us naturally are called natural resources. This is a simple definition and our students would be able to appreciate it easily. The supply of most of the resources is finite and their indiscriminate use is causing their depletion and degeneration. The theme, therefore, should be seen as an attempt to sensitise children to this issue as well as make them understand the variety and types of natural resources. You should ask children to explore the idea of natural resources. They can really come up with a big list and then ask them to examine which of the resources are living and which are non-living. You could also ask them to identify those resources which can be regenerated and those which cannot be regenerated or those which exhaust as they are used. You could ask children to work in groups and make a presentation on resources and how they can be categorised in different ways.

In the process of its utilisation, men often misuse resources and also affect nature adversely. This was a neglected aspect earlier but it is now realised that these resources are not unlimited and they should be used judiciously. This has raised the issue of conservation of these resources.

Most human involvements generate some waste, and if these wastes are not handled properly, they pollute our resources and the most important of the resources, air and water are most susceptible to pollution caused by mismanagement of waste/garbage.

In this theme of natural resources, we shall deal with the following sub-themes:

1. Importance of water;
2. Importance of air; and
3. Generation and management of waste.

Importance of Water

The teacher may initiate a dialogue with the students about the most abundant and useful resource available to us i.e., water. A list of various uses of water can be made through the classroom discussion.

Uses of Water:

- Drinking, cooking, washing, bathing;
- Agriculture-irrigation; and
- Industrial.

As we discuss the uses of water, we realise that it is all pervading throughout our life. You may also talk about some special properties of water e.g., it is a very good solvent. Salt and sugar are two common examples. It can dissolve a variety of substances in it. It is also a renewable natural resource which is recycled naturally through the phenomenon of water cycle.

Is it possible to germinate a seed and grow plants/ crops, vegetables and fruits without water? Can animals or humans live without water? What happens to the crops of wheat or rice when there is no rain? What happens if we don't get water for long? The big question is, can we survive without water?

Sources of Water

You may ask students to list the various sources from where they get water in their daily life. This list may then be divided into two categories:

1. In which water is available on the surface of the earth like lakes, ponds, dams, rivers (called surface sources).
2. In which water comes from sources like wells, tube wells, hand pumps and springs (called underground sources).

Water Cycle and the Rain

Children are aware of scarcity of water. They think that the amount of water in earth is diminishing. This needs to be explained to them. During the day time, heat of the sun makes water evaporate from oceans, lakes, rivers, ponds and other water bodies. Plants also lose significant amount of water mainly from

Oceans have lots of water, but can we drink it? Sea water is not drinkable, because it is too salty. In some countries, it is purified and then used for drinking. Get information about such countries and purification plants.

leaves through transpiration. This water goes into the air in the form of vapour. This vapour rises up in the air and forms clouds. The clouds float to a cooler place in the atmosphere, where it condenses to form tiny drops of water. Many such tiny drops merge together to form big drops. When air is unable to hold them, they fall down on the earth as rain (or under still cold conditions as snow). Questions like the following may be raised to facilitate the discussion:

1. Is there any lake or river in your village which dries up in summer?
2. Where do you think the water goes?
3. What is necessary for evaporation in open places?
4. Do you think the process of evaporation take place in big water bodies like sea also?
5. Does evaporation also take place from the covered water pots in the kitchen?
6. Where according to you does the water vapour goes?
7. What are clouds?

Rains Refill our Water Sources

Students prepare a report or visual chart on the theme: 'Rains Refill our Sources of Water' based on media and living experiences.

What happens if it does not rain for long (Drought)?

Students know about droughts in various regions of the world and our country from newspaper, magazines, TV and at times from their personal experiences also. It is the condition of absence of rains for long, which causes scarcity of water. You may ask

students to mention effects of drought.

- Drought causes plants to dry and finally die.
- Animals die due to non-availability of their food and water.
- Food crops, grains, vegetables, fruits etc., do not grow.
- Surface sources of water go dry.
- Level of underground water falls.
- There is scarcity of water for drinking and other essential uses.
- People face a great hardship in the drought-affected area.

A related story that you may use with your students is "Waiting for the Rain" written by Kamakshi Balasubramaniam, published by National Book Trust, New Delhi.

