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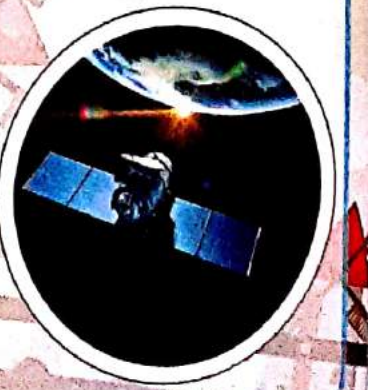
Contents



1 Crop Production and Management

Use **Cordova Smart Class Software** on the **smart board** in class to know the various agricultural practices and understand the production and management of crops.

Food is one of the basic necessities of life for all organisms. Food gives us energy for carrying out all body functions such as digestion, respiration and excretion. We need food for growth, development and body repair. It also protects the body against diseases.

Among all the organisms, only green plants make their own food. Animals depend on plants and other animals for their food. We also get our food from plants and animals.

Till 10,000 BCE, the nomadic people wandered from place to place in search of food and shelter. They ate fruits and raw vegetables of forest plants and hunted animals for food.

Later, people learnt farming and cultivated wheat, rice and other food crops. They also domesticated animals to meet their food requirements and did hard physical work. This marked a new era in the history of humans—**from food-gatherers to food-producers.**

AGRICULTURE

Agriculture is an applied Science that deals with the mass production of crop plants and animals useful to human beings. Besides crop production, several other related activities like poultry, fishing and sericulture come within the scope of agriculture. The population of India is increasing rapidly. To fulfil the food requirement of such a large population, increased production, proper management and distribution of food is necessary.

CROPS AND CROPPING PATTERNS

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

Table 1.1 Some crop plants grown in India

S. No.	Types of crops	Crop produce
1.	Cereals	Wheat, rice, maize, *bajra*, barley
2.	Pulses	Gram, pea, bean, *moong*
3.	Vegetables	Cabbage, cauliflower, brinjal
4.	Fruits	Mango, apple, pear, guava
5.	Spices	Cardamom, black pepper
6.	Fibre crops	Cotton, jute, hemp
7.	Plantation crops	Tea, coffee, rubber, coconut
8.	Sugar crops	Sugar cane, sugar beet
9.	Oil crops	Groundnut, mustard, castor
10.	Medicinal crops	*Tulsi, Asparagus, neem*
11.	Timber	Teak, *sheesham*, pine

Horticulture (*Hortus*- garden, *culture*-cultivation) is a branch of agriculture that deals with the production of vegetables, fruits and ornamental (decorative) plants.

India is a very vast country. A rich variety of crops is grown in different parts of the country because the climatic conditions like temperature, humidity

and rainfall vary from one region to another. Despite this diversity, two broad cropping patterns can be identified. They are:

(i) Kharif crops (ii) Rabi crops

1. Kharif Crops

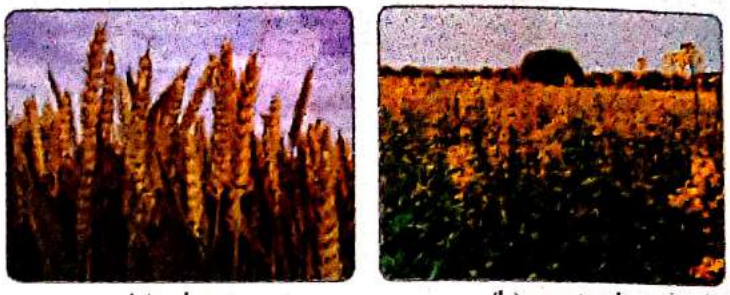
The crops that are sown in the rainy season are called kharif crops. Kharif crops are sown at the beginning of the monsoon season (June/July) and harvested at the end of the monsoon season (September/October). Kharif crops depend on monsoon rain for growth. Rice, maize, soya bean, groundnut and cotton are kharif crops (Fig. 1.1).

(a) rice (b) maize

Fig. 1.1 Kharif crops

2. Rabi Crops

The crops that are sown in the winter season are called rabi crops. Rabi crops are sown at the beginning of winter season (October/November) and harvested in the months of March/April. Rabi crops do not depend on monsoon rain for growth. Wheat, gram, pea, mustard and linseed are rabi crops (Fig. 1.2).



(a) wheat (b) mustard

Fig. 1.2 Rabi crops

AGRICULTURAL PRACTICES

Agricultural practices are activities in a particular sequence undertaken by farmers over a period of time to cultivate a good crop (Fig. 1.3).

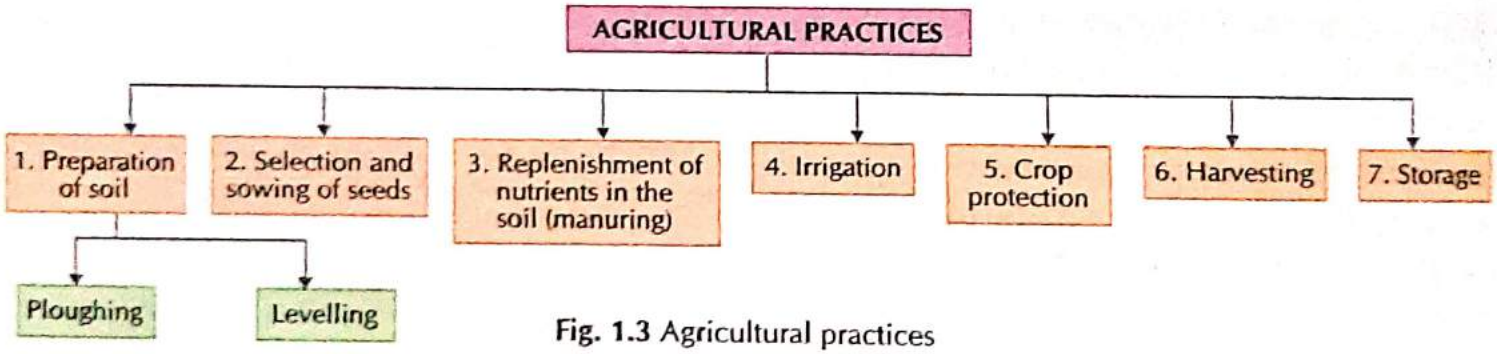


Fig. 1.3 Agricultural practices

1. Preparation of Soil

It is the first step of growing crops. It involves loosening and turning of soil.

Preparation of soil involves the following two steps: (i) Ploughing (ii) Levelling.

Agricultural Implements

The various tools needed during agricultural practices are called agricultural implements. The main tools used in preparation of soil are **plough, hoe and cultivator.**

Plough: It is used for tilling and scraping of soil, weeding, manuring, etc. It consists of a strong triangular iron strip called **ploughshare**. The main part of the plough is a long rod of wood called **ploughshaft.** There is a handle at one end of the shaft. The other end of the ploughshaft is attached to a beam that is put on the

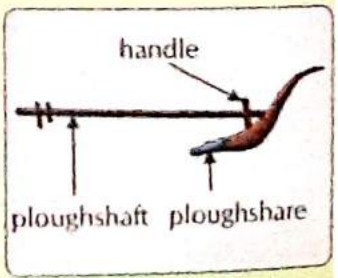


Fig. 1.4 A plough

neck of the bulls. Some other animals like horses and camels are also used to draw plough. The ploughshare is curved to turn the soil after cutting (Fig. 1.4).

Hoe: It is used for removing weeds and for loosening the soil. It consists of a long rod of wood or iron. A strong, broad and bent plate of iron is fixed at one end of the long rod that works like a blade. At the other end, a beam is attached (Fig. 1.5). The beam is placed on the neck of the bulls.

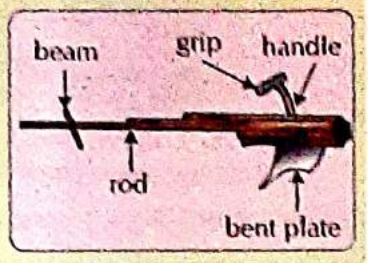


Fig. 1.5 A hoe

Cultivator: The tractor-driven plough is called cultivator (Fig. 1.6). The use of cultivator saves both time and labour.


Fig. 1.6 A tractor-driven cultivator

A. **Ploughing: The process of loosening and turning of the soil is called ploughing or tilling.** This is done by using a plough that is either drawn by a pair of bulls or driven by a tractor (Fig. 1.7).


Fig. 1.7 Ploughing

Loosening of soil is important because of the following reasons:

(i) Loose soil particles have more air spaces, that help the roots of crop plants to breathe better.

(ii) Loose soil particles hold more water for a longer duration. This helps the roots to absorb more water.

(iii) Loose soil helps roots to penetrate deeper through the layers of soil. This helps to fix the plants more firmly.

(iv) Loose soil mixes with manure and fertilisers more easily.

(v) It helps to remove weeds from the field.

(vi) Loose soil promotes the growth of useful soil microbes. These microbes help to add humus to the soil.

(vii) While turning the soil during ploughing, nutrient-rich soil is brought up from lower levels of soil. So, the plants can use these nutrients.

Earthworms live in soil (Fig. 1.8). They turn and loosen the soil. Their burrowing action creates channels through which plant roots penetrate the soil more easily. So, earthworms are called farmer's friends.


Fig. 1.8 Earthworm–farmer's friend

B. **Levelling:** After ploughing, the ploughed land is levelled and pressed lightly with the help of a **wooden plank** or **iron leveller** (Fig. 1.9). A leveller can be driven by animals or by a tractor in the field.

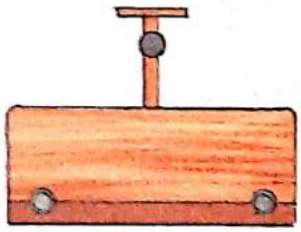


Fig. 1.9 A wooden leveller

Levelling is done for the following reasons:

(i) The ploughed field may have big pieces of soil called **crumbs** that need to be crushed.

(ii) Levelling prevents soil erosion. The levelled

soil is not blown away by the wind or drained of by water.

(iii) Levelling also helps in the uniform distribution of water (moisture) and manure.

Sometimes, manure is added to the soil before ploughing. This helps in proper mixing of soil with manure. Some fertilisers are also added before the sowing of seeds and some are added later.

Multiple Choice Questions (MCQs)

Tick (✓) the correct options:

1. The crops that are sown in the rainy season are called _____ crops.
   (a) kharif ◯ (b) rabi ◯
   (c) cash ◯ (d) none of these ◯
2. The process of loosening and turning of the soil is called _____.
   (a) ploughing ◯ (b) levelling ◯
   (c) manuring ◯ (d) none of these ◯

2. Selection and Sowing of Seeds

After soil preparation, the next step is selection and sowing of seeds. This is the most important stage in crop production.

Plants grow from seeds. While selecting seeds, the following precautions should be taken:

(i) **only clean, healthy and disease-free seeds should be selected.**

(ii) **Seeds should be treated with fungicides** (chemicals that kill disease-causing fungi).

ACTIVITY 1 *Use Cordova Smart Class Software on the smart board in class to perform this activity.*

To separate good and healthy seeds from damaged (unhealthy) ones

Things needed: A beaker, water, a stirrer and wheat seeds

Method:

1. Take a beaker and fill more than half of it with water.
2. Put a handful of wheat seeds in the beaker containing water. Stir the water well and leave the beaker. Wait for some time (Fig. 1.10).

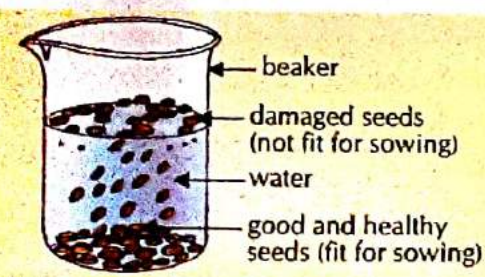


Fig. 1.10 Method for separating the healthy seeds from the damaged ones

Observation: Some seeds float in water, while others settle down at the bottom.

Discussion: Damaged seeds become hollow and are thus, lighter. Therefore, they float in water. Good and healthy seeds are heavier and thus, they sink at the bottom.

After selection of seeds, they need to be sown in the field. **Sowing of seeds is the process of placing seeds in the soil.** Care must be taken while sowing them. Seeds have to be sown—

(a) **at the right depth,** neither too shallow nor too deep.

(b) **at right intervals** so that they get proper air, sunlight and nutrients.

Seeds are sown in the field by any of the methods described below:

A. By traditional tool: The traditional tool for sowing seeds is shaped like a funnel having two or three vertical long tubes with sharp ends (Fig. 1.11). The seeds are filled into the funnel, passed down through the pipes with sharp ends. The sharp ends pierce the soil and place the seeds there.

Fig. 1.11 Traditional method of sowing

B. By seed drill: A seed drill has a funnel-shaped seed bowl connected to several tubes (Fig. 1.12). The drill is attached to a plough. As the plough makes furrows along the field, the

seeds in the seed bowl are released through the tubes and get deposited in the soil. Nowadays, a seed drill is used for sowing seeds with the help of a tractor.

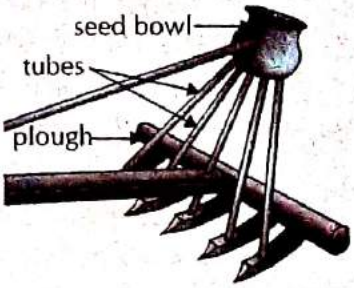


Fig. 1.12 A seed drill

The advantages of using a seed drill for sowing seeds are as follows:

(i) It sows the seeds uniformly at appropriate distances and depths.

