



0854CH01

**P**aheli and Boojho went to their uncle's house during the summer vacation. Their uncle is a farmer. One day they saw some tools like *khurpi*, sickle, shovel, plough, etc., in the field.



I want to know where and how we use these tools.

You have learnt that all living organisms require food. Plants can make their food themselves. Can you recall how green plants synthesise their own food? Animals including humans can not make their own food. So, where do animals get their food from?

But, first of all why do we have to eat food?

You already know that energy from the food is utilised by organisms for carrying out their various body functions, such as digestion, respiration and excretion. We get our food from plants, or animals, or both.



Since we all need food, how can we provide food to a large number of people in our country?

Food has to be produced on a large scale.



In order to provide food for a large population—regular production, proper management and distribution is necessary.

### 1.1 Agricultural Practices

Till 10,000 B.C.E. people were nomadic. They were wandering in groups from place to place in search of food and shelter. They ate raw fruits and vegetables and started hunting animals for food. Later, they could cultivate land and produce rice, wheat and other food crops. Thus, was born 'Agriculture'.

When plants of the same kind are cultivated at one place on a large scale, it is called a **crop**. For example, crop of wheat means that all the plants grown in a field are that of wheat.

You already know that crops are of different types like cereals, vegetables and fruits. These can be classified on the basis of the season in which they grow.

India is a vast country. The climatic conditions like temperature, humidity and rainfall vary from one region to another. Accordingly, there is a rich

variety of crops grown in different parts of the country. Despite this diversity, two broad cropping patterns can be identified. These are:

**(i) Kharif Crops :** The crops which are sown in the rainy season are called kharif crops. The rainy season in India is generally from June to September. Paddy, maize, soyabean, groundnut and cotton are kharif crops.

**(ii) Rabi Crops :** The crops grown in the winter season (October to March) are called rabi crops. Examples of rabi crops are wheat, gram, pea, mustard and linseed.

Besides these, pulses and vegetables are grown during summer at many places.

## 1.2 Basic Practices of Crop Production



Why paddy can not be grown in the winter season?



Paddy requires a lot of water. Therefore, it is grown only in the rainy season.

Cultivation of crops involves several activities undertaken by farmers over a period of time. You may find that these activities are similar to those carried out by a gardener or even by you when you grow ornamental plants in your house. These activities or tasks are referred

to as **agricultural practices** which are listed below:

- (i) Preparation of soil
- (ii) Sowing
- (iii) Adding manure and fertilisers
- (iv) Irrigation
- (v) Protecting from weeds
- (vi) Harvesting
- (vii) Storage

### 1.3 Preparation of Soil

The preparation of soil is the first step before growing a crop. One of the most important tasks in agriculture is to turn the soil and loosen it. This allows the roots to penetrate deep into the soil. The loose soil allows the roots to breathe easily even when they go deep into the soil. Why does the loosening of soil allow the roots to breathe easily?

The loosened soil helps in the growth of earthworms and microbes present in the soil. These organisms are friends of the farmer since they further turn and loosen the soil and add humus to it. But why the soil needs to be turned and loosened?

You have learnt in the previous classes that soil contains minerals, water, air and some living organisms. In addition, dead plants and animals get decomposed by soil organisms. In this way, various nutrients in the dead organisms are released back into the soil. These nutrients are again absorbed by plants.

Since only a few centimetres of the top layer of soil supports plant growth, turning and loosening of soil brings the nutrient-rich soil to the top so that plants can use these nutrients. Thus,

turning and loosening of soil is very important for cultivation of crops.

The process of loosening and turning of the soil is called **tilling** or **ploughing**. This is done by using a plough. Ploughs are made of wood or iron. If the soil is very dry, it may need watering before ploughing. The ploughed field may have big clumps of soil called crumbs. It is necessary to break these crumbs. Levelling the field is beneficial for sowing as well as for irrigation. Levelling of soil is done with the help of a leveller.

Sometimes, manure is added to the soil before tilling. This helps in proper mixing of manure with soil. The soil is moistened before sowing.

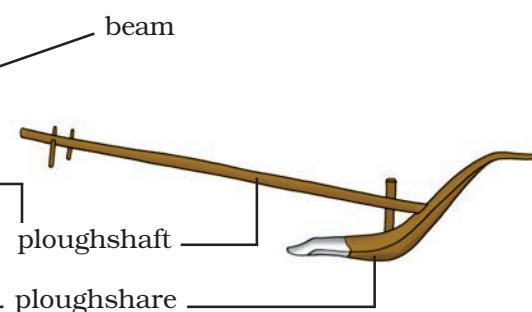
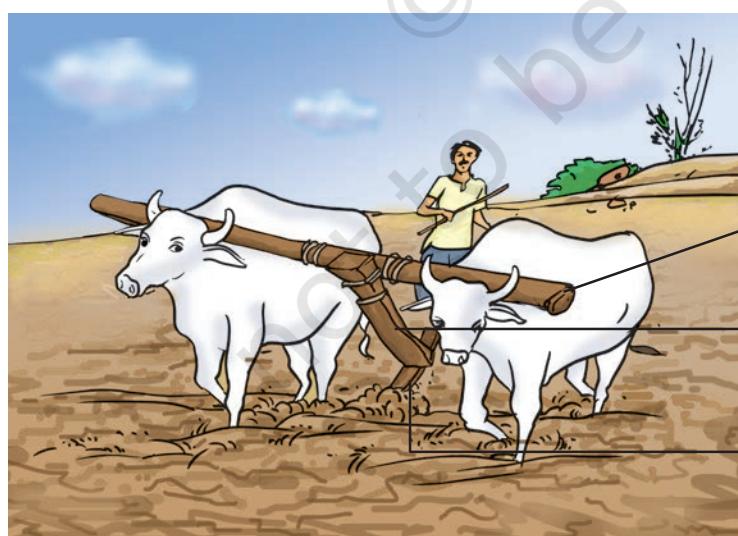
### Agricultural Implements

Before sowing the seeds, it is necessary to break soil clumps to get better yield. This is done with the help of various tools. The main tools used for this purpose are the plough, hoe and cultivator.

**Plough** : This is being used since ancient times for tilling the soil, adding fertilisers to the crop, removing the weeds and turning the soil. This is made of wood and is drawn by a pair of bulls or other animals (horses and camels). It contains a strong triangular iron strip called ploughshare. The main part of the plough is a long log of wood which is called a ploughshaft. There is a handle at one end of the shaft. The other end is attached to a beam which is placed on the bulls' necks. One pair of bulls and a man can easily operate the plough [Fig. 1.1 (a)].

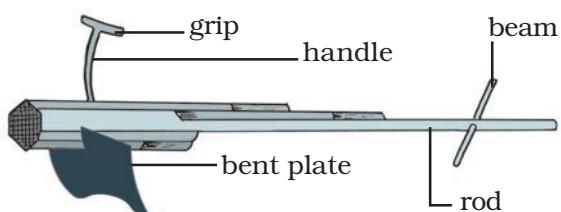
The indigenous wooden plough is increasingly being replaced by iron ploughs nowadays.

**Hoe** : It is a simple tool which is used for removing weeds and for loosening the soil. It has a long rod of wood or iron. A strong, broad and bent plate of iron is fixed to one of its ends and



**Fig. 1.1 (a) : The plough**

works like a blade. It is pulled by animals [Fig. 1.1 (b)].



**Fig. 1.1 (b) : A hoe**

**Cultivator** : Nowadays ploughing is done by tractor-driven cultivator. The use of cultivator saves labour and time. [Fig. 1.1 (c)].



**Fig. 1.1 (c) : Cultivator driven by a tractor**

## 1.4 Sowing

Sowing is an important part of crop production. Before sowing, good quality, clean and healthy seeds of a good variety—are selected. Farmers prefer to use seeds which give high yield.

### Selection of Seeds



One day I saw my mother put some gram seeds in a vessel and pour some water on them. After a few minutes some seeds started to float on top. I wonder why some seeds float on water!

### Activity 1.1

Take a beaker and fill half of it with water. Put a handful of wheat seeds and stir well. Wait for some time.

Are there seeds which float on water? Would those be lighter or heavier than those which sink? Why would they be lighter? Damaged seeds become hollow and are thus lighter. Therefore, they float on water.

This is a good method for separating good, healthy seeds from the damaged ones.

Before sowing, one of the important tasks is to know about the tools used for sowing seeds [Fig. 1.2 (a), (b)].

**Traditional tool** : The tool used traditionally for sowing seeds is shaped like a funnel [Fig. 1.2 (a)]. The seeds are filled into the funnel, passed down through two or three pipes having sharp ends. These ends pierce into the soil and place seeds there.



**Fig. 1.2 (a) : Traditional method of sowing**



Fig. 1.2 (b) : A seed drill

**Seed drill :** Nowadays the seed drill [Fig. 1.2 (b)] is used for sowing with the help of tractors. This sows the seeds uniformly at equal distance and depth. It ensures that seeds get covered by the soil after sowing. This protects seeds from being eaten by birds. Sowing by using a seed drill saves time and labour.

There is a nursery near my school. I found that little plants were kept in small bags. Why are they kept like this?



Seeds of a few plants such as paddy are first grown in a nursery. When they grow into seedlings, they are transplanted to the field manually. Some forest plants and flowering plants are also grown in the nursery.

Appropriate distance between the seeds is necessary to avoid overcrowding of plants. This allows plants to get

sufficient sunlight, nutrients and water from the soil. At times a few plants may have to be removed to prevent overcrowding.

