3 Synthetic Fibres and Plastics

Lesson at a Glance

- **Fabrics** are made from fibres obtained from natural or artificial source.
- Jute, cotton, wool and silk are **natural fibres,** they are obtained from plants or animals. Nylon, rayon like fibres are **synthetic** or **man-made** fibres.
- **Polymers:** Man has made a very large number of compounds which may be moulded easily into things of different shapes and fibres. These substances are called **polymers.** A *polymer* is *an aggregated structure consisting of numerous small simple molecules of one or more kind called monomers.* Polymers are carbon compounds. **Cellulose** is *a natural polymer* occurring in the walls of plant cells. Its simple unit is *glucose. Starch* is also a *natural polymer* occurring in the walls of plant cells. Its simple unit is *glucose. Starch* is also a natural polymer occurring in grains, potatoes, etc. It is also made of glucose. Proteins of various kinds are also polymers, having amino acids as their monomers. *Silk* and *wool are made of long chain proteins* and so acquire special properties.

  Man-made common polymers are nylon, rayon, teflon, etc. They are all made by the action of heat and high pressure on the simple molecular **units**, forming a polymer made of many repeating units.
- **Types of Synthetic Fibres**
  - ➤ **Rayon or Artificial silk:** It is made from pure cotton or *wood pulp.* The fibres of rayon are long, smooth and shiny. It sheds dirt easily. It is a good conductor of heat and coal to wear. The *rayon fibres have properties similar to that of silk.* It can be cotton to make bed sheets or mixed with wool to make carpets.

➤ **Nylon:** Nylon is a fully synthetic polymer developed simultaneously in New York and London. (Name is derived from the names of these two cities.) It was prepared from *coal, water* and *air*. Its fibres resemble the silk fibre. Chemically nylon is a polyamide like that of natural silk but these fibres are strong, tough, hard and water resistant. Nylon is used for making ropes for rocks climbing, fishing nets, combs, brushes, raincoats, parachutes, etc.

➤ **Polyesters:** *Terrylene* and *Acrylic* are synthetic fibres called polyesters. The fibres of polyester are long and smooth. These fibres do not absorb stains and easy wash. They are used from making clothes, curtains and dress material (a popular polyester). **Terrylene** when blended with cotton is called *Terrycot* while with wool it gives *Terrywool*. Clothes made of such polymers are convenient to use. They are crease-proof and may be used as wash and wear clothes. They are not suitable in summer as they do not absorb water and do not allow the air to pass through.

➤ **Acrylic:** These are the synthetic fibres which resemble to natural wool. They are durable and affordable.

➤ All the synthetic fibres are prepared by a number of processes using *raw material of petroleum origin*, called **petrochemicals**.

- **Characteristic of Synthetic Fibres**

➤ **Advantages:** (*a*) They dry up quickly, and are *durable, less expensive,* readily available and easy to maintain.

(*b*) Synthetic fibres melt on heating.

➤ **Disadvantages:** If synthetic fibre clothes catch fire, they can melt and stick to the body of the person wearing it.

- **Plastics:** Plastics is also polymer like the synthetic fibre. All plastics do not have the same type of arrangement of units.
- Some plastic polymers have *linear* arrangement of units, whereas in others it is *cross-linked* arrangement.

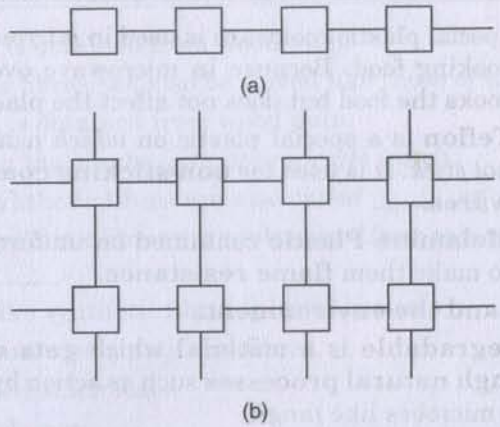

Fig. 3.1 (a) Linear (b) Cross-linked arrangement.