(ii) It ensures that seeds get covered with soil after sowing. This prevents the damage caused by birds.

(iii) It saves time and labour.

C. Transplantation: Seeds of some plants like paddy, tomato, onion, chilli and brinjal are first grown in small nurseries. When seedlings grow, they are manually transplanted in the field. **The process of transferring the seedlings from nurseries to fields is called transplantation** (Fig. 1.13). This practice has the following advantages:


Fig. 1.13 Transplantation

(i) It helps in selecting and planting only healthy seedlings.

(ii) Spacing can be controlled because of manual plantation.

(iii) Plants get sufficient sunlight, nutrients and water from the soil.

3. Replenishment of Nutrients in the Soil

Soil supplies mineral nutrients to the crops. These nutrients are essential for the growth of plants. Due to economic reasons, farmers grow crops in the same field year after year. Continuous growing of crops makes the soil deficient in certain nutrients and the soil loses its fertility. So, the soil nutrients should be replenished from time to time. This could be done either by natural methods or addition of manure or fertilisers.

A. Natural methods to restore soil fertility: The fertility of soil is restored naturally by adopting the following methods:

(i) Fallowing: In this method, land is left uncultivated (fallow) for one or more seasons. The fallow land regains the nutrients by decomposition of remains of plants and animals by the action of microbes.

(ii) Crop rotation: Crop rotation is the method of growing different crops alternately on the same field. For example, the farmers grow crops like wheat or barley in the first year. This is followed by growing leguminous plants like pea or soya bean in the next season. This helps in replenishment of soil with nitrogen.

Fig. 1.14 Roots of leguminous plant

You have learnt earlier in class 7 that bacteria called *Rhizobium* are present in the root nodules of leguminous plants (Fig. 1.14). These bacteria convert atmospheric nitrogen into simpler nitrogen compounds (nitrates) that can easily be absorbed by plants. Farmers are being encouraged to adopt this practice.

(iii) Mixed cropping: In this method, two or more crops are grown together in the same field. The crops are selected in such a manner that the nutrient requirement of one crop is fulfilled by the other.

Leguminous crops such as pea, soya bean and cereal crops like wheat or rice can be grown together in the same field. Cotton and groundnut (leguminous crop) are grown together.

B. Manure and fertilisers: The use of manure or fertilisers is called manuring. These substances increase the fertility of the soil.

(i) **Manure: Manure is an organic substance rich in nutrients obtained by the decomposition of plant and animal wastes by microbes.** Compost is prepared by the decomposition of farm and domestic organic waste materials like animal excreta, faecal matter of human beings, sewage wastes, weeds, dry leaves, etc., in a compost pit. The process of producing compost is called composting. We may define composting as **a biological process in which microbes decompose the organic matter (present in organic waste materials) to produce manure.**

(ii) **Fertilisers: Fertilisers are human-made chemical substances that are rich in one or more nutrients like nitrogen (N), phosphorus (P) and potassium (K). Fertilisers are produced in factories.** Some examples of fertilisers are urea, ammonium sulphate, superphosphate, ammonium phosphate, potash and nitrophosphate.

Fertilisers are soluble in water and thus, are easily absorbed by the plants and increase the crop yield. Fertilisers are usually applied either by spraying (using a sprayer) or through irrigation canals.

Advantages of manure: The organic manure is considered better than fertilisers. This is because it–

- enhances the water-holding capacity of the soil.
- makes the soil porous that makes exchange of gases easy.
- increases the number of soil-friendly microbes.
- improves the texture of the soil.
- adds humus to the soil.
- is not expensive and can easily be prepared from wastes in the farm.
- does not cause water pollution.

Table 1.2 Differences between fertiliser and manure

S.No.	Parameters	Fertiliser	Manure
1.	Nature	It is an inorganic salt.	It is a natural organic substance.
2.	Preparation	It is prepared in factories.	It is prepared in fields by the decomposition of animal wastes, human wastes and plant residues.
3.	Humus	It does not add humus to the soil.	It provides a lot of humus to the soil.
4.	Amount of nutrients present	It is rich in plant nutrients like nitrogen, phosphorus and potassium.	It contains less amount of essential plant nutrients.
5.	Cost	It is costly.	It is cheap.
	Examples	Urea and potash	*Sunn hemp, Sesbania,* cow dung

Disadvantages of using fertilisers: Modern agriculture depends greatly on chemical fertilisers. Excessive use of fertilisers increases the crop yield, but when fertilisers get washed off through irrigation and rainfall, they reach water bodies like rivers and lakes. This causes **water pollution.** The polluted water is unfit for human consumption. It even kills the aquatic animals such as fishes. Fertilisers are **non-biodegradable**, thus, also cause **soil pollution.**

To maintain the fertility of the soil, excessive use of fertilisers should be avoided and use of manure should be promoted.

ACTIVITY 2 *Use Cordova Smart Class Software on the smart board in class to perform this activity*

To observe the growth of seedlings with manure and fertiliser

Things needed: Some gram seeds, three thermocol glasses, soil, compost (manure), urea (fertiliser) and water

Method:

1. Take some gram seeds. Let them germinate and grow into seedlings.
2. Now, take three empty thermocol glasses and label them A, B and C.
3. In glass A, put little amount of soil mixed with a little compost. In glass B, put soil mixed with little urea. In glass C, put the same amount of soil without adding anything.
4. Plant the seedlings in each glass. Sprinkle little water in each and keep them at a place where they get sufficient air and sunlight. Water them regularly and observe their growth.

(a) with manure (b) with fertiliser (c) only soil

Fig. 1.15 Growing seedlings

Observation:

Glass A : The seedlings grow well, look green and healthy [Fig. 1.15 (a)].

Glass B : The seedlings grow faster, look green and healthy [Fig. 1.15 (b)].

Glass C : The seedlings show very little growth and look pale yellow [Fig. 1.15 (c)].

Discussion: Seedlings of glass B grow the fastest because fertilisers are soluble and easily absorbed by plants. They are very rich in essential plant nutrients. Seedlings of glass A grow well because manure is good for plant growth. They show comparatively less growth because manure is not directly absorbed by the plants. Seedlings in glass C show very less growth because of less availability of nutrients.

4. Irrigation

Water is important for the survival of plants because of the following reasons:

(i) Water is important for the proper growth and development of flowers, fruits and seeds of plants.

(ii) Water is absorbed by the roots. Along with water, minerals and fertilisers are also absorbed.

(iii) Water is essential for germination of seeds.

(iv) Water is essential for carrying out the process of photosynthesis to make food.

(v) Water dissolves nutrients that are transported to each part of the plant.

(vi) Water also protects the crop from both frost and hot air currents.

Therefore, supply of water to crops at regular intervals is essential for crop production. Rainfall is one of the main sources of water for crops. Since we cannot always depend upon rainfall, so, it is essential that farmers should have other ways of supplying water to the crop fields.

The supply of water to the crop plants at regular intervals through sources other than rain is called irrigation. The time and frequency of irrigation depend on the following three factors :

(a) nature of crop plants (b) nature of soil

(c) season when the crop grows

Let us study the above factors in detail.

(a) **Crop-based irrigation:** Some crop plants require more water, while others need less water. For example, rice crop requires standing

water and continuous water supply, whereas some crops like wheat and cotton require less water.

(b) **Soil-based irrigation:** Irrigation also depends on the nature of the soil in which the crop is grown. Sandy soil needs more frequent irrigation due to its poor water-retaining capacity. Clayey soil needs less frequent irrigation due to its good water-retaining capacity.

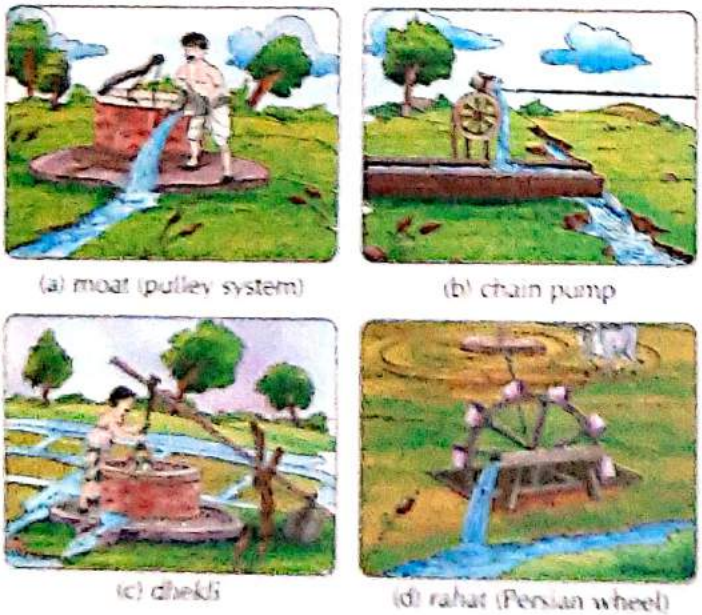
(c) **Season-based irrigation:** The rate of evaporation of water from soil and leaves increases in summers. So, the frequency of irrigation has to be increased.

Sources of irrigation: The sources of irrigation are wells, tube wells, ponds, lakes, rivers, dams, tanks and canals.

Traditional methods of irrigation: The water available in wells, lakes and canals is lifted up by different methods for irrigating the fields in different regions of our country.

Cattle or human labour is used in these methods. So, these methods are cheaper, but less efficient.

The various traditional ways are: **moat (pulley system), chain pump,** ***dhekli*** and ***rahat*** [Fig. 1.16 (a-d)].



(a) moat (pulley system) (b) chain pump

(c) *dhekli* (d) rahat (Persian wheel)

Fig. 1.16 Traditional methods of irrigation

These days, pumps are commonly used for lifting water. Diesel, electricity or solar energy is utilised in these pumps.

Multiple Choice Questions (MCQs)

Tick (✓) the correct options:

1. Leguminous plants help in the replenishment of the soil with _____.
   (a) oxygen ◯ (b) nitrogen ◯
   (c) hydrogen ◯ (d) carbon dioxide ◯
2. Which of the following is not a traditional method of irrigation?
   (a) moat ◯ (b) drip ◯
   (c) *dhekli* ◯ (d) *rahat* ◯

Modern methods of irrigation: The modern methods of irrigation help us to use water economically. Two main methods are—

(i) Drip system (ii) Sprinkler system

1. **Drip system:** In this system, holes in pipes allow water to fall drop by drop just at the position of the roots (Fig. 1.17). Water is not wasted at all. This system also prevents water loss due to evaporation. It is a boon in regions where less water is available. This method is good for watering fruit plants, gardens and trees.

Fig. 1.17 Drip irrigation system

2. **Sprinkler system:** In sprinkler system, water is sprayed on the plants using sprinklers. The perpendicular pipes having rotating nozzles on top are called **sprinklers** (Fig. 1.18). The sprinklers are joined to the main pipeline at regular intervals. **Pumps** are fitted in this

system for lifting water. When the pump is switched 'ON', the water is lifted and allowed to flow through the main pipe under pressure. Through the rotating nozzles, it gets sprinkled on the crop as if it is raining. Sprinkler is very useful for sandy soil or for the uneven land where sufficient water is not available. It is used in lawns and coffee plantation.

Fig. 1.18 Sprinkler system

During irrigation, it is necessary to ensure the proper availability of water with adequate drainage in irrigated field. Excessive irrigation causes waterlogging. Due to waterlogging, the air in the soil gets replaced with water that reduces the supply of air to the roots of plants. This adversely affects the growth of plants.

ACTIVITY 3

Visit a nearby field and find out which method do the farmers use for irrigation. Prepare a report.

5. Crop Protection

A. Protection from weeds

The unwanted plants that grow along with a cultivated (main) crop in a field are called weeds. Some common weeds found in India include *Amaranthus* (*chaulai*) and *Chenopodium* (*bathua*) [Fig. 1.19 (a), (b)].

Weeds harm crops in the following ways:

(i) The growth of weeds in crop fields is harmful because they consume a great amount of nutrients, water, sunlight and space that is available for crop plants.

(a) *Amaranthus* (*chaulai*) (b) *Chenopodium* (*bathua*)

Fig. 1.19 Some common weeds

(ii) The weeds harbour pests (harmful insects that destroy crops). Crop pests spread various diseases.

(iii) Some weeds produce toxic substances that may be poisonous for animals and human beings.

Hence, it is necessary to remove the weeds to protect the crop plants. The best time for the removal of weeds is before they produce flowers and seeds. **The process of removing the weeds from a crop field is called weeding.**

Weeding can be done by the following methods:

(i) **Mechanical method:** Weeds may be pulled out with **hand** or through **ploughing.**

They can also be removed by using tractor-driven **seed drill, hoe** and **harrow** [Fig. 1.20 (a)]. The weeds that appear during the growth of crop plants are removed manually by using a **trowel** (***khurpi***) [Fig. 1.20 (b)].