What preparations should we make in advance to avoid hardship due to drought? How can we help in managing drought and the people affected by it?

Water Conservation

Shortage of clean and usable water as compared to its need is water crisis. It requires management of water resources and water conservation to meet the crisis.

- Use water judiciously. Close the taps if not required.
- Stop wasteful flow of water wherever you notice.
- Do not pollute sources of water.
- Harvest rain water.

You may ask your students to make posters spreading awareness about water conservation.

You can raise a question with your students about the effects of digging tubewells i.e., on source management. Is rain water harvesting a solution?

What Happens if it Rains Excessively (Flood)?

Rain is very essential to maintain availability of water, but excessive rains create many problems too. Students are aware of floods in various parts of the country from their experience and media. Group discussions on this topic may be encouraged.

- Roads are blocked, traffic is disrupted and rail and air traffic is also affected.

- Water is blocked in pits and drains. This causes many diseases.
- Heavy rains may lead to high rise in water level of lakes, rivers and dams and overflow of water from these sources consequently, leads to flood which may submerge large surface areas causing damage to crops, death of animals and human beings, soil erosion, loss of plants' and animals' habitats, food stocks, damage to houses, machinery, industry, goods and diseases due to the mixing of flood water with the waste material, sewage etc.

Water Pollution

Activities, which use water, influence both its usable quantity and quality. Influence of human activity on water resource was limited earlier but now this has become a major environmental concern throughout the world. Water gets contaminated/polluted when it comes in contact with human, agricultural and industrial waste. Water flowing over the surface of earth comes in contact with human/animal excreta, insecticides and pesticides of agricultural fields and other wastes, etc., which are the major causes of its pollution.

The classroom should be a place for discussion on issues related to pollution. What are the water sources available around the school and home, and in what ways are they getting polluted?

What is the colour of water of that water body? What are the kinds of things or waste thrown in the water body? What is our role in controlling water pollution?

From the window of history

All the ancient civilisations developed near river valleys e.g., Indus valley, Mesopotamia, Harappan etc. This is also true about medieval townships and the modern developments which are also related directly or indirectly with availability/source of water. Before the age of aeroplanes, most of the intercontinental transport was over the water surface. Boats were used for human and goods transport from one place to another. Civilisations flourished and perished because of water. One comes across many instances of severe droughts and floods, which have changed geographical scenario of human civilisations.

Importance of Air

Necessity of Air for Life

Air, like food and water is another basic necessity of life. In fact, we cannot live without it more than a few minutes.

Air is all around us. We can feel it when air blows. We can feel it on our body, tree leaves and our clothes and most importantly in breathing. It is also required in other activities like burning, drying clothes, moving wind mills, sailing boats etc.

Air is a mixture of many gases, which, in one way or the other, play vital role in sustaining life on earth.

Oxygen helps in respiration and burning, carbon dioxide is required for photosynthesis in plants and nitrogen helps in growth of plants. Most human activities have a negative impact on the quality of air we breathe. We can no longer assume that good quality fresh air is an endless resource.

The present sub-theme deals with importance of air for living organisms.

Students have heard about deaths due to drowning of human beings in rivers, ponds, lakes etc. You may pose the questions: Why do people die in water? Why animals die in floods? Why do earthworms come out of soil in rainy season?

All organisms need air to breathe which is very essential for life. They die inside water in the absence of air for breathing.

Composition of Air

At this stage, it is also important to let the students recognise other functions of air in which gases other than oxygen take part. For

Most people take for granted the ability to breathe. We breathe automatically 1000 times a day, awake or asleep. A healthy person breathes 22,000 times a day i.e., approx. 900 times per hour and takes in about 16kg of air every hour.

Some questions to ponder on:
Why does a mountaineer carry oxygen cylinder?
Why do divers wear oxygen masks when they dive inside water?
Why do astronauts carry oxygen masks while moving in space?
Can an insect, a fly, an ant or a cockroach survive for long in a closed bottle?
Can we hold our breath for a long time?
Why do we feel uneasy in a poorly ventilated room?