### 1.5 Adding Manure and Fertilisers

The substances which are added to the soil in the form of nutrients for the healthy growth of plants are called **manure and fertilisers**.

I saw a healthy crop growing in a farm. In the neighbouring farm, the plants were weak.

Why do some plants grow better than others?



Soil supplies mineral nutrients to the crop plants. These nutrients are essential for the growth of plants. In certain areas, farmers grow crop after crop in the same field. The field is never left uncultivated or fallow. Imagine what happens to the nutrients?

Continuous cultivation of crops makes the soil poor in nutrients. Therefore, farmers have to add manure to the fields to replenish the soil with nutrients. This process is called manuring. Improper or insufficient manuring results in weak plants.

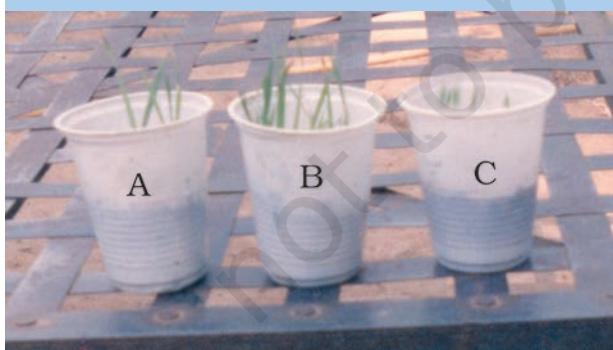
Manure is an organic substance obtained from the decomposition of plant or animal wastes. Farmers dump plant and animal waste in pits at open places and allow it to decompose. The decomposition is caused by some microorganisms. The decomposed matter is used as organic manure. You have already learnt about vermicomposting in Class VI.

## Activity 1.2

Take *moong* or gram seeds and germinate them. Select three equal sized seedlings. Take three empty glasses or similar vessels. Mark them A, B and C. To glass A add little amount of soil mixed with a little cow dung manure. In glass B put the same amount of soil mixed with a little urea. Take the same amount of soil in glass C without adding anything [Fig. 1.3(a)]. Now pour the same amount of water in each glass and plant the seedlings in them. Keep them in a safe place and water them daily. After 7 to 10 days observe their growth [Fig. 1.3(b)].



**Fig. 1.3 (a) :** Preparation of the experiment



**Fig. 1.3 (b) :** Growing seedlings with manure and fertiliser

Did plants in all the glasses grow at the same pace? Which glass showed

better growth of plants? In which glass was the growth fastest?

Fertilisers are chemicals which are rich in a particular nutrient. How are they different from manure? Fertilisers are produced in factories. Some examples of fertilisers are— urea, ammonium sulphate, super phosphate, potash, NPK (Nitrogen, Phosphorus, Potassium).

The use of fertilisers has helped farmers to get better yield of crops such as wheat, paddy and maize. But excessive use of fertilisers has made the soil less fertile. Fertilisers have also become a source of water pollution. Therefore, in order to maintain the fertility of the soil, we have to substitute fertilisers with organic manure or leave the field uncultivated (fallow) in between two crops.

The use of manure improves soil texture as well as its water retaining capacity. It replenishes the soil with nutrients.

Another method of replenishing the soil with nutrients is through **crop rotation**. This can be done by growing different crops alternately. Earlier, farmers in northern India used to grow legumes as fodder in one season and wheat in the next season. This helped in the replenishment of the soil with nitrogen. Farmers are being encouraged to adopt this practice.

In the previous classes, you have learnt about *Rhizobium* bacteria. These are present in the nodules of roots of leguminous plants. They fix atmospheric nitrogen.

**Table 1.1 : Differences between Fertiliser and Manure**

S. No.	Fertiliser	Manure
1.	Fertiliser is a man-made inorganic salt.	Manure is a natural substance obtained by the decomposition of cattle dung and plant residues.
2.	Fertiliser is prepared in factories.	Manure can be prepared in the fields.
3.	Fertiliser does not provide any humus to the soil.	Manure provides a lot of humus to the soil.
4.	Fertilisers are very rich in plant nutrients like nitrogen, phosphorus and potassium.	Manure is relatively less rich in plant nutrients.

Table 1.1 gives the differences between a fertiliser and manure.

**Advantages of Manure :** The organic manure is considered better than fertilisers. This is because

- it enhances the water holding capacity of the soil.
- it makes the soil porous due to which exchange of gases becomes easy.
- it increases the number of friendly microbes.
- it improves the texture of the soil.

## 1.6 Irrigation

All living beings need water to live. Water is important for proper growth and development. Water is absorbed by the plant roots. Along with water, minerals and fertilisers are also absorbed. Plants contain nearly 90% water. Water is essential because germination of seeds does not take place under dry conditions. Nutrients dissolved in water are transported to each part of the plant. Water also

protects the crop from both frost and hot air currents. To maintain the moisture of the soil for healthy crop growth, fields have to be watered regularly.

The supply of water to crops at regular intervals is called **irrigation**. The time and frequency of irrigation varies from crop to crop, soil to soil and season to season. In summer, the frequency of watering is higher. Why is it so? Could it be due to the increased rate of evaporation of water from the soil and the leaves?



I am very careful this year about watering the plants. Last summer my plants dried up and died.

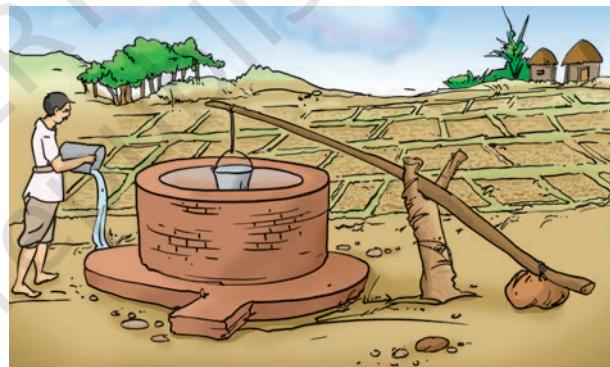
**Sources of irrigation :** The sources of water for irrigation are— wells, tubewells, ponds, lakes, rivers, dams and canals.



**Fig. 1.4 (a) : Moat**



**Fig. 1.4 (b) : Chain pump**



**Fig. 1.4 (c) : Dhekli**



**Fig. 1.4 (d) : Rahat**

## Traditional Methods of Irrigation

The water available in wells, lakes and canals is lifted up by different methods in different regions, for taking it to the fields.

Cattle or human labour is used in these methods. So these methods are cheaper, but less efficient. The various traditional ways are:

- (i) moat (pulley -system)
- (ii) chain pump

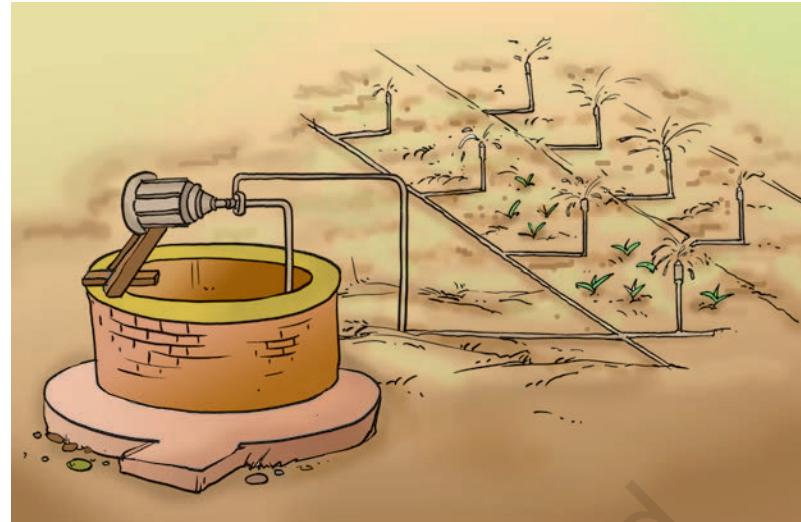
- (iii) dhekli, and
- (iv) rahat (Lever system)  
[Figs. 1.4 (a)- (d)].

Pumps are commonly used for lifting water. Diesel, biogas, electricity and solar energy is used to run these pumps.

## **Modern Methods of Irrigation**

Modern methods of irrigation help us to use water economically. The main methods used are as follows:

**(i) Sprinkler System:** This system is more useful on the uneven land where sufficient water is not available. The perpendicular pipes, having rotating nozzles on top, are joined to the main pipeline at regular intervals. When water is allowed to flow through the main pipe under pressure with the help of a pump, it escapes from the rotating nozzles. It gets sprinkled on the crop as if it is raining. Sprinkler is very useful for lawns, coffee plantation and several other crops [Fig. 1.5 (a)].



**Fig. 1.5 (a) : Sprinkler system**

**(ii) Drip system :** In this system, the water falls drop by drop directly near the roots. So it is called drip system. It is the best technique for watering fruit plants, gardens and trees [Fig. 1.5(b)]. Water is not wasted at all. It is a boon in regions where availability of water is poor.



**Fig. 1.5 (b) : Drip System**

## 1.7 Protection from Weeds

Boojho and Paheli went to a nearby wheat field and saw that there were some other plants in the field, growing along with wheat plants.

Have these other plants been planted purposely?



In a field many other undesirable plants may grow naturally along with the crop. These undesirable plants are called **weeds**.

The removal of weeds is called weeding. Weeding is necessary since weeds compete with the crop plants for water, nutrients, space and light. Thus, they affect the growth of the crop. Some weeds interfere even in harvesting and may be poisonous for animals and human beings.