(a) a harrow (b) a garden trowel

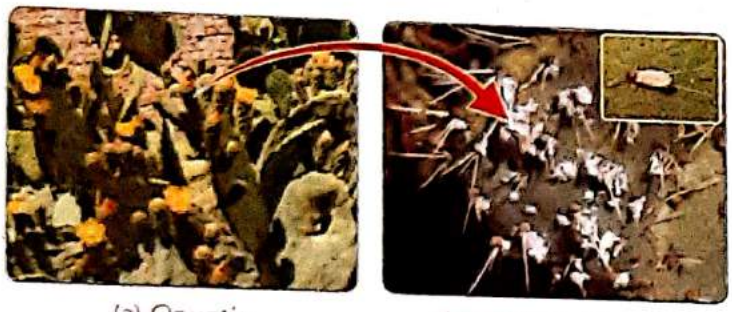
Fig. 1.20 Mechanical implements used for weeding

(ii) **Chemical method: Weed-killing chemicals, called weedicides, are sprayed on weeds in the field to destroy or kill them.** A common weedicide is 2,4-D (2,4-dichlorophenoxy acetic acid). Weedicides do not damage the main crops. Spraying of weedicides may affect

the health of farmers. So, they should use these weedicides very carefully. They should cover their nose and mouth with a piece of cloth during spraying of weedicides with a sprayer (Fig. 1.21). The grains should be washed thoroughly before consumption because weedicides are poisonous.

Fig. 1.21 A farmer spraying weedicides with a sprayer

(iii) **Biological method:** Insects or some other organisms that consume and specifically destroy the weed plants are introduced in the crop fields. This is called **biological control of weeds.** The best Indian example of biological control is weeding of prickly-pear cactus (*Opuntia*) by using the cochineal insects (Fig. 1.22).



(a) *Opuntia* (b) cochineal insects

Fig. 1.22 Biological control of weeds

B. Protection from pests and diseases

Pests are organisms that attack and damage crops. They may be **rodents** (rats), **insects** (locusts, weevils and termites) (Fig. 1.23) and many more. These pests can be controlled by pesticides. Pesticides kill the pests and their eggs without damaging the crops. These include **rodenticides** (kill rodents) and **insecticides** (kill insects). They must be sprayed manually by hand-operated machines or by low-flying aircrafts, if fields are large. Some common insecticides are BHC (commonly called gammexane), malathion and disyston.

(a) a locust (b) a weevil (c) a termite

Fig. 1.23 Some insect pests

Science In Life

We should wash all the fruits and vegetables thoroughly before consuming them because they have a coating of pesticides that may be harmful for us and may cause various harmful diseases.

The modern day agricultural practices use a huge amount of pesticides that is very dangerous for humans and other animals. These pesticides usually get mixed with the soil particles, get dissolved in the soil water and are absorbed by the plants. When we consume fruits, leaves, seeds, etc., of these plants, the pesticides enter our bodies and cause diseases.

6. Harvesting

It usually takes 3 to 4 months for a cereal crop to mature. **The process of cutting and gathering of crop after its maturation is called harvesting.** Once the crop matures, it is harvested (cut and gathered). In harvesting, crops are pulled out or cut close to the ground.

DO YOU KNOW?

Harvest time is the happiest time for the farmers and their families. The sight of golden fields of standing crop loaded with grains, fills the hearts of farmers with joy and a sense of prosperity. The farmers sing traditional songs to express their joy and pleasure for getting the product of their hard work and labour. Special festivals associated with the harvest season are **Pongal, Baisakhi, Holi, Nabanya** and **Bihu.**

Baisakhi festival

Harvesting in our country is either done manually by sickle (Fig. 1.24) or by a machine called **harvester**.

Fig. 1.24 A sickle

Fig. 1.25 Manual threshing

After the crop is harvested, the grains are separated from the chaff by a process called threshing. This can be done manually by striking the crop against a hard surface (Fig. 1.25) or by making farm animals trample the crop.

A machine called **thresher** is also used for threshing. In large farms, a machine called **combine** (Fig. 1.26) is used. A combine machine performs a dual job, as a harvester (for harvesting) and a thresher (for threshing).

Fig. 1.26 A combine is used for both harvesting and threshing.

The grains separated by the above method need to be winnowed. **Winnowing helps in the separation of the grains from the husk** (Fig. 1.27).

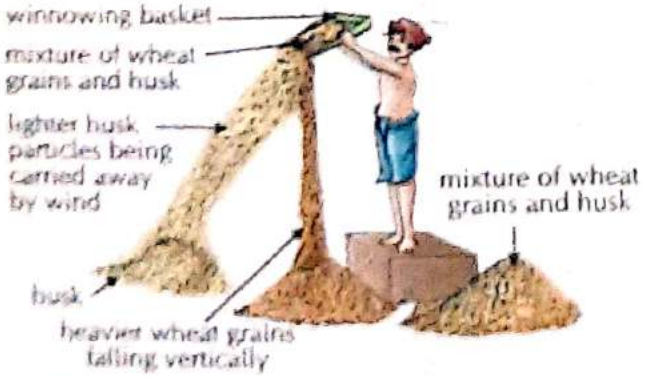


Fig. 1.27 A farmer separating husk from wheat grains by winnowing

The seeds being heavier, fall straight to the ground, while the light husk and hay are blown a little farther away by the wind. Winnowing is also done by a **winnowing machine** (Fig. 1.28).

Fig. 1.28 Winnowing machine

7. Storage

Proper storage of food grains is necessary to get regular supply of food products throughout the year as proper storage protects the food grains and other agricultural products from pests, rodents and other microbes. Due to improper storage, more than 10% of crop produce is spoiled in India. The harvested crop grains have more moisture content. So, before storing them, the grains should be properly **dried in the Sun** to reduce the moisture content. On a commercial scale, **mechanical driers** with hot blowing air are used. This prevents the attack by insects, pests, bacteria and fungi.

Science Update

'Sandesh Pathak', is a software application, that uses TTS (Text-To-Speech) software. It takes the received SMS containing agriculture-related advice to solve farming problems, viz., use of fertilisers, weed management, weather forecasts, updates on the latest technology for agriculture, etc., as input and reads the SMS loudly to help the illiterate farmers who may have difficulty in reading.

The dried food grains are then stored in suitable storage containers.

- On a small scale, farmers store grains in **jute bags** or **metallic bins**.

(a) granaries (b) silos

Fig. 1.29 Storage of grains in granaries and silos

- On a commercial (large) scale, food grains are stored in **gunny bags in granaries or in silos** [Fig. 1.29 (a) and (b)].

DO YOU KNOW?

Fruits and vegetables are stored in cold storages where the temperature is maintained in between 0 °C - 4 °C. The low temperature prevents the growth of microorganisms. It also stops the action of enzymes present in fruits and vegetables and prevents their spoilage. The cold storages are used to store crop produce for a long time, reduce loss and spoilage of food and maintain their nutritive value.

The gunny bags filled with the dried food grains are stacked in a large granary (godown). Pathways (called **alleys**) are provided between the stacks of grain-filled bags for periodic inspection, spraying and fumigation. This treatment protects the food grains from pests and microorganisms.

The silos are big and tall cylindrical structures. They store different stocks of food items at different levels. Each level has an opening through which grains can be taken out when required.

INCREASING CROP YIELD

The population of our country is increasing very rapidly. To fulfil the food requirements of such a large population, we need to increase the production of food grains. Our country has achieved success in increasing the production of food to some extent because of certain new discoveries and techniques that are introduced in this field. Carrying out the basic agricultural practices systematically can substantially increase the crop yield. Providing better irrigation facilities, proper use of natural methods of replenishing nutrients in soil, using suitable methods of protection from weeds, pests and diseases and use of advanced agricultural implements may improve the crop yield.

Use of better crop varieties can increase the crop yield. Better crop varieties having disease resistance and higher yield can be developed through plant breeding. **Plant breeding is a technique through which scientists control the reproduction in plants to get the desired offspring.**

Hybridisation

Hybridisation is a technique used for developing new varieties of crops by cross-breeding two different varieties. The new variety (hybrid) contains the desired characteristics of both the parents.

For hybridisation, one plant is selected as male and the other one as female. The anthers of female plant are removed at the bud stage to prevent self-pollination. This process is called **emasculation**. Then, the pollens of male plant are dusted on the stigma of emasculated flower. Once the process of pollination is done, the male and female gametes fuse and produce hybrid seeds that contain the characteristics of both the male and female plants. For example, to get a variety having higher yield and disease resistance, scientists select two plants one having a higher yield and the other having disease resistance. This seed is called stock of new variety.

FOOD FROM ANIMALS

The animals need good food, shelter and care for proper growth and food production. **The Science that deals with breeding, feeding and caring of domestic animals is called animal husbandry.**

We get milk from cow, buffalo, goat and camel. Milk is used to prepare many products like butter, cheese, curd and *ghee*. We get eggs and meat from hen, duck, turkey. **The production of fish on a large scale by farming fish in fish nurseries (called hatcheries) is known as pisciculture.** We get cod liver oil from fish that is rich in vitamin D.

EXERCISES

*Use **Cordova Smart Class Software** on the **smart board** in class to do these exercises.*

A. Tick (✓) the correct options:

1. The Science that deals with breeding, feeding and caring of domestic animals is called _____.
   (a) animal husbandry ◯ (b) breeding ◯ (c) horticulture ◯ (d) pisciculture ◯
2. Which of the following is not a cereal?
   (a) maize ◯ (b) pea ◯ (c) *bajra* ◯ (d) barley ◯
3. Urea is a _____.
   (a) fertiliser ◯ (b) compost ◯ (c) manure ◯ (d) none of these ◯
4. *Rhizobium* bacteria are found in _____.
   (a) leaves ◯ (b) stem ◯ (c) root nodules ◯ (d) flowers ◯
5. On commercial scale, food grains are stored in big cylindrical structures called
   (a) godown ◯ (b) silos ◯ (c) alleys ◯ (d) none of these ◯
6. Uprooting of weeds by a garden trowel is a method of controlling them _____.
   (a) chemically ◯ (b) mechanically ◯ (c) biologically ◯ (d) none of these ◯
7. Before sowing, seeds should be treated with _____.
   (a) insecticides ◯ (b) pesticides ◯ (c) fungicides ◯ (d) fertilisers ◯
8. The soil that needs less frequent irrigation is _____.
   (a) sandy ◯ (b) clayey ◯ (c) rocky ◯ (d) loamy ◯
9. The process of removal of anthers to prevent self pollination is called
   (a) hybridisation ◯ (b) emasculation ◯ (c) harvesting ◯ (d) irrigation ◯

B. Fill in the blanks:

1. The crops that are sown in the winter season are called _____.
2. The ploughed land is levelled with the help of _____.
3. The supply of water to plants at regular intervals through sources other than rain is called _____.
4. The unwanted plants that grow along with the main crop in a field are called _____.
5. _____ helps in the separation of grains from husk.
6. Plants of the same kind grown at one place on a large scale is called a _____.
7. The process of transferring the seedlings from nurseries to fields is called _____.
8. Pesticides include rodenticides and _____.

C. State whether the following statements are True (T) or False (F). Rewrite the false statements correctly:

1. On a small scale, farmers store grains in jute bags.
2. Introduction of fertilisers into the field is called biological control of weeds.
3. The product of cultivated plant is called harvesting.
4. Pests are organisms that attack and damage crops.
5. Kharif crops are harvested at the end of monsoon season.

D. Very Short Answer Questions:

1. What are the two methods of sowing seeds?

2. Name two main modern methods of irrigation.
3. Name the machine that performs a dual job as a harvester and a thresher.
4. Name two rabi crops.
5. What is the first step for growing a crop?
6. Name the nitrogen-fixing bacteria present in root nodules of leguminous plants.
7. Name a common weedicide.

E. Short Answer Type-I Questions:

1. What is meant by agricultural implements?
2. What is hybridisation? How is it done in plants?
3. What is pisciculture?
4. Why is it important to sow seeds at a correct distance from one another?
5. Give two precautions that must be taken while sowing seeds.
6. How does winnowing help in separation of grains from husk?
7. Why is the spraying of pesticides harmful to us?

F. Short Answer Type-II Questions:

1. (a) Why is irrigation necessary? (b) Why is the drip system of irrigation a water-economical method?
2. What are the natural methods to restore soil fertility?
3. The farmers of a village are celebrating the harvest festival of Baisakhi along with their families. They are dancing and singing traditional songs.
   (a) What is harvesting? Why do farmers celebrate Baisakhi?
   (b) What do we learn from celebrating festivals?

G. Long Answer Questions:

1. (a) What are weedicides? (b) Name one weedicide.
   (c) What are the harmful effects of weeds in the crop field?
2. (a) Differentiate between manure and fertiliser. (b) What are the advantages of using manure?

H. HOTS (Higher Order Thinking Skills) Questions:

1. Why do farmers level the field before sowing?
2. During ploughing, why is the land pressed lightly and not tightly?

I. Practical Skill Based Question:

How will you separate good and healthy seeds from damaged ones? Write your observation also.

ACTIVITY

Home Assignment/Group Activity/Project

1. Pull out a leguminous plant gently, without damaging its roots. Wash the roots and observe. You will see little swellings. These swellings are called nodules and are formed due to the presence of nitrogen-fixing bacteria.
2. Take three containers, put soil in all. Place a few wheat seeds in each container at different depths like 3 cm, 6 cm and 9 cm. Water them every day. Observe the germination in each container and discuss.

Field Visit: Visit some nearby agricultural fields with your teacher and classmates. Form groups and investigate the different aspects of growing crops. Make a list of the crops and classify them into rabi and kharif crops.