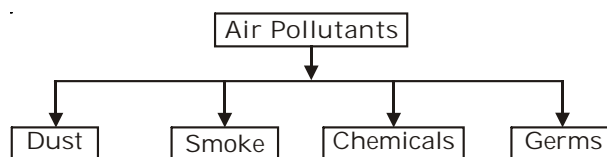
example, plants take in carbon dioxide and give out oxygen. Plants also need nitrogen for growth. It is, therefore, essential that air also supply these necessary ingredients for the living world. Air contains a mixture of such gases. Nature is great! To understand the constitution of air, several activities have been suggested in the textbook. As the child goes through these activities and recognise the presence of various gases in the air, a discussion about mixture and how air is a mixture can also be taken up.

Pollution of Air

Students would be able to recollect certain experiences when they felt suffocated in a crowded place or on the roadside, had burning sensation in eyes, suffered or saw somebody suffering from breathing difficulty. It is caused by various human and industrial activities which use constituent gases of air and inject harmful components into it.

A discussion about what was common in all the situations where they experience such uneasiness would help them understand the concept of air pollution and the common pollutants. Burning of leaves, smoke and particulate matter adds harmful components in the air, thereby degrading its quality and causing difficulty in breathing.

Understanding a problem is a first step and after this one should (and even our students should) think about what needs to be done to prevent air pollution and in what ways could they do that. You may have group discussions on the theme "what all I need to do to reduce air pollution".



While dealing with this sub-theme, let us aim at developing attitudes in the students to:

- create a socio-scientific awareness regarding optimum utilisation of natural resources;

- prefer use of biodegradable materials;
- minimise waste and recycle them;
- utilise waste materials to make art objects thus reuse/reduce the waste.

Waste Generation

You may start the discussion of waste material with a simple activity where all the students are asked to prepare a record of the material that they threw in the dustbin or saw others discarding those things. This should be done for discarded things in the class, at home, and if possible, on the road.

You may ask your students to make a list of the waste generated and the nature of the waste. Some examples could be:

- House: Vegetable and fruit peels, groundnut and dry fruits shell, polythene, disposable utensils, leftover food, used tea leaves etc.
- Schools: Paper, aluminium foil, wrappers, polythene, used paper etc.

Ask your students to observe the following points in the process of controlling pollution:

Do not use vehicle for short distances. Go walking.

Look after the trees in your neighbourhood.

Do not burn tree leaves; put them in a compost pit.

Teachers should explain the process of energy production, otherwise students will not be able to connect switching off lights with air pollution.

Reduce the use of aerosols in the household.

Whenever possible use your bicycle in place of an automobile.

Did you notice some other waste material being generated which is not thrown in the dustbin? Give examples.

Is it possible that this waste material can be classified into some categories? You would let the students decide what criterion they use for this classification. It can be based on the process due to which waste is produced or the type of waste or anything else that the students may think of. You may here add how different kind of waste is treated by nature itself. Some of it like fruits and vegetable peels rot with foul smell i.e., breaks down by bacterial activity, and finally mix with soil while some do not rot or decompose and remain there on the soil for a long period e.g., plastic, ceramics, thermocol. They have to be removed away.

Looking at the amount of waste being generated some viable solution has to be found out in addition to the natural processes. Landfill is one such process.

How is Polythene Different from Vegetable Peel?

In some places the civic administration and environmentalists have asked people to give their household waste in different packets based on whether they are biodegradable or non-biodegradable. Please note that the textbook has not used these terms, but talk about the distinction between the two. Organise an activity asking students to separate the two kinds of waste before throwing it.

Cloth fibres are being manufactured in Germany, USA and India from waste packaging material and plastic water bottles.

In order to help the students understand the difference between biodegradable and non-biodegradable wastes, you can ask students to bury different kinds of waste material under the ground and then open it up every month to see the progress. It is an important activity as it also demonstrates that sometimes you need to wait for months to see the effect of natural processes and even then you may not be able to say something concretely at times. Not the whole class may be interested in such a long-term activity so you should try and get some students who are prepared to take monthly observation.

Ask the children to think of ways of dealing with waste?

