

# Science Success

with Practice Assignments

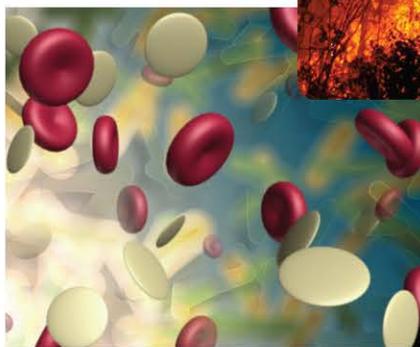
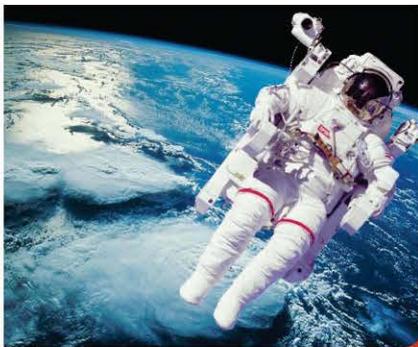
8  
Book

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GOYAL BROTHERS PRAKASHAN



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# PREFACE

The series **Science Success** is meant for **Classes 1 to 8**. It fulfills the vision of **National Curriculum Framework (NCF)** meant for the schools affiliated to **CBSE** and other schools affiliated to various **State Education Boards**. This series emphasises meaningful learning of science for the overall development of learners. It focuses on helping children understand their natural environment and correlate science with their everyday experiences in an interesting and comprehensive manner.

The text has been designed with beautiful illustrations to help children develop skills of observation, investigation and scientific attitude.

## Components of this Series are:

- **Science Success Text Books — Books 1 to 8** for Primary and Middle Classes.
- **Science Success Teacher’s Resource Books 1 to 8.**
- **Online Support for Books 1 to 8.**

The series has been designed for teaching a basic course in science and includes various **Key Features (Tools)** to fulfill needs and requirements of learners.

## A. LEARNING TOOLS (Books 6 to 8)

*These Tools help students to gain knowledge, understand concepts thoroughly and retain it in their memory.*

- **Learning Objectives** : Gives a view of the main learning objectives to be achieved.
- **Comprehensive Text** : Explains the science concepts in simple and lucid language accompanied with lively illustrations, diagrams and pictures followed by examples from day-to-day life.
- **Science Bits** : Gives extra information about the topics being taught.
- **Activity** : Simple experiments to make the understanding of the concept being taught crystal clear.
- **Keywords** : Contains all the difficult terms along with their meanings/definition from the whole chapter.
- **Summary** : Gives a quick recap of the whole chapter.

## B. ASSESSMENT TOOLS (Books 6 to 8)

*These Tools test the understanding and knowledge of concepts through Exercises, Revision-practice and Life Skill techniques.*

- **Check Your Knowledge** : Provides **in-text exercises** to evaluate the understanding of concept being covered.

- **Exercises** : Provides a variety of graded questions under various heads – MCQs, Fill in the blanks, Match the columns, True/False, Very short answer questions, Short answer questions, Long answer questions, Flow chart, Label the diagrams, HOTS questions, Value based questions.
- **Project Ideas** : Enables the students to work on some interesting projects based on the concepts learnt in chapter.
- **Activities to Ponder and Act** : Provides the situations to use the skills and values developed.
- **For the Teacher** : Gives some helpful suggestions to the teacher to make learning lively and more interesting.
- **In the Laboratory** : Gives an opportunity to the children to get practical experience.

## Additional Tools

### Teacher's Resource Books

- **Plan to achieve the Learning Objectives** to guide the teachers with effective teaching techniques.
- **Overview of the Lesson** to help teachers easily recapitulate the finer points of the lesson.
- **Complete Solution-key** of the Text Books.

### Online Support

- **Chapterwise Assignments for practice**
- **Chapterwise Question Bank with solutions**
- **Animated Lessons**
- **Animated Activities**
- **Science Dictionary**

We hope this series fulfills all the needs and requirements of NCF and the latest syllabi. We look forward for feedback and constructive criticism from the students, teachers and parents, which will be given every consideration in the future.

—Authors

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# 1



## Crop Production and Management

### Learning Objectives

At the end of this chapter, students will be able to understand :

- The crops and their classification
- Basic practices of crop production — How do you prepare the soil for cultivation? — What are manures, fertilizers and their importance? — What are the methods of selection and sowing of seeds? — What do you mean by irrigation and their methods? — What are crop protection and their methods? — What do you mean by harvesting, threshing, winnowing and storage of food grains?
- What is green revolution?
- What are crop rotation and mixed cultivation?
- The food obtained from animals.

All living organisms require food. It is very hard to imagine even a single day without food. We require energy to do work, to carry out life processes like respiration and digestion. You have already learnt that green plants synthesise their own food by the process of photosynthesis. Animals are unable to make their own food and obtain their food from plants and other animals. In order to produce food man started growing plants and domesticating useful animals, giving rise to agriculture.

The practise of raising plants and rearing animals for food and other useful products is known as **agriculture**.

### **1.1 CROPS**

Same type of plants being cultivated at one place on a large scale is called a **crop**. For example — rice, wheat, etc.

The plot of land used for cultivation of crop plants is known as **agricultural field**.

Based on the useful products obtained from them, crops can be classified into :

- (i) **Cereal Crops** : They are grown for their seed grains which are rich in starch and fibre e.g., wheat, rice, maize.
- (ii) **Fibre Crops** : Grown for fibres used in clothing and upholstery e.g., jute, cotton.
- (iii) **Pulses or Legumes** : They are a rich source of proteins e.g., pulses, gram, beans.
- (iv) **Oil yielding crops** : They are rich in edible oil e.g., groundnut, sunflower, mustard.
- (v) **Sugar yielding crops** : They have high sugar content e.g., sugarcane.
- (vi) **Vegetables** : They have high water content and are rich in minerals and vitamins and can be obtained from leaves, stems, roots and flowers e.g. spinach, potato, carrot and cauliflower.
- (vii) **Fruits** : They are rich in water content, minerals and other dissolved nutrients e.g., apple, mango.
- (viii) **Spices** : These are the flavouring plant products adding taste to the food. e.g., pepper, ginger, cloves.



Sugarcane (Sugar)



Potato (Vegetable)



Cloves and Pepper (Spices)



Two types of cropping patterns are followed in India based on seasons or their climatic conditions like temperature, rainfall, humidity, etc. These climatic conditions vary from one place to another. Therefore, a variety of crops are grown in different parts of India. So, these cropping patterns are *rabi crops* and *kharif crops*.

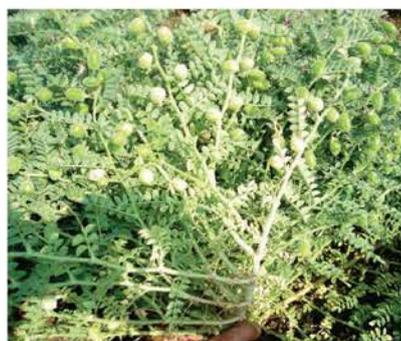
**A. Rabi Crops** : Crops grown in winter are known as **Rabi Crops**. They are planted in October and harvested in the month of March or April. Wheat, barley, gram, pea and mustard are examples of **rabi** crops.



Rice (Cereal)



Cotton (Fibre)



Gram (Pulses)



Sunflower (Oil)



Wheat



Gram



Mustard

**B. Kharif Crops** : Crops sown during the rainy season are known as *kharif* Crops. They are planted in June and harvested in September. *Kharif* crops include paddy, sugarcane, groundnuts and maize. *Kharif* crops require large quantities of water.

### SCIENCE BITS!

The word agriculture, is derived from two Latin words **ager** = field or land, and **cutter** = cultivation.



Maize plants



Groundnut plants

## 1.2 BASIC PRACTICES OF CROP PRODUCTION

To ensure a good crop yield several activities are undertaken by farmers over a period of time. These activities are known as **agricultural practices**, which are listed below :

- Preparation of soil
- Selection and sowing of seeds
- Irrigation
- Weeding
- Crop protection
- Harvesting
- Storage

The machines and tools used for agricultural practices are known as **agricultural implements**.

### 1.2.1 Preparation of Soil

Before sowing the seeds the soil should be prepared for good yield.

Three steps are involved in soil preparation.

- Ploughing** : The process of loosening and turning of soil is called tilling or ploughing. It is done by a plough, hoe or cultivator.

**Plough** : It is a wooden implement and contains a strong triangular iron strip called *plough share*. Main part of plough is a long log of wood known as

plough shaft having a handle at one end. The other end is attached to a beam placed on bull's neck. A pair of bulls and a man operate the plough. Iron ploughs have now replaced wooden ploughs.



Iron plough



Wooden plough

**Hoe** : It is a simple tool for removing weeds and loosening a soil. It consists of a long wooden or iron rod with a strong bent plate of iron fixed at one of its ends which works like a blade.



Hoe

**Cultivator** : A tractor driven implement for ploughing is known as cultivator.



Cultivator



Cultivator driven by a tractor

### Advantages of Ploughing :

- It provides aeration to the roots as air spaces are created, making it easy to breathe.
- Roots can grow deep into the soil.
- Weeding is easier in loose soil.
- Helps in growth of earthworms and microbes in soil which are important decomposers providing nutrients and making the soil humus rich.
- It becomes easier for the farmer to apply fertilizers.
- Ploughing brings nutrient rich soil on the top, so that plants can use it easily.

## 2. Levelling

Levelling is done to make the surface of the soil uniform after the process of ploughing. It is done with the help of a wooden or iron leveller.



Leveller

### Advantages of Levelling

- (i) Bigger chunks of soil are broken down to smaller pieces.
- (ii) Prevention of soil erosion by wind or water.
- (iii) Promotes uniform irrigation thus helping in water conservation and prevents water logging.

## 3. Adding Manures and Fertilisers

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

**Manure** : It is an organic substance obtained from the decomposition of animal and plant wastes.

It can be of two types :

- (i) **Compost** : Manure obtained by decomposition of dead plant and animal matter is known as compost. The dead matter is put in a compost pit, decomposed by microbes and turned into manure.



Compost

- (ii) **Farmyard Manure** : Commonly used manure in India. It is obtained from farmyard wastes such as cattle dung, urine, and crop waste. All these are mixed and dried in the sun. The manure thus obtained is directly used as farmyard manure.

**Fertilisers** : They are inorganic chemicals produced in factories. They are rich in a particular nutrient and are applied in small quantities. They are easy to apply and easy to store and thus favoured over manures. Application of fertilizers help in increasing crop yield but excessive use of fertilizers make soil less fertile and make the soil either too acidic or too alkaline. Fertilizers also lead to water pollution.

Some of the common fertilizers are urea, ammonium sulphate, potash, NPK (Nitrogen, Phosphorus and Potassium), CAN (calcium and nitrogen).

Advantages of using manures over fertilizers :-

1. Manures enhance water holding capacity of soil.
2. Manures make the soil porous for easy exchange of gases.
3. Manures make the soil rich in humus and increase the number of friendly microbes.
4. Manures improve the soil texture as well as its water retaining capacity.

### CHECK YOUR KNOWLEDGE-1

#### 1. Name the following :

- (a) The plot of land used for cultivation of crop plants.
- (b) The plant products, adding taste to the food.
- (c) The process of loosening and turning of soil.

#### 2. True (T) or False (F) :

- (a) Crops grown during the rainy season are called *rabi* crops.
- (b) Ploughing provides aeration to the roots.
- (c) Manure is an organic substance which increase soil fertility.



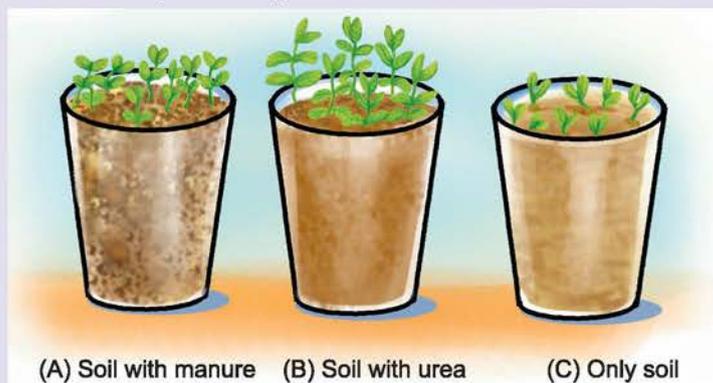
### ACTIVITY 1.1

**Aim :** To study the effect of manure and fertilizer on plant growth.

**Materials Required :** Moong seeds, soil, 3 plastic glasses, cow dung manure, urea, water, petridish, blotting paper.

**Procedure :**

1. Take a petridish and put a wet blotting paper in each of them.
2. Place the moong seeds at a distance on the petridish, cover it and keep it aside.
3. After one or two days seedlings germinate from the seeds. Select some equal sized seedlings out of these.
4. Take 3 empty glasses and add little amount of soil mixed with cow dung manure in A, same amount of soil mixed with urea in B and only soil in glass C.



5. Pour same amount of water in each glass and plant the seedlings in them.
6. Keep them in a safe place and water them daily and observe their growth for 7-10 days.

**Observation :** Seedlings in glass A and B show good growth whereas growth in glass C is very less. Seedlings in glass B containing urea grow fastest followed by A and least in C.