Farmers adopt many ways to remove weeds and control their growth. Tilling before sowing of crops helps in uprooting and killing of weeds, which may then dry up and get mixed with the soil. The best time for the removal of weeds is before they produce flowers and seeds. The manual removal includes physical removal of weeds by uprooting or cutting them close to the ground, from time to time. This is done with the help of a *khurpi*. A seed drill [Fig. 1.2(b)] is also used to uproot weeds.

Weeds are also controlled by using certain chemicals, called **weedicides**, like 2,4-D. These are sprayed in the fields to kill the weeds. They do not damage the crops. The weedicides are diluted with water to the extent required and sprayed in the fields with a sprayer. (Fig. 1.6).



**Fig. 1.6 :** Spraying weedicide

Do weedicides have any effect on the person handling the weedicide sprayer?



As already mentioned, the weedicides are sprayed during the vegetative growth of weeds before flowering and seed formation. Spraying of weedicides may affect the health of farmers. So they should use these chemicals very carefully. They should cover their nose and mouth with a piece of cloth during spraying of these chemicals.

## 1.8 Harvesting

Harvesting of a crop is an important task. The cutting of crop after it is mature is called **harvesting**. In harvesting, crops are pulled out or cut close to the ground. It usually takes 3 to 4 months for a cereal crop to mature.

Harvesting in our country is either done manually by sickle (Fig. 1.7) or by a machine called harvester. In the harvested crop, the grain seeds need to be separated



**Fig. 1.7 :**  
Sickle

from the chaff. This process is called **threshing**. This is carried out with the help of a machine called 'combine' which is in fact a harvester as well as a thresher (Fig. 1.8).



**Fig. 1.8 : Combine**



After harvesting, sometimes stubs are left in the field, which are burnt by farmers. Paheli is worried. She knows that it causes pollution. It may also catch fire and damage the crops lying in the fields.

Farmers with small holdings of land do the separation of grain and chaff by **winnnowing** (Fig. 1.9). You have already studied this in Class VI.



**Fig. 1.9 : Winnowing machine**

### Harvest Festivals

After three or four months of hard work there comes the day of the harvest. The sight of golden fields of standing crop, laden with grain, fills the hearts of farmers with joy and a sense of well-being. The efforts of the past season have borne fruit and it is time to relax and enjoy a little. The period of harvest is, thus, of great joy and happiness in all parts of India. Men and women celebrate it with great enthusiasm. Special festivals associated with the harvest season are Pongal, Baisakhi, Holi, Diwali, Nabanya and Bihu.

### 1.9 Storage

Storage of produce is an important task. If the harvested grains are to be kept for longer time, they should be safe from moisture, insects, rats and microorganisms. Harvested grains have more moisture. If freshly harvested grains (seeds) are stored without drying, they may get spoilt or attacked by organisms, making them unfit for use or for germination. Hence, before storing them, the grains are properly dried in the sun to reduce the moisture in them. This prevents the attack by insect pests, bacteria and fungi.

I saw my mother putting some dried neem leaves in an iron drum containing wheat. I wonder why?





**Fig. 1.10 (a) : Silos for storage of grains**



**Fig. 1.10 (b) : Storage of grains in gunny bags in granaries**

Farmers store grains in jute bags or metallic bins. However, large scale storage of grains is done in **silos** and **granaries** to protect them from pests like rats and insects [Fig. 1.10 (a) and (b)].

Dried neem leaves are used for storing food grains at home. For storing large quantities of grains in big godowns, specific chemical treatments are required to protect them from pests and microorganisms.

## 1.10 Food from Animals

### Activity 1.3

Make the following Table in your note book and complete it.

S.No.	Food	Sources
1.	Milk	Cow, Buffalo, She-goat, She-camel . . .
2.		
3.		
4.		

After completing this Table, you must have seen that, like plants, animals also provide us with different kinds of food. Many people living in the coastal areas consume fish as a major part of their diet. In the previous classes you have learnt about the food that we obtain from plants. We have just seen that the process of crop production involves a number of steps like selection of seeds, sowing, etc. Similarly, animals reared at home or in farms, have to be provided with proper food, shelter and care. When this is done on a large scale, it is called **animal husbandry**.



Fish is good for health.  
We get cod liver oil from fish  
which is rich in vitamin D.

## KEYWORDS

**AGRICULTURAL PRACTICES**

**ANIMAL HUSBANDRY**

**CROP**

**FERTILISER**

**GRANARIES**

**HARVESTING**

**IRRIGATION**

**KHARIF**

**MANURE**

**PLOUGH**

**RABI**

**SEEDS**

**SILO**

**SOWING**

**STORAGE**

**THRESHING**

**WEEDS**

**WEEDICIDE**

**WINNOWING**

## WHAT YOU HAVE LEARNT

- ⦿ In order to provide food to our growing population, we need to adopt certain agricultural practices.
- ⦿ Same kind of plants cultivated at a place constitute a crop.
- ⦿ In India, crops can be broadly categorised into two types based on seasons - rabi and kharif crops.
- ⦿ It is necessary to prepare soil by tilling and levelling. Ploughs and levellers are used for this purpose.
- ⦿ Sowing of seeds at appropriate depths and distances gives good yield. Good variety of seeds are sown after selection of healthy seeds. Sowing is done by seed drills.
- ⦿ Soil needs replenishment and enrichment through the use of organic manure and fertilisers. Use of chemical fertilisers has increased tremendously with the introduction of new crop varieties.
- ⦿ Supply of water to crops at appropriate intervals is called irrigation.
- ⦿ Weeding involves removal of unwanted and uncultivated plants called weeds.
- ⦿ Harvesting is the cutting of the mature crop manually or by machines.
- ⦿ Separation of the grains from the chaff is called threshing.
- ⦿ Proper storage of grains is necessary to protect them from pests and microorganisms.
- ⦿ Food is also obtained from animals for which animals are reared. This is called animal husbandry.

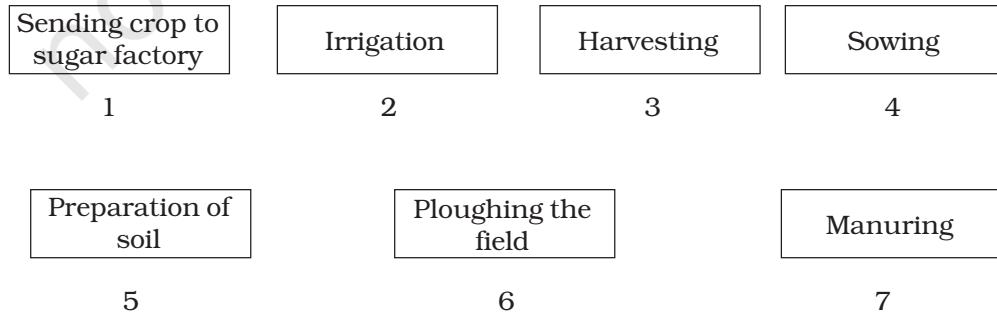
## Exercises

1. Select the correct word from the following list and fill in the blanks.

float, water, crop, nutrients, preparation

- (a) The same kind of plants grown and cultivated on a large scale at a place is called \_\_\_\_\_.
- (b) The first step before growing crops is \_\_\_\_\_ of the soil.

- (c) Damaged seeds would \_\_\_\_\_ on top of water.  
 (d) For growing a crop, sufficient sunlight and \_\_\_\_\_ and \_\_\_\_\_ from the soil are essential.
2. Match items in column **A** with those in column **B**.
- | <b>A</b>                   | <b>B</b>   |
|----------------------------|--|
| (i) Kharif crops           | (a) Food for cattle                                |
| (ii) Rabi crops            | (b) Urea and super phosphate                       |
| (iii) Chemical fertilisers | (c) Animal excreta, cow dung urine and plant waste |
| (iv) Organic manure        | (d) Wheat, gram, pea                               |
|                            | (e) Paddy and maize                                |
3. Give two examples of each.  
 (a) *Kharif* crop  
 (b) *Rabi* crop
4. Write a paragraph in your own words on each of the following.  
 (a) Preparation of soil      (b) Sowing  
 (c) Weeding      (d) Threshing
5. Explain how fertilisers are different from manure.
6. What is irrigation? Describe two methods of irrigation which conserve water.
7. If wheat is sown in the *kharif* season, what would happen? Discuss.
8. Explain how soil gets affected by the continuous plantation of crops in a field.
9. What are weeds? How can we control them?
10. Arrange the following boxes in proper order to make a flow chart of sugarcane crop production.



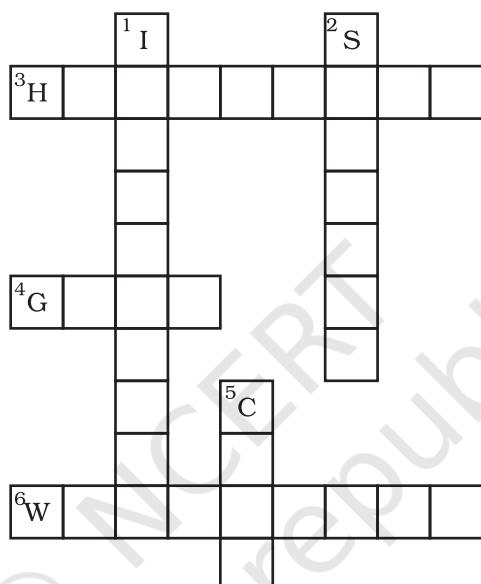
11. Complete the following word puzzle with the help of clues given below.

