

Based on the **National Curriculum Framework**; adheres to the latest **NCERT** guidelines covering the latest **CBSE** and **ICSE** syllabus.

General Science

Text Book for Class VIII

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Syllabus

Sub-theme	Questions	Key concepts	Resources	Activities/ Processes
1. FOOD				22
Crop production	Crop production: How are different food crops produced? What are the various foods we get from animal sources?	Crop production: Soil preparation, selection of seeds, sowing, applying fertilisers, irrigation, weeding, harvesting and storage; nitrogen fixation, nitrogen cycle;	Interaction and discussion with local men and women farmers about farming and farm practices; visit to cold storage, go-downs; visit to any farm/ nursery/ garden;	Preparing herbarium specimens of some crop plants; collection of some seeds etc; preparing a table/chart on different irrigation practices and sources of water in different parts of India; looking at roots of any legume crop for nodules, hand section of nodules
Micro-organisms	What living organisms do we see under a microscope in a drop of water? What helps make curd? How does food go bad? How do we preserve food?	Micro organisms – useful and harmful	Microscope, kit materials; information about techniques of food preservation	Making a lens with a bulb; Observation of drop of water, curd, other sources, bread mould, orange mould under the microscope; experiment showing fermentation of dough – increase in volume (using yeast) – collect gas in balloon, test in lime water.
2. MATERIALS				26
Materials in daily life	Are some of our clothes synthetic? How are they made? Where do the raw materials come from? Do we use other materials that are synthetic? Do we use cloth (fabric) for purposes other than making clothes to wear? What kind of fabric do we see around us? What are they used for?	Synthetic clothing materials. Other synthetic materials, especially plastics; usefulness of plastics and problems associated with their excessive use There are a variety of fibrous materials in use. A material is chosen based on desired property.	Sharing of prior knowledge, source materials on petroleum products Collection of material from neighbourhood or should be part of the kit.	Survey on use of synthetic materials. Discussion Testing various materials - for action of water, reaction on heating, effect of flame, electrical conductivity, thermal conductivity, tensile strength.
Different kinds of materials and their reactions	Can a wire be drawn out of wood? Do copper or aluminium also rust like iron? What is the black material inside a pencil? Why are electrical wires made of aluminium or copper?	Metals and non-metals	Kit items	Simple observations relating to physical properties of metals and non-metals, displacement reactions, experiments involving reactions with acids and bases. Introduction of word equations.
How things change/react with one another	What happens to the wax when a candle is burnt? Is it possible to get this wax back? What happens to kerosene/natural gas when it is burnt? Which fuel is the best? Why?	Combustion, flame All fuels release heat on burning. Fuels differ in efficiency, cost etc. Natural resources are limited. Burning of fuels leads to harmful by products.	"The Chemical History of a Candle", by M. Faraday, 1860. Collecting information from home and other sources.	Experiments with candles. Collecting information. Discussions involving whole class.
3. THE WORLD OF THE LIVING				44
Why conserve	What are reserve forests/ sanctuaries etc? How do we keep track of our plants and animals? How do we know that some species are in danger of disappearing? What would happen if you continuously cut trees?	Conservation of biodiversity/wild life/ plants; zoos, sanctuaries, forest reserves etc. flora, fauna endangered species, red data book; endemic species, migration	Films on wild life, TV programmes, visit to zoo/forest area/ sanctuaries etc.; case study with information on disappearing tigers; data on endemic and endangered species from MEF, Govt. of India, NGOs	Discussion on whether we find as many diverse plants /animals in a 'well kept area' like a park or cultivated land, as compared to any area left alone. Discussion on depletion of wild life, why it happens, on poaching, economics.

Sub-theme	Questions	Key concepts	Resources	Activities/ Processes
The cell	What is the internal structure of a plant – what will we see if we look under the microscope? Which cells from our bodies can be easily seen? Are all cells similar?	Cell structure, plant and animal cells, use of stain to observe, cell organelles – nucleus, vacuole, chloroplast, cell membrane, cell wall	Microscope, onion peels, epidermal peels of any leaves, petals etc, buccal cavity cells, Spirogyra; permanent slides of animal cells	Use of a microscope, preparation of a slide, observation of onion peel and cheek cells, other cells from plants e.g. Hydrilla leaf, permanent slides showing different cells, tissues, blood smear; observation of T.S stem to see tissues; observing diverse types of cells from plants and animals (some permanent slides).
How babies are formed	How do babies develop inside the mother? Why does our body change when we reach our teens? How is the sex of the child determined? Who looks after the babies in your homes? Do all animals give birth to young ones?	Sexual reproduction and endocrine system in animals, secondary sexual characters, reproductive health; internal and external fertilisation.	Counsellors, films, lectures	Discussion with counsellors on secondary sexual characters, on how sex of the child is determined, safe sex, reproductive health; observation on eggs, young ones, life cycles. Discussion on Gender issues and social taboo's.

4. MOVING THINGS, PEOPLE AND IDEAS

28

Idea of force	What happens when we push or pull anything? How can we change the speed, direction of a moving object? How can we shape the shape of an object?	Idea of force-push or pull; change in speed, direction of moving objects and shape of objects by applying force; contact and non-contact forces	Daily-life experience, kit items	Observing and analysing the relation between force and motion in a variety of daily-life situations. Demonstrating change in speed of a moving object, its direction of motion and shape by applying force. Measuring the weight of an object, as a force (pull) by the Earth using a spring balance.
Friction	What makes a ball rolling on the ground slow down?	Friction – factors affecting friction, sliding and rolling friction, moving; advantages and disadvantages of friction for the movement of automobiles, airplanes and boats/ships; increasing and reducing friction	Various rough and smooth surfaces, ball bearings.	Demonstrating friction between rough/smooth surfaces of moving objects in contact, and wear and tear of moving objects by rubbing (eraser on paper, card board, sand paper). Activities on static, sliding and rolling friction. Studying ball bearings. Discussion on other methods of reducing friction and ways of increasing friction.
Pressure	Why are needles made pointed? Why does a balloon burst if too much air is blown into it? Why does an inverted glass/bottle/pitcher resist being pushed down into water? How can air / liquids exert pressure?	Idea of pressure; pressure exerted by air / liquid; atmospheric pressure	Daily-life experiences; Experimentation improvised manometer and improvised pressure detector.	Observing the dependence of pressure exerted by a force on surface area of an object. Demonstrating that air exerts pressure in a variety of situations. Demonstrating that liquids exert pressure. Designing an improvised manometer and measuring pressure exerted by liquids. Designing improvised pressure detector and demonstrating increase in pressure exerted by a liquid at greater depths.
Sound	How do we communicate through sound? How is sound produced? What characterises different sounds?	Various types of sound; sources of sound; vibration as a cause of sound; frequency; medium for propagation of sound; idea of noise as unpleasant and unwanted sound and need to minimize noise.	Daily-life experiences; kit items; musical instruments	Demonstrating and distinguishing different types (loud and feeble, pleasant/ musical and unpleasant / noise, audible and inaudible) of sound. Producing different types of sounds. using the same source. Making a 'Jal Tarang'. Demonstrating that vibration is the cause of sound.

Sub-theme	Questions	Key concepts	Resources	Activities/ Processes
				Designing a toy telephone. Identifying various sources of noise. (unpleasant and unwanted sound) in the locality and thinking of measures to minimise noise and its hazards (noise pollution)
5. HOW THINGS WORK				14
Electric current and circuits	<p>Why do we get a shock when we touch an electric appliance with wet hands?</p> <p>What happens to a conducting solution when electric current flows through it?</p> <p>How can we coat an object with a layer of metal?</p>	<p>Water conducts electricity depending on presence/absence of salt in it. Other liquids may or may not conduct electricity</p> <p>Chemical effects of current</p> <p>Basic idea of electroplating</p>	<p>Rubber cap, pins, water, bulb or LED, cells, various liquids</p> <p>Carbon rods, beaker, water, bulb, battery</p> <p>Improvised electrolytical cell, CuSO_4</p>	<p>Activity to study whether current flows through various liquid samples (tap water, salt solution, lemon juice, kerosene, distilled water if available)</p> <p>Emission of gases from salt solution. Deposition of Cu from copper sulphate solution. Electric pen using KI and starch solution</p> <p>Simple experiment to show electroplating.</p>
6. NATURAL PHENOMENA				26
Rain, thunder and lightning	<p>What is lightning?</p> <p>What safety measures should we take against lightning strikes?</p>	<p>Clouds carry electric charge.</p> <p>Positive and negative charges, attraction and repulsion.</p> <p>Principle of lightning conductor</p>	<p>Articles on clouds and lightning; kit items</p>	<p>Discussion on sparks.</p> <p>Experiments with comb and paper to show positive and negative charge.</p> <p>Discussion on lightning conductor</p>
Light	<p>What are the differences between the images formed on a new utensil and an old one? Why is there this difference?</p> <p>When you see your image in the mirror it appears as if the left is on the right – why?</p> <p>Why don't we see images on all surfaces around us?</p> <p>What makes things visible?</p> <p>How do we see images of our back in a mirror?</p> <p>Why do we sometimes see colours on oil films on water?</p> <p>What is inside our eye that enables us to see?</p>	<p>Laws of reflection</p> <p>Characteristics of image formed with a plane mirror.</p> <p>Regular and diffused reflection</p> <p>Reflection of light from an object to the eye.</p> <p>Multiple reflection</p> <p>Dispersion of light</p> <p>Structure of the eye</p>	<p>Mirror, source of light, ray source (mirror covered with black paper with a thin slit)</p> <p>Plane glass, candle, scale.</p> <p>Experience</p> <p>Mirrors and objects to be seen</p> <p>Plane mirror, water</p> <p>Model or chart of the human eye</p>	<p>Exploring laws of reflection using ray source and another mirror</p> <p>Locating the reflected image using glass sheet and candles</p> <p>Discussion with various examples.</p> <p>Activity of observing an object through an object through a straight and bent tube; and discussion.</p> <p>Observing multiple images formed by mirrors placed at angles to each other. Making a kaleidoscope.</p> <p>Observing spectrum obtained on a white sheet of paper/wall using a plane mirror inclined on a water surface at an angle of 45°.</p> <p>Observing reaction of pupil to a shining torch. Demonstration of blind spot.</p>