**Explanation and Conclusion :** Seedlings in glass B grow fastest because moong requires nitrogen for good growth which was provided by urea. Seedlings in glass A also showed good growth because manure added to it helped in better growth. Whereas the growth of seedlings in glass C was poor because the soil was deficient in nutrients and no manure or fertilizer was added to replenish the nutrients.

#### 1.2.2 Selection and sowing of seeds

After preparing the soil the next step is seed sowing. But before sowing, a farmer should select good quality seeds to ensure maximum grain production and to avoid wastage.

Following points should be kept in mind while selecting seeds –

- (a) Seeds should be viable with high percentage of germination.
- (b) High yielding varieties free from insects and pests should be selected.
- (c) Seeds should be treated with fungicides before sowing.

### ACTIVITY 1.2

**Aim :** Selection of healthy seeds.

**Materials Required :** Beaker, barley seeds, water.

**Procedure :**

1. Take a beaker filled with water.
2. Put some barley grains in the beaker.
3. Leave them untouched for sometime and then observe.

**Observation :** Some of the grains settle down at bottom and others float on the surface.

**Explanation and Conclusion :** Seeds which are unhealthy, infected by pests or insects become hollow and thus lighter in weight. Therefore, these seeds float on water whereas the healthy seeds are settled down at the bottom.

The following points should be kept in mind by the farmer while sowing seeds :

- (i) Seeds should be sown at the right distance from each other. Seeds sown too close to each other will not get sufficient water and nutrients from the soil. They will also have competition for sunlight and air.
- (ii) Seeds should be sown at the right depth. They should neither be too shallow nor too deep.

### ACTIVITY 1.3

**Aim :** To show the importance of right depth and right distance for sowing seeds.

**Materials Required :** 3 wide pots, kidney beans, soil containing nutrients and water.

**Procedure :**

1. Take three wide pots. Label A, B and C.
2. Put fertile soil in all the pots.
3. Take pot A and sow seeds very close to each other.
4. In pot B, sow seeds at a distance of  $\frac{1}{2}$  inch from each other.
5. In pot C, sow seeds at a distance of 1 inch from each other.
6. Water them regularly and keep them in proper sunlight.

**Observation :** Seeds in pot C germinate first and show good growth whereas seeds in pot B germinate after C with less growth and in pot A only few seeds germinate and that too showing poor growth.

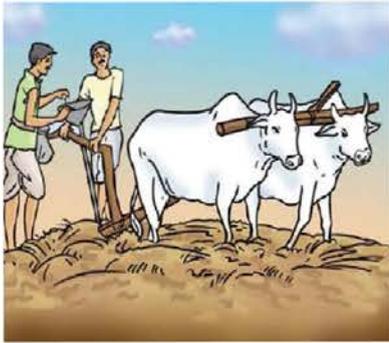
**Explanation and Conclusion :** Seeds in pot C germinate first and show good growth because the seeds are placed at a proper distance allowing proper nutrition to the seeds. The distance between two seeds is less in pot B hence less growth is seen, whereas seeds in pot A are very close hence, they show very poor growth.

### Tools for Sowing Seeds

1. **Traditional tool :** It is a funnel shaped tool attached to the plough. Seeds are filled in the funnel and passed through 2 or 3 pipes piercing the soil and placing the seeds in soil.
2. **Seed drill :** A seed drill consists of a set of vertical tubes with a funnel at the top. Seeds are put in the funnel and distributed through these vertical tubes while attached to the plough.
3. **Broadcaster :** A wide mouthed tube that spreads seeds randomly on the ground.
- randomly in the field is known as broadcasting. It can be done by hands or by using mechanical broadcasters.
2. **Sowing by seed drills :** By seed drills, seeds are sown uniformly at proper distances and depths. This helps the plant to obtain proper nutrition, protects the seeds from birds and saves time and labour.
3. **Transplantation :** Seeds of rice and some other plants cannot be sown directly into the field. Their seeds are first grown in a nursery till the seedling stage. Healthy seedlings are then selected from the nursery beds and transplanted to the field by hand.

### Methods of sowing seeds

1. **Broadcasting :** Scattering of seeds



Traditional method of sowing



Seed-drill



Broadcasting (by hand)



Transplantation of seedlings of paddy

### 1.2.3 Irrigation

Supply of water to crops at different intervals is known as irrigation.

Time and frequency of irrigation varies from

- (a) Crop to crop
- (b) Soil to soil
- (c) Season to season

Some of the crops require more water like rice requires standing water whereas others require less water. Similarly, soils which are loamy require less water as they have good water holding capacity but clayey soils having low water holding capacity require more water. Water is evaporated in large amounts from soil and leaves during summer. Therefore, water requirement increases during summer as compared to winter.

#### Why do plants need water?

1. For proper growth and development of flowers, fruits and seeds of plants.

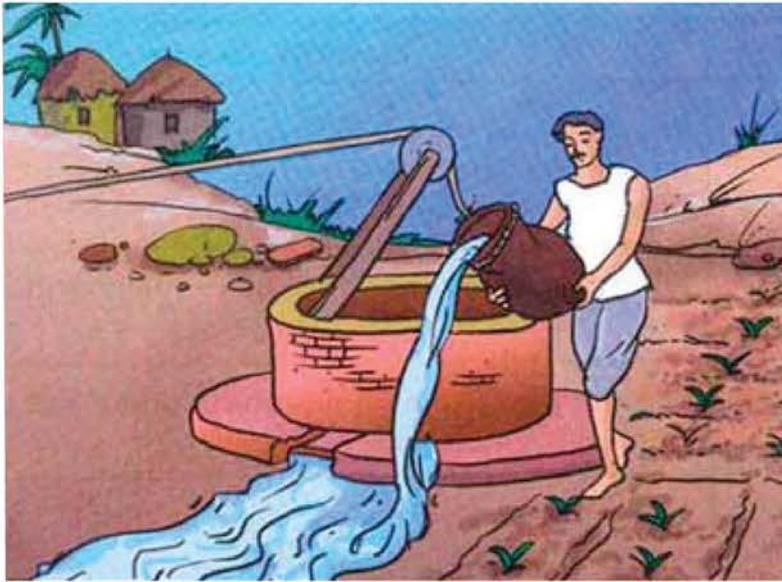
2. Roots absorb mineral and fertilisers dissolved in water.
3. Seed germination requires presence of water.
4. Water protects the crop from frost and hot air currents.
5. All nutrients are transported in the plant body using water as a medium.

**Sources of irrigation :** The sources of irrigation are wells, tube wells, ponds, rivers, dam and canal.

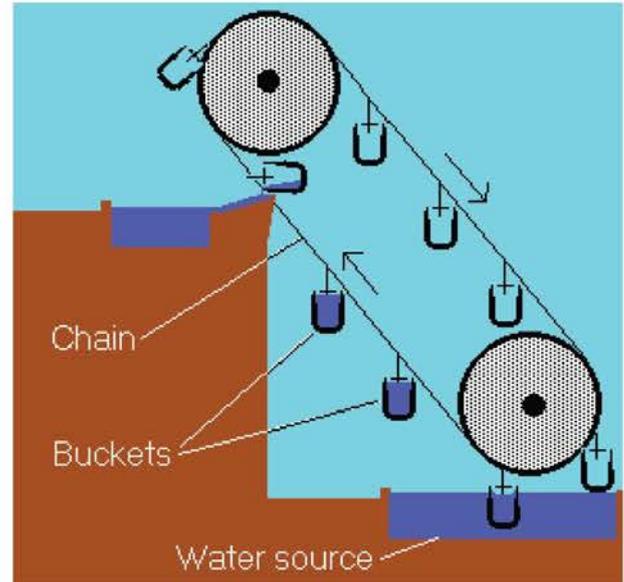
**Methods of irrigation :** Various methods are used to take out water from the sources to the field.

**Traditional methods :** Simple crude lever systems are used in traditional methods. These methods are cheaper as cattle or human labour but these methods are time consuming and less efficient. Some of the traditional methods of irrigation are :

- (i) **Moat (Pulley System) :** A pulley system is used to lift water from the well.
- (ii) **Chain pump :** It consists of a pump having endless chains running over a drum or wheel by which it is moved and water is raised.
- (iii) **Dhekli :** A very crude system using a log of wood to pull out water from the well.
- (iv) **Rahat :** It is a simple lever system consisting of a wheel attached to a number of buckets. The wheel rotates which pulls out water and distributes it to the field.



Moat



Chain pump

**Modern methods :** They are more economical and efficient. Some commonly practised methods are :

**(i) Drip irrigation :** It uses underground pipes having small holes at regular intervals positioned at the roots. Thus, they carry water directly to the roots and prevent evaporation and flooding. Mostly used in case of fruit plants, gardens and trees.

**(ii) Sprinkler system :** It consists of a main pipeline connected with several perpendicular pipes having rotating nozzles at the top. Water flows through the main pipe under pressure with the help of a pump, and escapes from the

rotating nozzles. It gets sprinkled on the crop like rain. It is useful for sandy soils which cannot retain water.

**(iii) Furrow irrigation :** The field is divided into ridges and furrows. Plants are grown on ridges and water flows in the furrows through a pump.

**(iv) Basin irrigation :** The field is converted into a basin and filled with water. Useful for the crops which require standing water.

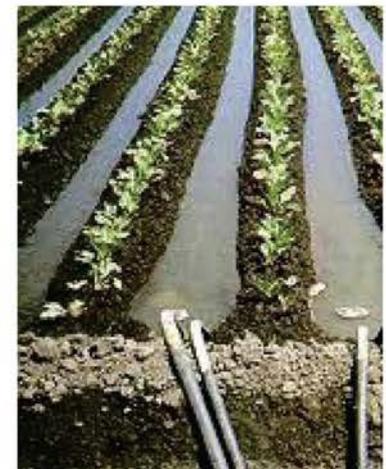
**Water logging :** If excessive irrigation is done water accumulates around the plants and causes damage by decreasing the aeration and increasing the amount of salts.



Drip irrigation



Sprinkler irrigation



Furrow irrigation

### 1.2.4 Weeding

Undesirable plants growing naturally along with the crop are known as **weeds** e.g., **Amaranthus**, **Chenopodium**. Removal of the weeds is known as **weeding**.

Weeding is necessary because weeds compete with crop plants for space, light and nutrients and thus affects the growth of crop plants. They can also be toxic to plants and animals and may interfere in harvesting. Weeding should always be done before the weeds produce flowers.

#### Methods of Weeding

1. **Tilling** : Tilling before sowing is done to uproot weeds.
2. **Manual method** : Weeds can be removed either by pulling them out manually or with the help of a **harrow** or **trowel**.
3. **Chemical method** : Weeds can be controlled by using certain chemicals called weedicides, like 2, 4-D, Metachlor, Siazine, MCPA, etc. Weedicides are diluted with water and sprayed on the fields with a sprayer. They should be sprayed before the weeds start flowering and seed formation. The farmers should be careful while handling weedicides because it can be toxic to their health.



Chenopodium



Implements used for weeding



Spraying insecticide

### 1.2.5 Crop protection

To ensure a good yield, crops should be protected from stray animals, birds and pests.

#### Methods of crop protection

- (i) Fencing of the field can be done to protect the crops from stray animals.
- (ii) Using a scare crow and beating drum is an effective method to protect the crops from birds.



Keeping birds away from the crop

- (iii) Crop plants are always prone to fungal, bacterial and viral disease. Treating the seeds with fungicides and spraying insecticides, pesticides can help the farmers to have a disease free crop. Moreover disease resistant seeds should be sown to avoid infection.
- (iv) Rodents, birds and insects causing damage to the crops are known as pests.
- (v) Pests can be controlled by spraying diluted pesticides. Example, BHC, malathion, polythion, etc.

### 1.2.6 Harvesting

The process of cutting and gathering of a crop upon its maturation is known as harvesting. A crop gets ready for harvesting in about 3-4 months. Harvesting can be done manually with a sickle or with a machine called harvester.

**Threshing** : Threshing is the process of beating cereal plants in order to separate the grains

from the straw. Threshing can be done manually or with a thresher. A combine is a combined harvester and thresher.



Thresher



Sickle



Combine

**Winnowing :** Farmers with small holdings of land do the separation of grain from chaff by the process of winnowing.



Manual winnowing

In this process, the grain mixture is thrown in the air so that wind blows away the lighter chaff, while the heavier grains fall down. These days it is being done with the help of a winnowing machine.



Winnowing machine

### 1.2.7 Storage

Once the grains have been harvested, they have to be stored in a proper manner so that they are available throughout the year in every place.

Following factors should be kept in mind while storing grains-

- (i) Storage area should be dry, free from moisture as moisture promotes microbial growth.
- (ii) Storage area should be free from rodents and insects.
- (iii) There should be no open spaces like window from where birds can come in and out to eat grains.

### Treatments for storage

1. Before storing seeds, they are sun dried to reduce moisture.
2. Dried neem leaves, garlic or turmeric pieces are used while storing grains at home to avoid microbial growth and pests.
3. Specific chemical treatments can also be given to store grains in a proper manner.

### Methods for storing

Small quantities of grains at home can also be stored in metallic or clay containers or in jute bags.

Large scale storage of grains is done in silos and granaries.

**Silos** are tall cylindrical storage structures with openings. They can store different stock of food grains at different levels. Whenever required, grains can be taken out from the opening.

**Granaries** consist of gunny bags filled with

food grains, which are stacked in a large godown on wooden raved platforms away from the walls with alleys for fumigation between the stacks.