Plastic is easily mouldable, recycled, reused, coloured, melted, rolled into sheets or made into wires.

Polythene (poly + ethene) is a plastic which is used for making commonly used polythene bags.

- **Thermoplastics:** Plastics which get deformed easily on heating and can be bent easily are known as **Thermoplastics.** *Polythene* and *PVC* are some examples of thermoplastics. These are used for manufacturing toys, combs and various types of containers.
- **Thermosetting Plastics:** Plastics which when *moulded once, cannot be softened by heating* are called *Thermosetting plastics.* **Bakelite** and **Melamine** are the examples of Thermosetting plastics.

Bakelite is a *poor conductor of heat and light.* **Melamine** is *resistant to fire and can tolerate heat better than other plastics.*

- **Plastics as Materials of Choice**

Due to various qualities plastics are used in our everyday life.

➤ **Plastics are non-reactive.** They do not react with water, air and do not corrode easily. So they are used to store various materials, including many chemicals.

➤ **Plastics are light, strong and durable.** They are generally cheaper than metal. So they are widely used in industry and household articles.

➤ **Plastics are poor conductors of heat and electricity:**

— handles of *screw drivers* and handles of frying pans.

— special plastic cookware is used in *microwave ovens* for cooking food. Because in microwave ovens, the heat cooks the food but does not affect the plastic vessel.

— **Teflon** is a special plastic on *which water and oil do not stick.* It is used for **non-sticking coating on cook wares.**

— **Melamine Plastic** contained on uniforms of firemen to make them **flame resistance.**

- **Plastics and the environment:**
  - ➤ **Biodegradable** is a material which **gets decomposed through natural processes** such as action by *bacteria* and other microbes like *fungi.*
  - ➤ **Non-biodegradable** is a material which is not easily decomposed by natural processes.
- Plastics take several years to decompose, thus *cause environmental pollution.*

  Burning of synthetic materials releases lots of poisonous fumes into the atmosphere causing *air pollution.*

  So, *plastics* and *synthetic fibres* are **not environmental friendly.**
- **How can we reduce abuse of plastics?**
  - ➤ Avoid the use of plastics as far as possible.
  - ➤ Recycle plastic waste, especially *thermoplastics which can be recycled.*
  - ➤ Collect biodegradable and non-biodegradable wastes separately. The carelessly thrown polythene wrappers of food and bags may cause clogging of drains and choking respiratory system of animals like cows resulting in their death.
  - ➤ The best way is to follow 4R principle, namely, **Reduce, Reuse, Recycle** and **Recover.**

TEXTBOOK QUESTIONS SOLVED

Q. 1. *Explain why some fibres are called synthetic.*

Ans. Some fibres are called synthetic fibre because they do not occur in the nature.

Q. 2. *Tick (√) the correct answer.*

Rayon is different from synthetic fibres because:

(*a*) It has a silk-like appearance.

(*b*) It is obtained from wood pulp.

(*c*) Its fibres can also be woven like those of natural fibres.

Ans. (*b*) It is obtained from wood pulp.

Q. 3. *Fill in the blanks with appropriate words.*

(*a*) Synthetic fibres are also called _____ or _____ fibres.

(*b*) Synthetic fibres are synthesised from raw material called _____.

(*c*) Like synthetic fibres, plastic is also a _____.

Ans. (*a*) man-made, artificial fibres.

(*b*) Petrochemicals.

(*c*) Polymer.

Q. 4. *Give examples which indicate that nylon fibres are very strong.*

Ans. Nylon fibres are strong so they are used for making parachutes and ropes for rock climbing.

Q. 5. *Explain why plastic containers are favoured for storing food.*

Ans. Advantages of plastic containers:

(*a*) Plastics do not react with food items.

(*b*) Plastics are strong and light.

(*c*) They are easy to handle and safe.