Sub-theme	Questions	Key concepts	Resources	Activities/ Processes
	Why are some people unable to see?	Lens becomes opaque, light not reaching the eye. Visually challenged use other senses to make sense of the world around. Alternative technology available. Role of nutrition in relation to blindness	Experiences of children; case histories. Samples of Braille sheets.	Description of case histories of visually challenged people who have been doing well in their studies and careers. Activities with Braille sheet.
Night sky	What do we see in the sky at night? How can we identify stars and planets?	Idea about heavenly bodies/celestial objects and their classification – moon, planets, stars, constellations. Motion of celestial objects in space; the solar system.	Observation of motion of objects in the sky during the day and at night; models, charts, role play and games, planetarium.	Observing and identifying the objects moving in the sky during the day and at night Observing and identifying some prominent stars and constellations Observing and identifying some prominent planets, visible to the naked eye, (Venus, Mars, Jupiter) in the night sky and their movement Design and preparing models and charts of the solar system, constellations, etc. Role-play and games for understanding movement of planets, stars etc.
Earthquakes	What happens during an earthquake? What can we do to minimise its effects?	Phenomena related to earthquakes	Earthquake data; visit to seismographic centre	Looking at structures/large objects and guessing what will happen to them in the event of an earthquake; activities to explore stable and unstable structures

7. NATURAL RESOURCES

20

Man's intervention in phenomena of nature	What do we do with wood? What if we had no wood? What will happen if we go on cutting trees/grass without limit? What do we do with coal and petroleum? Can we create coal and petroleum artificially?	Consequences of deforestation: scarcity of products for humans and other living beings, change in physical properties of soil, reduced rainfall. Reforestation; recycling of paper. Formation of coal and petroleum in nature. (fossil fuels?) Consequences of over extraction of coal and petroleum.	Data and narratives on deforestation and on movements to protect forests Background materials, charts etc.	Narration and discussions. Project- Recycling of paper. Discussion
Pollution of air and water	What are the various activities by human beings that make air impure? Does clear, transparent water indicate purity?	Water & air are increasingly getting polluted and therefore become scarce for use. Biological and chemical contamination of water; effect of impure water on soil & living beings; effect of soil containing excess of fertilisers & insecticides on water resources. Potable water	Description of some specific examples of extremely polluted rivers.	Case study and discussion. Purification of water by physical and chemical methods including using sunlight. Discussion on other methods of water purification

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Subjectwise Division of Chapters

Physics



- Force and Pressure
- Friction
- Sound
- Some Natural Phenomena
- Light
- Stars and the Solar System

Chemistry



- Synthetic Fibres and Plastics
- Metals and Non-metals
- Coal and Petroleum
- Combustion and Flame
- Chemical Effects of Electric Current
- Pollution of Air and Water

Biology



- Crop Production
- Microorganisms
- Conservation of Plants and Animals
- Structure and Function of Cell
- Reproduction
- Reaching the Age of Adolescence

Crop Production

Let us learn about

- Crop and its types
- Different kinds of agricultural practices
- Obtaining food from animals

Food is the basic need of all living organisms. It provides energy to perform various activities. Food is obtained from plants and animals. With growing population, the demand for food is increasing day by day. Therefore, food has to be produced on a large scale. Its proper management and distribution is also essential.

The prehistoric people were hunters and food gatherers. Later, they discovered how to grow crops by sowing seeds. This was the beginning of agriculture.

Agriculture stands for growing plants and rearing animals for food, clothing and other useful purposes.

When a plant of the same kind is grown and cultivated on a large scale at one place, it is called a **crop**. *For example*, when rice plant is grown and cultivated in a field on a large scale, it is called rice crop.

Types of Crops

India is a vast country and the climatic conditions like humidity, temperature, rainfall etc. vary from place to place. The crops grown in different places depend on the weather conditions prevalent in these regions. Crops grown in India are classified as kharif crops and rabi crops.

Kharif Crops

The **kharif crops** are grown during the rainy season. They are generally planted in June and harvested in October. These are

also known as **monsoon crops** or **autumn harvest**. The major kharif crops include paddy (rice), maize, millets (jowar, bajra, ragi, etc.), jute, cotton, and pulses (chickpea, pigeon pea, groundnut, etc.).



Paddy crop



Chickpea crop

Learn More

Paddy grows in the rainy season because it requires a lot of water for its growth. It cannot grow in summer or in winter.

Rabi Crops

The **rabi crops** are grown during the winter season. They are generally planted in November and harvested in April. These are also known as **winter crops** or **spring harvest**. The major rabi crops include wheat, gram, barley, pea, potato, and some oil seeds like linseed and mustard.



Wheat crop



Pea crop

Learn More

Crops can also be classified as food crops and cash crops. **Food crops** are grown mainly for the purpose of food, e.g. wheat, rice and pulses. **Cash crops** are grown mainly for the purpose of sale and profit, e.g. jute, cotton, tea and coffee.

Agricultural Practices

A farmer carries out various activities to cultivate a crop over a period of time. These activities are known as **agricultural practices**. The various agricultural activities are :

1. Preparation of soil
2. Selection of seeds and sowing
3. Adding manures and fertilisers
4. Irrigation
5. Weeding and crop protection
6. Harvesting
7. Storage of food grains

Preparation of Soil

Soil is the medium in which plants grow. Soil anchors the roots of plant and provides it water, air and vital nutrients.

Preparation of soil is the first and foremost activity by which the soil is turned and loosened so that the roots of the plants can penetrate deep into the soil. Soil preparation involves ploughing (tilling) and levelling.

Ploughing

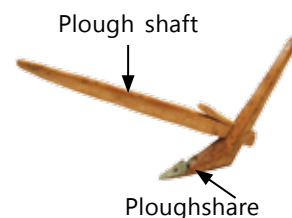
Ploughing is the process of loosening and turning the soil. It is carried out for the following purposes :

- It makes the soil loose and allows the roots to penetrate deep. This holds the plants more firmly on to the ground.
- It helps in aeration and enables the roots to breathe easily.
- It increases the ability of soil to retain water.

- It brings the nutrient rich soil to the top for the plants to use it for their growth.
- It helps the soil to get mixed with fertilisers more uniformly.
- It helps in the removal of weeds and unwanted plants.
- It promotes the growth of useful soil microorganisms.

Sometimes, when the soil is very dry it may require watering before ploughing. Ploughing is done using various **agricultural implements** such as plough, hoe and cultivator.

Plough : A plough is usually made of wood and iron. It contains a long log of wood called **plough shaft**. It has a strong triangular iron strip which is called **ploughshare**. It can be pulled either by an animal or by a tractor. As the plough is pulled, it cuts and moves the soil.



A plough



Ploughing the field with a plough

Hoe : A hoe is a simple agricultural tool which has a long log of wood or an iron rod. A strong and bent plate of iron is fixed at one end which acts as a blade. It is used for removing weeds and to loosen the soil.



A hoe



Ploughing the field with a hoe

Cultivator : A cultivator is a popular ploughing tool which has multiple metal blades. It saves labour and time as it is driven by a tractor.



A cultivator



Ploughing the field with a cultivator

Levelling

Even after ploughing, the field may have big lumps of soil called **crumbs**. These crumbs are crushed and levelled with the help of a wooden or an iron leveller. This process is called **levelling**. It ensures uniform water distribution in the field during irrigation and avoids water logging.



A leveller



Levelling the field with a leveller

Selection of Seeds and Sowing

After ploughing and levelling, the soil becomes ready for sowing seeds. Seeds must be of good quality, healthy and free from diseases. Healthy seeds are important for abundant crop yield. Seeds should be bought from trusted or government sources.

The process of putting seeds in the soil to grow a crop is called **sowing**. The following points should be kept in mind while sowing seeds :

- Seeds should be planted at proper depth in the soil. This ensures proper supply of air, water and nutrients to the crop.

- Seeds should be sown at a proper distance from one another. This prevents overcrowding of plants and ensures proper supply of sunlight, water and nutrients to each plant.

Sowing can be done manually or by using a seed drill.

Manual Method

Manual method is a traditional method for sowing seeds. This method is also called **broadcasting**. It involves scattering of seeds in the soil by hand. However, this method has certain disadvantages -

- The seeds may not get distributed evenly.
- They may not be sown at the proper depth in the soil.
- They may lie on the surface of field and are likely to be eaten up by birds.



Sowing seeds by broadcasting

Using a Seed Drill

A **seed drill** is a sowing device that places seeds in the soil at correct depth and covers them with soil. It also ensures proper spacing between the seeds. A seed drill is pulled across the field using bullocks or a tractor. Seed drill saves labour and time.



Seed drill attached to a tractor

Activity 1

Aim : To differentiate healthy seeds from unhealthy ones.

Materials required : Water, beaker and seeds.

Procedure : 1. Take a beaker half filled with water.
2. Put some seeds in it and stir well.
• Keep this beaker untouched for some time.

Observation : Some seeds settle down at the bottom of the beaker while some float on the surface of water.

Conclusion : The seeds which are healthy and heavy, get settled down at the bottom of the beaker. However, those which are unhealthy and lighter, float at the top.



Learn More

Sometimes, seeds are grown into saplings (young plants) in a nursery and transferred to the actual field. This process is called **transplantation**. This technique ensures that only healthy plantlets are planted. This increases the crop yield.

Adding Manure and Fertilisers

Plants derive their nutrients from the soil. Different plants need different types of nutrients for their growth. Over a period of time, the soil becomes deficient in the nutrients needed by the crops. Thus, the soil loses its fertility.

To maintain the fertility of the soil, farmers add certain substances to it called manures and fertilisers.

Manure

Manure is the organic material obtained from the decomposition of dead plants and animal waste. Farmers dump animal and plant waste in pits in open places. The waste is then allowed to decompose by microorganisms and an organic material is obtained. This is called manure.

Advantages of using manure

- It improves the texture of the soil.
- It makes the soil porous.
- It enhances the water-holding capacity of the soil.
- It increases the number of soil-friendly microbes.

Fertilisers

Fertilisers are the chemical substances which provide one or more nutrients to the soil. They are produced or manufactured in factories. Urea, ammonia, potassium sulphate and NPK (Nitrogen Phosphorous Potassium) are some common fertilisers. Farmers get better crops by using these fertilisers.



Farmer adding fertilisers in the field

Fertilisers get easily dissolved in water and hence, are easily absorbed by plants. However, excessive use of fertilisers over a long period may affect the fertility of soil and adversely affect the crop production.

Difference between Manure and Fertilisers

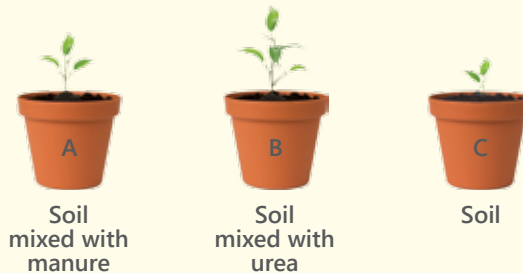
Manure	Fertilisers
1. A natural organic substance obtained from animal and plant wastes.	1. Chemical substances made by humans.
2. Prepared in the field.	2. Prepared in the factories.
3. Biodegradable.	3. Non-biodegradable.
4. Provides humus to the soil.	4. Do not provide humus to the soil.
5. Less rich in plant nutrients.	5. Very rich in plant nutrients.