Perishable food such as fruits and vegetables are stored in cold storage houses.



Grain-silos



Granaries



Cold Storage

### CHECK YOUR KNOWLEDGE-2

#### 1. True (T) or False (F) :

- (a) Seed drill is used by farmer for the seed dispersal.
- (b) Seed germination do not require water.
- (c) Weeding should always be done before the weed produce flowers.



#### 2. Fill in the blanks :

- (a) Supply of water to crop at different intervals is called \_\_\_\_\_ .
- (b) Rodents, birds and insects causing damage to the crops are known as \_\_\_\_\_ .
- (c) \_\_\_\_\_ are tall cylindrical storage structures with an opening.

### Green revolution

The green revolution refers to the dramatic increase in agricultural productivity due to use of improved variety of seeds. The other factors leading to increased productivity are :

- Expansion of farming areas.
- Mixed farming

Dr. Norman Borlaug was instrumental in introducing disease resistant varieties of wheat from Mexico to India. Dr. M.S. Swaminathan, an agricultural genetist, obtained a hybrid variety of wheat by cross breeding seeds from Mexico and local seeds of wheat. This was a high yielding variety that is also resistant to pests. His efforts have largely contributed towards making India an agriculturally self-sufficient nation.



Dr. M.S. Swaminathan



Dr. N. Borlaug

### 1.3 CROP ROTATION

The practice of growing two or more dissimilar crops on same plot of land alternately is known as crop rotation. When we keep on growing the same crop over and over again, the land becomes deprived of nutrients. Crop rotation with crops such as pulses is done to replenish the nutrients. Leguminous plants contain nitrogen fixing bacteria in the root nodules which help to overcome nitrogen deficiency.

## 1.4 MIXED CULTIVATION

The process of growing two or more different types of crops in a particular field at the same period of time is known as mixed cultivation. Leguminous plants and cereals can be grown close to each other. The nutrients required by one crop are fulfilled by the other. Thus two crops can be grown at the same time.



Mixed Cultivation

## 1.5 FOOD FROM ANIMALS

Along with plants, animals also provide us with different kinds of food and other food products which we use in our daily life. The practice of breeding and raising livestock is known as **animal husbandry**.

### SCIENCE BITS!

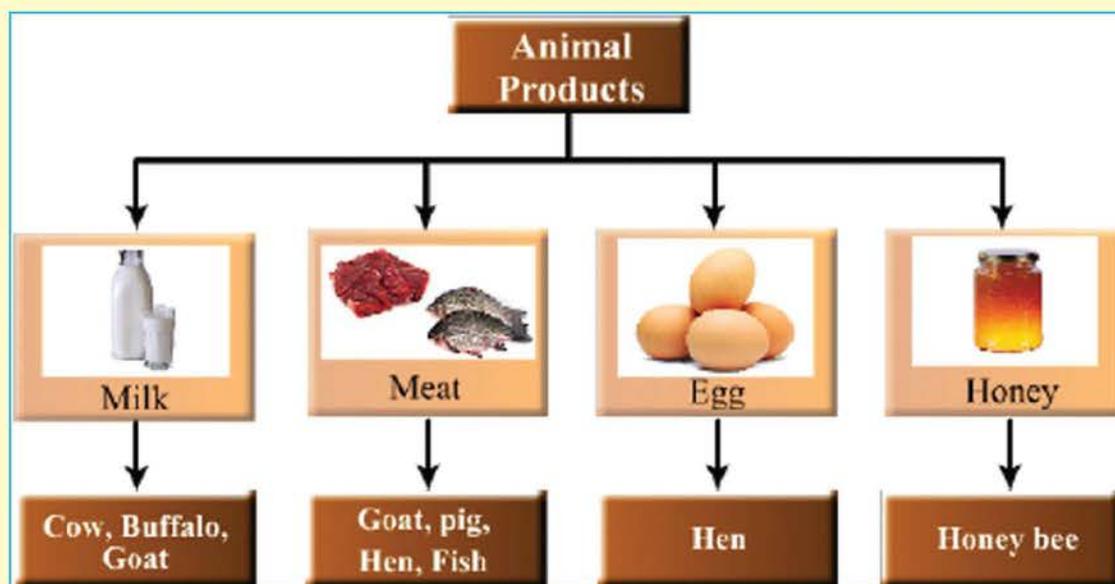
#### White Revolution or Operation Flood

What green revolution did to agriculture, it was done to milk and milk products by 'operation flood'. Launched by National Dairy Development Board, the programme was aimed at creating nationwide milk grid. It stopped malpractices by traders and milk merchants and making India the world leader in milk production. Dr. V. Kurien, the 'Amul Man' is the father of white revolution.

The following table gives a list of food items obtained from animals :

S.No.	Food Obtained	Sources
1.	Milk and milk products	Cow, buffalo, she goat, she camel
2.	Meat	Hen, duck, turkey, goat, fish
3.	Honey	Honeybees
4.	Eggs	Hen, Duck
5.	Cod liver oil	Fish

### SCIENCE BITS!



- Fish is a good source of food. The cod liver oil of fish is rich source of vitamin D.
- Rearing of honeybees commercially for honey is known as apiculture.

## KEYWORDS

- ◆ **Agriculture** : The practice of growing plants and rearing animals for food and other things.
- ◆ **Crops** : Similar types of plants cultivated on a large scale for food, cloth, etc., is called a crop.
- ◆ **Rabi Crop** : It is planted in the month of October and harvested in the month of April, the following year.
- ◆ **Kharif crop** : Kharif crop is sown during the month of June and harvested by October.
- ◆ **Ploughing** : Loosening and turning of the soil using a plough.
- ◆ **Levelling** : Agricultural practice of making the surface of the soil uniform after the process of ploughing.
- ◆ **Manure** : Organic substances obtained by decomposition of animal and plant residue.
- ◆ **Fertilizers** : Fertilizers are inorganic chemicals applied to the field to increase fertility.
- ◆ **Broadcasting** : Sowing seeds by hand.
- ◆ **Drilling** : Sowing of seeds by seed drills at proper distance and depth.
- ◆ **Transplantation** : Seeds of some crops such as rice and tomatoes are first grown in a patch of land in a 'nursery'. After they germinate and become seedlings, they are transferred to the agricultural field. This is known as transplantation.
- ◆ **Irrigation** : Supply of water to crops at different intervals.
- ◆ **Weed** : A plant that grows and reproduces aggressively and limits the growth of other plants by blocking light or using up nutrients from the soil.
- ◆ **Weeding** : The process of removing weeds with the help of a harrow or trowel.
- ◆ **Harvesting** : The process of cutting and gathering mature crops from the fields.
- ◆ **Threshing** : The process of beating cereal plants in order to separate the grains from the straw.
- ◆ **Winnowing** : The process of removing the chaff from the grains by blowing air, is known as winnowing.
- ◆ **Green revolution** : The dramatic increase in agricultural productivity due to use of improved variety of seeds.
- ◆ **Crop rotation** : The practice of growing two or more dissimilar crops on the same patch of land alternatively.
- ◆ **Mixed cultivation** : The process of growing two or more different types of crops in a particular field at the same time.
- ◆ **Storage** : Storing grains and other food products by adopting suitable means.
- ◆ **Apiculture** : The process of rearing honeybees for honey.

## SUMMARY

- ◆ Food is one of the basic requirement of all living beings and to fulfill this we need to adopt agricultural practices of growing plants and rearing animals for useful products.
- ◆ Same type of plants being cultivated at one place on a large scale, is called a crop.
- ◆ Tools used for large scale agricultural production are known as agricultural implements.
- ◆ Ploughing is the process of loosening and turning of soil with the help of ploughs.
- ◆ Levelling of soil is done with levellers.
- ◆ Manures and fertilizers are applied to the soil to increase soil fertility.
- ◆ Seeds are sown into the field either by using seed drill or by broadcasting. Good variety of seeds and their placement at a proper distance and depth is necessary for a good yield.
- ◆ Supply of water to crops at appropriate intervals is known as irrigation.
- ◆ Removal of unwanted plants growing with crop plants is called weeding.
- ◆ Weedicides are the chemicals used for weeding.

- ◆ Cutting of crops at maturation is known as harvesting. It is done manually with sickle or by machine called harvester.
- ◆ Threshing is the separation of grain from straw.
- ◆ The process of separating grain from chaff by blowing wind is known as winnowing.
- ◆ Food grains are stored in silos, granaries, cold storages, etc.
- ◆ Breeding and raising of animals for useful products is known as animal husbandry.
- ◆ A variety of products are obtained from animals.

## EXERCISES

### A. Multiple Choice Questions

Select the correct option :

1. Which of the following is a Kharif Crop?  
 (a) Wheat                                      (b) Barley                                      (c) Gram                                      (d) Sugarcane
2. Transplantation is done in case of  
 (a) Rice                                      (b) Wheat                                      (c) Sugarcane                                      (d) Potato
3. The system of irrigation where fields are irrigated like artificial rain is  
 (a) Furrow Irrigation                      (b) Basin Irrigation                      (c) Sprinkler Irrigation                      (d) Drip Irrigation
4. NPK stands for  
 (a) Calcium and Nitrogen                      (b) Nitrate and Potassium  
 (c) Nitrogen, Phosphorus and Potassium                      (d) None of them
5. Tall cylindrical structures for storage of grains are known as  
 (a) Granaries                                      (b) Jute bags                                      (c) Gunny bags                                      (d) Silos

### B. Fill in the blanks :

1. \_\_\_\_\_ is a machine which does both harvesting and threshing.
2. The same kind of plants cultivated on a large scale for food, cloth, etc., is called a \_\_\_\_\_.
3. \_\_\_\_\_ is the first step for the preparation of a field before sowing seeds.
4. \_\_\_\_\_ crop is grown by the process of transplantation.
5. The process of giving water to crop plants is called \_\_\_\_\_.
6. \_\_\_\_\_ are the chemical substances used to destroy weeds.

### C. Match the items in Column A with those in Column B :

Column A	Column B
1. Sickle	(a) Storage of grains
2. Granaries	(b) Weedicide
3. 2, 4-D	(c) Harvester with thresher
4. Combine	(d) Separation of grain from chaff
5. Threshing	(e) Tool for harvesting

**D. State whether the statements are True (T) or False (F) :**

1. Levelling increases soil erosion.
2. Soil fertility decreases after crops are grown regularly in it.
3. Chenopodium is a weed.
4. Chaff is the edible covering of grains.
5. In mixed cropping, different crops are alternately grown in the same field.
6. Cutting of crops on maturation is known as irrigation.

**E. Short-answer type questions :**

1. What are the different methods of weeding?
2. Explain the process of threshing and winnowing.
3. Why do we need to store food?
4. What is crop protection and what are the methods of crop protection?
5. Make a list of some useful products obtained from animals.

**F. Long-answer type questions :**

1. Write and describe the various steps involved in preparation of soil.
2. Define sowing and describe various methods adopted for sowing seeds.
3. Describe the process of irrigation along with all the methods of irrigation.

**G. HOTS Questions :**

1. Why are some food items stored in cold stores while others are stored in normal places?
2. Which types of bad impacts of fertilizers are observed on crops?

**H. Value based questions :**

Radha went to a farm house. In the farm house, the farmers were using drip system to water the plants. She enquired from the farmers about the drip system and was quite impressed to learn that in this method water is not wasted at all and its, therefore, of great advantage in regions of poor water availability. Later when she went to her village, she advised the farmers to use the drip system of irrigation.

Based on the above information answer the following questions :

- (a) What would have happened if drip system of irrigation was not used?
- (b) What is the message you get from Radha's action?
- (c) Which system of watering the plants would you suggest to be followed in your school garden?

## PROJECT IDEAS

1. Visit your village and talk to the farmer uncles about the agriculture practices, they adopted and write the information you got from them. Make a report and submit it to your teacher.
2. You can also use the agricultural practices in your garden for some vegetable plants.
3. Visit to different fields in which different types of plants are being grown. So ask the farmers why do they grow different plants in different fields? And ask if you find any difference in cropping patterns and irrigation methods.

## ACTIVITIES TO PONDER AND ACT

### (Life Skill and Value Development)

1. The agricultural scientists developed disease-resistant varieties of wheat and some other cereals. They also provided a new technique for their cultivation. Find out more about work of agricultural scientists on new varieties of seeds and new technique of cultivation which are helpful to increase production of crop enormously.

**Objective :** To know more about scientific method of agriculture.

**Skill and Value Development :** Thinking skill, hard working, research, analysis and application.

2. Visit a nearby village and collect information on
  - (i) name of crops grown
  - (ii) time of growth and harvest
  - (iii) irrigation process
  - (iv) kinds of fertilisers or manures used
  - (v) pesticides used
  - (vi) storage of grains

**Objective :** To increase the knowledge of modern agriculture.

**Skill and Value Development :** Thinking skill, data collection, research, analysis and application.

## FOR THE TEACHER

1. You can organise a visit to a farm where you can give the information about agriculture practices.
2. You can also visit to godowns and cold storage house or the building of Food Corporation of India to teach the students about how the food products or grains are kept in these houses.





# 2



## Microorganisms : Friend and Foe

### Learning Objectives

At the end of this chapter, students will be able to understand :

- What is microorganism? • Where do you find these microorganisms? • What are the types of microorganisms? • Do all microorganisms cause diseases? • What are the diseases caused by viruses, bacteria, fungi, protozoan? • What are the beneficial effects of microorganisms? • What fungal products prevent us from bacterial diseases? • What are communicable diseases? • What is vaccine? • Who discovered vaccine and how does it prepared? • What are the methods of food preservation? • What is nitrogen cycle?