Group Discussion: Discuss in the class: 'Modern methods of agriculture used in India'

2 Microorganisms: Friend and Foe

Use **Cordova Smart Class Software** on the **smart board** in class to identify various kinds of microorganisms and to know their benefits and harmful effects.

There are a large number of organisms around us. We can see most of the organisms with the naked eye. However, there are a large number of other organisms that are so small that it is not possible to see them with the naked eye. They can be observed only with the help of a microscope.

The organisms that cannot be seen with the naked eye and can only be observed through a microscope are called microorganisms or microbes. Microorganisms may be **unicellular** (single-celled) or **multicellular** (many-celled).

The Science that deals with the study of microorganisms is called **microbiology**. The scientists who study microorganisms are called **microbiologists.**

DO YOU KNOW?

The first scientist to describe microorganisms was a Dutch scientist, **Antonie Van Leeuwenhoek.** In 1674, he observed living cells for the first time with the help of his microscope.

WHERE MICROORGANISMS LIVE

Microorganisms are present everywhere. Some live alone, while others grow in groups called colonies. They are found in every kind of environment. They are found in air, soil and in water bodies like seas, lakes and ponds. They are also found in dead and decaying organisms and even inside our bodies. They can exist in extreme conditions of temperature like droughts, in hot water springs, in deserts, polar regions and marshy lands. They survive in extreme environmental conditions by forming a hard outer covering called **cyst.**

ACTIVITY 1 *Use Cordova Smart Class Software on the smart board in class to perform this activity*

To show the presence of microorganisms in water and soil

Things needed: A beaker, pond water, soil, clean water, glass slides, coverslips, a microscope and a dropper

Method:

1. Collect some water in a beaker from a pond or a stagnant pool. Take a few drops of water and spread them on a glass slide. Put a coverslip on the water drops and examine under the microscope (Fig. 2.1).

Fig. 2.1 Water contains a large number of microorganisms.

2. Collect some moist soil from the field in a beaker. Add some clean water to it and mix well. After the soil gets settled down, take out water with the help of a dropper. Take a few drops of water on a slide and observe under a microscope.

Observation: You observe a large number of minute organisms (microorganisms) moving in the water.

Conclusion: Pond water and soil contain a large number of microorganisms.

MAJOR GROUPS OF MICROORGANISMS

Microorganisms are classified in the following five major groups— (a) **Bacteria** (singular: **bacterium**), (b) **Viruses** (singular: **virus**), (c) **Algae** (singular: **alga**), (d) **Fungi** (singular: **fungus**) and (e) **Protozoa** (singular: **protozoan**).

1. Bacteria

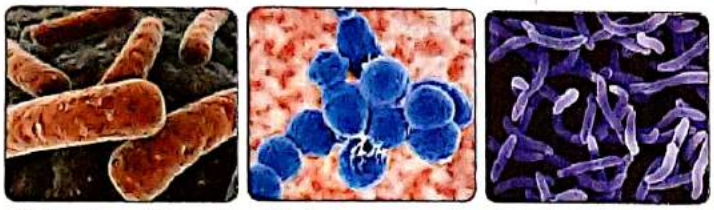
Bacteria are very small and the simplest organisms. They can vary in size from 0.2 to 100 microns (1 micron = $\frac{1}{1000}$ mm). They are single-celled organisms found almost everywhere. Bacteria are found in four different shapes (Fig. 2.2).

(a) **Bacilli** (rod-shaped bacteria), e.g., ***Escherichia coli***

(b) **Cocci** (spherical bacteria), e.g., ***Streptococcus pneumoniae***

(c) **Vibrio** (comma-shaped bacteria), e.g., ***Vibrio cholerae***

(d) **Spirilla** (spiral-shaped bacteria), e.g., ***Spirillum***



(a) *Escherichia coli* (b) *Streptococcus pneumoniae* (c) *Vibrio cholerae*

Fig. 2.2 Some examples of bacteria

DO YOU KNOW?

Bacteria occur in intestine of humans and other animals. In humans, they synthesise some B-complex vitamins that help in digesting food. In animals, like cows and buffaloes, they help to digest cellulose.

2. Viruses

The word '**virus**' means **poisonous liquid**. **Viruses are the smallest microorganisms** (size ranges from 20–300 nm). They can only be studied under an electron microscope. Viruses cannot grow and reproduce on their own. However, when they enter a living cell, they use the host machinery to reproduce. Viruses are considered as a connecting link between living things and non-living things. Some examples of viruses are **vaccinia virus, influenza virus, HIV-I** and **polio virus** (Fig. 2.3).

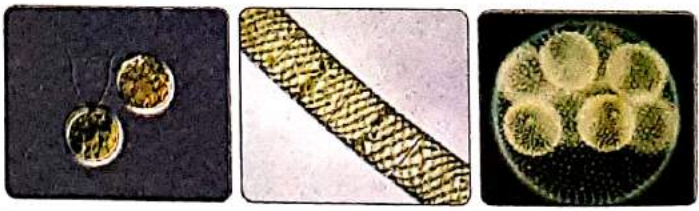
(a) influenza virus (b) HIV-I (c) polio virus

Fig. 2.3 Some examples of viruses

3. Algae

Algae is a group of simple plants. Algae in Latin means 'sea weeds'. They vary in size, shape and habitat. Some are unicellular *(e.g., Chlamydomonas)* and microscopic, while others are multicellular *(e.g., Volvox)* and can be a few metres long.

They have no stem, roots and leaves like other plants, but they have chlorophyll and they can make their food through photosynthesis. Some examples of algae are ***Chlamydomonas***, **sea weeds**, ***Spirogyra***, ***Volvox*** (Fig. 2.4).



(a) *Chlamydomonas* (b) *Spirogyra* (c) *Volvox*

Fig. 2.4 Some examples of algae

4. Fungi

Fungi is a group of diverse organisms that lack chlorophyll. They generally grow in dark, warm and moist conditions. Most fungi feed on dead things, while some live on other organisms. Fungi may be unicellular (like yeast) or multicellular (like mushroom). Some examples of fungi are **yeast, mould (or *Mucor*), mushroom**, ***Penicillium*** (Fig. 2.5).

(a) yeast (b) mould (c) mushroom

Fig. 2.5 Some examples of fungi

5. Protozoa

Protozoan means the '**first animal**'. Protozoa are unicellular microorganisms. They are included in a separate kingdom **protista.** They are found in ponds, lakes, rivers, sea and damp soil. They are either saprophytic or parasitic. *Euglena* is an exception. It contains chlorophyll and can prepare its own food. Some examples of protozoa are ***Amoeba, Paramecium, Euglena, Trypanosoma*** (Fig. 2.6).

(a) *Amoeba* (b) *Paramecium* (c) *Euglena*

Fig. 2.6 Some examples of protozoa

USEFUL MICROORGANISMS

Microorganisms are useful to us in the following ways:

1. Making of Food Items

Bacteria help us in making certain food items like curd, cheese, bread and pastries.

(a) ***Lactobacillus* bacteria help make curd from milk.** Curd is formed when a protein called **casein,** present in milk, clumps together to form a solidified mass. **Casein coagulation (clump formation) takes place only when the milk is acidic.** A spoonful of curd contains the bacteria *Lactobacillus* that promote the formation of curd from milk.

Milk + Curd (containing *Lactobacillus* bacteria) —*Lactobacillus* multiplies, using the non-fat components of milk to produce acidic product→ Milk becomes acidic. —Casein coagulates in acidic milk.→ Formation of curd (from milk)

DO YOU KNOW?

Warm milk turns acidic when curd is added. Milk contains a sugar called lactose. *Lactobacillus* bacteria present in the curd help in converting the lactose sugar present in the milk to lactic acid by the process of fermentation. This creates the acidic medium needed for casein protein present in the milk to coagulate to form curd.

Lactose sugar (present in milk) —*Lactobacillus* bacteria, Fermentation→ Lactic acid (turns milk acidic)

(b) Cheese and *paneer* are also made by the action of bacteria *Lactobacillus* and *Streptococcus* on milk.

(c) Bacteria act upon tough meat and make it soft. This process is called **tenderisation of meat.**

(d) Yeast cells are used in baking industries for making breads, pastries and cakes. For baking bread, yeast along with a little sugar is mixed with flour to make dough. The dough is kept in a warm place. The yeast uses sugar present in the dough as food. During the breakdown of sugar, carbon dioxide and alcohol are formed. This process is called **fermentation.** The dough rises due to carbon dioxide. When this dough is used to make bread and is baked, carbon dioxide escapes from the loaf, making it light and fluffy.

(e) Yeast is also used in day-to-day household food items like *idli, dhokla* and *dosa*. For making *idli* and *dosa*, the mixture of ground rice and *dal* is first allowed to stand for a few hours. This mixture rises and becomes sour due to the growth of yeast cells.

ACTIVITY 2 *Use **Cordova Smart Class Software** on the **smart board** in class to perform this activity.*

To observe the increase in the volume of dough during the fermentation of sugar present in dough by yeast cells

Things needed: Half a kg of flour, sugar, yeast powder, warm water and a container

Method:

1. Take flour (*atta* or *maida*), add two tablespoons of sugar and mix with warm water.
2. Add a tablespoon of yeast powder and knead to make a soft dough.
3. Put the soft dough in a container and leave it in a warm place for 2-3 hours or more.

Observation: You observe that there is an increase in the volume of the dough. The dough rises and looks fluffy.

Conclusion: Yeast break down sugar molecules to produce carbon dioxide gas that increases the volume of dough.

(f) Some algae like *Chlorella* and sea weeds are used as food. They are a rich source of proteins and minerals.

2. Commercial Use

(a) Yeast is used for commercial production of alcohol, beer, wine and acetic acid. For this purpose, yeast is grown on natural sugars present in grains like barley, wheat, rice and fruit juices. **The process of conversion of sugar into alcohol by the action of microbes, like yeast, is called fermentation. Louis Pasteur** discovered the process of fermentation in 1857.

(b) Some bacteria are used in the production of tea, coffee and tobacco.

(c) Some bacteria take part in the production of certain acids like lactic acid, citric acid and acetic acid (vinegar).

ACTIVITY 3 *Use Cordova Smart Class Software on the smart board in class to perform this activity.*

To observe fermentation of sugar by yeast

Things needed: Sugar, warm water, yeast and a beaker

Method: Take a 500 mL beaker. Fill it three-fourths with warm water. Dissolve 2-3 teaspoonful sugar in it and add half a teaspoonful yeast powder in it. Cover the beaker and allow the mixture of sugar solution and yeast powder to stand in a warm place for 4-5 hours. Now, smell the solution.

Observation: You find characteristic smell of alcohol that is formed by fermentation.

Multiple Choice Questions (MCQs)

Tick (✓) the correct options:

1. Microbes are seen through a _____.
   (a) microscope ◯ (b) telescope ◯
   (c) periscope ◯ (d) kaleidoscope ◯
2. _____ is/are used as food.
   (a) *Lactobacillus* ◯ (b) *Chlorella* ◯
   (c) Sea weeds ◯ (d) both (b) and (c) ◯

3. Medicinal Use

A. **Production of antibiotics:** When we fall ill, the doctor gives us some antibiotic tablets, capsules or injections. What are antibiotics? How are they produced? **The medicines produced by organisms such as bacteria and fungi that kill or stop the growth of the disease-causing microorganisms (pathogens) present in our body are called antibiotics.** The source of these antibiotic medicines are microorganisms. These days, a number of antibiotics are produced from bacteria and fungi. **Streptomycin, tetracycline** and **erythromycin** are some of the commonly known antibiotics that are made from **fungi** and **bacteria.** The first antibiotic discovered was **penicillin.** It was prepared by a fungus called ***Penicillium notatum***. Antibiotics are also mixed with the feed of livestock and poultry to check microbial infections in animals. Antibiotics are also used to control many plant diseases.

Precautions to be taken while using antibiotics

(i) Antibiotics should be taken only on **the advice of a qualified doctor.**

DO YOU KNOW?

In 1929, **Sir Alexander Fleming** was working on a culture of disease-causing *Staphylococci* bacteria in his laboratory. Suddenly, he found the spores of a mould (a fungi which he named *Penicillium*) in one of his culture plates. He observed that the presence of mould not only prevented the growth of bacteria but also killed many of these disease-causing bacteria. From this mould, penicillin drug was prepared. In this way, Sir Alexander Fleming discovered penicillin drug that is an effective antibiotic.

Alexander Fleming

(ii) We must complete the **entire course of antibiotics** prescribed by the doctor. This completely destroys the disease-causing microorganisms in our body. We may fall ill again if we do not complete the course.

(iii) We should **not take antibiotics when not needed or in wrong doses.** It may make the antibiotic drug less effective when we might really need it in future.

(iv) Antibiotics taken unnecessarily may kill the beneficial bacteria in the body.

(v) Antibiotics should not be taken when we are suffering from cold and flu (caused by viruses) because antibiotics are not effective against diseases caused by viruses.

B. Production of vaccines: Microorganisms are also used in the production of vaccines. Vaccines protect humans and other animals against several diseases by providing immunity against the concerned disease (Fig. 2.7).

Fig. 2.7 Vaccination

The ability of one's body to resist a disease is called immunity. Immunity against a particular disease can be developed by a technique called **vaccination.**

A small dose of dead and weakened disease-causing microbes used to stimulate immune response in the body is called vaccine.