Activity 2

Aim : To show that plants require nutrients for better growth.

Materials required : Three pots, soil, germinated gram seeds, manure, and urea.

Procedure : 1. Label the three pots as A, B and C.
2. In pot 'A', add a little amount of soil mixed with manure. In pot 'B', take same amount of soil mixed with urea. In pot 'C', take the same amount of soil without adding manure or urea.
3. Pour the same amount of water in all three pots and plant the germinated gram seeds in them.
4. Keep the pots in the Sun and water them regularly for 10 days.



Observation : You will find that the growth of the plant in pot 'C' is less as compared to pots 'A' and 'B'.

Conclusion : Plants require manure and fertilisers for their better growth.

Natural Methods to Replenish the Nutrients in the Soil

Apart from using manures and fertilisers, the nutrients in the soil can be replenished through natural methods as well. Some of these methods are :

Field Fallow - In this method, the land is left uncultivated for one or more seasons to regain nutrients naturally by the decomposition of dead plants, animals and other organic matter.

Crop Rotation - In crop rotation, farmers change their crops in each season so that soil does not become deficient in any specific nutrient. *For example*, farmers grow wheat in one season and legumes in the next season in the same field. Wheat crop uses nitrogen from the soil while leguminous plants help in replenishing nitrogen in the soil.

Mixed Cropping - In this method, two or more varieties of crops are grown together in the same field. The crops are chosen in such a way that the nutrients needed for one crop are fulfilled by the other crop. *For example*, cotton and groundnut crops are often grown together in the same field.

Irrigation

Like human beings, plants also require water for their proper growth and development of flowers, fruits and seeds. Plants contain about 90% water. Water is the medium by which plants get minerals and fertilisers from the soil. Under dry conditions, seeds do not germinate.

Irrigation is the process of providing water to the field at regular intervals for assisting better growth of crops. However, the requirements of water depend on the **type of crop**, **weather conditions** and the **type of soil**.

The frequency and amount of irrigation required varies from crop to crop. *For example*, paddy crops require plenty of water throughout their growth whereas wheat crops require less water.

Water for irrigation is obtained from wells, rivers, reservoirs, tube wells, dams, canals, and ponds.

Methods of Irrigation

Methods of irrigation can be broadly categorised as **traditional** and **modern**.

Traditional Methods of Irrigation - The traditional methods of irrigation involve the use of human or cattle for lifting water. These include chain pump, moat, rahat, and dhekli. These methods are cheaper but less efficient and often lead to wastage of water.



Rahat

Modern Methods of Irrigation - The modern methods of irrigation include sprinkler system and drip irrigation system. In these methods, water is used economically.

Sprinkler System - In this system, water is sprinkled on the crop through a system of pipes. The water is pumped in the pipes and is sprayed into the air through rotating spray heads (nozzles). The water falls on the crop in the form of small water droplets, similar to rainfall. This method is useful for irrigating uneven land and regions having sandy soil.



Sprinkler system of irrigation

Drip System - In this system, water is dripped onto roots of the plants, drop by drop, through small holes in the pipes. This technique saves a lot of water and is very useful in areas which have shortage of water.



Drip system of irrigation

Weeding and Crop Protection

The undesirable plants that grow along with the main crop are called **weeds**. Amaranthus (chaulai), wild oat, bathua, and doob grass are some examples of weeds.



Amaranthus (chaulai)



Wild oat

Weeds compete with the main crop for air, sunlight and nutrients, which adversely affect the growth of crop. Some of them may even be poisonous to human beings and animals. They spread very fast and should be removed before they produce flowers and seeds. The process of removing weeds is called **weeding**. It can be done manually or by using chemicals.

Manual Weeding

Manual weeding is removing weeds by uprooting them with hands or cutting them close to the ground. This is done with the help of implements such as khurpi, harrow and hoe.



Manual weeding using harrow

Weeding by Using Chemicals

A chemical used to destroy weeds is called **weedicide**. 2,4-D and MCPA are some examples of weedicides. They check the growth of weeds without affecting the main crops.

Weedicides are diluted with water and sprayed onto the field to kill weeds.

Weedicides are poisonous for human beings. The farmers should cover their nose and mouth with a piece of cloth to protect themselves while spraying them. The grains, fruits and vegetables that we eat should be properly washed before being consumed as they may be coated with weedicides.



Farmer spraying weedicide

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Nowadays, eco-friendly natural weedicides called **bio-weedicides** are preferred over chemical weedicides. Some microorganisms, such as fungi and bacteria are used as bio-weedicides to destroy weeds.

Crop Protection from Pests and Diseases

The organisms that damage the crops are called **pests**. Rodents (rats and squirrels) and insects (termites and locusts) are some examples of pests. Pesticides and insecticides are used to destroy the pests without affecting the plants.

Sometimes, crops are also attacked by diseases which spoil them and make them unfit for human consumption. These diseases are caused by fungi, bacteria or viruses and are generally transmitted through seeds, air, soil or insects. Various chemicals called **herbicides** are sprayed on plants to prevent crop diseases.

Harvesting



Sickle

Harvesting is the process of cutting and gathering of crops when they are matured. It can be done manually with the help of a sickle or by using a machine called **harvester**. After harvesting, the grain is separated from the rest of the plant. This process is called **threshing**. It can be done manually (by making buffaloes trample over the cut crop) or by a machine called **thresher**. Harvesting and threshing can be done together by using a machine called **combine harvester**.



Combine harvester

After threshing, the grain is separated from the chaff by fast moving wind. This is called **winnowing**. It can be done manually or by using a winnowing machine. During this process, the grains are dropped from a height slowly against the direction of wind. As a result, the lighter materials are carried away by the wind and the grains are separated.



Winnowing by machine

Learn More

Pongal, Holi, Onam, Baisakhi and Bihu are all harvest festivals of India. These are celebrated at the time of harvesting of crops.

Storage of Food grains

After the production of crop grains, storage is an important task. It is not possible to sell the entire harvest immediately. Thus, the storage of grains is required for future use. The grains have to be protected from moisture, insects, rats, and microorganisms. Before storing, the grains are properly dried in the Sun in order to reduce the moisture and store them for a longer time.

At commercial level, grains are stored in **granaries** or **silos**. Before storing grains, granaries or silos should be free from rodents, insects and microbes.

The grain is packed in gunny bags or jute bags and stored in stacks. After storing the grain, it is inspected periodically to ensure that it is not eaten up by pests or infected



Silos



Grains in gunny bags

by diseases. The storage area is kept clean, dry and properly ventilated. Pesticides are sprayed to keep the pests away.

Animal Husbandry

Like plants, we get variety of food items from animals also. Rearing of animals on a large scale for food and other purposes is called **animal husbandry**.



Dairy farming

Some examples of food products obtained from animals are :

Eggs - obtained from poultry animals such as hen, duck and turkey.

Honey - obtained from honeybees.

Milk - obtained from milch animals such as cow, buffalo, goat, and camel.

Meat - obtained from animals such as goat, sheep, fish, and pig.

Learn More

Large scale rearing of honeybees for honey is called **apiculture**. Large scale rearing of fish for food is called **pisciculture**.

WORD POWER

- Agriculture** : growing plants and rearing animals for food, clothing and other useful products
- Broadcasting** : the process of scattering seeds in a field manually
- Crops** : Plant of the same kind grown on a large scale for food, clothing, etc.
- Granaries** : a storehouse for keeping the harvested grain
- Kharif crops** : crops that are sown in the rainy season
- Plough** : a wooden agricultural tool used for loosening and turning the soil
- Rabi crops** : crops that are sown in the winter season
- Seeds** : the small, hard part produced by a plant, from which a new plant will grow
- Silo** : a tall tower on a farm used to store grains
- Sowing** : the process of scattering seeds in the soil for growing crops
- Threshing** : the process of separation of grains or seeds from the stalks of plants
- Weedicide** : a chemical used for killing weeds
- Weeds** : the unwanted plants that grow along with the main crop
- Winnowing** : the method of separating grains from the chaff with the help of fast moving wind

POINTS TO REMEMBER

- Based on the sowing season, crops grown in India are classified as kharif crops and rabi crops.
- The agricultural practices involved in crop production are • Preparation of soil • Selection of seeds and sowing • Adding manures and fertilisers • Irrigation • Weeding and crop protection • Harvesting • Storage of food grains.
- Soil preparation involves ploughing (tilling) and levelling.
- Seeds must be of good quality, healthy and free from diseases. They should be sown at a proper depth in the soil and at a proper distance from one another.
- Manures and fertilisers are added to the soil to get good crop yield and maintain soil fertility.
- Natural methods to replenish the nutrients in the soil are field fallow, crop rotation and mixed cropping
- Irrigation is the process of providing water to fields at regular intervals for assisting better growth of crops.
- Weeding involves removal of undesirable plants, called weeds, that grow along with the main crop.
- Pesticides and insecticides are used to destroy the pests without affecting the plants.
- Harvesting is the process of cutting and gathering of mature crop manually or by machines.
- The grain is separated from the harvested plant by the process of threshing and winnowing.
- Grains must be stored properly to protect them from moisture, insects, rats and microorganisms.
- The rearing of farm animals on a large scale for food and other needs is called animal husbandry.

ASSESSMENT 1

A. Tick the correct option.

1. An example of a kharif crop is
 wheat maize gram barley
2. The agricultural implement which can do both harvesting and threshing of crops is
 plough sickle hoe combine harvester
3. The organic material obtained from the decomposition of dead plants and animal waste is called
 manure fertiliser weedicide pesticide
4. The modern method of irrigation is
 chain pump pulley system sprinkler system lever system
5. The unwanted plants that grow along with the crop are called
 weeds fertilisers pesticides manures
6. The plough is an agricultural implement used for
 sowing the seeds tilling the land
 spraying weedicides cutting crops
7. A device that places seeds in the soil at correct depth and covers them with soil is
 seed drill plough hoe cultivator

B. Fill in the blanks.

1. Soil preparation involves _____ and _____.
2. Rearing of animals on a large scale for food and other purposes is called _____.
3. A chemical used to destroy weeds is called _____.
4. Based on the growing season, crops are classified as _____ and _____.
5. To maintain the fertility of the soil, farmers add _____ and _____ to the soil.
6. Leaving the field uncultivated for sometime is called _____.
7. In _____ system of irrigation, water is dripped onto roots through small holes in pipes.