A better way of dealing with biodegradable waste is vermi-composting. The book has given the process of making it and we recommend that this activity be done in the school. You can also choose a site outside for this purpose if there is not sufficient space in the school.

Best out of Waste

The textbook explains about various useful things being created out of waste material. It would be good if in the class you can give some hands-on-experience

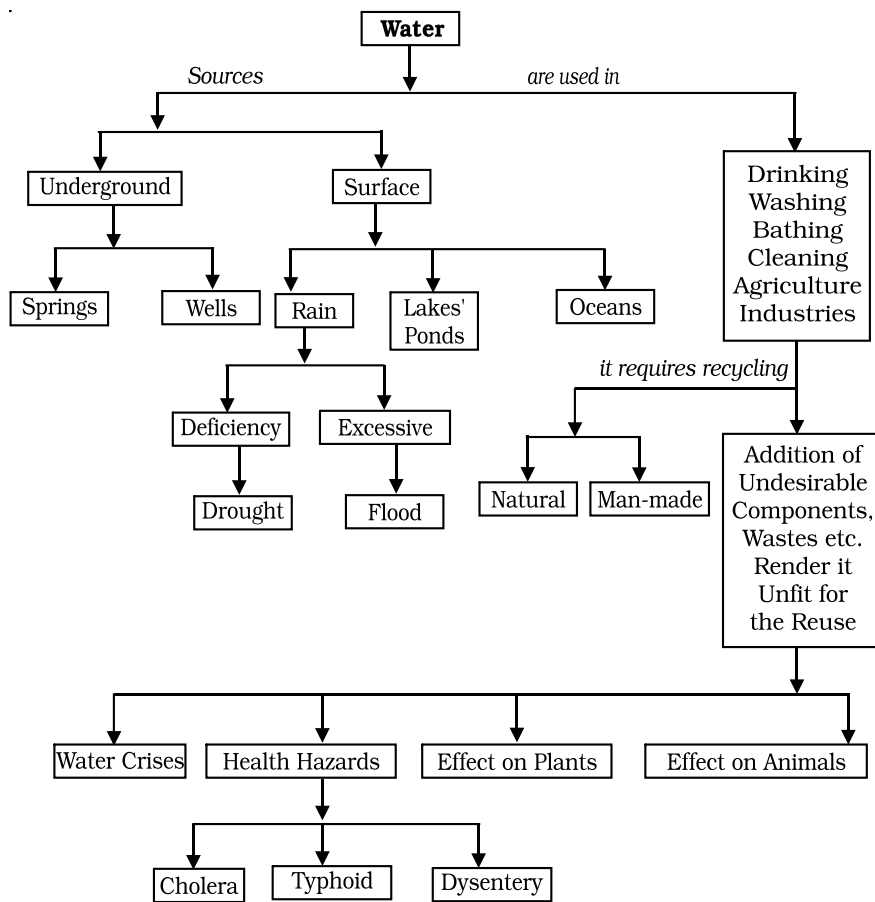
The best example of creativity in handling waste is Rock Garden of Chandigarh! You must read the books "Kabaad se Jugaad" and "Dump se Pump" by Arvind Gupta published by National Book Trust, New Delhi.