When a vaccine is introduced in the body of a healthy person, it acts like an antigen (any foreign substance that elicits an immune response). The body of the person produces antibodies (proteins produced in body in response to entry of antigens to render them harmless) against these introduced microbes. These antibodies remain in the body and protect him/her against future infections of the same microbe.

Several diseases including **cholera, tuberculosis, smallpox, tetanus, polio, hepatitis-B** can be prevented by vaccination. A vaccine can either be injected or given orally.

National Pulse Polio Programme is practised to eradicate polio from the country. Under this, children below the age of five years are regularly given polio drops (vaccine for polio).

In our childhood, we are given injections or vaccine drops to protect us against several diseases. **A particular vaccine is given at a particular age. This is called immunisation schedule.**

Table 2.1 Immunisation schedule in India

S.No.	Age	Vaccination
1.	0 month	Smallpox, BCG (for protection against tuberculosis)
2.	3-12 months	DPT [for protection against Diphtheria, Pertussis (whooping cough) and Tetanus], Polio (oral), BCG
3.	9-15 months	Measles, smallpox (revaccination)
4.	18-24 months	DPT : booster dose, Polio (oral) : booster dose (if the same antigen is introduced again, it is called **booster dose**)
5.	5-6 years	Smallpox (revaccination)
6.	5-6 years	DT (for protection against diphtheria and tetanus) : booster dose, Typhoid vaccine

DO YOU KNOW?

Edward Jenner

Edward Jenner, a British doctor, discovered the vaccine for smallpox in 1798. He noticed that milkmen did not suffer from smallpox even during epidemics, if they had earlier suffered from cowpox. On May 14, 1796, Dr Jenner took cowpox matter from blisters on the arm of a milkmaid and injected that into the arm of an eight-year old boy, James Phipps. Phipps quickly developed cowpox and recovered. On July 1, 1796, Dr Jenner injected the same boy Phipps with smallpox, but he did not contract smallpox. He had acquired immunity from smallpox. In this way, Edward Jenner discovered the vaccine for smallpox. Smallpox has been completely eradicated from the world.

C. Bacteria are also used for making vitamin B complex tablets.

4. Increasing Soil Fertility

In the previous chapter, we have learnt about ***Rhizobium*** **bacteria.** These are present in the root nodules of leguminous plants (Fig. 2.8). *Rhizobium* bacteria absorb nitrogen gas from the atmosphere and convert it into simple nitrogenous compounds called **nitrates**. After harvesting, when the roots decompose, the nitrates present in the root nodules mix with the soil and enrich it with nitrogenous compounds and hence, increase the soil fertility.

Fig. 2.8 Root nodules of a leguminous plant

Some **bacteria** and **blue-green algae** (Fig. 2.9) living in the soil also fix atmospheric nitrogen as nitrates. These microbes are commonly called **biological nitrogen fixers.**

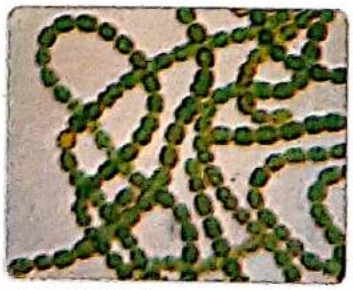


Fig. 2.9 Blue-green algae

5. Cleaning the Environment

The microorganisms decompose dead organic wastes of plants and animals by converting them into harmless simpler substances that are restored to the soil and increase its fertility. In the absence of these microorganisms, the piles of dead organisms would have covered the earth. Some bacteria decompose sewage and other wastes of water. This is a natural method to keep water clean. In this way, they help in keeping the environment clean.

6. Some Other Uses of Microbes

(a) Bacteria are useful for leather and jute industries.

(b) Bacteria also help in generating biogas. They act on waste products like animal waste, garbage, agricultural wastes and produce biogas. Biogas is used as a fuel.

(c) Some bacteria live in the digestive system of ruminants like cows and goats. These bacteria help the ruminants digest cellulose present in grass and plants.

HARMFUL MICROORGANISMS

Microorganisms are harmful in many ways. Let us study the following harmful effects of micro-organisms:

1. Microorganisms Cause Communicable Diseases

Some of the microorganisms cause diseases in human beings, plants and animals. **The disease-causing microorganisms are called pathogens.**

A. **In humans:** Pathogens enter our body through the air we breathe, the water we drink or the food we eat. They also get transmitted by direct contact with an infected person or are carried through animals.

Microbial diseases that can spread from an infected person to other healthy person through air, water, food, physical contact or by animals

are called **communicable diseases**. Examples of some communicable diseases are cholera, common cold, chickenpox and tuberculosis.

Table 2.2 Common diseases caused by microorganisms in humans

S. No.	Disease-causing microorganisms	Diseases
1.	Viruses	Common cold, influenza, dengue fever, poliomyelitis (polio), hepatitis-B, chickenpox, measles, mumps, smallpox, rabies, AIDS (Acquired Immuno Deficiency Syndrome)
2.	Bacteria	Typhoid, cholera, tuberculosis, anthrax, tetanus, food poisoning, diphtheria, plague
3.	Protozoa	Malaria, kala-azar, amoebic dysentery, sleeping sickness
4.	Fungi	Ringworm (a skin disease)

Let us study in detail the various ways by which communicable diseases spread (Fig. 2.10).

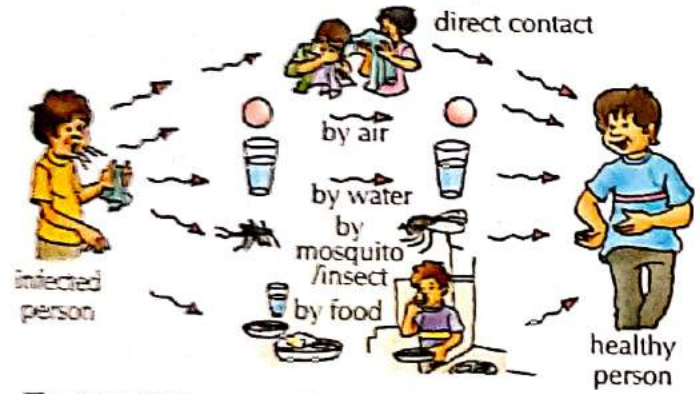


Fig. 2.10 Different modes of transmission of diseases

(a) **Through air we breathe:** Microorganisms that cause **common cold, tuberculosis, pneumonia,** etc., spread through air we breathe. For example, when a person suffering from common cold sneezes or coughs, fine droplets of moisture carrying germs are released in the air. When a healthy person breathes this air, the germs enter his/her body and infect the person. For this reason, we should keep our hand or handkerchief on our mouth and nose while coughing and sneezing.

(b) **Through water we drink:** Some diseases spread through water, e.g., **cholera, typhoid, jaundice, hepatitis-A, polio,** etc. The cholera causing microbes enter a healthy person through the water he/she drinks and infect him/her. After floods or any other natural calamity, we are advised to drink boiled water because many disease-causing micro-organisms are present in the water at that time. Boiling of water kills the microorganisms.

(c) **Through the food we eat: Protozoa, bacteria** and **spores of fungi** are present in the soil, from where they enter our food. Therefore, we should wash fruits and vegetables after bringing them from the market and before eating them.

(d) **Through insects and animals:** There are some insects and animals that act as carriers of disease-causing microbes. These animals and insects are called vectors. **Vectors carry the disease-causing microbes from an infected person to a healthy person and cause diseases.** Some of the vectors are :

(i) **Housefly:** Housefly collects [Fig. 2.11 (a)] the disease-causing microbes on its legs and mouth parts from faeces and other organic wastes. The same housefly, when sits on our exposed food items, leaves the disease-causing microbes on the food.

(a) a housefly (b) a mosquito

Fig. 2.11 Some insects that transmit the disease-causing microorganisms from one person to another

When we consume such food, we get infected. Various diseases like **cholera, typhoid, dysentery** and **tuberculosis** are spread by **houseflies** through contaminated food and water. So, we should avoid eating uncovered food items.

(ii) **Mosquito:** The female *Anopheles* mosquito [Fig. 2.11 (b)] sucks the blood of human beings. While sucking blood, it transmits *Plasmodium* (a protozoan) into human blood. *Plasmodium* causes **malaria**. *Aedes* mosquito acts as a carrier of **dengue** virus.

All the mosquitoes breed in water. Hence, one should not let water collect in coolers, tyres, flower pots, etc. By keeping our surroundings clean and dry, we can prevent mosquitoes from breeding.

General Preventive Measures Against Microbial Diseases

1. Wash vegetables and fruits properly before eating.
2. Boil drinking water particularly when there are chances of infection.
3. Keep the infected person in complete isolation.
4. Keep the personal belongings of the patient away from those of the others.
5. Maintain personal hygiene and good sanitary habits.
6. Vaccination should be given at suitable age to get immunity.
7. Maintain good sanitation in the community.
8. Do not eat stale food.
9. Protect yourself from mosquito bites by using mosquito nets and mosquito repellant creams.
10. Do not allow water to collect in the surroundings to prevent breeding of mosquitoes. Spray insecticides.
11. Put fine wire mesh on doors and windows to prevent mosquitoes from entering the homes.

Multiple Choice Questions (MCQs)

Tick (✓) the correct options:

1. The disease that has been eradicated from most parts of the world is _____.
   (a) AIDS ◯ (b) tetanus ◯
   (c) smallpox ◯ (d) tuberculosis ◯
2. Which of the following vaccines is given for protection against tuberculosis?
   (a) BCG ◯ (b) DPT ◯
   (c) DT ◯ (d) polio booster ◯

B. In animals: Several microorganisms cause diseases not only in humans but also in other animals like cows, buffaloes [Fig. 2.12 (a), (b)] and poultry. These diseases reduce the milk production, egg production, growth of birds and may even cause their death.

(a) foot and mouth disease

(b) rinderpest

Fig. 2.12 Some diseases of animals

Some common diseases caused by microorganisms in animals are given in Table 2.3.

Table 2.3 Common diseases caused by microorganisms in animals

S. No.	Disease-causing microorganisms	Infected animals	Diseases
1.	Bacteria	Cattle	Anthrax, tuberculosis
		Poultry	Tuberculosis, fowl cholera, diarrhoea
2.	Viruses	Cattle	Foot and mouth disease, rinderpest (cattle plague), cow pox
		Poultry	Fowl pox, ranikhet, bird flu

DO YOU KNOW?

Robert Koch (1876) discovered the bacterium, *Bacillus anthracis* that causes anthrax disease in animals.

C. **In plants:** Several microorganisms cause diseases in plants like wheat, rice, potato, sugar cane, apples, oranges, cotton and jute (Fig. 2.13). The diseases reduce the yield of crops. Plant diseases are transmitted through seed, air and soil. Some of the common diseases affecting the plants are given in Table 2.4.

Table 2.4 Common diseases caused by microorganisms in plants

S. No.	Plant disease	Disease-causing microorganisms	Plant (crop) infected
1.	Blight	Bacteria	Rice
2.	Citrus canker	Bacteria	Citrus fruits
3.	Rust	Fungi	Wheat, mustard
4.	Smut	Fungi	Wheat
5.	Tobacco mosaic	Virus	Tobacco
6.	Yellow vein mosaic	Virus	*Bhindi*

(a) blight of rice

(b) citrus canker

(c) rust of wheat

(d) yellow vein mosaic of *bhindi*

Fig. 2.13 Some plant diseases

Plant diseases can be controlled by spraying chemicals that kill the microbes on infected parts of the plants.

2. Microorganisms Cause Spoilage of Food

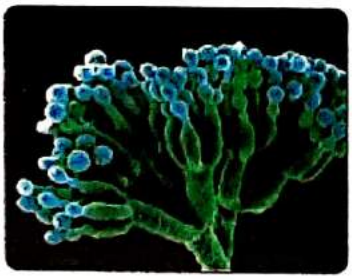
Sometimes, food may get spoiled due to a variety of reasons like not keeping it covered, improper cooking, not preserving the food properly and change in the temperature of refrigerated foods due to power fluctuations.

Microorganisms that grow on our food, sometimes produce toxic substances that are harmful for our health. The toxic substances produced by microorganisms make the food poisonous causing food poisoning. It can sometimes even cause death. The spoiled food can be identified by its unpleasant smell, changed odour and bad taste. The major symptoms of food poisoning are vomiting, diarrhoea, abdominal pain, headache and fever.

Bacteria that cause food poisoning are ***Salmonella*** [Fig. 2.14 (a)], ***Staphylococci*** and ***Clostridium***.

Fungi that cause food poisoning are ***Aspergillus*** and ***Penicillium*** [Fig. 2.14 (b)].

(a) *Salmonella*



(b) *Penicillium*

Fig. 2.14 Microbes that cause food poisoning

So, it is very important that we preserve food to prevent it from being spoilt. There are many ways of preserving food.

FOOD PRESERVATION

We know that when cooked food or milk is left in a warm and moist place for a long time, it gets spoiled. Food gets spoiled due to microbial contamination. Most microorganisms cannot grow or multiply when the

(a) conditions are dry.

(b) temperature is very low.

(c) temperature is very high.

All methods of food preservation ensure that favourable conditions are not provided for microorganisms to grow and multiply.

The process by which spoilage of food is prevented by using chemical or physical methods is called food preservation.

Methods Used for Food Preservation

1. **Chemical method:** Food can be preserved by using food preservatives. **Food preservatives are chemical substances that can check the growth of microorganisms.** Most chemical preservatives prevent microbial growth by removing oxygen from the food items.