C. State whether the following statements are True or False.

1. Rabi crops require less water than kharif crops. _____
2. All plants require the same amount of water and time period for their growth. _____
3. Irrigation is the process of providing water to the crop at regular intervals. _____
4. Multiple cropping drains the soil of its nutrients. _____
5. 2,4-D is an example of weedicide. _____
6. Wheat and gram are examples of kharif crops. _____
7. Crop rotation helps in replenishing nutrients in the soil. _____

D. Answer each of the following questions in few sentences.

1. What is the difference between kharif and rabi crops? Give one example of each.
2. Why does the soil need to be turned and loosened before growing crops?
3. Why is it important to maintain an appropriate distance between seeds?
4. What are ploughing and levelling?
5. How do weeds affect crops?
6. What are agricultural implements? Name any three and write the use of each.
7. What are weedicides? Why does a person handling a weedicide sprayer have to be careful?
8. How does soil get affected by the continuous plantation of same crop in a field?
9. What is animal husbandry? Give three examples of food products obtained from animals.

E. Answer each of the following questions in detail.

1. What are agricultural practices? List them in correct sequence.
2. What precautions should be taken while selecting and sowing seeds?
3. Write a short note on each of the following :
(a) Threshing (b) Preparation of soil (c) Weeding
4. Differentiate between :
(a) Manures and fertilisers (b) Crop rotation and multiple cropping
(c) Pesticides and weedicides
5. Explain the various methods used for sowing seeds in a field.
6. Explain the natural methods of replenishing nutrients in the soil.
7. What is harvesting? What precautions should be taken while storing harvested grains?
8. Why is it essential to irrigate fields? Explain the modern methods of irrigation.

- Complete the crossword with the help of the clues given.



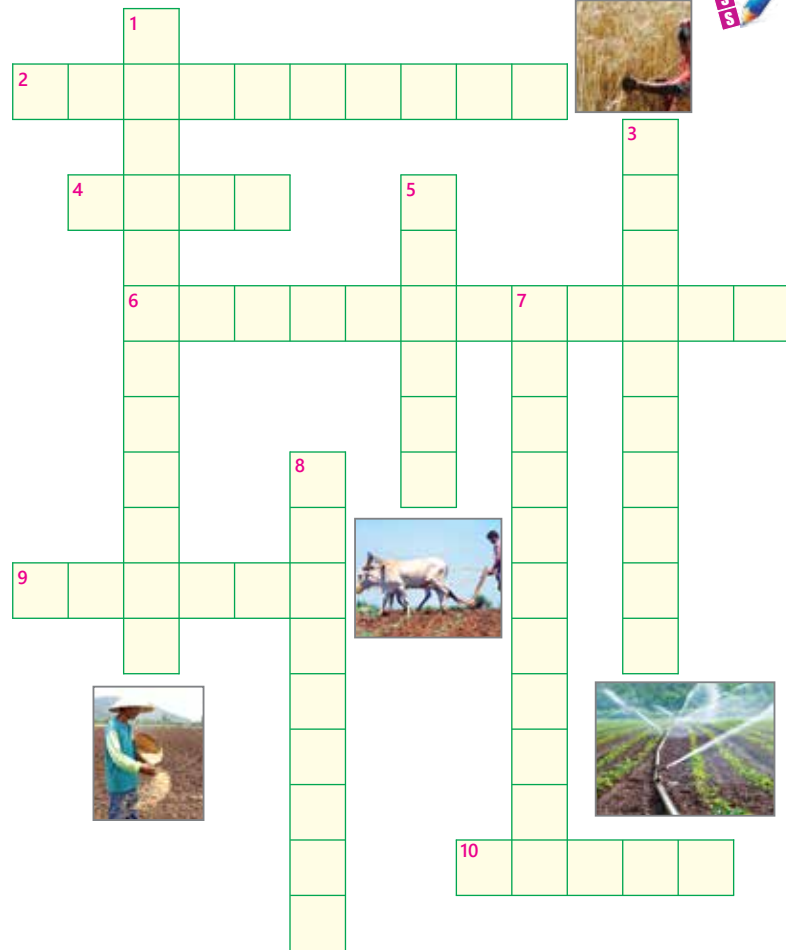
Clues :

Across :

2. Process of cutting and gathering of mature crop.
4. Crops grown during the winter season.
6. Process in which farmers change their crops after every season to maintain fertility of soil.
9. Organic material used to increase fertility of soil.
10. Organisms that damage the crops.

Down :

1. Process of scattering seeds in a field.
3. Providing water to the field at regular intervals.
5. Agricultural implement used for loosening soil.
7. Growing plants and rearing animals for food, clothing, and other useful products.
8. Chemical used for killing weeds.



1. What would happen if wheat crop is sown during kharif season?
2. We should wash fruits and vegetables properly before eating them. Why?
3. A farmer used chemical fertilisers extensively in his fields. Fishes in a pond adjacent to his fields were found dead after some time. Explain why.



Group Discussion

- Imparting education to farmers is important to ensure better crop yields.

PROJECT IDEAS

- Make a drip irrigation system for the plants in your home. Make tiny holes at regular intervals in a length of hosepipe. Seal one end of the pipe. Attach the other end of the pipe to a small supply of water. Use tape or twine to hold the pipe in place near the plants.

Let us learn about

- Microorganisms and their types
- Useful and harmful microorganisms
- Food poisoning
- Methods of food preservation

Living organisms are all around us. Some are extremely large while others are so small that they cannot be seen through naked eyes. We need a microscope to view such organisms.

Organisms that are visible only through a microscope are called **microorganisms** or **microbes**.



Microscope



Stale bread under microscope

You must have seen grey patches growing on stale bread. If you scrap a part of the patch and view it under a microscope, you will find it is made up of tiny plant-like organisms. These organisms are microorganisms.

Let us observe microorganisms through the activities given below.

Activity 1

Aim : To observe microorganisms in water.

Materials required : Water, glass slide, dropper, and microscope.

Procedure : 1. Take a few drops of water from a pond.
2. Using the dropper, put a drop of water on the glass slide and observe it under the microscope.



Activity 2

Aim : To observe microorganisms in the soil.

Materials required : Water, beaker, garden soil, glass slide, dropper, and microscope.

Procedure : 1. Pour some water in the beaker and add some garden soil in it.
2. Allow the soil particles to settle down.
3. Using the dropper, put a drop of water from the beaker on a glass slide and observe it under a microscope.



In the activities, you will be able to see a number of microorganisms in the samples of water and soil.

Microorganisms are found everywhere, from the hottest desert to the coldest polar regions. They can be found inside the bodies of humans, animals as well as plants. Some microorganisms live alone while some grow in colonies or groups.

Microorganisms are capable of surviving under extreme conditions. They can survive in a volcanic eruption as well as in marshy lands. Under unfavourable conditions, they form a hard, protective coating around them called **cyst**. Once the conditions become favourable, they break out from the cyst and become active again.

Learn More

The study of microorganisms is known as **microbiology**. A scientist who studies microorganisms is called a **microbiologist**.

Types of Microorganisms

Microorganisms are divided into five major groups:

1. Bacteria
2. Fungi
3. Protozoa
4. Algae
5. Viruses

Bacteria

Bacteria are single celled organisms and are found almost everywhere. Normally, a bacteria exists alone but at times they form groups also.

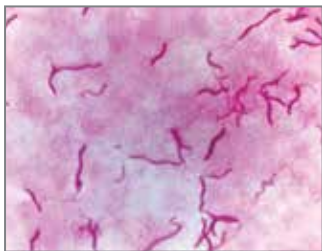
They are found in four different shapes – spherical (cocci), rod shaped (bacilli), spiral (spirilla) and comma shaped (vibrio).



Cocci



Bacilli



Spirilla



Vibrio

Fungi

Fungi are plants that lack chlorophyll. These are also called **saprophytes** as they feed on decaying matters. However, some fungi also feed on living things and cause diseases like athlete's foot. They can be unicellular as well as multicellular.

They grow best in dark, warm and moist places. Some fungi are large in size and can be seen with naked eyes. Some common fungi are yeast (unicellular), bread mould (multicellular) and mushroom (multicellular).



Yeast



Mushroom

Protozoa

Protozoa are single celled animals. They move from place to place in search of food. They are found in water as well as soil. Some protozoa are **parasites** (who live in the body of other organisms) and cause diseases like dysentery and malaria. Some examples of protozoa are amoeba, euglena, paramecium, and giardia.



Amoeba



Euglena



Paramecium

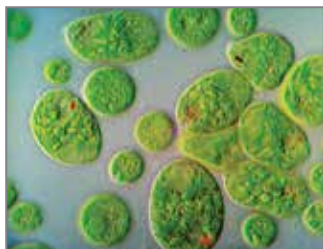


Giardia

Algae

Algae are simple plants having chlorophyll and can make their own food by photosynthesis. Most algae are found in water but some are also found in snow, hot springs and barks of trees. Some examples of algae are chlamydomonas and spirogyra.

Algae such as seaweed and kelp, found in seas and oceans, are large in size. Kelp can grow upto 200 m in length. Some varieties of algae are edible and are used as food in some parts of the world.



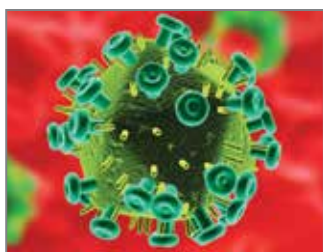
Chlamydomonas



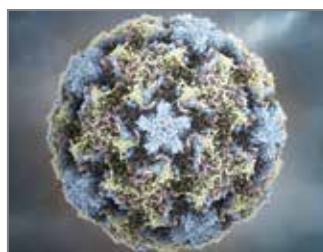
Kelp

Viruses

Viruses are the smallest microscopic organisms. They cannot be seen with an ordinary microscope and require a high-powered electron microscope. A virus exists in two states – living and non-living. It is like non-living, when not in contact with a living body or cell. The non-living state of a virus is called **virion**. It becomes alive when it comes in contact with a living cell or body and starts reproducing. A virus is parasitic. Some examples of viruses are HIV (Human Immuno Deficiency Virus), mosaic virus and rhinovirus.



HIV virus



Rhinovirus

Useful Microorganisms

We often associate microorganisms with diseases. But they are useful to us as well as to the environment in many ways.

The uses of microorganisms can be broadly divided into following categories – commercial, medicinal, agricultural and environmental.

Commercial Uses

Some common commercial uses of microorganisms are as follows :

Making of Curd

Curd contains bacteria called **lactobacillus**. Milk contains a protein called **casein**. Curd is formed due to the chemical reaction between lactobacillus and casein. When a spoonful of curd is added to lukewarm milk, the lactobacillus bacteria present in curd cause coagulation of casein and convert milk into curd.