**Down**

1. Providing water to the crops.
2. Keeping crop grains for a long time under proper conditions.
5. Certain plants of the same kind grown on a large scale.

**Across**

3. A machine used for cutting the matured crop.
4. A *rabi* crop that is also one of the pulses.
6. A process of separating the grain from chaff.

**Extended Learning — Activities and Projects**

1. Sow some seeds in the soil and arrange to water them by drip irrigation. Observe daily.
  - (i) Do you think it can save water?
  - (ii) Note the changes in the seed.
2. Collect different types of seeds and put them in small bags. Label them.
3. Collect pictures of some other agricultural machines and paste them in a file. Write their names and uses.
4. Project Work  
Visit a farm, nursery or a garden nearby. Gather information about
  - (i) importance of seed selection.
  - (ii) method of irrigation.

- (iii) effect of extreme cold and extreme hot weather on the plants.
- (iv) effect of continuous rain on the plants.
- (v) fertilisers/manure used.

### **An Example for Field Trip Work**

Himanshu and his friends were very anxious and curious to go to Thikri village. They went to Shri Jiwan Patel's farmhouse. They had taken bags to collect some seeds and other things.

Himanshu : Sir *namaskar*, I am Himanshu. Here are my friends Mohan, David and Sabiha. We want some information about crops. Please guide us.

Shri Patel : *Namaskar* and welcome all of you. What are your queries?

Sabiha : When did you start this work and what are the main crops that you grow?

Shri Patel : About 75 years ago, my grandfather started this work. The main crops that we grow are wheat, gram, soyabean and *moong*.

David : Sir, can you tell us the difference between traditional and modern agricultural practices?

Shri Patel : Earlier we used traditional tools like sickle, bullock plough, trowel, etc., and depended on rain water for irrigation. But now we use modern methods of irrigation. We use implements like tractors, cultivators, seed drill and harvester. We get good quality seeds. We carry out soil testing and use manure and fertilisers. New information about agriculture is obtained through radio, T.V. and other sources. As a result we are able to get good crops on a large scale. This year we got 9 to 11 quintals of gram crop/acre and 20 to 25 quintals of wheat/acre. In my opinion awareness of new technology is important for better crop yield.

Mohan : Sabiha, come here and see some earthworms. Are they helpful to the farmers?

Sabiha : Oh Mohan! we learnt about it in Class VI.

Shri Patel : Earthworms turn the soil and loosen it for proper aeration, so they help the farmer.

David : Can we have some seeds of the crops you grow here?

[They put some seeds, fertilisers and soil sample in the bags.]

Himanshu : Sir, we are thankful to you for making this visit pleasant and for providing useful information.



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You have seen several kinds of plants and animals. However, there are other living organisms around us which we normally cannot see. These are called **microorganisms** or **microbes**. For example, you might have observed that during the rainy season moist bread gets spoilt and its surface gets covered with greyish white patches. Observe these patches through a magnifying glass. You will see tiny, black rounded structures. Do you know what these structures are and where do these come from?

## 2.1 Microorganisms

### Activity 2.1

Collect some moist soil from the field in a beaker and add water to it. After the soil particles have settled down, observe a drop of water from the beaker under a microscope. What do you see ?

### Activity 2.2

Take a few drops of water from a pond. Spread on a glass slide and observe through a microscope.

Do you find tiny organisms moving around?

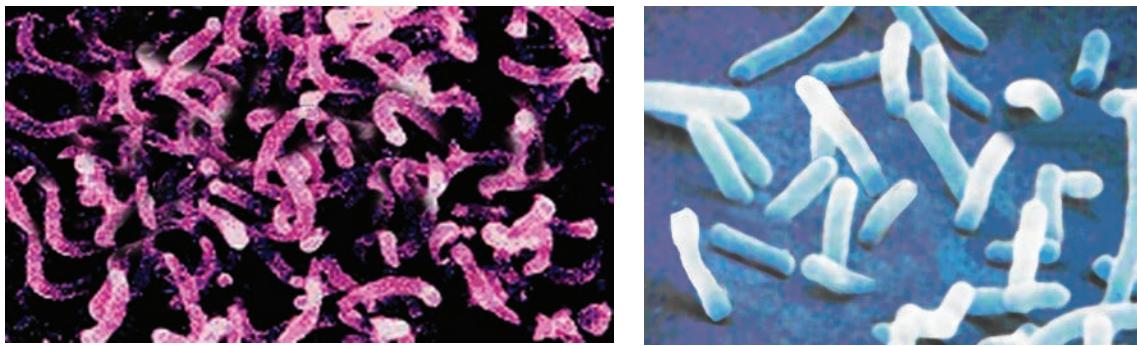
These observations show that water and soil are full of tiny organisms, though not all of them fall into the category of microbes. These microorganisms or microbes are so small in size that they cannot be seen with the unaided eye. Some of these, such as the fungus that grows on bread, can be seen with a magnifying glass. Others cannot be seen without the help of a microscope. That is why these are called microorganisms or microbes.

Microorganisms are classified into four major groups. These groups are **bacteria**, **fungi**, **protozoa** and some **algae**. Some of these common microorganisms are shown in Figs. 2.1 - 2.4.

**Viruses** are also microscopic but are different from other microorganisms. They, however, reproduce only inside the cells of the host organism, which may be a bacterium, plant or animal. Some of the viruses are shown in Fig. 2.5. Common ailments like cold, influenza (flu) and most coughs are caused by viruses. Serious diseases like polio and chicken pox are also caused by viruses.

Diseases like dysentery and malaria are caused by protozoa(protozoans) whereas typhoid and tuberculosis (TB) are bacterial diseases.

You have learnt about some of these microorganisms in Classes VI and VII.

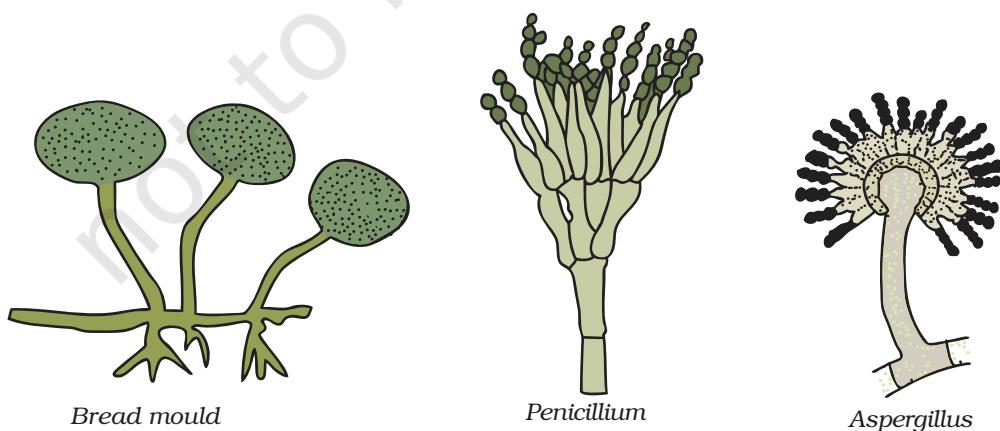


**Fig. 2.1:** Bacteria

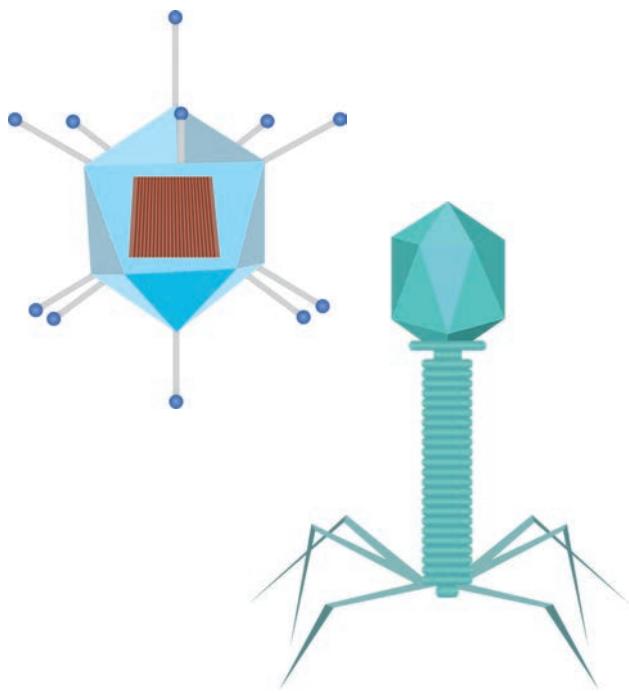


**Fig. 2.2 :** Algae

**Fig. 2.3 :** Protozoa



**Fig. 2.4 :** Fungi



**Fig. 2.5 : Viruses**

## 2.2 Where do Microorganisms Live?

Microorganisms may be single-celled like bacteria, some algae and protozoa, or multicellular, such as many algae and fungi. They live in all types of environment, ranging from ice cold climate to hot springs; and deserts to marshy lands. They are also found inside the bodies of animals including humans. Some microorganisms grow on other organisms while others exist freely.

## 2.3 Microorganisms and Us

Microorganisms play an important role in our lives. Some of them are beneficial in many ways whereas some others are harmful and cause diseases. Let us study about them in detail.

### Friendly Microorganisms

Microorganisms are used for various purposes. They are used in the preparation of curd, bread and cake.