   Sodium benzoate, sodium metabisulphite and **citric acid** are common food preservatives. Sodium benzoate is used for preserving fruit juices and squashes. Sodium metabisulphite is used for preserving cut fruits, jams and jellies. Citric acid is used as a preservative in confectionaries.

2. **Preservation by common salt:** For ages, people have preserved fish and meat by **salting**. Meat and fish are covered with common salt to prevent the growth of microbes. Salting draws out water (moisture) from the food and thus, it prevents the microbial growth. Salting is also used to preserve *amla*, raw mangoes and tamarind.

3. **Preservation by sugar:** Jams, jellies and squashes are preserved for a long time because of the presence of sugar in them. Sugar inhibits the growth of food-spoiling microorganisms by reducing the moisture content of the food.

4. **Preservation by oil and vinegar:** Oil and vinegar prevent the growth of food-spoiling microorganisms. Mustard oil and vinegar (*sirka*) are widely used as preservatives for fruits and vegetables in the form of pickles. Meat and fish are also preserved by this method.

5. **Pasteurisation: Pasteurisation is a process for preservation of milk.** In this method, milk is heated at about 70 °C for 15 to 30 seconds to kill the bacteria present in it and cooled quickly to 10 °C to prevent the remaining bacteria from growing. The milk is then stored in sterilised bottles or pouches in cold places. Pasteurised milk can be consumed without boiling because it is free from harmful microorganisms. This method was invented by **Louis Pasteur** in 1862.

6. **By cooling or freezing:** Fruits, vegetables, meat and cooked food are kept at low temperature in the refrigerator or deep freezers to prevent their spoilage. Low temperature prevents the spoilage of food by inhibiting the growth of microorganisms.

7. **By dehydration:** Since moisture is one of the main requirements for microbial growth, removal of water from food materials is an efficient method of food preservation. **The process of removal of water from a substance is called dehydration. Sun-drying** is a traditional method for preserving food. Wheat, rice and pulses are cleaned and dried in the sunlight. Vegetables like cauliflower, spinach and *methi* are also preserved in this manner for a long time.

Nowadays dry fruits and vegetables are sold in sealed airtight packets to prevent the attack of microbes.

Advantages of Food Preservation

1. It decreases the wastage of food by avoiding spoilage.
2. It increases the storage period of food materials.
3. Nutritional value of the food is retained for a long period.
4. It ensures the availability of food at distant places and during the off season.

NITROGEN CYCLE

Nitrogen is needed for the formation of proteins, amino acids and nucleic acids.

The circulation of nitrogen through living things (plants and animals) and non-living environment (air, soil and water) is called nitrogen cycle (Fig. 2.15).

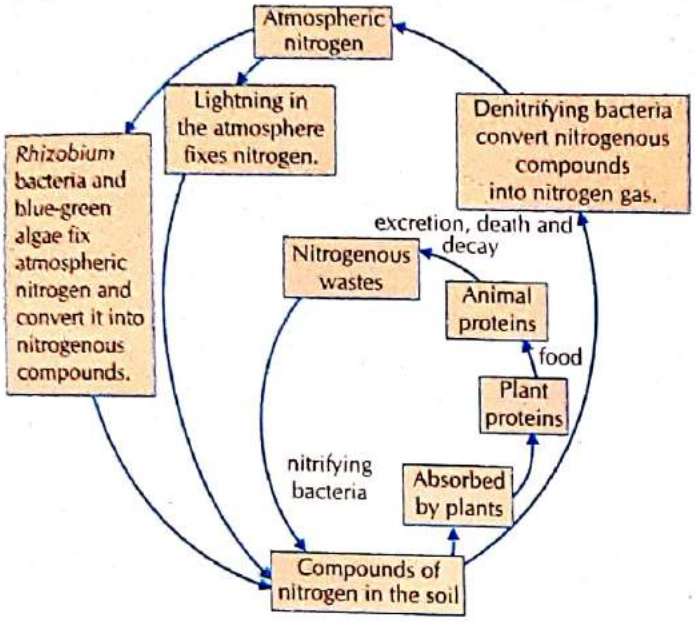


Fig. 2.15 Nitrogen cycle

The steps involved in nitrogen cycle are : nitrogen fixation, nitrogen assimilation, ammonification, nitrification and denitrification.

1. Nitrogen Fixation

Our atmosphere has 78% nitrogen gas. Plants and animals cannot take atmospheric nitrogen directly. It has to be first converted into useful nitrogen compounds that can easily be absorbed. **The conversion of free atmospheric nitrogen into nitrogenous compounds is called nitrogen fixation.** Nitrogen fixation occurs by the following two ways:

(a) **Lightning:** When lightning strikes, nitrogen and oxygen in atmosphere react and form oxides of nitrogen. They dissolve in rainwater and form nitric acid. Nitric acid reacts with limestone in the soil and converts into nitrates.

$$N_2 + O_2 \xrightarrow{\text{lightning}} 2NO$$
$$2NO + O_2 \longrightarrow 2NO_2$$

(oxides of nitrogen)

$$4NO_2 + 2H_2O + O_2 \longrightarrow \underset{\text{nitric acid}}{4HNO_3}$$

$$\underset{\text{limestone}}{CaCO_3} + \underset{\text{nitric acid}}{2HNO_3} \longrightarrow \underset{\text{calcium nitrate}}{Ca(NO_3)_2} + H_2O + CO_2$$

(b) **Biological nitrogen fixation:** Certain plants such as peas, beans, pulses (leguminous plants) contain ***Rhizobium*** **bacteria** in their root nodules. These bacteria can take atmospheric nitrogen and convert it into nitrogen compounds. Some cyanobacteria like *Nostoc* and *Anabaena* also fix atmospheric nitrogen into nitrates.

2. Nitrogen Assimilation

Plants absorb nitrates from the soil dissolved in water with the help of roots and convert them into plant proteins. The herbivorous animals eat green plants and convert the plant proteins into animal proteins. The herbivorous animals are then eaten by carnivorous animals. **The process of conversion of inorganic nitrogen compounds into organic compounds that become a part of living organism is called nitrogen assimilation.**

3. Ammonification

When plants and animals die, the proteins present in them are converted into ammonium compounds by the putrefying bacteria and fungi (decomposers) present in the soil. This process is called **ammonification.** We can define ammonification as **conversion of complex organic compounds like proteins into ammonia.**

4. Nitrification

Ammonium salt in the soil is converted first into nitrites by ***Nitrosomonas*** **bacteria.** The nitrites are then converted into nitrates by ***Nitrobacter*** **bacteria.** These bacteria are called **nitrifying bacteria.** The nitrates, so formed in the soil, can once again be absorbed by the plants. This process is called nitrification. So, **the conversion of ammonia into nitrates is called nitrification.**

5. Denitrification

Some of the nitrates are absorbed by plants. Rest of the nitrates in the soil are converted by *Pseudomonas* bacteria into nitrogen gas that escapes into the atmosphere. **The conversion of nitrates into free nitrogen gas by denitrifying bacteria (*Pseudomonas*) is called denitrification.** Thus, the nitrogen cycle maintains the percentage of nitrogen in the atmosphere.

EXERCISES

*Use **Cordova Smart Class Software** on the **smart board** in class to do these exercises.*

A. Tick (✓) the correct options:

1. _____ was the first scientist to describe microorganisms.
   (a) Edward Jenner ◯ (b) Louis Pasteur ◯
   (c) Alexander Fleming ◯ (d) Antonie Van Leeuwenhoek ◯
2. Which of the following is not responsible for spoilage of food? ◯
   (a) algae ◯ (b) fungi ◯ (c) bacteria ◯ (d) chemicals
3. Which of the following is a biological nitrogen fixer? ◯
   (a) housefly ◯ (b) fungi ◯ (c) *Rhizobium* ◯ (d) protozoa
4. Edward Jenner discovered the vaccine for _____. ◯
   (a) cholera ◯ (b) smallpox ◯ (c) tuberculosis ◯ (d) polio
5. *Chlamydomonas* belongs to a group called _____. ◯
   (a) bacteria ◯ (b) viruses ◯ (c) algae ◯ (d) fungi
6. The microbes that help make *idli* and *dosa* are _____. ◯
   (a) bacteria ◯ (b) yeast ◯ (c) viruses ◯ (d) algae
7. The smallest microorganisms are _____. ◯
   (a) bacteria ◯ (b) viruses ◯ (c) algae ◯ (d) fungi

B. Look at the figure given alongside and tick (✓) the correct options:

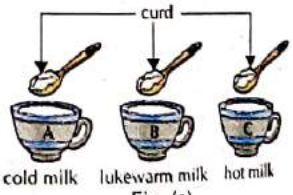


Fig. (a)

1. In Fig. (a), curd is formed only in _____. ◯
   (a) Cup A ◯ (b) Cup B ◯
   (c) Cup C ◯ (d) all three cups ◯
2. In Fig. (a), curd is not formed in cup C because bacteria are _____. ◯
   (a) active ◯ (b) inactive ◯ (c) killed ◯ (d) none of these

C. Fill in the blanks:

1. Microorganisms may be unicellular or _____.
2. _____ bacteria help to make curd from milk.
3. Disease-causing microorganisms are called _____.
4. Ammonium salt in the soil is converted first into nitrites by _____ bacteria.
5. The ability of one's body to resist a disease is called _____.
6. Salting draws out _____ from food.
7. Nitrates in the soil are converted by _____ bacteria into nitrogen gas.
8. The process of preventing food spoilage by chemical or physical methods is called food _____.

D. Very Short Answer Questions:

1. Name any two antibiotics.
2. Give the names of any two communicable diseases.
3. Name any two common diseases each that occur in plants and animals.
4. Name two microbial diseases that spread through air.
5. What are microorganisms?
6. Name any disease caused by virus in humans.

E. Short Answer Type-I Questions:

1. What is pasteurisation?
2. How do leguminous plants increase the soil fertility?
3. What is meant by nitrifying bacteria?
4. How does female *Anopheles* mosquito spread malaria?
5. How do antibiotics work?

F. Short Answer Type-II Questions:

1. (a) How do viruses differ from other microorganisms? (b) What is meant by fermentation?
2. What are communicable diseases? Name any two diseases each caused by viruses and bacteria.
3. What is vaccine? How does it work?
4. Microorganisms decompose dead organic waste of plants and animals and help in keeping the environment clean.
   (a) What would happen, if microorganisms do not perform this function?
   (b) Being a student, how can you contribute in keeping the environment clean? Give two ways.

G. Long Answer Questions:

1. Explain two methods of food preservation. Also, discuss the advantages of food preservation.
2. Draw a neat diagram to show nitrogen cycle and explain the process of nitrification and denitrification.
3. Describe the principle on which the following methods of food preservation are based: (a) boiling (b) canning (c) freezing (d) dehydration

H. HOTS (Higher Order Thinking Skills) Questions:

1. Why do we say that if a person suffers from chickenpox once, he/she is not likely to be attacked by the same disease in future?
2. Why should we always wash our hands before handling food items?

I. Practical Skill Based Question:

Write the steps to observe fermentation of sugar by yeast.

ACTIVITY

Home Assignment/Group Activity/Project: 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. What do you observe? Write your observations in your notebook.

Field Visit: Visit a dairy and collect information on the methods used during milk production to ensure that freshness of milk is retained when it reaches the consumer.

Group Discussion: Discuss in the class: 'Microorganisms— useful and harmful'

3 Synthetic Fibres and Plastics

Use Cordova Smart Class Software on the smart board in class to observe various types of synthetic fibres, their nature, uses and applications. Also, to understand plastics in detail and their environmental hazards.

We wear clothes made up of different types of fabrics. Fabrics are made from different types of fibres. **A fibre is a strong and flexible thread-like material that is used to make fabric.**

TYPES OF FIBRES

There are two kinds of fibres—(a) natural fibres and (b) human-made or synthetic fibres.

1. Natural Fibres

Fibres obtained from plants and animals are called natural fibres. Cotton, jute and **linen** are examples of **plant fibres. Wool** and **silk** are examples of **animal fibres.**

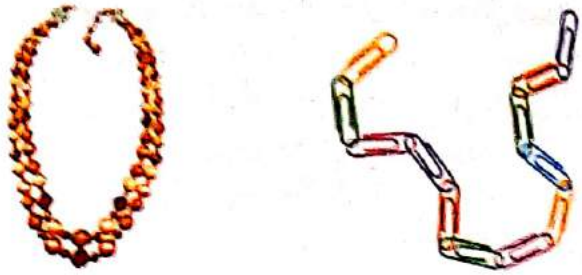
2. Human-made or Synthetic Fibres

Fibres obtained through different chemical processes in the industries are called human-made or synthetic fibres. Synthetic fibres are prepared using raw materials of petroleum origin called **petrochemicals. Rayon, nylon** and **terylene** are some human-made or synthetic fibres. In this chapter, we will learn about synthetic fibres, their characteristics and uses.

NATURE OF SYNTHETIC FIBRES

Take a necklace of beads and carefully observe it. You find that a large number of beads are joined together to form a necklace [Fig. 3.1 (a)].

Take about 12 paper clips and join them together to make a long chain [Fig. 3.1. (b)]. In both the examples, a large number of beads or clips are joined together to form a long chain. So, beads or paper clips are smaller units that join together to form a large unit. The smaller units are called **monomers** and the large single unit is called a **polymer.**



(a) (b)

Fig. 3.1 (a) Necklace of beads (b) Paper clips joined to form a long chain

A polymer is a very large unit formed by the combination of a large number of smaller molecules (called monomers) joined end to end by chemical bonds. The word 'polymer' came from two Greek words, '***poly***' means '***many***' and '***mer***' means '***repeating units***'.