Apart from plants and animals there are other living organisms around us which we cannot see. These minute organisms are not visible to us through naked eyes. To observe them we have to use a magnifying glass or a microscope therefore these organisms are known as **microorganisms**.

### **2.1 MICROORGANISMS**

The branch of science that deals with the study of microorganisms is known as **microbiology**.

Microorganisms were observed for the first time by **Leeuwenhoek**. Based on a number of

studies, microorganisms can be divided into five major groups :

- (1) Viruses
- (2) Bacteria
- (3) Fungi
- (4) Protozoa
- (5) Algae

### **Habitat of Microorganisms**

Microorganisms are present everywhere around us. They can survive under all types of environment, ranging from ice cold climate to hot springs and deserts to marshy lands. They are present in air, water and soil. All organisms including plants and animals are good carrier

of these microorganisms. They are found in the human body, on the skin, in our nose, throat, mouth, intestinal tracts and other body cavities. These microorganisms may be found living singularly or in colonies.

### SCIENCE BITS!

Leeuwenhoek, in 1673, was the first to observe and study microorganisms. He observed by using single lens, which magnified the objects fifty to three hundred times.

### ACTIVITY 2.1

**Aim :** To demonstrate that microorganisms are present in soil, water and human body.

**Materials Required :** Slides, droppers, microscope, soil, tap water, and scrapper.

**Procedure :**

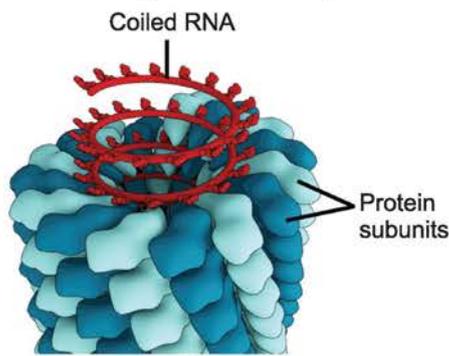
1. Collect a sample of soil, sample of tap water and scraping from the mouth of a man.
2. Take a drop from each sample with the help of droppers and place these drops on three separate slides.
3. Carefully observe each of the slides under the microscope.

**Observation :** A number of microorganisms in each of the slides observed.

**Explanation and Conclusion :** Microorganisms were seen in all the slides because microorganisms are present everywhere around us be it in the soil, water or human body.

## 2.2 VIRUSES

They are microscopic organisms even smaller than bacteria. They can be both living and non-living. They are seen as crystalline structures outside the host body but once inside the host body they are living and they reproduce rapidly.



Tobacco Mosaic Virus

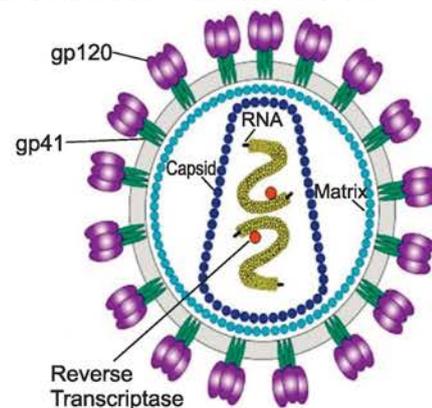
**Habitat :** They are found in air, water, soil and living organisms.

**Structure :** The viral body consists of a nuclear core having DNA or RNA surrounded by a protein coat known as capsid.

**Nutrition :** They derive their nutrition from the host cell.

### Harmful Effects of Viruses

**Diseases in human :** Viruses cause a number of diseases in human. For example, common cold, influenza, polio, measles, AIDS, etc.

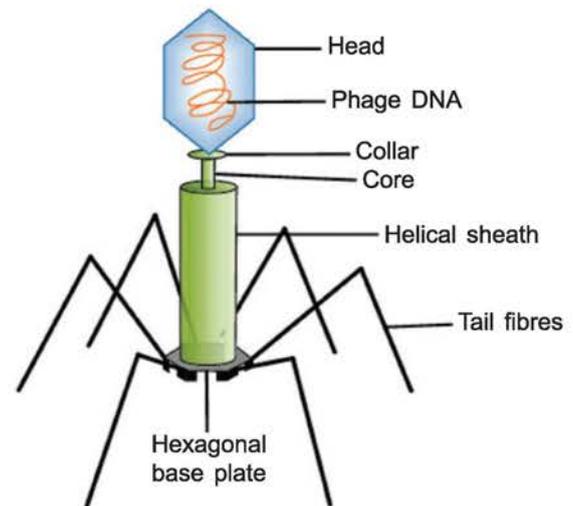


HIV Virus

**Diseases in plants :** Several plant diseases such as tobacco mosaic of tobacco, maize dwarf mosaic, etc. are caused by viruses.

**Diseases in animals :** Foot and mouth disease of cattle, pigs and hoofed animals, canine hepatitis in dogs and cats are all viral diseases.

**Bacteriophage :** Viruses infecting bacteria are known as bacteriophages.



T4 Bacteriophage

**Vaccine production by viruses :** Vaccines are produced from viruses for polio, small pox, chicken pox, measles, etc.

## 2.3 BACTERIA

**Habitat :** Bacteria are unicellular organisms and are found everywhere around us. They are present in soil, water, air, animals, plants and even in humans.

**Size :** Size of bacteria varies from  $0.15\ \mu\text{m}$  –  $1.5\ \mu\text{m}$ .

**Shape :** They are found in variety of shapes.

- (a) Spherical (Cocci)
- (b) Rod shaped (Bacillus)
- (c) Spiral shaped (Spirillum)
- (d) Comma shaped (Vibrio)

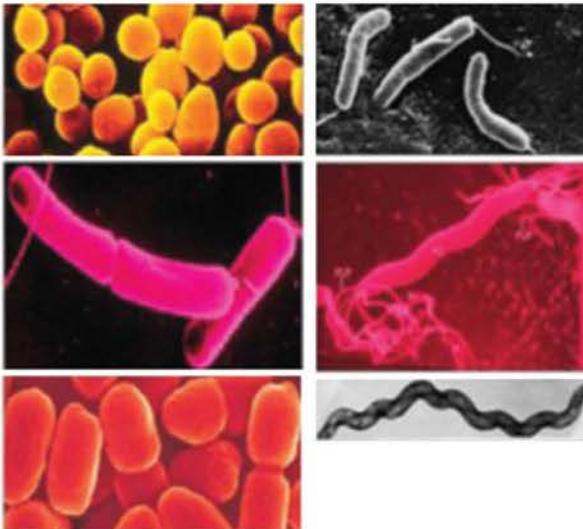
**Structure :** Bacteria are unicellular organisms having a prokaryotic structure.

**Locomotion :** They possess flagella for movement.

**Nutrition :** Bacteria may be saprophytic or parasitic.

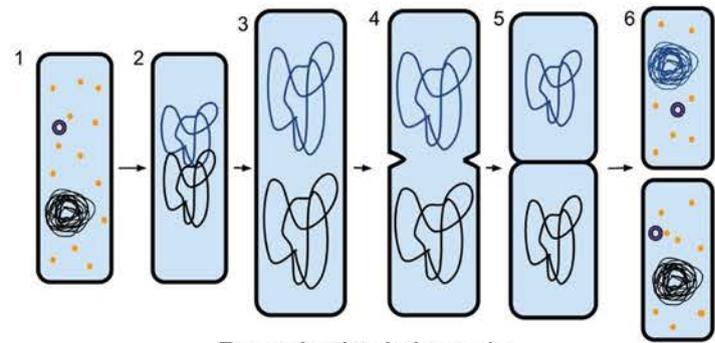
**Saprophytic :** They feed on dead and decaying matter.

**Parasitic :** They obtain nutrition from the host body.



Bacteria

**Reproduction :** Bacteria reproduce by the process of binary fission. In this process, a cell divides into two size along with cytoplasm and nucleus.



Reproduction in bacteria

### Beneficial Bacteria

There are many bacteria which are very beneficial to us in our day to day life. Some of the important uses of bacteria are :

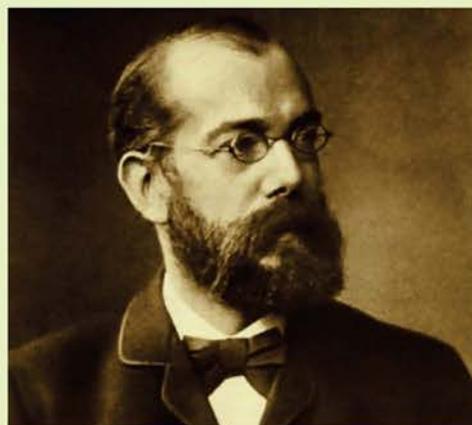
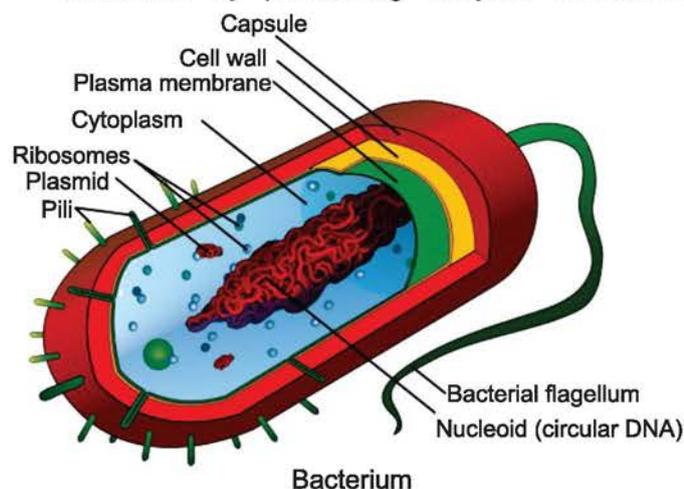
- 1. Making of curd and cheese :** Curd contains *Lactobacillus* which promotes the formation of curd. It multiplies in milk and converts it into curd. Similarly, bacteria also helps in cheese production.
- 2. Decomposition :** Dead and decaying matter is decomposed by bacteria into simple organic substances which can be used by plants and animals.
- 3. Nitrification :** Proteins from dead matter is first converted into ammonia by ammonifying bacteria. Ammonia is then converted into the atmospheric nitrates useful to plants and animals by nitrification. *Nitrosomonas* is a good example of nitrifying bacteria.
- 4. Nitrogen fixation :** *Rhizobium* living in symbiotic association in root nodules of leguminous plants has the ability to fix nitrogen into nitrates. Other bacteria such as *Azotobacter* and *Clostridium* residing in soil also have the capability to fix nitrogen.

All the three processes – decomposition, nitrification and nitrogen fixation help to increase the soil fertility.

### SCIENCE BITS!

One teaspoonful of soil may contain a billion bacteria and 100 metres of fungal hyphae.

5. **Production of antibiotics** : Antibiotics are chemicals which help or stop the growth of disease causing microorganisms. Some of the antibiotics produced from bacteria are streptomycin, aureomycin, tetracycline, chloromycetin, etc.  
Antibiotics can be given to man, mixed with feed of livestock and poultry and applied to plants to control certain diseases.
6. **Vaccine production** : Dead or weakened microbes used to initiate antibody production in a healthy individual form a vaccine. Several vaccines for diseases such as cholera, tuberculosis, etc. are being produced by bacteria.
7. **Production of vinegar** : Bacteria help in the production of vinegar, wines and alcohol from fruit juices and cereals by their fermentation.
8. **Retting of fibres** : Bacteria bring about retting of jute and flex so that they can be converted into ropes.
9. **Biogas production** : Animal and plant wastes are decomposed by bacteria to obtain biogas on a commercial scale.
10. Tanning of leather and curing of tea is done by bacteria.
11. *Escherichia coli* resides in human intestine and helps in digestion and absorption of food.
12. Bacteria present in the intestine of herbivorous animals help in digestion of cellulose by producing enzyme cellulase.



Robert Koch (1976) discovered the bacterium *Bacillus anthracis* causes anthrax disease.

### ACTIVITY 2.2

**Aim** : To show that organic matter is decomposed by microbes present in soil.

**Materials Required** : 2 pots, soil, plant wastes, polythene bags, empty glass bottles and plastic toys.

**Procedure** :

1. Take two pots A and B and fill each of the pot half with soil.
2. Take Pot A and put some plant wastes in it.
3. In Pot B put polythene bags, empty glass bottles and plastic toys.
4. Put the pots aside and observe them after 3-4 weeks.

**Observation** : The plant wastes in Pot A is degraded and converted into manure but things in Pot B remained as such.

**Explanation and Conclusion** : Microbes are able to decompose dead and decaying matter into simple substances but they do not act on non-biodegradable matter such as plastics. Simple substances are again used up by the plants and animals. Moreover, degradation of plant and animal waste cleans up the environment.

### SCIENCE BITS!

In many countries such as Brazil, ethanol produced from sugar is used as a fuel for cars and buses. It is advantageous as the non-polluting like other fuels.