Learn More

Cheese is prepared from milk in a similar manner as curd. During its preparation, lemon juice or vinegar is added to the milk. It causes coagulation of casein. The solid part is separated and pressed to form cheese.

Making of Bread

Bread, cake and pastries are made using a fungus called **yeast**. To make bread – flour, water, yeast, and baking soda are kneaded together to form a dough. Yeast mixed in dough reproduces rapidly and decomposes baking soda to produce carbon dioxide gas. This carbon dioxide rises up and escapes the dough forming holes in it. This makes the bread rise and become spongy and porous.



Kneading dough

Making of Alcoholic Beverages

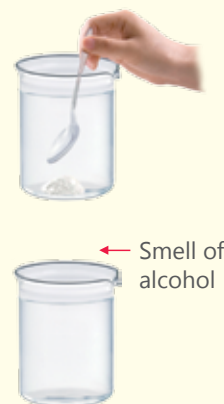
Yeast is used in manufacturing of alcoholic drinks like wine and beer. It involves fermentation of sugar present in barley, grapes, etc. by yeast. It breaks down sugar to form alcohol and carbon dioxide.

Learn More

The process of decomposition of organic substances, such as sugar, by microorganisms (yeast) to form carbon dioxide and water, or alcohol is called **fermentation**.

Activity 3

- Aim** : To study fermentation of sugar by yeast.
- Materials required** : Beaker, water, sugar, and yeast powder.
- Procedure** : 1. Fill one-third of a beaker with warm water.
2. Add 2-3 spoons of sugar in it.
3. Add about half a spoon of yeast powder to this solution.
4. Keep it covered in a warm place for 4-5 hours.
5. Smell the solution.
- Observation** : A smell of alcohol is observed.
- Conclusion** : Yeast converts sugar into alcohol.



Other Uses

Algae is used in making toothpaste. Bacteria are used in the processing of coffee, tobacco and vinegar. Seaweeds are used as food in some countries.

Medicinal Uses

Some common medicinal uses of microorganisms are as follows :

Preparation of Antibiotics

Certain bacteria and fungi are used to prepare medicines called antibiotics. **Antibiotics** are the medicines that destroy disease-causing microbes. They are also used to control some diseases in plants and animals. Some examples of antibiotics are streptomycin, penicillin, tetracycline, and erythromycin.



Antibiotics

Learn More

We should always take antibiotics under the supervision of a qualified doctor. If taken unnecessarily or in excess, antibiotics may kill the useful bacteria in the body or become less effective when taken in future.

Preparation of Vaccine

Microorganisms are also used to make vaccines in order to protect us from several diseases. A **vaccine** is a special type of

medicine which provides protection or increases our immunity against a particular disease. Vaccine for a particular disease is often made from weakened or dead microbes which cause the disease.

When it is introduced in the body of a healthy person, either by swallowing or injection, the body produces antibodies to fight against the disease.

These antibodies remain in the body and protect the body from future attacks by the same microbes. Some common diseases like smallpox, cholera, polio, typhoid, and hepatitis are prevented by vaccination.



Vaccination

Learn More

Edward Jenner discovered the vaccines for smallpox in 1798.



Other Uses

Bacteria and yeast are used for making vitamin B complex. Insulin is obtained from bacteria. It is used by diabetic patients.

Agricultural Uses

Blue-green algae and bacteria like rhizobium help in fixing atmospheric nitrogen and enrich the soil which ultimately increases the soil fertility of soil.

Nitrogen Fixation and Nitrogen Cycle

Nitrogen is freely available in its gaseous state in the atmosphere. It constitutes 78% of the Earth's atmosphere. It plays a vital role in the formation of amino acids, proteins and nucleic acids which are essential for living organisms.

Atmospheric nitrogen cannot be used directly by living organisms. It gets converted into a usable form by the process of nitrogen fixation.

The process of conversion of atmospheric nitrogen gas into nitrogenous compounds is called **nitrogen fixation**. Nitrogen fixation occurs during lightning or by the nitrogen fixing bacteria and blue-green algae.

The nitrogen fixing bacteria called **rhizobium** are found in the root nodules of leguminous plants such as gram, peas and beans.



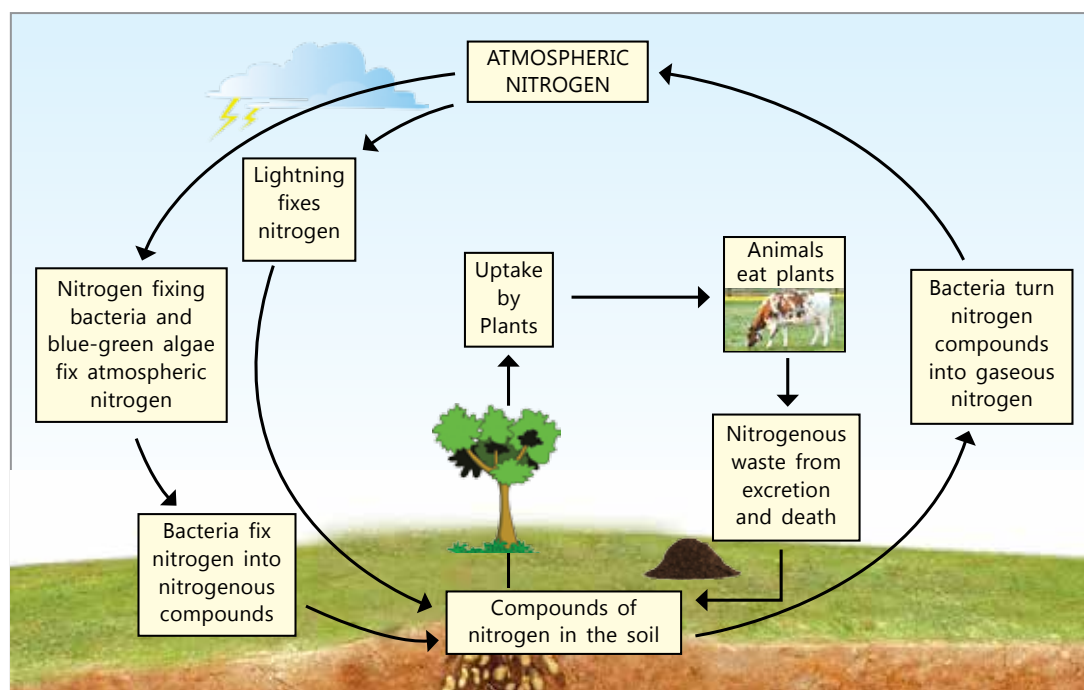
Rhizobium
in roots of a leguminous plant

Nitrogen fixation is also done by other bacteria like azotobacter and clostridium.

The nitrogen fixed by these microorganisms is taken in by the plants from the soil through their root system and gets converted into plant proteins and other nitrogenous compounds. These proteins and compounds reach humans and animals when they feed on these plants. When plants and animals die, the nitrogen compounds present in their bodies are decomposed and returned to the soil. Some of these nitrogen compounds are taken up by the plants while some are converted into nitrogen gas and returned to the atmosphere by special bacteria present in the soil.

The cyclic process in which atmospheric nitrogen is fixed in the soil, used by plants and animals and later returned to the atmosphere as free nitrogen is called **nitrogen cycle**.

As a result of the nitrogen cycle action, the percentage of nitrogen in the atmosphere always remains constant.



Nitrogen cycle

Environmental Uses

Microorganisms such as bacteria and fungi act as **decomposers**. They obtain nutrients by breaking down the remains of dead plants and animals and transfer them to the soil. Some bacteria are used in sewage treatment plants where they help in the decaying of waste organic matter. Hence, we can say that microorganisms decompose waste materials, thereby cleaning the environment.

Harmful Microorganisms

We have learnt that microorganisms are beneficial to our health and environment. However, some microorganisms are harmful and may even cause diseases in animals, humans and plants.

Diseases Caused by Microorganisms in Humans

Microorganisms that cause diseases in living organisms are called **pathogens**. Pathogens are all around us in the environment. Some pathogenic agents include viruses, bacteria, fungi and protozoa. These pathogens are able to enter the body and cause communicable diseases. **Communicable diseases** are those diseases which get transmitted from a patient to a healthy person.

The various ways by which communicable diseases spread are:

Air

Pathogens may enter our body through breathing. When a person suffering from common cold or flu, sneezes or coughs, he releases thousands of germs in the air. When a healthy person breathes this air, he can also get infected. Some common diseases that



Sneezing

spread through air are measles, polio and tuberculosis.

In order to safeguard ourselves, we should keep the infected person separate from others. The patient is advised to use a handkerchief while sneezing.



A child using handkerchief while sneezing

Food and Water

Pathogens may enter our body through the food we eat or water we drink. Some food and water borne diseases are typhoid, hepatitis and cholera.

Direct Contact

Pathogens may enter our body through any direct contact with an infected person. Some common diseases that spread through direct contact are ringworm, chickenpox and flu.

Insects

Some insects like mosquitoes and flies also carry pathogens. Pathogens stick to the bodies of houseflies when they sit on garbage and animal excreta. Later, these flies transfer pathogens to uncovered food items and contaminate them. Anyone who eats this contaminated food falls ill.



Female anopheles mosquito

Similarly, when the female anopheles mosquito bites a person suffering from malaria, they carry germs of malaria which they inject into a healthy person. The female aedes mosquitoes act as carrier for the dengue virus.

List of common communicable human diseases caused by microorganisms

Disease	Causative Pathogen	Mode of transmission	Measures for prevention
Cholera	Bacteria	Food or Water	Eat properly cooked food. Drink boiled water. Maintain personal hygiene and good sanitary habits. Get vaccinated.
Typhoid	Bacteria	Water	
Hepatitis A	Virus	Water	Drink boiled water. Get vaccinated.
Dengue	Virus	Mosquito	Use mosquito net and repellents. Do not allow water to collect in surroundings. Spray insecticides to control breeding of mosquitoes.
Malaria	Protozoa	Mosquito	
Measles	Virus	Air	Get vaccination done at suitable age. Avoid direct contact with an infected person.
Chicken pox	Virus	Air or Physical contact	
Polio	Virus	Air or Water	
Tuberculosis	Bacteria	Air	

Diseases caused by Microorganisms in Plants

All species of plants are subject to diseases. Microorganisms cause diseases in plants which can lead to rotting and retarded growth. Common symptoms of these diseases are curling of leaves, formation of lesions on the leaves, fruits and stem, discolouration of flowers and leaves.