Microorganisms have been used for the production of alcohol since ages.

They are also used in cleaning up of the environment. For example, the organic wastes (vegetable peels, remains of animals, faeces, etc.) are broken down into harmless and usable substances by bacteria. Recall that bacteria are also used in the preparation of medicines. In agriculture they are used to increase **soil fertility** by fixing nitrogen.

### Making of Curd and Bread

You have learnt in Class VII that milk is turned into curd by bacteria.



I saw that my mother added a little curd to warm milk to set curd for the next day. I wonder why?

Curd contains several micro-organisms. Of these, the bacterium, *Lactobacillus* promotes the formation of curd. It multiplies in milk and converts it into curd. Bacteria are also involved in the making of cheese, pickles and many other food items. An important ingredient of *rava (sooji) idlis* and *bhaturas* is curd. Can you guess why? Bacteria and yeast are also helpful for fermentation of rice idlis and dosa batter.

### Activity 2.3

Take  $\frac{1}{2}$  kg flour (*atta* or *maida*), add some sugar and mix with warm water. Add a small amount of yeast powder and knead to make a soft dough. What do you observe after two hours? Did you find the dough rising?



*Maida with yeast powder*



*Raised maida*

**Fig. 2.6**

Yeast reproduces rapidly and produces carbon dioxide during respiration. Bubbles of the gas fill the dough and increase its volume (Fig. 2.6). This is the basis of the use of yeast in the baking industry for making breads, pastries and cakes.

### Commercial Use of Microorganisms

Microorganisms are used for the large scale production of alcohol, wine and acetic acid (vinegar). Yeast is used for commercial production of alcohol and wine. For this purpose yeast is grown on natural sugars present in grains like barley, wheat, rice, crushed fruit juices, etc.

### Activity 2.4

Take a 500 mL beaker filled upto  $\frac{3}{4}$  with water. Dissolve 2-3 teaspoons of sugar in it. Add half a

spoon of yeast powder to the sugar solution. Keep it covered in a warm place for 4-5 hours. Now smell the solution. Can you get a smell?

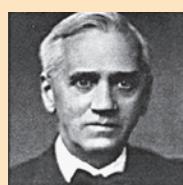
This is the smell of alcohol as sugar has been converted into alcohol by yeast. This process of conversion of sugar into alcohol is known as **fermentation**.



Louis Pasteur  
discovered  
fermentation  
in 1857.

### Medicinal Use of Microorganisms

Whenever you fall ill the doctor may give you some antibiotic tablets, capsules or injections such as of penicillin. The source of these medicines is microorganisms. These medicines kill or stop the growth of the disease-causing microorganisms. Such medicines are called **antibiotics**. These days a number of antibiotics are being produced from bacteria and fungi. Streptomycin, tetracycline and erythromycin are some of the



In 1929, Alexander Fleming was working on a culture of disease-causing bacteria. Suddenly he found the spores of a little green mould in one of his culture plates. He observed that the presence of mould prevented the growth of bacteria. In fact, it also killed many of these bacteria. From this the mould penicillin was prepared.

commonly known antibiotics which are made from fungi and bacteria. The antibiotics are manufactured by growing specific microorganisms and are used to cure a variety of diseases.

Antibiotics are even mixed with the feed of livestock and poultry to check microbial infection in animals. They are also used to control many plant diseases.

It is important to remember that antibiotics should be taken only on the advice of a qualified doctor. Also you must complete the course prescribed by the doctor. If you take antibiotics when not needed or in wrong doses, it may make the drug less effective when you might need it in future. Also antibiotics taken unnecessarily may kill the beneficial bacteria in the body. Antibiotics, however, are not effective against cold and flu as these are caused by viruses.

## Vaccine



Why are children/infants given vaccination?

When a disease-carrying microbe enters our body, the body produces **antibodies** to fight the invader. The body also remembers how to fight the microbe if it enters again. If dead or weakened microbes are introduced into a healthy body, the body fights and kills the invading bacteria by producing suitable antibodies. The antibodies remain in the body and we are protected

from the disease-causing microbes for ever. This is how a vaccine works. Several diseases, including cholera, tuberculosis, smallpox and hepatitis can be prevented by vaccination.



Edward Jenner discovered the vaccine for smallpox in 1798.

In your childhood, you must have been given injections to protect yourself against several diseases. Can you prepare a list of these diseases? You may take help from your parents.

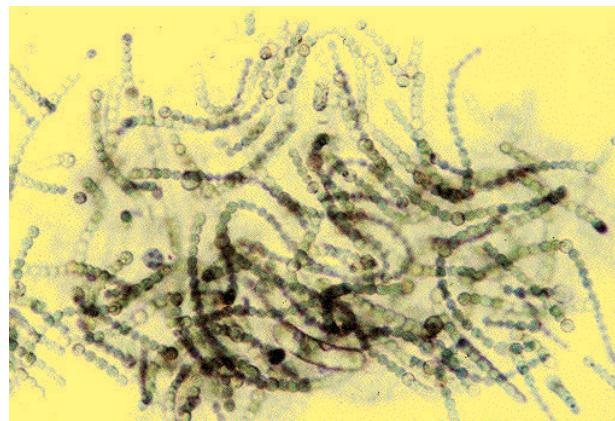
It is essential to protect all children against these diseases. Necessary vaccines are available in the nearby hospitals. You might have seen the advertisement on TV and newspapers regarding protection of children against polio under the Pulse Polio Programme. Polio drops given to children are actually a vaccine.

A worldwide campaign against smallpox has finally led to its eradication from most parts of the world.

These days vaccines are made on a large scale from microorganisms to protect humans and other animals from several diseases.

## Increasing Soil Fertility

Some bacteria (Fig. 2.7) are able to fix nitrogen from the atmosphere to enrich soil with nitrogen and increase its fertility. These microbes are commonly called biological nitrogen fixers.



**Fig. 2.7 : The Nitrogen fixing cyanobacteria (blue green algae)**

### Cleaning the Environment

Boojho and Paheli had observed the school gardener making manure. Along with their friends, they collected wastes of plants, vegetables and fruits from nearby houses and gardens. They put them in a pit meant for waste disposal. After some time, it decomposed and got converted to manure. Boojho and Paheli wanted to know how this had happened.

### Activity 2.5

Take two pots and fill each pot half with soil. Mark them A and B. Put plant waste in pot A and things like polythene bags, empty glass bottles and broken plastic toys in pot B. Put the pots aside. Observe them after 3-4 weeks.

Do you find any difference in the contents of the two pots? If so, what is the difference? You will find that plant waste in pot A, has been decomposed. How did this happen? The plant waste has been converted into manure by the action of microbes. The nutrients

released in the process can be used by the plants again.

Did you notice that in pot B, the polythene bags, empty glasses, bottles and broken toy parts did not undergo any such change? The microbes could not 'act' on them and convert them into manure.

You often see large amounts of dead organic matter in the form of decaying plants and sometimes dead animals on the ground. You find that they disappear after some time. This is because the microorganisms decompose dead organic waste of plants and animals converting them into simple substances. These substances are again used by other plants and animals. Thus, microorganisms can be used to degrade the harmful and smelly substances and thereby clean up the environment.

### 2.4 Harmful Microorganisms

Microorganisms are harmful in many ways. Some of the microorganisms cause diseases in human beings, plants and animals. Such disease-causing

microorganisms are called **pathogens**. Some microorganisms spoil food, clothing and leather. Let us study more about their harmful activities.

### Disease causing Microorganisms in Humans

Pathogens enter our body through the air we breathe, the water we drink or the food we eat. They can also get transmitted by direct contact with an infected person or carried by an animal. Microbial diseases that can spread from an infected person to a healthy person through air, water, food or physical contact are called **communicable diseases**. Examples of such diseases include cholera, common cold, chicken pox and tuberculosis.

When a person suffering from common cold sneezes, fine droplets of moisture carrying thousands of viruses are spread in the air. The virus may enter the body of a healthy person while breathing and cause infection.



Then how do you prevent the spread of communicable diseases?

We should keep a handkerchief on the nose and mouth while sneezing. It is better to keep a distance from infected persons.



There are some insects and animals which act as **carriers** of disease-causing microbes. Housefly is one such carrier. The flies sit on the garbage and animal excreta. Pathogens stick to their bodies. When these flies sit on uncovered food they may transfer the pathogens. Whoever eats the contaminated food is likely to get sick. So, it is advisable to always keep food covered. Avoid consuming uncovered items of food. Another example of a carrier is the female *Anopheles* mosquito (Fig. 2.8), which carries the parasite of malaria (Plasmodium). Female *Aedes* mosquito acts as carrier of dengue virus. How can we control the spread of malaria or dengue?

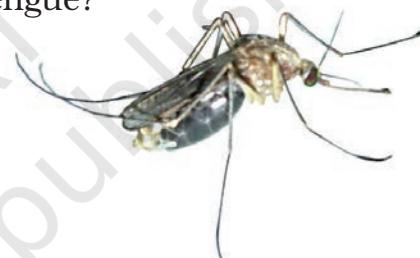


Fig. 2.8 : Female *Anopheles* mosquito



Why does the teacher keep telling us not to let water collect anywhere in the neighbourhood?

All mosquitoes breed in water. Hence, one should not let water collect anywhere, in coolers, tyres, flower pot, etc. By keeping the surroundings clean and dry we can prevent mosquitoes from breeding. Try to make a list of measures which help to avoid the spread of malaria.