Polymerisation is a process of joining together a large number of smaller molecules (monomers) to form a very large molecule (polymer).

Natural fibres are also polymers. Cotton fibre is a polymer made up of cellulose. It is made up of many glucose monomers (Fig. 3.2).

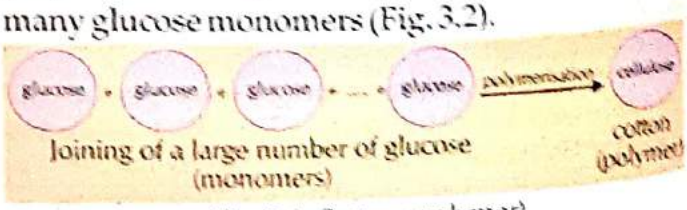


Fig. 3.2 Cotton (polymer)

Similarly, nylon is prepared by the polymerisation of **amide molecules.**

TYPES OF SYNTHETIC FIBRES

There are many types of synthetic fibres. Some of them are rayon, nylon, polyester and acrylic fibre.

1. Rayon

It is a synthetic fibre prepared by the chemical treatment of wood pulp. These fibres are spun into yarn and then woven into fabric. It is also called **artificial silk** because it resembles silk in appearance. It is cheaper than silk and can be dyed easily. It absorbs sweat and thus, can be comfortably worn in summers.

Uses of rayon

(i) It is used in the textile industry for making fabrics.

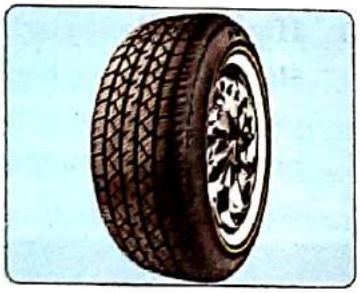
(ii) It is mixed with cotton to make bed sheets, dresses, aprons and caps.

(iii) It is mixed with wool to make beautiful and durable carpets [Fig. 3.3 (a)].

(iv) It is used to manufacture tyre cords [Fig. 3.3 (b)].

(v) It is used for making bandages and lints for surgical dressing of wounds.

(a) carpets



(b) a tyre

Fig. 3.3 Things made from rayon

2. Nylon

Nylon is the first synthetic fibre made by humans.

It is a polyamide fibre (polymer) prepared by joining a large number of amide molecules (monomers).

Nylon is very strong, lustrous, highly elastic, extremely fine, lightweight, easy to wash, wrinkle-free, does not absorb water and is resistant to fungi and moths. It remains insoluble in most of the common solvents.

Uses of nylon

(i) Due to its high tensile strength, nylon fibre is used for making fishing nets, climbing ropes [Fig. 3.4 (a)], parachute fabrics, strings for sports racquets [Fig. 3.4 (b)] and musical instruments, bristles for toothbrushes and paint brushes.

(a) climbing rope

(b) a sports racquet made from nylon

(c) nylon socks

Fig 3.4 Various things made from nylon

(ii) Wool blended with nylon is used to make socks [Fig. 3.4 (c)], suits and carpets.

(iii) It is used in the production of textiles (clothing) like sari, shirts, neckties (Fig. 3.5), socks and other garments.

(iv) It is widely used for making parts of machines such as washers, pulleys, etc.

(a) a nylon sari

(b) a nylon shirt

(c) a necktie

Fig. 3.5 Textile products made from nylon

3. Polyester

It is a polymer made up of repeating units of an organic chemical called an ester. (Esters are the chemicals that give fruity smell.)

Terylene, terene and dacron are some examples of polyester fibres. Terylene forms terrycot when mixed with cotton and terrywool when mixed with wool.

Polyester can be drawn into very fine fibres that can be woven like any other yarn. Polyester is

lightweight, strong, elastic, absorbs little amount of water, dries quickly after washing and is wrinkle-free.

Uses of polyester

(i) Polyester fibres (like terylene) are used for manufacturing sari [Fig. 3.6 (a)], dress materials and curtains.

(ii) It is used for making sails for sail boats [Fig. 3.6 (b)].

(iii) It is used for making water hoses for fire-fighting operations.

(iv) It is used for making conveyor belts.

(v) **Terrycot** is used for making shirts, trousers and other dress materials [Fig. 3.6 (c)].

(vi) **Terrywool** is used for making suits.

(a) a polyester sari (b) a polyester sail (c) a terrycot shirt

Fig. 3.6 Various things made from polyester

Polythene Terephthalate (PET) is a familiar form of polyester. Bottles made of PET are used in industries for selling oils, soft drinks and other food items. PET is used in making synthetic clothes that are easy to wash and are wrinkle-free. It is also used for making films, utensils and wires.

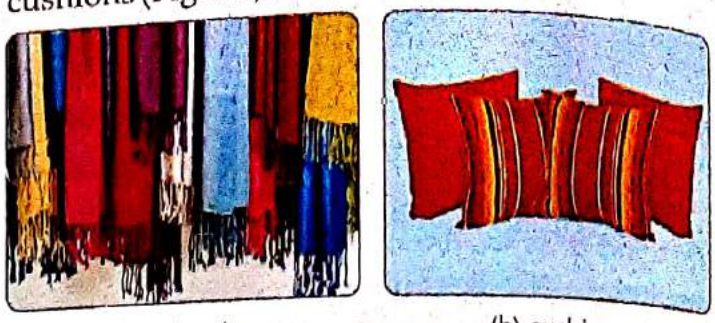
PET bottles

4. Acrylic Fibre

Acrylic fibre is a synthetic fibre made from a polymer called polyacrylonitrile. Acrylic fibre is lightweight, soft and warm with a wool-like feel. It can be dyed with different colours.

Uses of acrylic fibres

The wool obtained from natural sources is quite expensive, whereas clothes made from acrylic fibres are relatively cheap. Acrylic fibres are used for making sweaters, shawls, blankets, jackets and cushions (Fig. 3.7).



(a) shawls (b) cushions

Fig. 3.7 Things made from acrylic fibres

Multiple Choice Questions (MCQs)

Tick (✓) the correct options:

1. Which of the following is not a synthetic fibre?
   (a) rayon ◯ (b) nylon ◯
   (c) wool ◯ (d) terylene ◯
2. Parachute fabric is made of _____.
   (a) nylon ◯ (b) rayon ◯
   (c) terylene ◯ (d) dacron ◯

ADVANTAGES OF SYNTHETIC FIBRES

1. **High tensile strength:** Synthetic fibres are very **strong** and have **high tensile strength** (as they can hold large amount of weight without breaking) in comparison to natural fibres like cotton and wool.

ACTIVITY 1

Use Cordova Smart Class Software on the smart board in class to perform this activity.

To compare the tensile strength of different fibres of the same thickness and the same length

Things needed: Threads (30 cm in length) of cotton, wool, silk and nylon, an iron stand with a clamp, a pan and marbles (of the same weight and size)

Note: All threads should be of the same length and thickness.

Method:

1. Take a cotton thread of about 30 cm in length and tie one of its end to the clamp. Leave the other end suspended freely.
2. At the free end of the cotton thread, suspend

a pan, so that weight can be placed on it (Fig. 3.8).

3. Gently place marbles one by one in the pan, till the cotton thread breaks.
4. Record the total number of marbles required to break the cotton thread. This is the measure of its tensile strength.

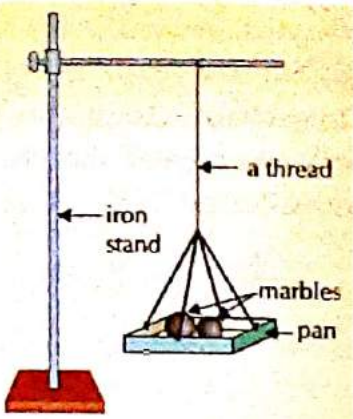


Fig. 3.8 An iron stand with a thread hanging from the clamp

5. Repeat the activity with threads of wool, silk and nylon. Record the total number of marbles required to break the thread in each case .

Observation: You observe that nylon thread holds maximum number of marbles before it breaks, followed by silk, cotton and wool (least strong). The thread that holds the maximum number of marbles in the pan is the strongest.

Conclusion: Tensile strength of nylon (synthetic fibre) is more than that of silk, cotton and wool.

2. **Low water absorbing capacity:** Synthetic fibres absorb very little amount of water (moisture). Due to this, a wet cloth of synthetic fibre dries out rapidly. Synthetic fibres are said to possess **'drip-dry'** property. Natural fibres, like cotton, wool and silk, absorb a large amount of water. So, they do not dry out rapidly.

ACTIVITY 2 Use *Cordova Smart Class Software* on the *smart board* in class to perform this activity

To compare the water absorbing capacity of nylon (synthetic) and cotton (natural) fabrics

Things needed: One piece of cotton cloth (half a metre square), one piece of nylon cloth (half a metre square), 2 equal size mugs and water

Method:

1. Take two mugs, each containing the same amount of water in it.
2. Take two pieces of cloths (one nylon and the other cotton) of the same size.
3. Soak each piece of cloth in water taken in different mugs.
4. Take the pieces out of the mugs after five minutes and spread them in the sunlight for a few minutes (Fig. 3.9).
5. Observe and compare the volume of the water remaining in each mug.
6. Also, compare the time taken by each piece of cloth to dry out completely.

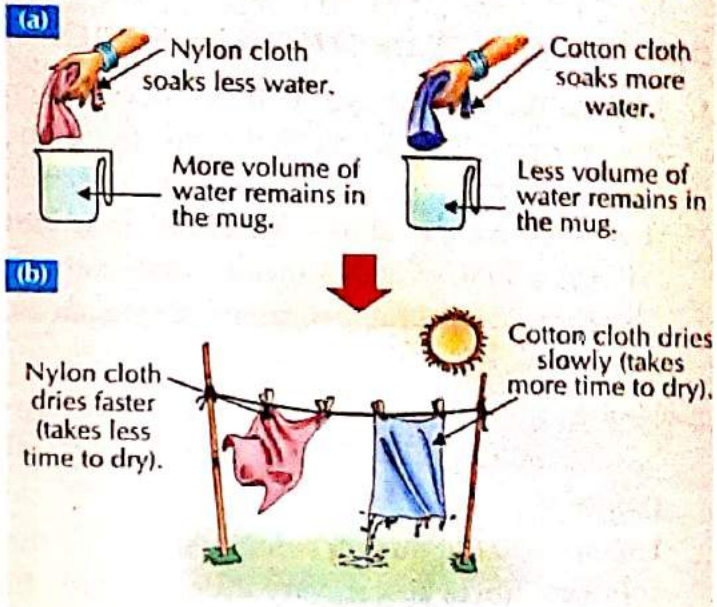


Fig. 3.9 Water absorbing capacity of nylon and cotton fabrics

Observations:

1. The volume of water left in the mug in which cotton cloth was soaked is comparatively less than the container in which nylon cloth was soaked.
2. Nylon dries up faster than cotton cloth.

Conclusion: Synthetic fabrics absorb less water than natural fabrics and take less time to dry than natural fabrics.

3. **Abrasion-resistant:** Most of the synthetic fibres have a **high abrasion (wear and tear) resistance.** So, clothes made of synthetic fibres are **long lasting** or **durable**. Natural fibres have low abrasion resistance. So, they are less durable.

4. **Less expensive:** Synthetic fibres are less expensive and more affordable than the natural fibres.
5. **Good elasticity:** Most synthetic fibres are fairly elastic. They can be stretched or compressed to some extent and on releasing the force, they regain their original shape and size. For example, socks made of nylon retain their shape even after repeated use. Natural fabrics are not fairly elastic as compared to synthetic fibres.

DISADVANTAGES OF SYNTHETIC FIBRES

1. **Melt and burn easily:** Synthetic fibres catch fire more readily than natural fibres. Synthetic fibres on catching fire shrink forming beads that stick to the skin. Therefore, it is not advisable to use clothes made from synthetic fibres while working near flame/fire, such as, in kitchen.
2. **Non-biodegradable:** Synthetic fibres are non-biodegradable. Therefore, they cause soil pollution.
3. **Uncomfortable during summers:** Most of the synthetic fibres absorb very little moisture. In hot and humid weather when we sweat, the sweat is trapped between the fabric and our skin. So, the synthetic fabric sticks to the body when the body sweats and makes the wearer uncomfortable.
4. **Develop skin problems:** Synthetic fibres may cause some skin diseases (like eczema) in some people.

PLASTICS

Present time is the '**age of plastics**'. Almost all the domestic items are now made up of plastics such as mug, bucket, chair, ballpen, etc. (Fig. 3.10). There is no end to the number of plastic items used by us. But, what are plastics?

Fig. 3.10 Things made of plastics

Plastics are polymers made up of a very large number of small units joined end to end to form long chains. All plastics do not have the same type of arrangement of units. It may be either linear or cross-linked [Fig. 3.11 (a) and (b)].