## Harmful Effects of Bacteria

- 1. Food poisoning :** Bacteria such as *Staphylococcus* and *Clostridium botulinum* produce toxins in food.
- Bacteria bring about souring of milk, rotting of meat, fruits and other eatables.
- 3. Diseases in human :** Several diseases such as tuberculosis, cholera, typhoid, dysentery are caused by bacteria.
- 4. Diseases in plants :** Fire blight of apple, pear, crown gall disease and bacterial ringspot of potato are some of the bacterial diseases in plants.
- 5. Diseases in animals :** Bovine disease in cattle, salmonellosis in chicken and horse are some of the diseases caused in animals by bacteria.

### CHECK YOUR KNOWLEDGE-1

#### 1. Name the following :

- A branch of science that deals with the microorganisms.
- Virus infecting bacteria.
- Those organisms which feed on dead and decaying matter.
- Dead or weakened microbes used to initiate antibody production.

#### 2. True (T) or False (F) :

- Nitrosomonas* is a nitrifying bacterium.
- Small pox is caused by bacteria.
- Bacteria reproduce by the process of binary fission.
- The ringspot of a potato is a disease, caused by virus.

## 2.4 FUNGI

They are plant like organisms having a cell wall but lacking chlorophyll. They cannot synthesize their own food.

**Habitat :** Generally, found in dark moist places with moderate temperatures such as moist bread, leather goods, vegetables, rotting fruits and vegetables and animal excreta.

**Structure :** Fungi may be unicellular or multicellular. They consist of a cell wall made up of chitin or fungal cellulose. They may live singly or reside in colonies.

Multicellular forms consist of thread like structures known as **hyphae**. Hyphae are interwoven together to make a network known as **mycelium**.

Moulds, yeast and mushroom are some of the common forms of fungi.

Mushroom is multicellular consisting of a stalk and an umbrella whereas yeast is unicellular.

**Nutrition :** They are heterotrophs and can be parasitic or saprophytic.

**Reproduction :** Fungi reproduce either by budding or by spore formation.

Yeast reproduces by budding whereas moulds and mushrooms reproduce by spore formation.

### Beneficial Fungi

- 1. Bakeries and breweries :** Yeast is the fungus which is largely employed in the bakeries and breweries.

Yeast undergoes anaerobic respiration known as **fermentation**. During the process of fermentation, yeast converts glucose into alcohol and  $\text{CO}_2$ . The  $\text{CO}_2$  released causes the dough to rise in case of bread and idlis making them fluffy. Because of this property yeast is largely used for making cakes, pastries, dhokla, etc. It is also used for the commercial

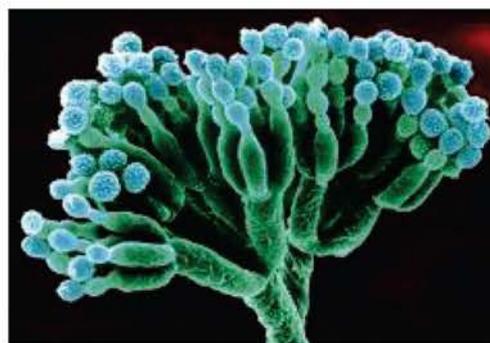
production of alcohol and wine. Barley, wheat, rice and crushed fruit juices are fermented to obtain alcohol and wine.



Yeast

- 2. Preparation of cheese :** Various species of *Penicillium* are used for preparing different types of cheese.
- 3. Organic acids :** Various organic acids such as oxalic acid, citric acid, gluconic acid, lactic acid, etc. are obtained from fungi.
- 4. Vitamins :** Yeast is a good source of Vitamin B complex.
- 5. Food :** Several mushrooms such as *Agaricus*, *Morchella* can be eaten as food preparations in several ways. Idli, dosa, dhokla, etc. are fermented food which are prepared using yeasts.
- 6. Production of antibiotics :** Several types of antibiotics are produced from fungi. Penicillin is obtained from *Penicillium chrysogenum*, **Cephalosporin**

from *Acremonium* and *Griseojuvin* by *Griseofulvum*.



Penicillium

### Harmful Effects of Fungi

- 1. Spoilage of food :** Fungi readily spoil food in moderate temperature and humidity.
- 2. Spoilage of leather :** Leather products are easily spoilt by fungi in high humidity.
- 3. Diseases in human :** A number of diseases such as, ringworm disease, athletes foot, scabies, etc. are caused by fungi in humans.
- 4. Diseases in plants :** Downy mildew of grapes, black rust of wheat, etc. are some of the diseases caused by fungi in plants.
- 5. Diseases in animals :** Fungi are known to cause diseases such as blastomycosis, coccidiomycosis, cryptococcosis in animals.

### ACTIVITY 2.3

**Aim :** To observe spoilage of food due to fungi.

**Materials Required :** Bread, water, orange.

- Procedure :**
1. Take a piece of bread and moisten it with water.
  2. Take the moistened bread piece and an orange and keep it in a moist place.
  3. Leave them as such for 2-3 days and observe.

**Observation :** The bread is covered by a powdery substance and the orange is rotted with blue-black patches all over it.

**Explanation and Conclusion :** Warm and humid places are the best places where fungi can thrive. When moist bread and oranges were kept in such a condition it promoted growth of fungus. The blue coloured fungi seen on orange is *Penicillium*.

### 2.5 ALGAE

They are primitive simple plants containing chlorophyll which help them to synthesize their own food. They are popularly known as **sea weeds**.

**Habitat :** They are found in moist places such as rock crevices and in aquatic habitats like lakes, ponds, ditches and stagnant water.

**Size :** Ranges from 1 micron to several metres.

**Structure :** Algae have a thalloid body instead of true roots, stems and leaves. They can be unicellular or multicellular, living in colonies or singularly.

Based on the type of pigments present, algae are classified into various classes :

- (i) Green algae : e.g. *Spirogyra*
- (ii) Blue-green algae : e.g. *Anabaena*
- (iii) Brown algae : e.g. *Fucus*
- (iv) Red algae : e.g. *Polysiphonia*
- (v) Golden brown algae : e.g. Diatoms.



Fucus



Polysiphonia

**Nutrition :** Algae can synthesize their own food by the process of photosynthesis and hence they are autotrophic.

**Reproduction :** Algae reproduce by binary fission, fragmentation or by sexual means.

### Beneficial Algae

1. **As fertilizer :** Blue-green algae such as *Nostoc* and *Anabaena* have the ability to

fix atmospheric nitrogen therefore they are used as fertilizers.

2. **Food for aquatic organisms :** Algae serve as food for fish and other aquatic animals.
3. **Food for humans :** Various types of algae are largely being used as food. *Spirulina* and *Chlorella* are rich sources of proteins. Various brown algae and sea weeds such as *Porphyra* *Chordrus* are used as food in various countries.
4. **Vitamins and minerals :** Algae are a rich source of vitamins and minerals. Brown algae such as *kelps* are an important source of iodine, sodium and potassium.
5. **Industrial Uses**
  - (i) **Agar-agar** obtained from red algae is used in the manufacture of jellies and cosmetics.
  - (ii) **Algin** is used for preparing ice-creams.
  - (iii) **Diatoms** are rich in silica therefore they are used in making filters, glasses and porcelain dishes.
6. **Fodder for animals :** Sea weeds such as *Laminaria* are used as fodder for sheep and cattle.

## CHECK YOUR KNOWLEDGE-2

### 1. Fill in the blanks by selecting appropriate words :

- (a) Yeast is a/an \_\_\_\_\_ .
- (b) \_\_\_\_\_ reproduce by spore formation.
- (c) \_\_\_\_\_ is a good source of vitamin B complex.
- (d) *Spirogyra* is a \_\_\_\_\_ algal.

### 2. Match the following :

Column I	Column II
(i) <i>Nostoc</i>	(a) A fungus
(ii) Ringworm	(b) Fodder of sheep
(iii) <i>Laminaria</i>	(c) Fix atmospheric N <sub>2</sub>
(iv) <i>Agaricus</i>	(d) Caused by fungus

## Harmful Effects of Algae

1. **Eutrophication** : Algae reproduce very rapidly and form a mat like structure on water bodies such as lakes. This algal mat creates oxygen deficiency in water and limits the sunlight making the conditions toxic for other aquatic organisms.
2. Algae such as *Oscillatoria* produces toxins in water, making the water unfit for drinking.

## 2.6 PROTOZOA

Protozoa are unicellular organisms having animal like characteristics.

**Habitat** : They are found in a variety of places such as pools, ditches, tanks, soil, inside the human bodies, animal bodies in insects such as termites, etc.

**Size** : Varies from 2 to 200 microns.

**Nutrition** : All protozoa have heterotrophic mode of nutrition except *Euglena* which is autotrophic in nature. They may be parasitic, saprophytic or symbiotic in nature.

**Shapes** : They exist in a variety of shapes. They may be irregular shaped like *Amoeba*, slipper shaped like *Paramecium* or spindle shaped like *Euglena*.



*Amoeba*



*Paramecium*

**Reproduction** : By binary fission, budding and spore formation.

## Beneficial Protozoa

1. Protozoans form an important link in the aquatic food chain. They feed on algae and in turn are eaten up by larger aquatic organisms.
2. Protozoans living in the gut of ruminants help in the digestion of cellulose.

## Harmful Protozoa

1. **Diseases in humans** : Various diseases in humans are caused by protozoa, for example amoebic dysentery by *Entamoeba histolytica*, sleeping sickness, malaria, leishmaniasis, vaginitis, etc.
2. **Diseases in animals** : Trichomoniasis in bird liver, coccidiosis in rabbit and kidney coccidiosis in geese.

## 2.7 COMMUNICABLE DISEASES

The diseases which can be transferred from an infected person to a healthy person through air, water, food or physical contact are known as communicable diseases. For example, viral disease such as common cold is easily transferred by sneezing. Fine droplets of moisture carrying thousands of viruses are spread in the air when we sneeze. These viruses may enter a healthy person breathing in the vicinity.

Insects and animals such as flies, mosquitoes, dogs act as carriers of disease and transfer microbes from an infected person to a healthy person.

*Anopheles* mosquitoes are a carrier of malaria and *Aedes* mosquitoes are a carrier of dengue. Spread of malaria and dengue can be controlled by destroying the breeding places of these mosquitoes such as water tanks, coolers, tyres, etc.

## Vaccine

Whenever a disease carrying microbe or any other foreign particle enters the body, the body reacts by producing antibodies to fight with the microbes. Once the antibodies have been produced they stay there in the blood and are ready to

fight in case of subsequent encounter. This very phenomena is utilised to develop vaccines. Dead or weakened disease causing microbes are given orally or injected in order to develop antibodies in the body which protect us from future infection by the microbes. These dead or weakened microbes constitute a **vaccine** and this phenomenon is known as **vaccination**.

Several diseases such as small pox have been completely eradicated by vaccination. Several vaccines are given in childhood to prevent diseases such as measles, cholera, hepatitis, mumps, etc. Campaigns such as Pulse Polio to eradicate polio must be undertaken on a large scale.

### Food Preservation

Food material has a tendency of getting spoiled by microorganisms. Therefore, we need to preserve food in order to keep it fresh for a longer time.

Spoiled food emits bad smell because microorganisms break down complex substances such as proteins into simple substances. The acids produced by microbes make the taste bad and gaseous by-products change the texture of food.

Various methods adopted for food preservation are:

1. The simplest method used for preserving cooked food at home is **refrigeration**.
2. **Preservation by common salt** : Common salt is used to preserve meat, fish, amla, raw mangoes, tamarind, etc.
3. **Preservation by sugars** : Jams, jellies and squashes are preserved by sugar. Sugar reduces the moisture content and inhibit the growth of bacteria which spoil food.
4. **Preservation by oil and vinegar** : Oil and vinegar make the environment inhabitable for bacteria. Vegetables, fruit, fish and meat are preserved by this method.
5. **Boiling** : Boiling food items kills the microbes present in them. Example—milk and water.
6. **Pasteurization** : It is a method of preserving milk. It was discovered by **Louis Pasteur**. In this process, the milk

is heated to about 70°C for 15-30 seconds and then suddenly chilled and stored.

**7. Canning** : Cooked and sterilized food is canned in air tight containers for example, jams, vegetables, fishes, etc.

**8. Chemical preservatives** : Chemicals which check microbial growth are known as chemical preservatives. They act as antioxidants (remove oxygen from food). Commonly used for pickles, squashes, ketchups, etc. Sodium benzoate and sodium metabisulphate are some chemical preservatives.

### Nitrogen Cycle

The atmosphere contains 78% of nitrogen gas. Nitrogen is an important constituent of various biomolecules such as protein, chlorophyll, nucleic acid, vitamins, etc.

The amount of nitrogen remains constant in the atmosphere and this is done by nitrogen cycle.

Nitrogen cycle is a biogeochemical cycle which brings about circulation of nitrogen through the living and non-living components of the biosphere.

Following are the steps of **nitrogen cycle** :

1. **Nitrogen fixation** : Free nitrogen in the atmosphere cannot be utilised by plants and animals as such. It has to be first converted into usable forms. This process of conversion of free atmospheric nitrogen into useful nitrogen compounds is called nitrogen fixation.