**Table 2.1: Some Common Human Diseases caused by Microorganisms**

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis	Bacteria	Air	Keep the patient in complete isolation. Keep the personal belongings of the patient away from those of the others. Vaccination to be given at suitable age.
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	
Polio	Virus	Air/Water	
Cholera	Bacteria	Water/Food	Maintain personal hygiene and good sanitary habits. Consume properly cooked food and boiled drinking water. Vaccination.
Typhoid	Bacteria	Water	
Hepatitis A	Virus	Water	Drink boiled drinking water. Vaccination.
Malaria	Protozoa	Mosquito	Use mosquito net and repellents. Spray insecticides and control breeding of mosquitoes by not allowing water to collect in the surroundings.

Some of the common diseases affecting humans, their mode of transmission and few general methods of prevention are shown in Table 2.1.

#### Disease causing Microorganisms in Animals

Several microorganisms not only cause diseases in humans and plants, but also



Robert Koch (1876) discovered the bacterium (*Bacillus anthracis*) which causes anthrax disease.

in other animals. For example, anthrax is a dangerous human and cattle disease caused by a bacterium. Foot and mouth disease of cattle is caused by a virus.

#### Disease causing Microorganisms in Plants

Several microorganisms cause diseases in plants like wheat, rice, potato, sugarcane, orange, apple and others. The diseases reduce the yield of crops. See Table 2.2 for some such plant diseases. They can be controlled by the

**Table 2.2: Some Common Plant Diseases caused by Microorganisms**

Plant Diseases	Micro-organism	Mode of Transmission
Citrus canker	Bacteria	Air
Rust of wheat	Fungi	Air, seeds
Yellow vein mosaic of <i>bhindi</i> (Okra)	Virus	Insect

use of certain chemicals which kill the microbes.

### Food Poisoning

Boojho was invited by his friend to a party and he ate a variety of foodstuff. On reaching home he started vomiting and had to be taken to a hospital. The doctor said that this condition could be due to food poisoning.



Paheli wonders how food can become a 'poison'.

Food poisoning could be due to the consumption of food spoilt by some microorganisms. Microorganisms that grow on our food sometimes produce toxic substances. These

make the food poisonous causing serious illness and even death. So, it is very important that we preserve food to prevent it from being spoilt.

### 2.5 Food Preservation

In Chapter 1, we have learnt about the methods used to preserve and store food grains. How do we preserve cooked food at home? You know that bread left unused under moist conditions is attacked by fungus. Microorganisms spoil our food. Spoiled food emits bad smell and has a bad taste and changed colour. Is spoiling of food a chemical reaction?

Paheli bought some mangoes but she could not eat them for a few days. Later she found that they were spoilt and rotten. But she knows that the mango pickle her grandmother makes does not spoil for a long time. She is confused.

Let us study the common methods of preserving food in our homes. We have to save it from the attack of microorganisms.

### Chemical Method

Salts and edible oils are the common chemicals generally used to check the growth of microorganisms. Therefore they are called **preservatives**. We add salt or acid preservatives to pickles to prevent the attack of microbes. Sodium benzoate and sodium metabisulphite are common preservatives. These are also used in jams and squashes to check their spoilage.

### Preservation by Common Salt

Common salt has been used to preserve meat and fish for ages. Meat and fish are covered with dry salt to check the growth of bacteria. Salting is also used to preserve *amla*, raw mangoes, tamarind, etc.

### Preservation by Sugar

Jams, jellies and squashes are preserved by sugar. Sugar reduces the moisture content which inhibits the growth of bacteria which spoil food.

### Preservation by Oil and Vinegar

Use of oil and vinegar prevents spoilage of pickles because bacteria cannot live in such an environment. Vegetables, fruits, fish and meat are often preserved by this method.

### Heat and Cold Treatments

You must have observed your mother boiling milk before it is stored or used. Boiling kills many microorganisms.

Similarly, we keep our food in the refrigerator. Low temperature inhibits the growth of microbes.



Why does the milk that comes in packets not spoil? My mother told me that the milk is 'pasteurised'. What is pasteurisation?

Pasteurised milk can be consumed without boiling as it is free from harmful microbes. The milk is heated to about 70°C for 15 to 30 seconds and then suddenly chilled and stored. By doing so, it prevents the growth of microbes. This process was discovered by Louis Pasteur. It is called **pasteurisation**.

### Storage and Packing

These days dry fruits and even vegetables are sold in sealed air tight packets to prevent the attack of microbes.

## 2.6 Nitrogen Fixation

You have learnt about the bacterium *Rhizobium* in Classes VI and VII. It is involved in the fixation of nitrogen in leguminous plants (pulses). Recall that *Rhizobium* lives in the root nodules of leguminous plants (Fig. 2.9), such as beans and peas, with which it has a symbiotic relationship. Sometimes nitrogen gets fixed through the action of lightning. But you know that the amount of nitrogen in the atmosphere remains constant. You may wonder how? Let us understand this in the next section.



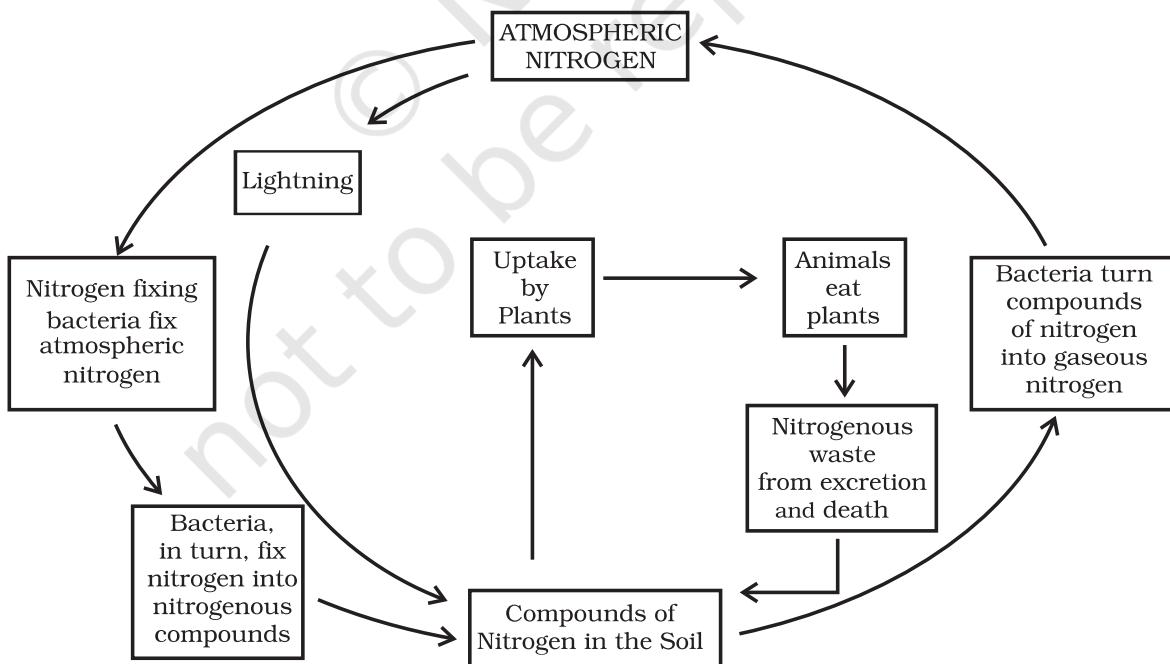
**Fig. 2.9 :** Roots of a leguminous plant with root nodules

## 2.7 Nitrogen cycle

Our atmosphere has 78% nitrogen gas. Nitrogen is one of the essential constituents of all living organisms as part of proteins, chlorophyll, nucleic acids and vitamins. The atmospheric

nitrogen cannot be taken directly by plants and animals. Certain bacteria and blue green algae present in the soil fix nitrogen from the atmosphere and convert it into compounds of nitrogen. Once nitrogen is converted into these usable compounds, it can be utilised by plants from the soil through their root system. Nitrogen is then used for the synthesis of plant proteins and other compounds. Animals feeding on plants get these proteins and other nitrogen compounds (Fig. 2.10).

When plants and animals die, bacteria and fungi present in the soil convert the nitrogenous wastes into nitrogenous compounds to be used by plants again. Certain other bacteria convert some part of them to nitrogen gas which goes back into the atmosphere. As a result, the percentage of nitrogen in the atmosphere remains more or less constant.



**Fig. 2.10 :** Nitrogen cycle

**KEYWORDS**

- ALGAE**
- ANTIBIOTICS**
- ANTIBODIES**
- BACTERIA**
- CARRIER**
- COMMUNICABLE DISEASES**
- FERMENTATION**
- FUNGI**
- LACTOBACILLUS**
- MICROORGANISM**
- NITROGEN CYCLE**
- NITROGEN FIXATION**
- PASTEURISATION**
- PATHOGEN**
- PRESERVATION**
- PROTOZOA**
- RHIZOBIUM**
- VACCINE**
- VIRUS**
- YEAST**

**WHAT YOU HAVE LEARNT**

- ⦿ Microorganisms are too small and are not visible to the unaided eye.
- ⦿ They can live in all kinds of environment, ranging from ice cold climate to hot springs and deserts to marshy lands.
- ⦿ Microorganisms are found in air, water and in the bodies of plants and animals.
- ⦿ They may be unicellular or multicellular.
- ⦿ Microorganisms include bacteria, fungi, protozoa and some algae. Viruses, though different from the above mentioned living organisms, are considered microbes.
- ⦿ Viruses are quite different from other microorganisms. They reproduce only inside the host organism: bacterium, plant or animal cell.
- ⦿ Some microorganisms are useful for commercial production of medicines and alcohol.
- ⦿ Some microorganisms decompose the organic waste and dead plants and animals into simple substances and clean up the environment.
- ⦿ Protozoans cause serious diseases like dysentery and malaria.
- ⦿ Some of the microorganisms grow on our food and cause food poisoning.
- ⦿ Some microorganisms reside in the root nodules of leguminous plants. They can fix nitrogen from air into soil and increase the soil fertility.
- ⦿ Some bacteria present in the soil fix nitrogen from the atmosphere and convert into nitrogenous compounds.
- ⦿ Certain bacteria convert compounds of nitrogen present in the soil into nitrogen gas which is released to the atmosphere.