Plant diseases caused by microorganisms

Disease	Causative Pathogen	Mode of transmission
Citrus canker	Bacteria	Air
Rust of wheat	Fungi	Air
Curly top	Virus	Insects
Yellow vein mosaic of okra (<i>bhindi</i>)	Virus	Insects



Citrus canker



Rust of wheat

Diseases caused by Microorganisms in Animals

All species of animals are subject to diseases caused by microorganisms. These diseases spread from infected animal to other animals through air, water, contact or grazing.

Animal diseases caused by microorganisms

Disease	Causative Pathogen	Affected Animal	Mode of transmission
Anthrax	Bacteria	Farm Animals	Grazing
Foot and mouth disease	Virus	Farm Animals	Physical contact
Bird flu	Virus	Many species of birds	Physical contact

Food Poisoning

Bacteria, parasites, viruses, and many other harmful microbes may contaminate food or water. These microbes grow in food or water under favourable conditions like warm temperature, moisture and air. Under these conditions, microbes often produce toxic substances and make the food or water unfit for consumption.

Consuming such contaminated food or water leads to an illness called **food poisoning**. It

can affect an individual or a group of people who ate the same contaminated food. Food can become contaminated at any stage – during production, processing or cooking.

We can detect that food is contaminated by its –

- (a) foul odour or sour taste
- (b) surface discolouration
- (c) cotton like growth on the surface
- (d) gas formation



Patches on bread due to growth of fungus



Discolouration of orange due to growth of mould

Food Preservation

We know that food gets spoiled due to the growth of microorganisms. We can prevent the spoilage of food by killing the microbes in it or by retarding their growth. The process of treating food items in such a way that they last for a longer time without getting spoiled is called **food preservation**.

Some common methods used for food preservation are :

Dehydration

Dehydration is the process of removing water or moisture from a food item. Food materials like cereals, pulses, dry fruits, and spices are dried in the Sun in order to remove the moisture content present in them. This ultimately inhibits the growth of microorganisms as they can not grow in dry conditions.

Refrigeration and Cooling

Microbes such as bacteria and fungi cannot survive in low temperature. Therefore, fruits, vegetables and meat are frozen or refrigerated to preserve them for a longer time.

Preservation by Sugar, Salt, Oil or Vinegar

Adding salt, sugar, oil or vinegar to the food prevents the growth of microorganisms. Jams, jellies and squashes are preserved by adding sugar. Meat and fish are preserved by rubbing salt on them. Pickles and vegetables are preserved by adding oil and vinegar.



Food containing preservatives

Canning

Canning is the process of sealing of food in airtight containers in order to prevent the attack of microorganisms. It is an effective way of storing food such as dry fruits, vegetables, fish and even cooked food.

Using Preservatives

The chemicals that help control microbial growth and check the spoilage of food are used as **preservatives**. Some preservatives commonly used in squashes and jams are sodium benzoate and potassium metabisulphite.

Boiling

Boiling kills many microorganisms. Milk and water are boiled before they are used or stored.

Pasteurization

Pasteurization involves heating food to a high temperature and then cooling it rapidly. It is named after its inventor, Louis Pasteur. This prevents the microbial growth without affecting the flavour, composition or nutritive value of food. *For example*, milk is pasteurized by heating it to about 70°C for some time and then rapidly cooling and storing it at temperature below 10°C.

WORD POWER

Antibiotics	: substances obtained from microorganisms that inhibit the growth of or kill disease-causing microbes
Antibodies	: substances produced in body for protection against microbes
Carrier	: an insect that transmits disease-causing pathogens from an infected person to a healthy person
Communicable diseases	: diseases caused by microbes that can spread from an infected person to a healthy person through air, water, food, or physical contact
Fermentation	: the process of conversion of organic substances to form carbon dioxide and water, or alcohol by the action of microorganisms
Food preservation	: the process of treating and handling food to stop or slow down its spoilage while maintaining its nutritional value, texture and flavour
Lactobacillus	: a rod-shaped bacterium that sours milk and is used for making curd
Microorganisms	: organisms that are visible only through a microscope
Nitrogen fixation	: the process of converting free atmospheric nitrogen into nitrogenous compounds
Pasteurisation	: the process of heating a foodstuff to a high temperature and then cooling it rapidly in order to kill the harmful bacteria present in it
Pathogen	: a disease-causing microbe
Vaccine	: a preparation of dead or weakened disease-causing microbes that provides immunity against a particular disease
Virion	: the non-living state of a virus

POINTS TO REMEMBER

- Microorganisms are found everywhere from the hottest desert to the coldest polar regions.
- Microorganisms are divided into five major groups – bacteria, fungi, protozoa, algae, and viruses.
- The uses of microorganisms can be broadly divided into following categories – commercial, medicinal, agricultural and environmental.
- The nitrogen fixing bacteria called rhizobium are found in the root nodules of leguminous plants such as gram, peas and beans.
- The cyclic process in which atmospheric nitrogen is fixed in the soil, used by plants and animals and later returned to the atmosphere as free nitrogen is called nitrogen cycle.
- Some microorganisms are harmful and cause diseases in animals, humans and plants.
- Malaria, cholera, typhoid, and common cold are some communicable diseases in human beings caused by microorganisms.
- Anthrax, bird flu and foot and mouth disease are some animal diseases caused by microorganisms.
- Citrus canker, rust of wheat and yellow vein mosaic of okra are some plant diseases caused by microorganisms.
- Bacteria, protozoa, viruses and other harmful microbes may contaminate food or water. Consumption of contaminated food or water leads to an illness called food poisoning.
- Some common methods used for preservation of foods are • Dehydration • Preservation by sugar, salt, oil or vinegar • Refrigeration and cooling • Canning • Using preservatives • Boiling • Pasteurization.

ASSESSMENT 2

A. Tick ✓ the correct option.

1. A microorganism which can neither be classified as living nor as non-living is
 virus fungi algae protozoa
2. Bacteria that are spherical in shape are called
 cocci bacilli spirilla vibrio
3. Microorganisms that can make their own food by photosynthesis are
 fungi algae bacteria viruses
4. Yeast is used for making
 sugar alcohol hydrochloric acid oxygen
5. A common carrier of communicable diseases is
 octopus housefly dragonfly spider
6. Production of alcoholic beverages such as wine and beer involves
 fermentation heating decomposition pasteurization
7. Citrus canker is a disease of
 humans plants animals none of these
8. A method of food preservation is
 fermentation vaccination antibiotics pasteurization

B. Fill in the blanks.

1. Blue-green algae can increase soil fertility by directly fixing _____ from atmosphere.
2. The study of microorganisms is known as _____.
3. A _____ reproduces only inside the cell of a host organism.
4. Curd is formed due to the chemical reaction between lactobacillus and _____.
5. Dough for making bread, cake and pastry is made soft and fluffy by adding _____.
6. A disease-causing microorganism is called _____.
7. _____ bacteria live in root nodules of leguminous plants.
8. _____ are the medicines that destroy diseases caused by harmful microorganisms.

C. State whether the following statements are True or False.

1. All microorganisms are harmful for living beings. _____
2. Food poisoning is caused by toxic substances getting mixed with food. _____
3. Yeast mixed in dough ferments sugar to produce oxygen gas. _____
4. The process of decomposition of sugar into alcohol is called fermentation. _____
5. Atmospheric nitrogen can be used directly by living organisms. _____
6. The female aedes mosquitoes act as carrier for the dengue virus. _____
7. Dehydration is the process of removing water or moisture from a food item. _____
8. Canning involves directly stuffing the food into air tight containers. _____

D. Answer each of the following questions in few sentences.

1. How do microorganisms help in cleaning the environment?
2. How are viruses different from other microorganisms?
3. Name three communicable diseases caused by microorganisms in animals and write their mode of transmission.
4. How do vaccines help in preventing diseases?
5. What causes food poisoning?
6. How do pathogens enter the body of a healthy person?
7. How do microorganisms survive in unfavourable conditions?

E. Answer each of the following questions in detail.

1. What are microorganisms? Write about the different groups of microorganisms.
2. Which microorganism is used to make bread soft and fluffy? Explain the process involved.
3. What is fermentation? Discuss how it is used in making alcoholic beverages.
4. Name the different ways in which communicable diseases are spread. Explain each way giving an example.
5. Explain how are microorganisms useful to us.
6. What is food preservation? Write about common methods used for preserving food.
7. Explain nitrogen cycle with the help of a diagram.



1. Why does drain water smell foul?
2. Why do mangoes rot but mango pickles do not?
3. Why does curd turn sour faster in summer than in winter?
4. Why should we wash our hands before eating food and after using toilet?
5. Why should antibiotics be taken only on the advice of a qualified doctor?

- Complete the crossword with the help of the clues given.



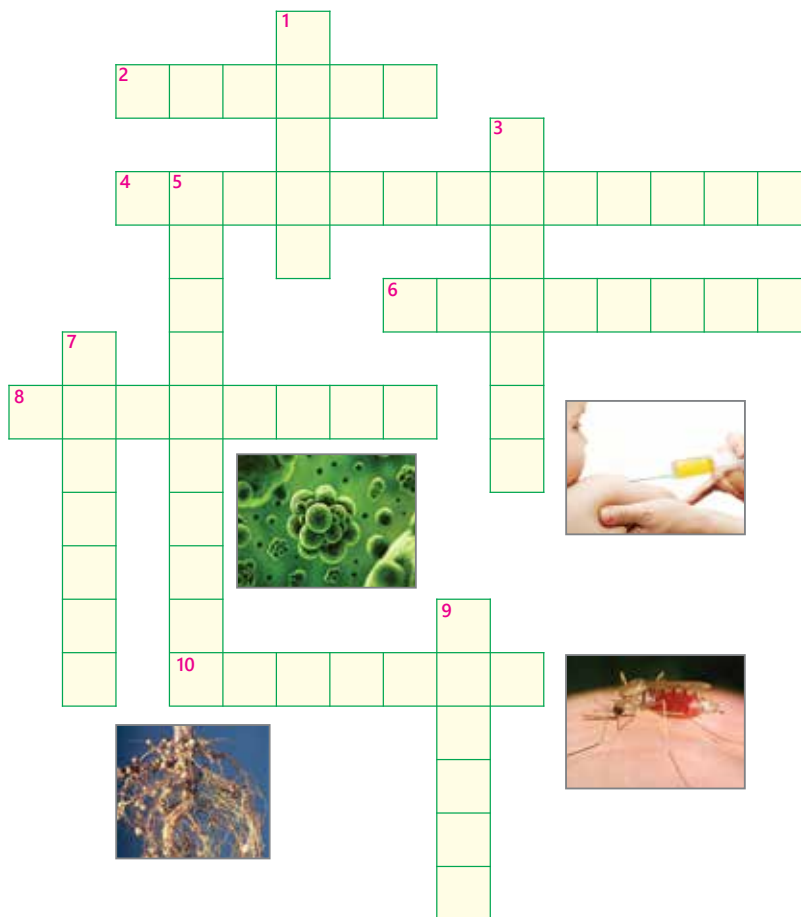
Clues :

Across :

2. Protein contained in milk and cheese.
4. Substances that control growth of microbes in food.
6. Minute organisms that are visible only through a microscope.
8. Disease causing microorganisms.
10. Disease transmitted by the female anopheles mosquito.