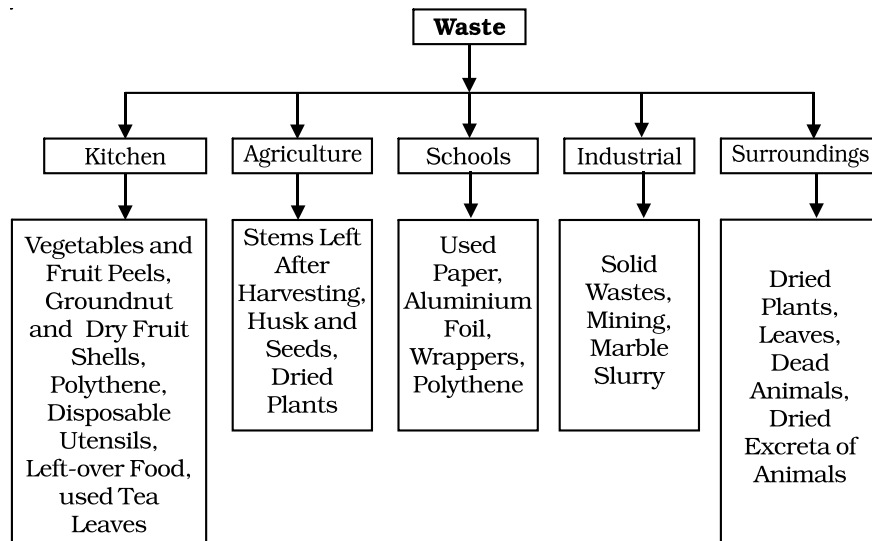
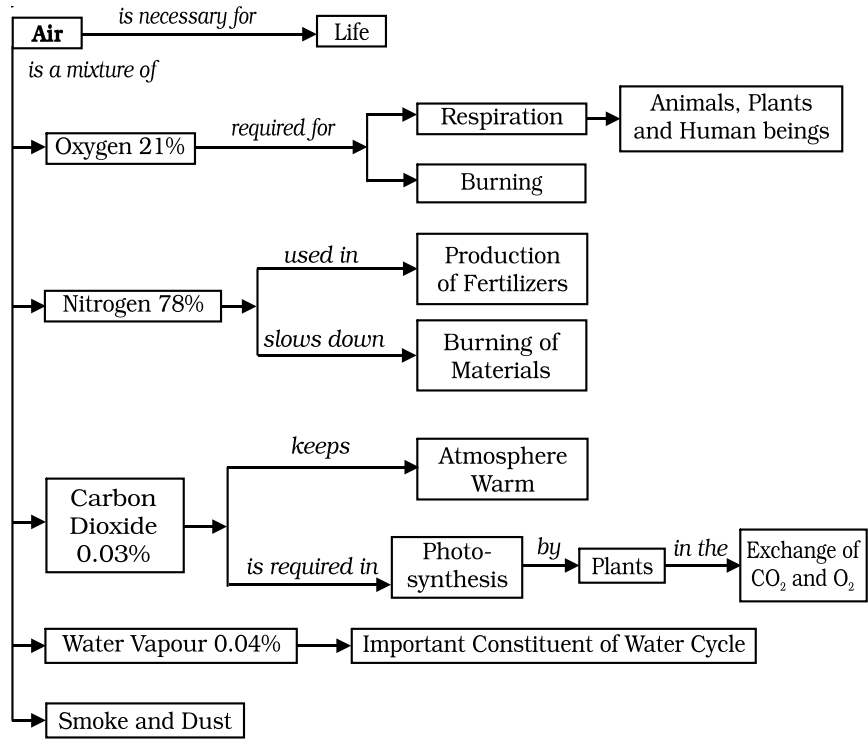
to the students. When they make something useful out of the waste, they would really feel happy and realise it is a good way of disposing and reusing the waste material.

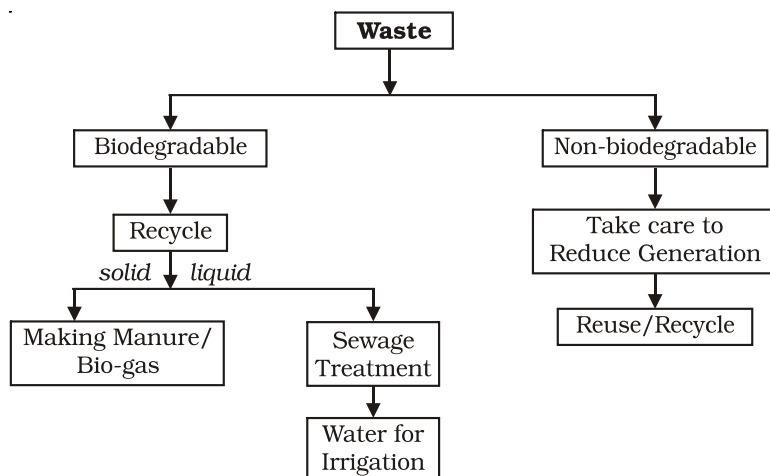
Summary

This can actually be prepared as an exercise for students in different ways.

Teacher may ask students to estimate how much waste is accumulated by a house/village/colony etc., over a day, month and a year.