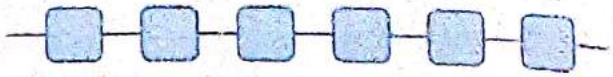


Fig. 3.11 (a) Linear arrangement

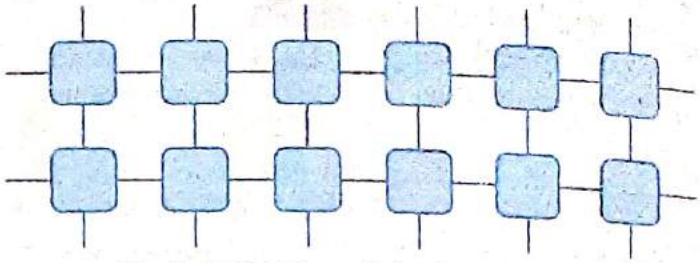


Fig. 3.11 (b) Cross-linked arrangement

Plastic can be coloured and melted. It becomes soft on heating. It can be moulded into any desired shape and then again hardened to make a durable article. **The property by the virtue of which a substance can easily be moulded into sheets or drawn into fibres on heating is called plasticity.** Some common plastics are bakelite, polythene, terylene and polyvinyl chloride (PVC).

Kinds of Plastics

1. **Thermoplastics: Plastics that easily get deformed on heating and can be bent easily are called thermoplastics.** They can be moulded into different shapes again and again by repeated heating and cooling. Examples of thermoplastics are polythene, polyvinyl chloride and polystyrene.
2. **Thermosetting plastics: Plastics that once moulded into a shape do not become soft on heating and cannot be moulded again are called thermosetting plastics.** They maintain their shape and size even at high temperatures. Examples of thermosetting plastics are bakelite, melamine and formica.

Table 3.1 Differences between thermoplastics and thermosetting plastics

S. No.	Parameters	Thermoplastics	Thermosetting plastics
1.	Nature	A plastic that can be melted repeatedly by heating, hardened on cooling and can be moulded again and again into different shapes	A plastic that once moulded into a particular shape, does not become soft on heating and cannot be moulded again
2.	Effect of heat	They become soft on heating.	They do not become soft on heating.
3.	Toughness	They are less tough as compared to thermosetting plastics.	They are more tough and rigid.
4.	Effect of high temperature	They are less resistant to high temperatures.	They are more resistant to high temperatures.
5.	Recycle	They can be recycled.	They cannot be recycled.
	Examples	Polythene, PVC, polyesters	Bakelite, melamine, formica

General Properties and Uses of Plastics

Although different types of plastics differ in some of their physical and chemical properties, the following properties are common to most of them :

1. **Plastics are non-reactive:** We know that metals like iron get rusted when left exposed to moisture and air. But plastics do not react with air and water and hence, do not get corroded. For this reason, polyvinyl chloride (PVC) is used for making water pipes (called PVC pipes) [Fig. 3.12 (a)], water tanks and sanitary fittings, soles of shoes and sandals [Fig. 3.12 (b)], raincoats [Fig. 3.12 (c)], handbags and bathroom curtains.

(a) PVC water pipes (b) a PVC sole of a shoe (c) a PVC raincoat

Fig. 3.12 Plastics are non-reactive.

2. **Plastics are lightweight:** Thermocol is the most common example of plastic known for its lightness and rigidity. It is used for making disposable cups and packaging materials for fragile items like computers, cell phones, television and refrigerator (Fig. 3.13).

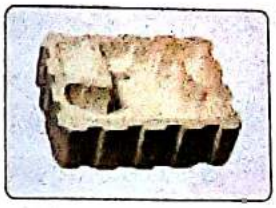


Fig. 3.13 Thermocol is used as a packaging material.

3. **Plastics are strong and durable:** They can be moulded into different shapes and sizes. Plastics are generally cheaper than metals. Thus, they are widely used in industries and for making household articles. For example,
   (a) Melamine is used for making unbreakable dinnerwares [Fig. 3.14 (a)], floor tiles, decorative objects, fire-resistant fabrics and kitchenwares.
   (b) Polythene is used for making carry bags [Fig. 3.14 (b)], adhesive tapes and pipes to transport liquids.

(a) melamine dinner set (b) carry bags (c) toys

Fig. 3.14 Plastics are strong and durable.

(c) PVC is used for making floor tiles, durable toys [Fig. 3.14 (c)], furniture and bottles.

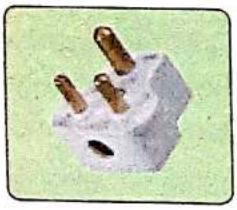
4. **Plastics are poor conductors of heat:** For this reason,
   (a) Bakelite is used for making handles of utensils [Fig. 3.15 (a)].
   (b) Polystyrene is filled in the hollow walls of refrigerators, air coolers and thermos flasks. It is also used for making ice boxes [Fig. 3.15 (b)].

(a) cookware: bakelite handle

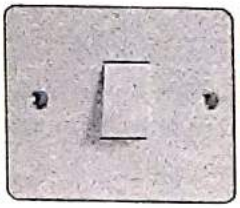
(b) an ice box

Fig. 3.15 Plastics are poor conductors of heat.

5. **Plastics are poor conductors of electricity:** For this reason,
   (a) Bakelite is used for making electrical plugs and switches [Fig. 3.16 (a) and (b)].
   (b) PVC is used as an insulation cover in electric wires [Fig. 3.16 (c)].



(a) a bakelite plugtop



(b) an electrical switch

(c) insulated wires

Fig. 3.16 Plastics are poor conductors of electricity.

DO YOU KNOW?

- Plastics are extensively used in health care industry. They are used in packaging of tablets, threads used for stitching wounds, syringes, doctor's gloves and medical instruments.
- Uniforms of firemen have a coating of melamine plastic to make them flame resistant.
- The cookwares used in microwave oven are made of a special type of plastic. The heat cooks the food inside the container without affecting the plastic container.

6. **Plastics are inert to chemicals: Teflon** is used for making non-stick cookwares because it is a special type of plastic on which oil and water do not stick.

   Also, plastics are cheaper in comparison to metals and are easy to handle.

Multiple Choice Questions (MCQs)

Tick (✓) the correct options:

1. Which of the following is used for making non-stick cookwares?
   (a) PVC ◯ (b) teflon ◯
   (c) thermocol ◯ (d) nylon ◯
2. Electric switches and plugs are made of _____.
   (a) PVC ◯ (b) polystyrene ◯
   (c) bakelite ◯ (d) melamine ◯

PLASTICS AND THE ENVIRONMENT

When we go to a shop to buy something, the shopkeeper gives those things in polythene bags. Mineral water and soft drinks are available in plastic bottles. Sometimes, we use disposable thermocol plates and cups in social gatherings. So, a lot of plastic waste is generated daily and this plastic waste keeps on accumulating in our homes. Ultimately, plastic finds its way to the garbage.

Plastic waste is a big threat to our environment because **plastics are non-biodegradable substances. Substances that cannot breakdown easily into simple, harmless substances through natural processes such as the action of bacteria are called non-biodegradable substances.** Synthetic fibres are also non-biodegradable substances.

Substances that can easily be broken down into simple harmless substances by the action of bacteria are called biodegradable substances. Peels of vegetables and fruits, leftover foodstuff, paper, cotton cloth, wool, etc., are biodegradable substances.

Science Update

Bioplastics have been made by scientists by using natural materials such as corn starch and vegetable oil. These plastics are used in making disposable items. They are biodegradable and thus environment friendly.

Disposal of plastic wastes leads to the following health and environmental hazards:

1. Plastic wastes do not get completely burnt and produce toxic gases and smoke that cause air pollution [Fig. 3.17 (a)].
2. When plastic wastes are dumped in water, they cause water pollution [Fig. 3.17 (b)].
3. Most of the plastic wastes dumped in landfills, cause soil pollution. Since, plastics buried in the soil cannot be decomposed by micro-organisms, they prevent rainwater from seeping into the earth. Thus, water remains on the earth's surface and forms muddy pools.
4. We throw polybags, wrappers of chips, biscuits and other eatables, disposable plastic bottles, etc., on the road or in parks. This not only makes the place look ugly but also provides breeding grounds for many disease-causing germs and insects.
5. Polybags, carelessly thrown here and there, are responsible for clogging drains and sewer lines.

(a) air pollution (b) water pollution

Fig. 3.17 Health and environmental hazards due to plastic disposal

6. Animals eat food wastes from the garbage dumps. During eating the food wastes, they sometimes swallow polythene bags and wrappers of food also. The plastic materials choke their respiratory system or sometimes digestive tract and can be the cause of their death.

Science In Life

Avoid keeping hot cooked food in coloured polythene bags. It is because food stored in coloured polythene bags becomes poisonous after some time. It is just like consuming a slow poison.

Solution to Problems Created by Plastics

As responsible citizens, we must remember the golden **5-R principle— Refuse, Reduce, Reuse, Recycle** and **Recover**. We should be environment-friendly in all our activities.

1. We should avoid the use of plastics. For example, we should not ask for plastic bags when we go for shopping. Instead, we should carry cotton or jute bags.
2. We should clean and dry plastic bags, plastic containers and plastic disposable bottles for reuse.
3. We should use two types of bins—**a green bin** and **a blue bin** for disposing wastes (Fig. 3.18). Biodegradable wastes such as peels of fruits and vegetables, leftover food, paper and cotton should be thrown in the green bin. Non-biodegradable wastes like plastic waste and glass should be thrown in the blue bin. These collected plastics are then melted and recycled.

(a) (b)

Fig. 3.18 (a) Green bin for biodegradable wastes (b) Blue bin for non-biodegradable wastes

4. We should not throw plastic disposable bottles, polybags, wrappers, etc., on the roads.
5. We should not dispose of articles made of plastic in the sewage system.

Presently, all kinds of thermoplastics are melted together to produce recycled plastic. For example, the black plastic bags are made from recycled plastic.

We should develop environment-friendly habits to reduce the harmful effects associated with plastic.

EXERCISES

*Use **Cordova Smart Class Software** on the **smart board** in class to do these exercises.*

A. Tick (✓) the correct options:

1. Which of the following fibres gives wool-like feeling?
   (a) nylon ◯ (b) acrylic ◯ (c) terylene ◯ (d) rayon ◯
2. Which of the following is not a thermoplastic?
   (a) polythene ◯ (b) melamine ◯ (c) polyester ◯ (d) PVC ◯
3. Which of the following plastics is used for making water pipes?
   (a) melamine ◯ (b) polythene ◯ (c) PVC ◯ (d) bakelite ◯
4. Terylene mixed with cotton form _____.
   (a) terrycot ◯ (b) terrywool ◯ (c) terrysilk ◯ (d) polyester ◯
5. Acrylic fibres are used for making _____.
   (a) sweaters ◯ (b) shawls ◯ (c) blankets ◯ (d) all of these ◯

B. Fill in the blanks:

1. Synthetic fibres absorb very little water. This property is called _____.
2. Thermosetting plastic does not become _____ on heating.
3. Plastic wastes dumped in water cause _____.
4. _____ is a common plastic known for its lightness and rigidity.

C. Match the following:

Column A	Column B
1. Biodegradable wastes	(a) thermosetting plastic
2. Air pollution	(b) natural fibre
3. Bakelite	(c) polymer
4. Thermoplastics	(d) making dress materials
5. Formica	(e) green bin
6. Single large unit	(f) burning of plastics
7. Linen	(g) making electrical plugs
8. Terrycot	(h) can be recycled

D. Very Short Answer Questions:

1. Name the smallest unit of nylon.
2. Give any two examples of thermoplastics.
3. Give any two examples to show that plastics are non-reactive in nature.
4. Which fibre is also called artificial silk?
5. Name the monomer of polyester.
6. Give two examples of plastics.

E. Short Answer Type-I Questions:

1. What are human-made or synthetic fibres?
2. What is a polymer?
3. Why is nylon used for making bristles of toothbrushes?
4. What is 5-R principle?

F. Short Answer Type-II Questions:

1. (a) What are plastics?
   (b) Give any two uses of plastics.
2. Give the differences between thermosetting plastics and thermoplastics.
3. (a) Why is polyester used for making water hoses for firefighting operations?
   (b) Why are saucepan handles, electric plugs and switches made of thermosetting plastics?
4. John goes for mountaineering with some selected students of his batch. Initially, he is scared of it. His trainer tells him that he should be strong. He provides him a strong rope and teaches him how to climb a mountain.
   (a) Name the fibre that is used in making the climbing rope.
   (b) What can we learn from John and his trainer?

G. Long Answer Questions:

1. Give any five environmental hazards caused due to plastics.
2. Give reasons for the following:
   (a) Cooking pans have plastic handles.
   (b) Burning of plastic causes air pollution.
   (c) Electric wires have a plastic covering.
   (d) Bakelite is used for making electrical switches.
   (e) Plastics are strong and durable.
3. What are the advantages of synthetic fibres? Explain.
4. Write any five eco-friendly habits.

H. HOTS (Higher Order Thinking Skills) Questions:

1. Which fibre would you use for making fishing nets and why?
2. Production of synthetic fibres helps in the conservation of forests. Comment.

ACTIVITY

Home Assignment/Group Activity/Project: Cut pieces of fabrics from old and discarded clothes. Categorise them as knitted or woven fabric. Separate thread from each of these fabrics. In which case is it easier to separate yarn? Why?

Field Visit: Visit ten families in your neighbourhood and enquire about the kind of clothes they use, the reasons for their choice and advantages of using them in terms of cost, durability and maintenance.

Group Discussion: Discuss in the class: 'Plastics— a Boon or a Curse'