### SCIENCE BITS!

#### Tetra Pack

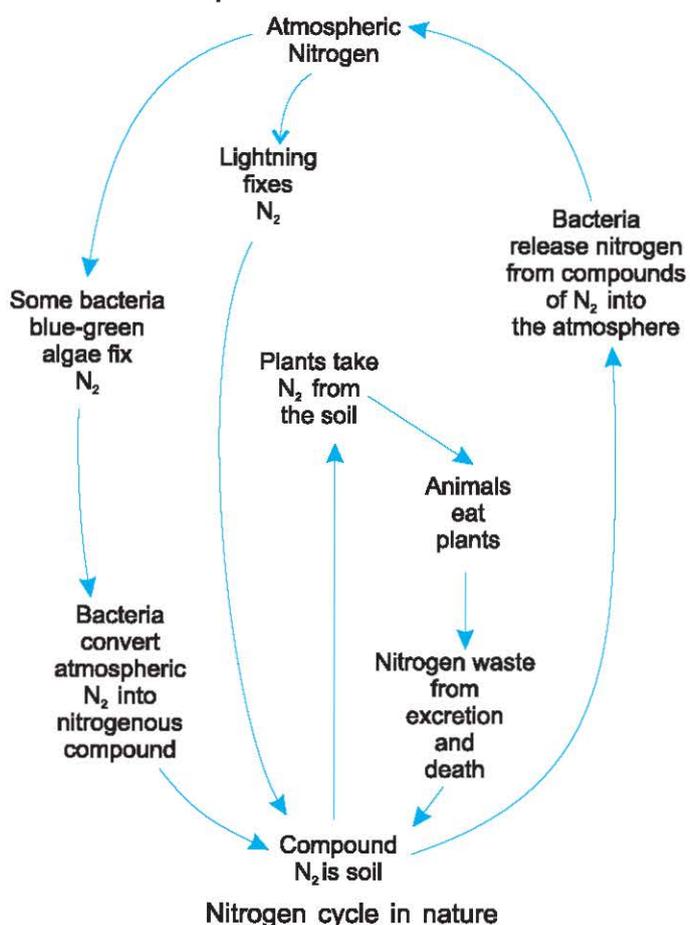
This aseptic packing technology can keep food for months without refrigeration.

Yoghurt, milk, fruit juices, etc. are kept safe for a longer time.



Nitrogen fixation occurs in following three ways:

(i) **Nitrogen fixation by *Rhizobium*** : *Rhizobium*, a bacterium lives in symbiotic association in the root nodules of leguminous plants. It gains nutrition from the plants and in turn converts free atmospheric nitrogen into usable forms for the plants.



(ii) **Nitrogen fixation by blue-green algae** : Blue-green algae *Nostoc* and *Anabena* have the capability to fix free nitrogen into usable forms for the plants.

(iii) **Nitrogen fixation by lightning** : During the lightning, the high temperature is produced. At this high temperature, the nitrogen gas of the atmosphere reacts with the oxygen to form nitrogen oxide. Nitrogen oxide comes to the soil along with the rainwater in the form of dilute nitric acid which reacts with the alkalis present in the soil to form nitrates. These nitrates increases the soil fertility and plant uses these nitrates.

2. **Absorption of nitrates by plants** : Nitrates are absorbed by plants and converted into proteins.

3. Plant proteins get converted into animal proteins when they are eaten up by animals.

4. **Ammonification** : Proteins from dead and decaying plants and animals matter are converted into ammonia by ammonifying bacteria.

5. **Nitrification** : Ammonia so formed is converted into nitrites and nitrates by nitrifying bacteria.

6. Nitrates are absorbed by plants.

7. **Denitrification** : The nitrates are converted into free nitrogen by denitrifying bacteria.

### CHECK YOUR KNOWLEDGE-3

1. **Fill in the blanks :**

- (a) *Euglena* is a \_\_\_\_\_ .
- (b) Amoebic dysentery is caused by \_\_\_\_\_ .
- (c) *Aedes* mosquitoes are carrier of \_\_\_\_\_ .

2. **True (T) or False (F) :**

- (a) Agar-agar is obtained from red algae.
- (b) Binary fission is the only method of reproduction in protozoa.
- (c) Dead or weakened microbes constitute a vaccine.
- (d) Viral diseases are communicable diseases.



## KEYWORDS

- ◆ **Microorganism** : A minute living organism which cannot be seen with naked eye, such as bacteria, virus, fungi, etc.
- ◆ **Viruses** : Microorganisms which are both living and non-living. They are living inside a host and form a crystalline structure outside the host.
- ◆ **Bacteria** : Unicellular microorganisms are both beneficial and harmful to us.
- ◆ **Saprophytes** : Organisms living on dead and decaying organisms are known as saprophytes.
- ◆ **Parasites** : Organisms living in a host cell and deriving their nutrition from the host cell are known as parasites.
- ◆ **Decomposition** : Breaking of complex molecules into simple molecules.
- ◆ **Antibiotics** : These are the chemicals produced by the body in response to microbes and other foreign particles.
- ◆ **Vaccines** : Dead or weakened microorganisms introduced into the body to develop antibodies against that particular disease.
- ◆ **Fungi** : Plant-like microorganisms with a cell wall but without chlorophyll.
- ◆ **Fermentation** : Anaerobic respiration undertaken by fungi which helps in the bakeries and breweries.
- ◆ **Algae** : Primitive simple plants containing chlorophyll in them.
- ◆ **Protozoa** : Unicellular organisms having animal like characteristics.
- ◆ **Communicable diseases** : Diseases which can be transferred from an infected person to a healthy person through air, water, food or physical contact are known as communicable diseases.
- ◆ **Refrigeration** : Method of keeping food substances at a low temperature.
- ◆ **Pasteurization** : Used for preserving milk. Milk is heated to about 70°C for 15-30 seconds and then suddenly chilled and stored.
- ◆ **Nitrogen Cycle** : Circulation of nitrogen through living and non-living components.
- ◆ **Nitrogen Fixation** : Plants and animals are unable to use free atmospheric nitrogen. It has to be converted to usable forms. This process of converting atmospheric  $N_2$  into usable forms is called nitrogen fixation.
- ◆ **Ammonification** : Conversion of proteins into ammonia by ammonifying bacteria.
- ◆ **Nitrification** : Conversion of ammonia into nitrates and nitrites.
- ◆ **Denitrification** : Conversion of nitrates into free nitrogen.

## SUMMARY

- ◆ Microorganisms are too small to be seen by naked eyes.
- ◆ They can live in all kinds of environment ranging from ice cold climate to hot springs and deserts to marshy lands.
- ◆ Microorganisms are found in air, water and in the bodies of plants and animals.
- ◆ They may be unicellular or multicellular.
- ◆ Bacteria, fungi, protozoans, algae and viruses form the main microorganisms.
- ◆ Viruses are living as well as non-living. They are living only inside the host.
- ◆ Viruses are the causative agents of many diseases in humans, plants and other animals.
- ◆ Bacteria are unicellular organisms, heterotrophic in nature.
- ◆ Bacteria are useful in making curd, cheese, antibiotics, nitrogen fixation, decomposition, vaccines. etc.
- ◆ Food poisoning and several diseases in humans, plants and other animals are caused by bacteria.
- ◆ Fungi are plant like organisms, lacking chlorophyll.

- ◆ Yeast are largely used in bakeries and breweries, antibiotic production, organic acids, cheese, etc.
- ◆ Fungi cause spoilage of food and several diseases in humans, plants and other animals.
- ◆ Algae are primitive simple plants containing chlorophyll.
- ◆ Algae can fix atmospheric  $N_2$ . They are sources of food for aquatic organisms and man. They produce vitamins and minerals and other substances like agar-agar and algin.
- ◆ Protozoans are unicellular having animals like characteristics.
- ◆ Protozoans are an important link in the aquatic food chain and cause diseases like malaria, sleeping sickness, etc.
- ◆ *Rhizobium* in the root nodules of leguminous plants fix atmospheric nitrogen for the plants.
- ◆ Denitrifying bacteria convert nitrates into atmospheric  $N_2$ .
- ◆ With all these microorganisms,  $N_2$  cycle keeps going in the atmosphere.

## EXERCISES

### A. Multiple Choice Questions

Select the correct option :

1. Which of the following microorganisms can make their own food by the process of photosynthesis?  
 (a) Protozoa                      (b) Viruses                      (c) Fungi                      (d) Algae
2. The microorganism which is largely used in bakeries and breweries is  
 (a) Yeast                      (b) *Streptococcus*                      (c) *Pseudomonas*                      (d) *Anabaena*
3. Sleeping sickness is caused by  
 (a) Algae                      (b) Protozoa                      (c) Fungi                      (d) Viruses
4. Which of the following is not a food preservative?  
 (a) Salt                      (b) Sugar                      (c) Water                      (d) Vinegar
5. Pasteurization is a method of preserving—  
 (a) Juice                      (b) Milk                      (c) Sugar                      (d) Pickles

### B. Fill in the blanks :

1. Amoebic dysentery is caused by \_\_\_\_\_ .
2. \_\_\_\_\_ is the bacterium living in the root nodules of plants.
3. \_\_\_\_\_ is the microorganism used for making curd.
4. \_\_\_\_\_ is a poisonous mushroom.
5. Chemical used to check microbial growth in food is known as \_\_\_\_\_ .

### C. Match the items in Column A with those in Column B :

Column A	Column B
1. Polio	(a) Dengue
2. <i>Azotobacter</i>	(b) Green algae
3. <i>Streptomycin</i>	(c) Yeast
4. Fungi	(d) Antibiotic
5. <i>Spirogyra</i>	(e) Nitrogen fixation
6. <i>Aedes</i>	(f) Virus

### D. Short-answer type questions :

1. How does a vaccine work?
2. How do microorganisms help us in cleaning the environment?

3. What measures must be taken to reduce the incidence of malaria and dengue?
4. Write a short note on nitrogen fixation.

**E. Long-answer type questions :**

1. List the various methods used for food preservation.
2. What are the various steps of Nitrogen cycle?
3. What are communicable diseases and how are they spread?
4. Why do we use yeast in bakeries and breweries?

**F. HOTS Questions :**

1. Why are protozoans known as an important link for aquatic food chains?
2. Most of the preservatives are chemicals still we use them in our foods to preserve. Why?

**G. Value based questions :**

Mukesh observed his grandma preparing mango pickle at home. She put cut pieces of unripe mango in three jars and then added a lot of salt and oil to the jars. Then, she kept the jars in the sun. After a few days, his grandma declared that the pickle was ready for use. Mukesh went to see the jars. In one of the jars, he found that there was some growth of microbes. He showed the jar to her grandma, who removed that jar from the others and threw away the contents.

- (a) What would have happened if the contents of the jar which had infection were consumed?
- (b) What values are displayed by Mukesh in taking such initiative?
- (c) Why are salt and oil added to the mango pieces?

## PROJECT IDEAS

1. The United Nation has declared that 74 countries have been affected from the swine flu and the number of the countries and the people increasing continuously. Make a report/project on the history of swine flu, their mode of transmission, causes and their preventive measures. Also, make a poster and paste it on the notice board to make more aware about this viral disease.
2. Find more information about the method of pasteurisation and other contributions made by **Louis Pasteur**.

## ACTIVITIES TO PONDER AND ACT

### (Life Skill and Value Development)

1. During the process of fermentation, yeast converts glucose into alcohol and  $\text{CO}_2$ . The  $\text{CO}_2$  released causes the dough to rise in case of bread and idlis making them fluffy. Find out how fermentation is used on large scale and list some commercial productions in which fermentation is applied.

**Objective :** To know more about fermentation and its application.

**Skill and Value Development :** Thinking skill, hard working, research, analysis and application

2. Several diseases such as small pox have been completely eradicated by vaccination. Several vaccines are given in childhood to prevent diseases such as measles, cholera, hepatitis, mumps, etc.

Visit nearby vaccination centre and collect information about kinds of vaccinations, their appropriate time period and fruitful results in the modern time.

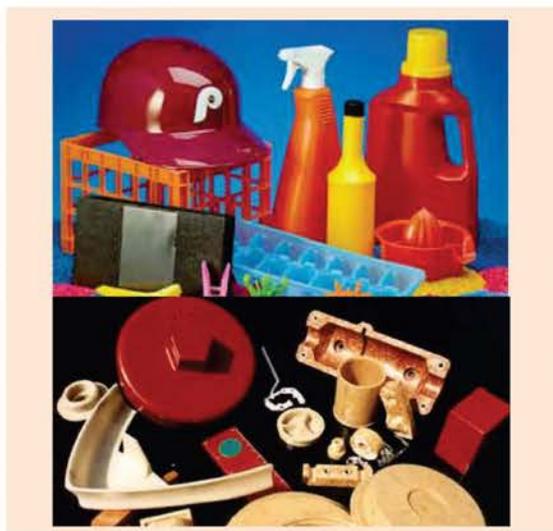
**Objective :** To know more about vaccination.

**Skill and Value Development :** Critical thinking, data collection, research, analysis and application.

## FOR THE TEACHER

1. The teacher can explain the viral, bacterial, fungal and protozoan diseases by taking examples from the locality, known to children.
2. Explain more information about the microorganisms — their benefits and harmful effects.
3. You could explain more about the stories related to the discoveries on microorganisms and other related things.





# Synthetic Fibres and Plastics

## Learning Objectives

At the end of this chapter, students will be able to understand :

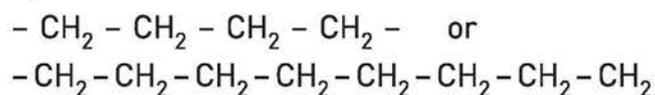
- What are synthetic fibres/polymers?
- The different types of synthetic fibres.
- What are plastics?
- The different kinds of plastics.
- Characteristics of the different types of plastics.
- Pollution due to excessive use of plastics
- Disposal of plastic waste and conservation action.