Assignments

- Estimate how much water is used per day in your family for various activities. Is sufficient water available? Is there any gap between its requirement and availability?
- Find out how much of the earth's surface is covered with water?
- What fraction of the total water on earth is useful for drinking purpose?
- Show distribution of water in different regions of the earth. Is this uniform?
- Estimate the amount of waste generated in your family.
- Suggest means to reuse/recycle various wastes in your house.
- Use the waste material to prepare some art/useful thing.

Organise poster campaign to:

- conserve water in your daily activity.
- point out causes and effects of water pollution.
- promote harvesting of rain water.
- prevent wastage of water.
- draw attention to various factors contributing to air pollution.
- prevent air pollution.
- plant more trees.

Evaluation

1. Write true or false:

- (i) Purest form of Natural water is rain water.
- (ii) Excessive rainfall leads to drought.
- (iii) Water is universal solvent.
- (iv) Floods improve the economy of a country.
- (v) Evaporation and condensation together forms rain.
- (vi) Plastic degrades in four months.
- (vii) Rubber and paper can be recycled.
- (viii) Cow dung can be recycled to form biogas and compost.
- (ix) By reusing and recycling we can help in cleaning the environment.
- (x) Dry leaves, twigs, dead plant parts should be burned.

2. Fill in the blanks:

- (i) _____ per cent of our body weight is water.
- (ii) Surface water sources are_____.
- (iii) Deficiency of water causes_____.
- (iv) Water vapour rises up in the sky due to sun's heat is called as_____.
- (v) The only substance, which exists in three states of matter, solid, liquid and gas is_____.
- (vi) Rock Garden is an example of _____things.
- (vii) Increase in human population and technology _____ waste.
- (viii) Plastic bag can be substituted by _____bags.
- (ix) Wood takes_____years to decompose.
- (x) Sewage water can be recycled to produce_____.

3. Write your views on:

- (i) How does water affect our climate?
- (ii) What effect do floods and droughts have on the national economy and growth?
- (iii) How does forestation contribute to rains?
- (iv) Classify the local sources of water available in your town.
- (v) How can you contribute in water conservation?

4. Tick the correct answer:
- (i) Vermi composting makes compost from kitchen waste by using:
 - (a) Snakes
 - (b) Roundworms
 - (c) Decomposers
 - (d) Ants
 - (ii) Matter present in the nature is returned to it through:
 - (a) Herbivores
 - (b) Carnivores
 - (c) Decomposers
 - (d) Recycling
 - (iii) Non-biodegradable thing is:
 - (a) Plant
 - (b) Glass pieces
 - (c) Plastic
 - (d) Rubber
 - (iv) Waste can be produced from:
 - (a) Agriculture
 - (b) Kitchen
 - (c) Industries
 - (d) All of them.
7. Short answer questions:
- (i) What type of wastes are produced in your school?
 - (ii) Name two organisms which are decomposers.
 - (iii) What are non-biodegradable things? Give two examples.
 - (iv) Why is recycling considered to be an efficient method of disposing garbage?
8. Skills and application-based questions:
- (i) All the living organisms are continuously using oxygen from the atmosphere, then why does it never stop?
 - (ii) What speciality an earthworm has that only it is used for vermi composting?
 - (iii) What should be the process of waste management of the remains of wheat and rice crops after cutting, so that it does not harm the environment?
 - (iv) What are the ill-effects that we may have to face due to excessive usage of polythene?

Supplementary Resource Material

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2. Berry, Nita. *The Wonder of Water*, Children's Book Trust, New Delhi.
3. Discovery Channel School—CD ROMs on (i) Conservation of Natural Resources; (ii) Water: Friend and Foe. These Interactive CD ROMs contain Interesting Audio Ventures, Simulation, Teacher Guide, Hundreds of Photos and Articles and Explorations Multimedia Presentations and Movie Clips. The CDs are very Informative and Educational.
4. Encyclopaedias: Britannica (Ultimate Reference Suite) and Microsoft Encarta: Articles on Natural Resources, Water, Droughts, Floods, Flood Control and Flood Legends, Air, Air Pollution and Waste.
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