## Exercises

1. Fill in the blanks.
  - (a) Microorganisms can be seen with the help of a \_\_\_\_\_.
  - (b) Blue green algae fix \_\_\_\_\_ directly from air and enhance fertility of soil.
  - (c) Alcohol is produced with the help of \_\_\_\_\_.
  - (d) Cholera is caused by \_\_\_\_\_.
2. Tick the correct answer.
  - (a) Yeast is used in the production of
    - (i) sugar
    - (ii) alcohol
    - (iii) hydrochloric acid
    - (iv) oxygen
  - (b) The following is an antibiotic
    - (i) Sodium bicarbonate
    - (ii) Streptomycin
    - (iii) Alcohol
    - (iv) Yeast
  - (c) Carrier of malaria-causing protozoan is
    - (i) female *Anopheles* mosquito
    - (ii) cockroach
    - (iii) housefly
    - (iv) butterfly
  - (d) The most common carrier of communicable diseases is
    - (i) ant
    - (ii) housefly
    - (iii) dragonfly
    - (iv) spider
  - (e) The bread or *idli* dough rises because of
    - (i) heat
    - (ii) grinding
    - (iii) growth of yeast cells
    - (iv) kneading
  - (f) The process of conversion of sugar into alcohol is called
    - (i) nitrogen fixation
    - (ii) moulding
    - (iii) fermentation
    - (iv) infection
3. Match the organisms in Column **A** with their action in Column **B**.

A	B
(i) Bacteria	(a) Fixing nitrogen
(ii) <i>Rhizobium</i>	(b) Setting of curd
(iii) <i>Lactobacillus</i>	(c) Baking of bread
(iv) Yeast	(d) Causing malaria
(v) A protozoan	(e) Causing cholera
(vi) A virus	(f) Causing AIDS
	(g) Producing antibodies
4. Can microorganisms be seen with the naked eye? If not, how can they be seen?

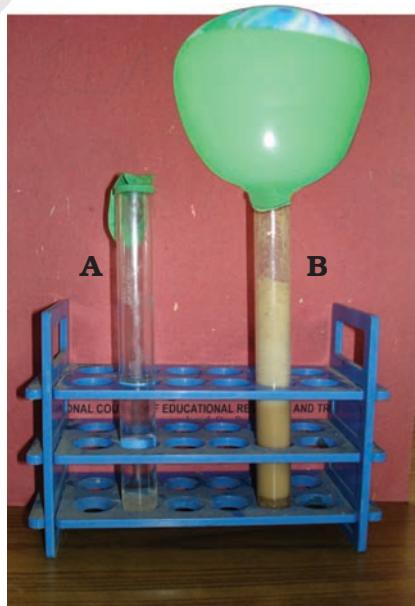
5. What are the major groups of microorganisms?
6. Name the microorganisms which can fix atmospheric nitrogen in the soil.
7. Write 10 lines on the usefulness of microorganisms in our lives.
8. Write a short paragraph on the harmful effects of microorganisms.
9. What are antibiotics? What precautions must be taken while taking antibiotics?

## Extended Learning — Activities and Projects

1. Pull out a gram or bean plant from the field. Observe its roots. You will find round structures called root nodules on the roots. Draw a diagram of the root and show the root nodules.
2. Collect the labels from the bottles of jams and jellies. Write down the list of contents printed on the labels.
3. Visit a doctor. Find out why antibiotics should not be overused. Prepare a short report.
4. Project : Requirements – 2 test tubes, marker pen, sugar, yeast powder, 2 balloons and lime water.

Take two test tubes and mark them A and B. Clamp these tubes in a stand and fill them with water leaving some space at the top. Put two spoonfuls of sugar in each of the test tubes. Add a spoonful of yeast in test tube B. Inflate the two balloons incompletely. Now tie the balloons on the mouths of each test tube. Keep them in a warm place, away from sunlight. Watch the setup every day for next 3-4 days. Record your observations and think of an explanation.

Now take another test tube filled 1/4 with lime water. Remove the balloon from test tube B in such a manner that gas inside the balloon does not escape. Fit the balloon on the test tube and shake well. Observe and explain.



### Did You Know?

Bacteria have lived on the earth for much longer than human beings. They are such hardy organisms that they can live under extreme conditions. They have been found living in boiling mudpots and extremely cold icy waters. They have been found in lakes of caustic soda and in pools of concentrated sulphuric acid. They can survive at depths of several kilometres. They probably can survive in space, too. A kind of bacterium was recovered from a camera which stood on the moon for two years. There is probably no environment in which bacteria cannot survive.



0854CH05

We use various materials for our basic needs. Some of them are found in nature and some have been made by human efforts.

### Activity 3.1

Make a list of various materials used by us in daily life and classify them as natural and man-made.

Natural	Man-made

Does this list include air, water, soil and minerals? Since all these are obtained from nature, they are called natural resources.



Can we use all our natural resources forever ?

Can air, water and soil be exhausted by human activities? You have already studied about water in Class VII. Is water a limitless resource?

In the light of the availability of various resources in nature, natural resources can be broadly classified into two kinds:

**(i) Inexhaustible Natural Resources:**

These resources are present in unlimited quantity in nature and are not likely to be exhausted by human activities. Examples are: sunlight, air.

**(ii) Exhaustible Natural Resources:** The amount of these resources in nature is limited. They can be exhausted by human activities. Examples of these resources are forests, wildlife, minerals, coal, petroleum, natural gas etc.

### Activity 3.2

*(It is a group activity)*

Take some containers. Fill them with popcorn/peanuts/roasted gram/toffees. Divide students into groups of seven each. Further divide each group into three subgroups containing 1, 2 and 4 students. Label them as first, second and third generation respectively.

These sub-groups represent the consumers. As population is growing, second and third generations have larger number of consumers.

Put one full container for each group on a table. Ask consumers of the first generation from each group to consume eatables from the container of their group. Now, ask the second generation consumers from each group to do the same. Ask students to observe carefully the availability of eatables in each container. If some thing is left in the containers, ask third generation from each group to consume it. Now, finally observe whether all the consumers of the third generation got the eatables or not. Also observe if anything is still left in any of the containers.

Assume that the eatables in the container represent the total availability of an exhaustible natural resource like coal, petroleum or natural gas. Each group may have a different consumption pattern. Are the earlier generations of any group too greedy? It may be that the earlier generations in some groups were concerned about the coming generation(s) and left something for them.

In this chapter we will learn about some exhaustible natural resources like coal, petroleum and natural gas. These were formed from the dead remains of living organisms (fossils). So, these are all known as **fossil fuels**.

### 3.1 Coal

You may have seen coal or heard about it (Fig. 3.1). It is as hard as stone and is black in colour.



**Fig. 3.1:** Coal

Coal is one of the fuels used to cook food. Earlier, it was used in railway engines to produce steam to run the engine. It is also used in thermal power plants to produce electricity. Coal is also used as a fuel in various industries.

#### Story of Coal

Where do we get  
coal from and how  
is it formed?



About 300 million years ago the earth had dense forests in low lying wetland areas. Due to natural processes, like flooding, these forests got buried under the soil. As more soil deposited over them, they were compressed. The temperature also rose as they sank deeper and deeper. Under high pressure and high temperature, dead plants got slowly converted to coal. As coal contains mainly carbon, the slow process of conversion of dead vegetation into coal is called carbonisation. Since it was formed from the remains of vegetation, coal is also called a fossil fuel. A coal mine is shown in Fig. 3.2.



**Fig. 3.2:** A coal mine

When heated in air, coal burns and produces mainly carbon dioxide gas.

Coal is processed in industry to get some useful products such as coke, coal tar and coal gas.

### Coke

It is a tough, porous and black substance. It is an almost pure form of carbon. Coke is used in the manufacture of steel and in the extraction of many metals.

### Coal Tar

It is a black, thick liquid (Fig. 3.3) with an unpleasant smell. It is a mixture of



**Fig. 3.3:** Coal tar

about 200 substances. Products obtained from coal tar are used as starting materials for manufacturing various substances used in everyday life and in industry, like synthetic dyes, drugs, explosives, perfumes, plastics, paints, photographic materials, roofing materials, etc. Interestingly, naphthalene balls used to repel moths and other insects are also obtained from coal tar.

These days, bitumen, a petroleum product, is used in place of coal-tar for metalling the roads.

### Coal Gas

Coal gas is obtained during the processing of coal to get coke. It is used

Coal gas was used for street lighting for the first time in London in 1810 and in New York around 1820. Now a days, it is used as a source of heat rather than light.

as a fuel in many industries situated near the coal processing plants.