Down :

1. Fungus used to make bread, pastries and cakes.
3. Medicine that provides immunity against diseases.
5. Nitrogen fixing bacteria present in root nodules.
7. Organism that transmits a pathogen from an infected person to a healthy person.
9. Non-living state of a virus.



Group Discussion

- Microorganisms have lived on Earth much longer than human beings.

PROJECT IDEAS

- Prepare a bread mould at home. Moisten a piece of bread with water. Keep it for a few days. Observe the growth of mould. Scrap a small amount of the mould into a small polythene pouch. Observe it under a microscope in school.
- Find out details about the discoveries made by the following scientists in the field of microbiology.
 - (a) Louis Pasteur
 - (b) Alexander Fleming
 - (c) Edward Jenner

Synthetic Fibres and Plastics

Let us learn about

- Fibres – natural and synthetic
- Common synthetic fibres – rayon, nylon, polyester, acrylic
- Plastics – types and uses
- Plastics and environment

Clothes are made of different fabrics. Fabrics are made from different kinds of fibres. A **fibre** is a long thread or filament from which textile or cloth is made.

Fibres are mainly of two types – Natural Fibres and Synthetic Fibres.

Natural Fibres

Natural fibres are obtained either from plants or animals. Cotton, silk, wool, and jute are some examples of natural fibres.



Cotton fibre



Jute fibre

Synthetic Fibres

Synthetic fibres are man-made fibres produced from chemical substances. Nylon, polyester and rayon are some examples of synthetic fibres.



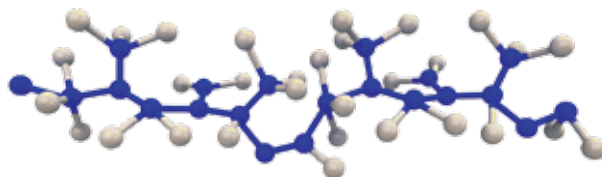
Rayon fibre

All fibres, natural or synthetic, are made up of special molecules called polymers.

Polymer

A woman usually wears a necklace of beads around her neck. In it, many beads are joined together to form a single beautiful necklace.

Similarly, small molecules of a substance are brought together to form a larger molecule. A **polymer** is a large molecule made up of many small molecules, called **monomers**, combined together chemically.



Polymer chain made of monomers

The process of combining small monomers to form a polymer is called **polymerisation**. All fibres are polymers of different substances. *For example*, cotton, a natural fibre, is formed of cellulose which is made up of long chains of glucose molecules.

Common Synthetic Fibres

Most synthetic fibres are produced in a chemical plant from the by-products of petroleum or natural gas. Synthetic fibres are available in wide variety which includes rayon, nylon, polyester, etc.

Let us study some synthetic fibres in detail.

Rayon

Rayon is produced from wood pulp. It is a synthetic fibre obtained from a naturally occurring polymer, **cellulose**. It is prepared by chemical treatment of wood pulp.

It has a silky texture and is also known as **artificial silk**.

Properties of Rayon

- It is soft, shiny and comfortable.
- It absorbs moisture and is preferred to other synthetic fabrics in summer.
- It is less expensive as compared to natural silk.
- It can easily be dyed in a variety of colours.

Uses of Rayon

- It is used in textile industry for making clothes such as shirts, skirts, hats, scarves, and socks.
- It is used in the manufacturing of tyre cord and surgical dressings.
- It is used in home furnishings such as curtains, carpets, sofa covers, and bed sheets.



Carpet

Nylon

Nylon is the first synthetic fibre prepared by man. It was first synthesized in 1931 by DuPont Company from coal, water and air. It is the most commonly used synthetic fibre.

Properties of Nylon

- It is strong, elastic and lightweight.
- It dries easily and does not require ironing.
- It is lustrous and its fibre does not lose strength even after repeated use.
- Its thread is stronger than a steel wire.
- It is not attacked by fungus, moth and chemicals.

Uses of Nylon

- It is used for making sarees, socks, neckties, and elastic hosiery.
- It is used in the manufacturing of parachutes, tent, climbing ropes, and cords.
- It is used in making bristles of brushes, fishing nets, curtains, sleeping bags, seat belts, etc.



Articles made from nylon

Polyester

Polyester is another well known synthetic fibre. It is a polymer of many ester units. Terylene is the most commonly used form of polyester. It can be blended and drawn into a very fine fibre which can be woven in order to make clothes.

Properties of Polyester

- It is lightweight, strong and elastic in nature.
- It is resistant to stretching and shrinking.
- It is resistant to wrinkles and easy to wash.
- It is resistant to moths.

Uses of Polyester

- It is used to make sarees, dress materials, curtains, etc.
- It is used to make polyester films (mylar) and magnetic recording tapes.
- It is used for making sails of sailboats.
- It can be blended with natural fibres such as cotton and wool to form polycot (terrycot) and polywool (terrywool) respectively.
- It is used for making conveyor belts and water hoses.



Sailboat

Acrylic

Acrylic fibres are synthetic fibres made from a polymer, polyacrylonitrile which closely resembles wool.

Properties of Acrylic

- It is lightweight, soft and warm with a wool-like touch.
- It is resistant to moths, chemical substances and oils.
- It is easy to wash and dries quickly.

Uses of Acrylic

- It is used to make warm clothes like shawls, sweaters and blankets.
- It is used to make furnishing fabrics and carpets.
- It is used to make craft yarn, awnings, boat sails, and vehicle covers.



Sweater

Advantages of Synthetic Fibres

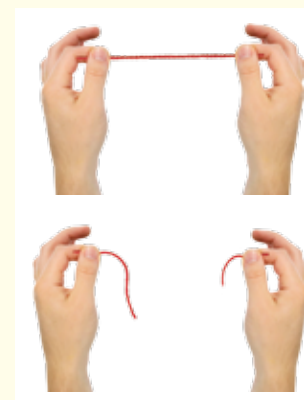
- They are stronger and have higher tensile strength than natural fibres.
- They are elastic and can be stretched easily.
- They are generally soft and comfortable.
- They do not wrinkle easily and are maintenance free.
- They do not retain water and dry quickly. Hence, they are called **drip-dry** fibres.
- They are generally less expensive as compared to natural fibres.

Learn More

Blended fibres are made by combining one or more types of fibres together. These fibres have different textures and properties from the component fibres. Fabrics made of blended fibres are more comfortable to wear, have a better fall and are more durable.

Activity 1

Aim	: To compare the tensile strength of natural and synthetic fibres.
Materials required	: Nylon, rayon, wool, and cotton threads of same length and thickness.
Procedure	: Try to break each thread one by one using your hands. Notice the difference in the force required to break each thread.
Observation	: Nylon and rayon threads require more force to break than wool and cotton threads.
Conclusion	: Synthetic fibres are stronger than natural fibres.



Disadvantages of Synthetic Fibres

- They do not absorb water or sweat and are uncomfortable to wear in hot and humid weather.
- They are non-biodegradable and cause pollution.
- They require very careful ironing as most of them melt very easily.
- They contain chemicals which may harm the skin.
- They catch fire quickly and stick to the body causing severe burns.

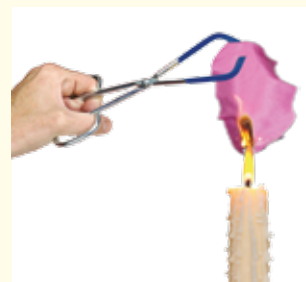
Activity 2

Aim : To observe the effect of burning of different fibres.

Materials required : Samples of cotton, wool, silk, polyester, rayon and acrylic, candle, matchbox, and a pair of tongs.

Procedure : Hold each piece of fabric one by one with a pair of tongs and put it over a burning candle till it catches fire.

Observation : The following table gives the list of effects of burning on different fibres.



Fibre	Inflame	Type of flame	Smoke/Smell	Residue
Cotton and rayon	Catches fire easily	Burns continuously with a bright yellow light	Burning paper	Soft dark ash
Silk and Wool	Does not catch fire easily	Burns slowly with yellow flame	Burning hair	Irregular hollow beads
Nylon, Polyester and Acrylic	Does not catch fire easily	Burns with spluttering, shrinks away from flame	No definite smell	Hard black beads

Plastics

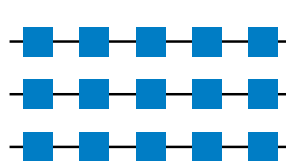
Plastics are synthetic materials that can be easily shaped and moulded into any form. Plastic is also a polymer like synthetic fibre. Different plastics get their properties from the way the polymer molecules are arranged in them.



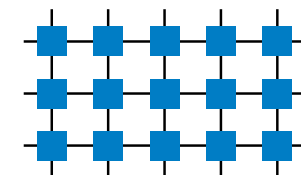
Articles made of plastic

Plastics are usually made by joining carbon and hydrogen atoms to create different molecules which are joined to form long chain polymers. Long linear chains of molecules that slide over each other easily make flexible

plastics. Cross-linked chains of molecules make rigid plastics. Most plastics are made from liquids extracted from crude oil.



Linear arrangement of molecules



Cross-linked arrangement of molecules

Types of Plastics

According to their behaviour on heating, plastics can be broadly classified into two categories – Thermoplastic and Thermosetting plastic.

Thermoplastic

A **thermoplastic** is a plastic that becomes soft and mouldable when hot and sets into a rigid form when cooled. It can be moulded repeatedly, after heating, into desired shapes and sizes. Polythene, PVC (polyvinyl chloride) and polystyrene are some examples of thermoplastics.

Thermosetting Plastic

A **thermosetting plastic** is a plastic which can be moulded into a desired shape only once. Once set, it cannot be remoulded again. It is comparatively harder and stronger than a thermoplastic. Bakelite and melamine are common examples of thermosetting plastics.

Properties of Plastics

Plastics have numerous properties that make them superior to other materials in many applications. Some common properties of plastics are :

Resistant to Chemicals

Plastics are resistant to chemicals and do not get corroded easily. They are used to make packages for storing chemicals.