Q. 6. *Explain the differences between thermoplastics and thermosetting plastics.*

Ans. Differences:

Thermoplastics	***Thermosetting plastics***
(*i*) These are the plastics which get deformed easily on heating and can be bent easily. Examples: Polythene and PVC.	(*i*) These are the plastics which when moulded once, cannot be softened by heating. Examples: Bakelite and Melamine.
(*ii*) These are used for manufacturing toys, combs, car grills and various types of containers.	(*ii*) (*a*) Bakelites are used for making electrical switches, handles of various utensils etc. (*b*) Melamines are used for making floor tiles, kitchen-wares and fabrics, which resist fire.

Q. 7. *Explain why the following are made of thermosetting plastics.*

(a) Saucepan handles

(b) Electric plugs/switches/plug boards

Ans. (a) The handles of saucepan are made of thermosetting plastic because it is a bad conductor of heat and do not get heated up while cooking.

(b) Electric plugs/switches/plug boards are made up of thermosetting plastic, because it is a bad conductor of electricity. The electric current does not pass through such plastics.

Q. 8. *Categorise the materials of the following products into 'can be recycled' and 'cannot be recycled'.*

Telephone instruments, plastic toys, cooker handles, carry bags, ball point pens, plastic bowls, plastic covering on electrical wires, plastic chairs, electrical switches.

Ans. **Can be recycled:** Toys, carry bags, plastic bowls, ball point pen, plastic chairs, electric wire covering.

Cannot be recycled: cooker handles, electric switches, telephone instruments.

Q. 9. *Rana wants to buy shirts for summer. Should he buy cotton shirts or shirts made from synthetic material? Advise Rana, giving your reason.*

Ans. Rana should buy cotton shirts for summer because cotton is a bad conductor of heat. It does not allow the transmission of heat from or to the body, thus protects body from heat. It has more capacity to hold moisture than the synthetic clothes. So, it retains the sweat of the body and keeps it cool. So Rana should buy cotton shirts.

Q. 10. *Give examples to show that plastics are noncorrosive in nature.*

Ans. Plastics are noncorrosive in nature:

(*i*) They do not react with any substances.

(*ii*) Plastics do not react with air and water which are essential for corrosion.

(*iii*) They do not show any chemical reaction.

Q. 11. *Should the handle and bristles of a tooth brush be made of the same materials? Explain your answer.*

Ans. No, handle and bristle of a tooth brush should not be made of the same material because the handle should be hard while bristle should be made of the soft materials. Bristle should be soft so that it does not harm the gum of teeth.

The handle gives the firm grip so it should be made of hard material.

Q. 12. *'Avoid plastics as far as possible'. Comment on this advice.*

Ans. Avoid the use of plastics as far as possible. Plastics are non-biodegradable materials. So use of plastics is harmful for our environment. The plastics cannot be finally disposed off. Thus, plastics should be avoided as far as possible.

Q. 13. *Match the terms of Column A correctly with the phrases given in Column B.*

Column A	***Column B***
(*i*) Polyester	(*a*) Prepared by using wood pulp
(*ii*) Teflon	(*b*) Used for making parachutes and stockings
(*iii*) Rayon	(*c*) Used to make non-stick cookwares
(*iv*) Nylon	(*d*) Fabrics do not wrinkle easily

Ans.

Column A	**Column B**
(*i*) Polyester	(*d*) Fabrics do not wrinkle easily
(*ii*) Teflon	(*c*) Used to make non-stick cookwares
(*iii*) Rayon	(*a*) Prepared by using wood pulp
(*iv*) Nylon	(*b*) Used for making parachutes and stockings

Q. 14. *'Manufacturing synthetic fibers is actually helping conservation of forests'. Comment.*

Ans. The natural fibres required the raw materials from plants and animals. So they lead cutting of trees and killing of animals. Synthetic fibres are made up of chemicals and these chemicals are not available in forests. So manufacturing synthetic fibres is actually helping conservation of forests.

Q. 15. *Describe an activity to show that thermoplastic is a poor conductor of electricity.*

Ans. Observe the electrical wires. These wires have plastic covering which show that plastics are poor conductors. The handles of screw drivers are made of plastics. These observations show that thermoplastic is a poor conductor of electricity.