We have learnt that fibres obtained from plants and animals are known as natural fibres. Cotton and jute are obtained from plants while wool and silk are obtained from animals. These fibres are spun into yarns and the yarns are then woven or knitted into fabrics. The fabrics are made into clothes and various other articles.

Besides natural fibres, there are other fibres made by man. These are known as **man-made fibres** or **artificial fibres**. Artificial fibres are made from chemicals derived mainly from petroleum. Chemicals obtained from coal and wood are also used to make synthetic fibres. Rayon, nylon and polyester are some synthetic fibres.

## 3.1 WHAT ARE SYNTHETIC FIBRES / POLYMER?

Synthetic fibres are made of long chains of repeating units called **polymer**. The word polymer is derived from the Greek words poly (meaning many) and mer (meaning unit or part). Each of the smaller units in the polymer is known as **monomer**. For example, ethene is the monomer of polyethene or polythene. Ethene is represented by the formula,  $\text{CH}_2 = \text{CH}_2$ , therefore the structure of polythene can be written as



or simply  $(-\text{CH}_2 - \text{CH}_2-)_n$ . The monomers combine by a process of **polymerisation** to form polymers. The polymers which are used to manufacture synthetic fibres are called synthetic or man-made polymers. They are made in the laboratories or factories.

Some polymers also occur in nature. They are known as **natural polymers**. Cotton is made up of the polymer **cellulose**. The monomer of cellulose is a glucose unit. A number of glucose units make up cellulose. Similarly, the polymer found in wool and silk is **protein**.

## Types of Synthetic Fibres

### A. Rayon

Rayon was the first synthetic fibre to be invented at the end of the nineteenth century. The lustre and texture of silk captivated millions of people. Therefore, in an attempt to prepare it artificially, rayon was produced. It resembles silk fibres in appearance and so it is known as **artificial silk**.

Rayon is prepared from cellulose obtained from wood pulp. It is known as a **regenerated fibre**, since, cellulose is broken down and then formed again. Except for its lustre, it is similar to cotton in all other respects since both are produced from cellulose. Wood pulp is first treated with sodium hydroxide and then carbon disulphide to obtain a thick syrupy liquid called **viscose**. The viscose solution is forced through tiny holes into a metal cylinder kept inside dilute sulphuric acid bath. In this way lustrous and continuous fibres of rayon are produced. It is then woven into fabric and dyed in different colours. It is cheaper than silk and mixed with cotton or woollen fibres to make **blended fibres**. Blended fibre is generally



Carpet

prepared by mixing a synthetic fibre to a natural fibre. Cotton blended with rayon is used to make bed sheets while wool blended with it is used for making carpets.

### Uses of Rayon

1. Rayon is used as a fabric for clothing since it is soft, comfortable and absorbent like cotton and lustrous like silk.



Rayon clothing

2. It is used in the manufacturing of carpets, when blended with wool.
3. It is used to make automobile tyre chords since it is a strong fibre.
4. It is also used to make bandages and surgical dressing for covering wounds, due to its highly absorbing nature.



Surgical dressing and bandages

### B. Nylon

**Nylon** was the first synthetic fibre made completely from chemicals, derived from coal alongwith water and air. It was produced in New York (NY) and London (LON) simultaneously and thus it got the name nylon. The fibre was invented in 1931.

The fibre is strong, light, lustrous, elastic and wrinkle free. It is easy to wash as it does not absorb water. Fungus or moth do not attack the fibre. All these properties make it a very popular clothing material.

### Uses of Nylon

1. Nylon fibre is used for making ropes, tyre chords, small machine parts, fishing nets and parachute fibres since it is strong and light weight. The fibre is even stronger than a steel wire of comparable size. Therefore, the ropes made from it can be used for mountaineering.
2. It is used for making socks, stockings and combat uniforms because of its strength and elastic nature.
3. It is also used to make garments and swimming wear as it dries quickly, is light and wrinkle resistant.



Articles made from nylon fibre

4. Toothbrushes, combs, etc., are other articles made from nylon.

### C. Polyester and Acrylic

**Polyester** is another synthetic fibre made from petroleum. Terylene, dacron and terene are some polyester fibres. Terylene is a very popular polyester fibre which has properties just like nylon. In general, the polyester fibres are strong, do not wrinkle, retain their crease, absorb very little water and dry quickly. Like nylon they can also be drawn into very thin fibres which are woven into clothes.

Polyester is made up of the monomer, **ester**. The ester units are repeated to produce polyester (poly + ester). Esters are organic substances which give fruits like their characteristic smell. Polyester is blended with cotton to produce **polycot** and with wool to produce **polywool**. Terylene blended with cotton is known as **terrycot**.

**PET** (Polyethylene terephthalate) is another commonly used polyester which is used for making bottles and jars.

**Acrylic** is another synthetic fibre which has properties similar to wool. It is cheaper than wool and can be dyed into a variety of colours.

### Uses of Polyester

1. Polyester is used for making sarees, dress materials, bed sheets, curtains, etc., because it does not stretch, shrink or wrinkle. The products are durable and can be worn or washed frequently. Clothes made from blended fibres are more comfortable to wear since they allow air to pass and retain moisture.



Clothes made from polyester

2. Fire hoses and conveyer belts are made from polyester since they are lightweight and compact.
3. It is used to make lightweight sails which are resistant to sea salts.
4. It is used for making jackets, other water resistant garments and carpets.
5. It is used in the industry to make filters, ropes and films.

6. PET bottles and jars made from it are used for storing grains and other food items.



Articles made from polyester

### Uses of Acrylic

It is used for making sweaters, shawls, carpets and blankets.



Articles made from acrylic

The fabrics used for making umbrella contains millions of tiny holes which allow air to flow freely through it. The fabric also does not allow UV rays to pass through it. This sophisticated waterproof fabric retains its colour for years even though it is exposed to the sun and the rain.

### ACTIVITY 3.1

**Aim :** To test the action of water on fabrics made of different fibres.

**Requirements :** Small pieces of fabric made of cotton, silk, wool, nylon, polyester and rayon of nearly the same size, a mug of water, a beam balance, some weights.

**Procedure :** Weigh each piece of fabric and note down their weights. Next dip each one of them in water, weigh them and again note down their weights. Subtract the first weight from the second weight of the same fabric. This will give you the weight of water absorbed by the fabric. Which fabric absorbs the maximum amount of water and which absorbs the minimum?

Keep all the fabrics out in the sun. Note the time taken for each of them to dry. Which fabric dries the fastest and which one dries at last?

Complete the following table and then answer the above questions.

Fabric taken	Weight of the dry fabric (A) (in grams)	Weight of the wet fabric (B) (in grams)	Weight of water (B-A) (in grams)	Time taken by the fabric to dry (in minutes)

### ACTIVITY 3.2

**Aim :** To test the action of heat on fabrics made of different fibres.

**Requirements :** Small pieces of fabric made of cotton, silk, wool, nylon, rayon, acrylic and a matchbox.

**Procedure :** Suspend small pieces of fabric made of cotton, wool, silk, nylon, rayon and acrylic from some support. Bring a burning matchstick to each of them at their loose ends. Allow them to burn for sometime and make observations. Draw your inferences about the nature of fibres on the basis of information given.

Fibre	Burn slowly or vigorously	Kind of smell	Bead formation
Cotton			
Wool and silk			
Rayon			
Nylon			
Polyester			
Acrylic			

### Characteristics of Synthetic Fibres

Synthetic fibres are strong, light, durable, easy to wash and moth proof. They do not shrink or wrinkle and therefore need little or no ironing. Since they do not absorb water or moisture, they dry quickly. This property becomes a disadvantage with the fabric made of this fibre, as they do not absorb sweat or allow it to evaporate. The fabrics stick to the body and make the wearer uncomfortable during summer.

Synthetic fibres catch fire easily. They burn, shrink and melt forming beads which stick to the skin. Therefore, they should not be worn in the kitchen or while working near fire.

These fibres are non-biodegradable and cause soil pollution. The fabrics made of synthetic fibres, develop a charge known as static electricity in the dry weather. Sparks, due to the charge developed, can be seen in the dark. This causes skin problems in many people.

### ACTIVITY 3.3

Take small pieces of fabric made of nylon, cotton, polyester and rayon. Tear a paper into very small bits and spread out the pieces on a dry wooden table. Rub one of the fabrics on the wooden surface (or on your dry, unoiled hair) and bring it near the paper bits. What do you observe? Does the fabric attract the bits of paper. Do they remain sticking to the fabric or do they fall down after some time? Repeat the same procedure for all the remaining pieces of fabric. Which of these fabrics attract the maximum number of paper pieces? What can you conclude from the above activity?

### CHECK YOUR KNOWLEDGE-1

1. What is the monomer of polythene?
2. What are the raw materials required to manufacture artificial fibres?
3. Name a fibre which resembles both cotton and silk.
4. State the properties of nylon due to which it can be used for making parachutes.
5. Name a synthetic fibre which resembles wool.

### 3.2 PLASTICS

Plastics are polymers in which the monomers are arranged in a **linear** manner or they may be **cross linked**.



Linear arrangement of units



Cross linked arrangement of units

They are manufactured from the chemicals found in crude oil. The polymers can be repeatedly melted, moulded into any desired shape or drawn into fibres. Therefore, they are available in a wide variety of shapes and sizes. They can be coloured in bright attractive colours, recycled, and reused.



Articles made of plastic

#### Plastics are of two kinds :

- (i) Thermoplastics
- (ii) Thermosetting plastics

**(i) Thermoplastics :** These can be softened on heating and moulded repeatedly into desired shapes. Polythene (or poly ethylene), PVC (polyvinyl chloride), polypropylene, polystyrene, polyester, perspex and nylon are some common thermoplastics. They bend easily on applying pressure and get deformed on heating.



Articles made of thermoplastics

**(ii) Thermosetting plastics :** These can be moulded into shape only once and cannot

be softened or melted on reheating. This is because the chains get highly crosslinked on heating. Bakelite and melamine are some examples of thermosetting plastics. They are hard and stiff and break on applying pressure.



Articles made of thermosetting plastics

#### Differences between Thermoplastics and Thermosetting plastics

S.No.	Thermoplastics	Thermosetting Plastics
1.	They can be softened on heating and moulded repeatedly.	They can be moulded into shape only once and cannot be softened or melted on heating.
2.	They are made up of long chain polymers with no cross linking.	The polymers get highly cross-linked when heated.
3.	Polythene, P.V.C., polyester, nylon, polystyrene are examples of thermoplastics.	Bakelite and melamine are some examples of thermosetting plastics.

#### Characteristics of Plastics

- Plastics are light, strong, durable and easy to handle. They are used in the manufacture of different parts of cars, aircrafts and spacecrafts in place of metals due to this property. They are also used for making various other household articles like furniture, storage jars, bottles, utensils, slippers, bags and toothbrushes.
- They can be moulded into any desired shape and size and can also be coloured. Crockery, cutlery, bottles, jars, etc., are made from it which have different shapes. Except bakelite, melamine and teflon, most of the plastics are transparent or translucent.

- They are poor conductors of heat and electricity. Therefore, they are used for making switches, plugs, sockets, coverings of wires, handles of screwdrivers and frying pans. Also special plastic cookware for microwave ovens, cook food but do not heat or melt the vessel.
- They do not corrode or rust or react with chemicals. Due to this reason, they have replaced iron pipes, buckets, mugs, etc., made of iron or steel. Food items and

chemicals can be stored in plastic containers as they do not react with the material.

- Plastics can be made on a large scale and some types of plastic can be recycled. But colouring agents added during recycling makes it unsafe to store food items.
- Plastics are waterproof and air tight and are used to store several solid and liquid food items like chips, biscuits, milk, oil, etc. They are also used to make bathroom curtains, raincoats, umbrella, gumboots, tablecloths, plastic films, bags, etc.

### Some commonly used plastics and their uses

S.N.	Plastics	Type of Plastics	Properties	Uses
1.	Polythene (or polyethylene)	Thermoplastic	Light, strong and flexible can be rolled into sheets and moulded into any shape. It is corrosion-resistant, water resistant, unaffected by acids or bases and bad conductor of heat and electricity.	For making polythene bags, sheets for storing water, oil and other solid and liquid materials, containers, bottles, pipes for transporting water, oil, etc., water proofing materials toys, brushes, combs, wrappers of chips, biscuits, etc.
2.	Polyvinyl chloride	Thermoplastic	Tougher than polythene, bad conductor of heat and electricity.	For making coverings of electrical wires and cables, floor coverings, floor and ceiling tiles, raincoats, handbags, plastic dolls, shoes, shoe-soles, bathroom curtains, furniture upholstery, doors, etc.
3.	Perspex (or acrylic)	Thermoplastic	Soft, transparent like glass and tough.	For making lenses, windows of aircrafts, wind screens of car, transparent domes and skylights.
4.	Polystyrene	Thermoplastic	Lighter than polythene, can be easily moulded, highly transparent, bad conductor of heat and electricity.	For making thermocol, safe packaging material for delicate objects and electronic goods, insulating material in refrigerators.
5.	Bakelite	Thermosetting plastic	Hard, stiff and bad conductor of heat and electricity.	For making plugs, switches and other electrical fittings, buttons, combs, records, gear wheels, fountain pen bodies, table top laminates, etc.
6.	Melamine	Thermosetting plastic	Hard, highly smooth and polished surface, fire proof.	For making unbreakable dinner sets, decorative items, table tops, flame resistant coating on the uniforms of firemen.
7.	Teflon (polytetrafluoro ethylene)	Thermoplastic	High melting point, not affected by chemicals or heat, slippery, water and oil do not stick on its surface.	For making non-stick cookware, corrosion proof coating.