Strength

Plastics are lightweight, strong and durable. They are slowly replacing metals in making parts of machines and bodies of objects like cars, washing machines, etc.

Thermal Conductivity

Plastics are insulators of heat. Thus, they are used for making dishes used in microwave oven and handles of cooking utensils. They are used as insulating materials in refrigerators and air conditioners.



Electrical Conductivity

Plastics are insulators of electricity. Thus, they are used as covering material for cords and wires, and for making bodies of electrical appliances.

Inexpensive

Plastics are less expensive than other materials like glass, wood and metal.

Uses of Common Plastics

Polythene, PVC, polystyrene, bakelite, melamine, teflon, and PET are some commonly used plastics.

Some of their uses are listed below :

- **Polythene** is commonly used for making grocery bags, toys, pipes, bottles, and packaging chemicals like acids, detergents and bleaches.
- **PVC (Polyvinyl Chloride)** is used in manufacturing of raincoats, plastic dolls, bathroom curtains, furniture, sanitary fittings, and insulation cover for cables and electric wires.
- **Polystyrene** is used for packing fragile objects like televisions and computers, making thermocol and insulating hollow walls of refrigerators and air conditioners.
- **Bakelite** is used for making electrical switches, plugs and handles of various utensils.
- **Melamine** is used for making kitchenware, floor tiles and fabrics. The fireman's uniform has a melamine coating to make it fire resistant.
- **Teflon** is used for making non-stick cooking utensils, washable paints and sanitary tapes.
- **PET (Polyethylene Terephthalate)** is used to make bottles, utensils, films, and wires.

Plastics and the Environment

Plastics were considered a boon but now they have become a curse for the society. Plastics are non-biodegradable substances. They do not get decomposed naturally.

There are several environmental and health hazards associated with the disposal of plastics and their products. Accumulation of

plastic waste is considered a serious problem because most of the methods used to dispose of plastics result in polluting the environment.



Littering of plastic waste

Littering of plastic waste in open spaces makes the environment unhygienic and ugly. Accumulation of plastic bags in pipelines causes blocking of the sewage systems.

Soil fertility is also affected as plastic wastes get mixed with soil but do not degrade into manure.

When plastics are burnt, they produce smoke and toxic gases which cause air pollution.

Animals feeding on garbage sometimes swallow plastic along with food which chokes them leading to their death. Plastic wastes

dumped in water bodies pose a threat to marine life as they cut off the supply of oxygen to aquatic plants and animals.

Our Responsibility towards the Environment

Each one of us is responsible for the hazards associated with the disposal of plastic wastes. Let us share our responsibility towards a clean environment by adopting the following practices :

- Dispose of biodegradable and non-biodegradable wastes separately, so that non-biodegradable waste can be recycled and reused.
- Never throw plastic garbage in public places and water bodies.
- Use bags made from paper, jute or cotton.
- Never burn plastic wastes in the open.

Learn More

Be a responsible citizen and develop environment friendly habits. Always follow the 4R's – Reduce, Reuse, Recycle, Recover.



WORD POWER

Biodegradable	: substances that can be decomposed by the action of microorganisms
Monomer	: a small molecule that can be bonded to other molecules of the same type to form a polymer
Natural fibres	: fibres obtained from either plants or animals
Non-biodegradable	: substances that can not be decomposed by the action of microorganisms
Plastics	: a synthetic material that can be moulded into a desired shape when soft and then hardened to produce a durable article
Polymer	: a large molecule formed by the combination of many smaller molecules of the same type
Polymerisation	: the process of chemically combining several monomers to form a polymer
Synthetic fibres	: man-made fibres produced from chemical substances
Thermoplastics	: plastics that can be remoulded by heating
Thermosetting plastics	: plastics that cannot be remoulded by heating

POINTS TO REMEMBER

- Fibres are thread from which cloth or fabric is made.
- Fibres are of two types – Natural fibres and Synthetic fibres.
- All fibres are polymers of different substances.
- Rayon is a synthetic fibre obtained from a naturally occurring polymer - cellulose. It is also known as artificial silk.
- Nylon is one of the most elastic and pure synthetic fibres.
- Polyester is a polymer of many ester units. It is lightweight, strong and elastic in nature.
- Acrylic fibres are synthetic fibres made from a polymer, polyacrylonitrile which closely resembles wool.
- Plastics can be classified as thermoplastic and thermosetting plastic based on their behaviour on heating.
- Commonly used plastics are polythene, PVC, polystyrene, bakelite, melamine, teflon and PET.
- Plastics have numerous properties that make them superior to other materials in many applications. Some of these properties are – resistance to chemicals, strength, poor conductivity of heat and electricity, and low cost.
- Plastics are non-biodegradable substances. Disposal of plastics leads to several environmental and health hazards.

ASSESSMENT 3

A. Tick the correct option.

1. A synthetic fibre among the following is

silk

nylon

cotton

wool

2. The fibre also known as artificial silk is

rayon

terylene

polyester

acrylic

3. Thermocol is a form of

PVC

polystyrene

bakelite

melamine

4. Plastic used for making non-stick cooking utensils is

teflon

terylene

bakelite

melamine

5. An example of thermosetting plastic is

polythene

bakelite

PVC

polystyrene

6. Plastics are

natural fibre

biodegradable substances

non-biodegradable substances

blended fibre

7. A synthetic fibre, which is a polymer of ester is

polyester

acrylic

nylon

rayon

B. Fill in the blanks.

1. A _____ is made of a number of monomers.
2. Plastics are _____ conductors of electricity.
3. _____ is often used as a substitute for wool.
4. Most of the synthetic fibres are obtained from _____.
5. Plastics that can be remoulded after heating are called _____.
6. _____ fibres require very careful ironing as they melt very easily.
7. _____ is a thermoplastic and _____ is a thermosetting plastic.

C. State whether the following statements are True or False.

1. Synthetic fibres are obtained from plants and animals. _____
2. Plastics release poisonous gases on burning. _____
3. Synthetic fibres are used for making clothes and other useful things. _____
4. Bakelite is a good conductor of heat and electricity. _____
5. Clothes made of synthetic fibres are suitable for wearing in summers. _____
6. Plastics corrode on coming in contact with air and water. _____
7. Man-made fibres produced from chemical substances are called natural fibres. _____

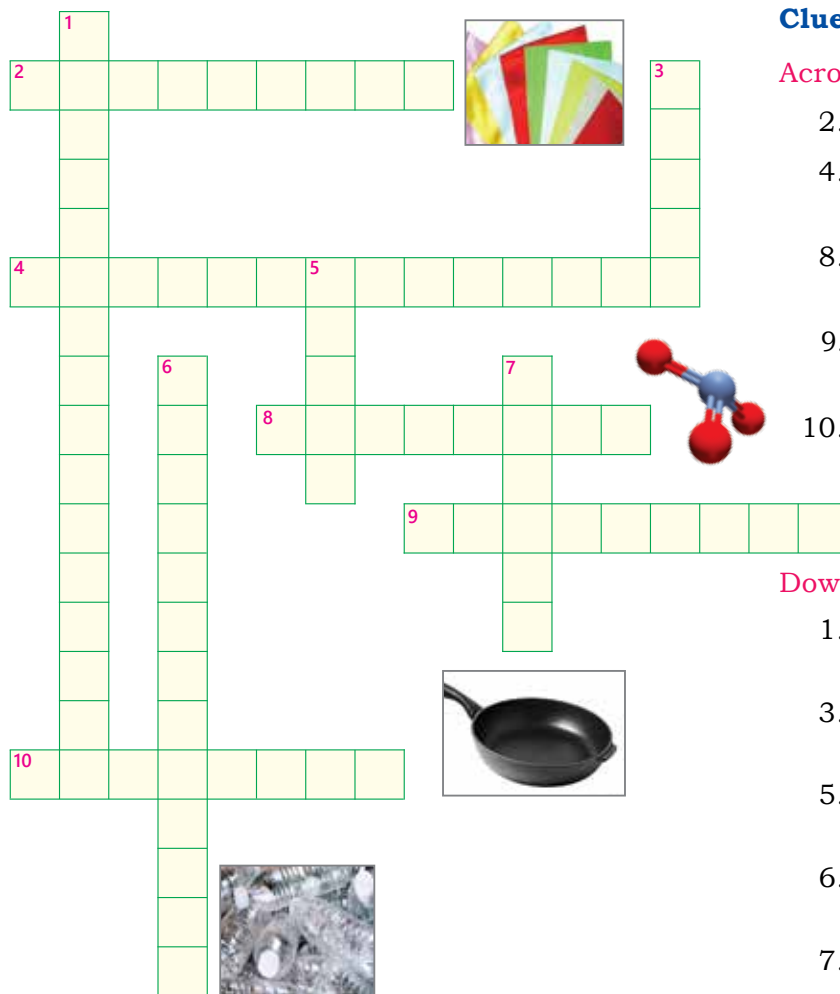
D. Answer each of the following questions in a few sentences.

1. Differentiate between a polymer and a monomer.
2. What is polymerisation?
3. What is polyester? Write two properties and two uses of it.
4. Why are clothes made from synthetic fibres not safe to be worn in kitchen?
5. Give three properties of plastics which make them superior over other materials.
6. Differentiate between thermosetting plastics and thermoplastics.

E. Answer each of the following questions in detail.

1. What are synthetic fibres? Write about the different types of synthetic fibres.
2. Write the advantages and disadvantages of synthetic fibres over natural fibres.
3. Explain why handles of cooking utensils, electric plugs and switches are made of thermosetting plastics.
4. Write two uses each of any four plastics.
5. What hazards do plastics pose to the environment?
6. What steps can be taken to limit the harmful effects of plastics on the environment?

- Complete the crossword with the help of the clues given.



Clues

Across:

2. A polymer of ester units.
4. Process of combining monomers into a polymer.
8. Molecules of same type which are combined to form polymer.
9. A naturally occurring polymer found in wood.
10. Plastic used to make a fireman's dress fire-proof.

Down:

1. Substances that do not get decomposed by microorganisms.
3. Synthetic fibre made from coal, water and air.
5. Synthetic fibre known as 'Artificial Silk'.
6. Plastic that can be remoulded after heating.
7. Plastic used for making non-stick utensils.



1. Why plastic containers are preferred over metallic containers for storing food?
2. Why would a person wearing a nylon shirt may suffer more severe burns than a person wearing a cotton shirt, in case of catching fire?
3. Why should we not wear clothes made of pure synthetic fibres?



Group Discussion

- Manufacturing synthetic fibres is actually a step towards conservation of forests.

PROJECT IDEAS

- Find about newer types of fibres being developed nowadays, including green fibres and biodegradable fibres.