### 3.2 Petroleum

You know that petrol is used as a fuel in light automobiles such as motor cycles/scooters and cars. Heavy motor vehicles like trucks and tractors run on diesel. Petrol and diesel are obtained from a natural resource called **petroleum**. The word petroleum is derived from petra (rock) and oleum (oil) as it is mined from between the rocks under Earth as shown in Fig. 3.4.

Do you know how petroleum is formed?

Petroleum was formed from organisms living in the sea. As these organisms died, their bodies settled at the bottom of the sea and got covered with layers of sand and clay. Over millions of years, absence of air, high temperature and high pressure

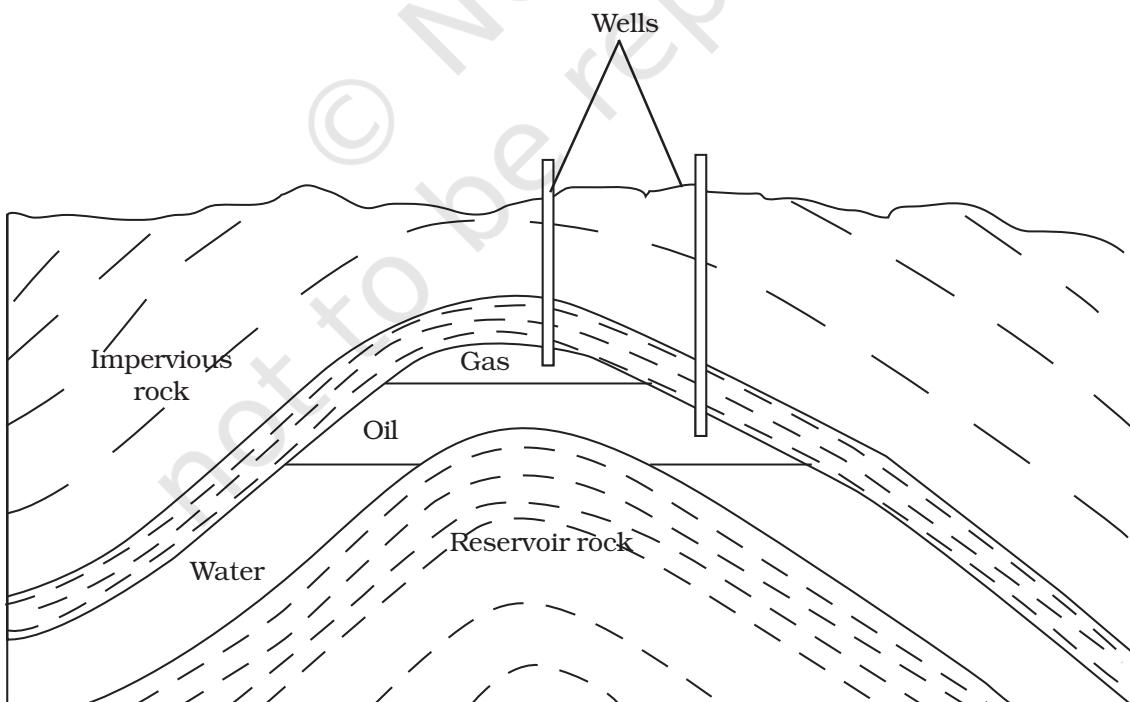
transformed the dead organisms into petroleum and natural gas.

Look at Fig. 3.4. It shows the deposits of petroleum and natural gas. You see that the layer containing petroleum oil and gas is above that of water. Why is it so? Recall that oil and gas are lighter than water and do not mix with it.

The world's first oil well was drilled in Pennsylvania, USA, in 1859. Eight years later, in 1867, oil was struck at Makum in Assam. In India, oil is found in Assam, Gujarat, Mumbai High and in the river basins of Godavari and Krishna.

### Refining of Petroleum

Petroleum is a dark oily liquid. It has an unpleasant odour. It is a mixture of various constituents such as petroleum gas, petrol, diesel, lubricating oil, paraffin wax, etc. The process of



**Fig. 3.4 : Petroleum and natural gas deposits**



**Fig. 3.5:** A petroleum refinery

separating the various constituents/fractions of petroleum is known as refining. It is carried out in a **petroleum refinery** (Fig. 3.5).

Various constituents of petroleum and their uses are given in Table 3.1.

Many useful substances are obtained from petroleum and natural gas. These are termed as 'Petrochemicals'. These are used in the manufacture of detergents, fibres (polyester, nylon, acrylic etc.), polythene and other man-made plastics. Hydrogen gas obtained from natural gas, is used in the production of fertilisers (urea). Due to its great commercial importance, petroleum is also called 'black gold'.

### 3.3 Natural Gas

Natural gas is a very important fossil fuel because it is easy to transport through pipes. Natural gas is stored under high pressure as compressed natural gas (CNG). CNG is used for power generation. It is now being used

**Table 3.1 Various Constituents of Petroleum and their Uses**

S.No.	Constituents of Petroleum	Uses
1.	Petroleum Gas in Liquid form (LPG)	Fuel for home and industry
2.	Petrol	Motor fuel, aviation fuel, solvent for dry cleaning
3.	Kerosene	Fuel for stoves, lamps and for jet aircrafts
4.	Diesel	Fuel for heavy motor vehicles, electric generators
5.	Lubricating oil	Lubrication
6.	Paraffin wax	Ointments, candles, vaseline etc.
7.	Bitumen	Paints, road surfacing

as a fuel for transport vehicles because it is less polluting. It is a cleaner fuel.

The great advantage of CNG is that it can be used directly for burning in homes and factories where it can be supplied through pipes. Such a network of pipelines exists in Vadodara (Gujarat), some parts of Delhi and other places.

Natural gas is also used as a starting material for the manufacture of a number of chemicals and fertilisers. India has vast reserves of natural gas. In our country, natural gas has been found in Tripura, Rajasthan, Maharashtra and in the Krishna Godavari delta.



Can coal, petroleum and natural gas be prepared in the laboratory from dead organisms?



No. Their formation is a very slow process and conditions for their formation cannot be created in the laboratory.

### 3.4 Some Natural Resources are Limited

You have studied in the beginning of the chapter that some natural resources are exhaustible like fossil fuels, forests, minerals etc.

You know that coal and petroleum are fossil fuels. It required the dead organisms millions of years to get converted into these fuels. On the other hand, the known reserves of these will last only a few hundred years. Moreover, burning of these fuels is a major cause of air pollution. Their use is also linked to global warming. It is therefore necessary that we use these fuels only when absolutely necessary. This will result in better environment, smaller risk of global warming and their availability for a longer period of time.

In India, the Petroleum Conservation Research Association (PCRA) advises people how to save petrol/diesel while driving. Their tips are

- drive at a constant and moderate speed as far as possible,
- switch off the engine at traffic lights or at a place where you have to wait,
- ensure correct tyre pressure.
- ensure regular maintenance of the vehicle.

## KEYWORDS

**COAL**

**COAL GAS**

**COAL TAR**

**COKE**

**FOSSIL FUEL**

**NATURAL GAS**

**PETROLEUM**

**PETROLEUM  
REFINERY**

## WHAT YOU HAVE LEARNT

- ➲ Coal, petroleum and natural gas are fossil fuels.
- ➲ Fossil fuels were formed from the dead remains of living organisms millions of years ago.
- ➲ Fossil fuels are exhaustible resources.
- ➲ Coke, coal tar and coal gas are the products of coal.
- ➲ Petroleum gas, petrol, diesel, kerosene, paraffin wax, lubricating oil are obtained by refining petroleum.
- ➲ Coal and petroleum resources are limited. We should use them judiciously.

## Exercises

1. What are the advantages of using CNG and LPG as fuels?
2. Name the petroleum product used for surfacing of roads.
3. Describe how coal is formed from dead vegetation. What is this process called?
4. Fill in the blanks.
  - (a) Fossil fuels are \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
  - (b) Process of separation of different constituents from petroleum is called \_\_\_\_\_.
  - (c) Least polluting fuel for vehicle is \_\_\_\_\_.
5. Tick True/False against the following statements.
  - (a) Fossil fuels can be made in the laboratory. (T/F)
  - (b) CNG is more polluting fuel than petrol. (T/F)
  - (c) Coke is almost pure form of carbon. (T/F)
  - (d) Coal tar is a mixture of various substances. (T/F)
  - (e) Kerosene is not a fossil fuel. (T/F)
6. Explain why fossil fuels are exhaustible natural resources.

7. Describe characteristics and uses of coke.
8. Explain the process of formation of petroleum.
9. The following Table shows the total power shortage in India from 1991–1997. Show the data in the form of a graph. Plot shortage percentage for the years on the Y-axis and the year on the X-axis.

S. No.	Year	Shortage (%)
1	1991	7.9
2	1992	7.8
3	1993	8.3
4	1994	7.4
5	1995	7.1
6	1996	9.2
7	1997	11.5

### Extended Learning — Activities and Projects

1. Get an outline map of India. Mark the places in the map where coal, petroleum and natural gas are found. Show the places where petroleum refineries are situated.
2. Choose any five families of your neighbourhood. Enquire whether their energy consumption (coal, gas, electricity, petrol, kerosene) has increased or decreased in the last five years. Enquire also about the measures they adopt to conserve energy.
3. Find out the location of major thermal power plants in India. What could be the reasons for their being located at those places?

For more information, visit:

- [www.energyarchive.ca.gov](http://www.energyarchive.ca.gov)
- [web.ccsd.k12.wy.us](http://web.ccsd.k12.wy.us)
- [web.pcra.org](http://web.pcra.org)