## CHECK YOUR KNOWLEDGE-2

1. Which type of plastic cannot be remoulded and why?
2. Which property of perspex is used for making lenses?
3. Name the type of thermoplastic used for making non-stick cookware.
4. Name a type of plastic which is flame resistant.
5. Why is polystyrene used as an insulating material in refrigerators?

### Pollution due to Excessive use of Plastics

Plastics cause serious environmental and health problems. This is due to their long life, durability, toughness and resistance to chemicals. The waste keeps piling up since they do not decompose (or rot) by natural or chemical processes. When such a situation arises, we say that the material is non-biodegradable (non = not, bio = living, degradable = able to be broken down). That is, the material does not break down by the action of living things like bacteria. A material is **non-biodegradable** when it does not decompose by natural processes, like the action of bacteria. **Biodegradable** materials are decomposed easily by natural processes. The time taken by various biodegradable and non- biodegradable materials to decompose are different. The vegetable and fruit peels, cooked and raw food items decompose very fast. They generally take a week or a maximum of two weeks to decompose and mix with the soil thus, increasing its fertility. Wood takes about ten to fifteen years while paper made from it take only 10 to 30 days to decompose.

Cotton clothes decompose in 2-5 months while woollen clothes take about a year's time.

The non-biodegradable materials like plastic bags take several years to decompose and metals take 100-500 years to do so.

The careless and irresponsible way of disposal of plastics chokes the drains and blocks the soil, thereby reducing the percolation of water. Thus, water collects on the surface of the earth forming puddles. The plants growing in those areas do

not get enough water from the soil. Plastics bags swallowed by cows while feeding on garbage, choke their respiratory system or form a lining in the stomach which ultimately lead to their death. The dyes used in recycled plastic materials contaminate food stuff which if consumed can lead to cancer. Since they are light weight, they can be blown about and get caught in trees and collect in open drains. The toxic substances present in plastic wastes dumped in rivers cause the death of fishes and other aquatic animals. Burning of plastic is a slow process which releases a lot of poisonous gases into the atmosphere. Moreover, the material does not get completely burnt and a lot of solid residue is left behind.

### SCIENCE BITS!

Though plastics are not environment-friendly yet, they are used in the healthcare industry for making a number of medical instruments, syringes, doctors gloves, threads for stitching wounds and packaging of tablets.

### 3.3. DISPOSAL OF PLASTIC WASTE AND CONSERVATION ACTION

Plastics take many years to decompose completely. So several methods have been suggested to reduce the pollution caused by it. The following steps should be taken for its disposal and conservation of the environment :

1. Segregating biodegradable and non-biodegradable wastes and disposing them accordingly.
2. Disposing plastic in proper places and not in the sewage system, on roads, streets or on barren lands.



3. Reducing the amount of plastic used with recycled paper bags, jute or cotton bags, metal containers, etc.
4. Recycling or reusing plastics. The plastic is collected, sorted, melted and remoulded.
5. **Incineration** or burning of plastics at very high temperatures reduces the volume of wastes, provides useful supply of heat

energy and also breakdown the polluting gases produced during the reaction.

### CHECK YOUR KNOWLEDGE-3

1. Why are plastics non-biodegradable?
2. Why is recycled plastic not used to store foodstuff?
3. Why is incineration of plastics a better method of disposal of plastics?
4. Why is burning of plastics not suggested?

## KEYWORDS

- ◆ **Artificial/Man-made fibres** : Fibres made by man from chemicals derived from petroleum.
- ◆ **Polymer** : A long chain of repeating units.
- ◆ **Monomer** : The smallest unit of a polymer.
- ◆ **Polymerisation** : The process in which the monomers combine to form polymer.
- ◆ **Natural polymers** : Polymers which occur in nature like, cellulose, cotton, wool and silk.
- ◆ **Cellulose** : The polymer of cotton fibre.
- ◆ **Protein** : The polymer of wool or silk.
- ◆ **Artificial silk** : Rayon resembles silk fibres in appearance and so it is known as artificial silk.
- ◆ **Viscose** : Chemical treatment of wood pulp with sodium hydroxide and carbon disulphide produces a thick syrupy liquid known as viscose.
- ◆ **Blended fibres** : When synthetic fibres are mixed with natural fibres.
- ◆ **Polycot** : Polyester blended with cotton.
- ◆ **Polywool** : Polyester blended with wool.
- ◆ **Terrycot** : Terylene blended with cotton.
- ◆ **PET** : It is a common polyester used for making bottles and jars.
- ◆ **Acrylic** : A synthetic fibre similar to wool but cheaper than it.
- ◆ **Cross-linked** : When the units in a polymer are linked to each other both horizontally (linear) and vertically.
- ◆ **Thermoplastic** : The type of plastic which can be softened on heating and moulded repeatedly into desired shapes.
- ◆ **Thermosetting Plastic** : The type of plastic which can be moulded into shape only once and cannot be softened or melted on reheating.
- ◆ **Biodegradable** : The substances which are decomposed easily by natural processes like the action of bacteria.
- ◆ **Non-biodegradable** : The substances which are not decomposed by natural processes.

## SUMMARY

- ◆ Artificial fibres are obtained from chemicals derived from coal, wood and petroleum.
- ◆ Rayon, nylon and polyester are some synthetic fibres.
- ◆ Rayon is prepared from cellulose obtained from wood pulp.
- ◆ Rayon fibre is soft, tough, absorbent and lustrous like silk.

- ◆ Rayon is used to make clothes, carpets, automobile tyre chords and surgical dressing and bandages.
- ◆ Nylon is prepared from coal, air and water in the laboratories or factories.
- ◆ Nylon fibre is strong, light, lustrous, elastic, does not absorb water, does not wrinkle, is not attacked by fungus or moth and dries quickly.
- ◆ Nylon is used for making dress materials, ropes, fishing nets, small machine parts, elastic hosiery, toothbrushes, combs, etc.
- ◆ Terylene, dacron and terene are some polyester fibres. Terylene is a very popular polyester fibre.
- ◆ Polyester fibre is strong, wrinkle free, retain their crease, absorb very little water and dry quickly. They can be drawn into thin fibres like nylon.
- ◆ Polyester is used for making sarees, dress materials, bedsheets and curtains.
- ◆ Polyester is usually blended with cotton and wool and these fibres are more comfortable to wear.
- ◆ Polyester fibre is light weight, compact and resistant to sea salts and therefore it is used as a material for making sails, fire hoses and conveyer belts.
- ◆ Acrylic fibres are used to make shawls, sweaters and carpets.
- ◆ Synthetic fibres do not absorb sweat or allow it to evaporate, so, they are uncomfortable during summer.
- ◆ Synthetic fibres catch fire easily and melt and stick to the body.
- ◆ Plastics are polymers in which the monomers are arranged in a linear or crosslinked manner.
- ◆ Polythene, PVC, polypropylene, polystyrene, perspex are some common thermoplastics.
- ◆ Bakelite and melamine are some thermosetting plastics.
- ◆ Plastics are light, strong, durable, poor conductors of heat and electricity, waterproof, airtight do not rust or corrode and can be moulded into any desired shape.
- ◆ Plastics are used to make a wide variety of objects.
- ◆ Plastics cause serious environmental and health problems due to non-biodegradable nature.
- ◆ Careless and irresponsible way of disposal of plastics cause pollution.
- ◆ The use of plastics should be minimised to reduce their piling up.

## EXERCISES

### A. Multiple Choice Questions

Select the correct option :

1. Bakelite is  
 (a) thermoplastic                      (b) polyester                      (c) thermosetting plastic                      (d) nylon
2. A number of glucose units make up the polymer  
 (a) protein                      (b) viscose                      (c) cellulose                      (d) rayon
3. Polycot is made up of  
 (a) polymer and cotton                      (b) polyester and nylon                      (c) polyester and cotton                      (d) terylene and cotton
4. Synthetic fibres cause soil pollution because they are  
 (a) biodegradable                      (b) non-biodegradable                      (c) tough                      (d) soft
5. Synthetic fibres  
 (a) wrinkle free                      (b) dry quickly                      (c) catch fire easily                      (d) all of these
6. Rayon blended with wool is used to make :  
 (a) polycot                      (b) surgical dressing                      (c) carpets                      (d) polywool

**B. Fill in the blanks**

1. Rayon is known as \_\_\_\_\_ .
2. Nylon got its name from the two cities \_\_\_\_\_ and \_\_\_\_\_ where it was produced.
3. \_\_\_\_\_ can be moulded into shape only once.
4. \_\_\_\_\_ contain long chain polymer with no cross-linking.
5. PET is a common \_\_\_\_\_ employed for making bottles and jars.
6. Iron used for making pipes, buckets and mugs have been replaced with \_\_\_\_\_ since they do not rust.

**C. Match the items in Column A with those in Column B :**

Column A	Column B
1. Biodegradable	(a) Lenses
2. Teflon	(b) Flame resistant coating
3. Melamine	(c) Handles of cookware
4. Bakelite	(d) Floor tiles
5. Polystyrene	(e) Cotton
6. Perspex	(f) Non stick cookware
7. P.V.C	(g) Thermocol

**D. State whether the statements are True (T) or False (F) :**

1. Plastic is decomposed both by natural and chemical processes.
2. Biodegradable and non-biodegradable wastes should be disposed together.
3. The monomer of polythene is ethane.
4. Polyester is used to make jackets and other water resistant garments.
5. Dyes added to recycled plastic make it attractive but unsafe for storage of food items.
6. Microwave ovens require special plastic cookware.

**E. Short-answer type questions :**

1. What are man made fibres? Give examples.
2. Why do we need to blend fibres? Name one blended fibre.
3. Nylon fibres are used in making ropes for climbing mountains. Explain.
4. What is the speciality of the fibre used for making an umbrella?
5. What are the similarities between nylon and polyester?
6. Why are plastic containers used to store food items?
7. What type of linking is found among the units which make up plastic?
8. How do plastic bags pose danger to cows feeding on them?

**F. Long-answer type questions :**

1. Define : Monomer, Polymer, Polymerisation.  
How are these terms related to each other? Explain with examples.
2. How is rayon manufactured?
3. Write in brief the characteristics of synthetic fibres.
4. Write short note on : (a) Thermoplastics and (b) Thermosetting Plastics
5. What is the proper method of disposal of plastic?

### G. HOTS Questions :

1. Rayon is used for making delicate materials like surgical bandages as well as tyre chords. Why?
2. What are the dangerous caused by careless disposal of plastic?
3. Why is recycling or reusing plastic not an environment friendly method of conservation?

### H. Value based questions :

Rekha's mother always wears cotton clothes when working in her kitchen.

- (a) Why does Rekha's mother wear such kind of clothes when working in her kitchen?
- (b) What value do you learn from Rekha's mother?

## PROJECT IDEAS

1. Visit a plastic recycling plant and observe the different process which convert used and damaged plastic into new usable plastic.  
For what purpose is recycled plastic used? What are the disadvantages of using recycled plastics?
2. Using jute, cotton and paper or any of these design a bag which can be used for carrying grocery or other heavy objects safely.
3. Collect and paste different samples of synthetic fabric in a scrapbook. Write down the properties of each fabric and their uses.

## ACTIVITIES TO PONDER AND ACT

(Life Skill and Value Development)

1. Research and find out various government regulations related to use of polythenes and plastic fibres.  
**Objective :** To know more about government interventions and polythene awareness.  
**Skill and Value Development :** To make awareness about polythene and synthetic fibres, research and attitude towards environment.
2. Suggest some ways how we can minimise the usage of polythene and plastic fibres and also some ways of proper disposal of synthetic fibres.  
**Objective :** To know more about plastic fibres disposal.  
**Skill and Value Development :** Thinking skill, attitude towards environment and report-making skill.

## FOR THE TEACHER

1. A discussion can be organised in the class about the harmful effects of using plastic materials and the ways in which their use can be minimised.
2. An awareness can be created among the children on the use of ecofriendly materials instead of plastics.

## KNOW THE SCIENTISTS

**Joseph Priestly (1733-1804)** was an English chemist who was a pioneer in the chemistry of gases. He is also one of the discoverers of oxygen gas. With the help of books supplied by another scientist, Benjamin Franklin, he wrote 'The History of Electricity' in 1767.

**Chandrasekhara Venkata Raman (1888-1970)** was the first Indian scientist to win a Nobel Prize. A native of Madras, he joined the Indian Finance Department in 1907 when he failed to get a suitable science job



Chandrasekhara  
Venkata Raman

there. He was posted in Calcutta where he discovered Sarkar's Indian Association for the cultivation of science and began his research there, before and after office hours. In 1917 he

was appointed the Polit Professorship in Physics at the new University College of Science. His initial research was focussed on sound and musical instruments and this led to his election as Fellow of the Royal Society in 1924. He also conducted simple experiments to show that the blue of the sea was due to scattering of light by water molecules. He began a systematic study of the scattering of light by different liquids and discovered a totally new kind of radiation which is named after him. These radiations are very useful in studying molecular structures.



Joseph Priestly

