

5 Synthetic Materials

Answers to Exercises

- A.
1. A polymer is a substance formed by many small units, called monomers, combining end to end.
 2. The process by which monomers combine end-to-end to form a polymer is called polymerisation.
 3. Viscose rayon, cuprammonium rayon and acetate rayon are the three types of rayon.
 4. Apart from making clothes, synthetic fibres are used for making bedspreads, curtains, bandages, mosquito nets, insulation for electric wires, etc.
 5. Plastics are synthetic materials that can be moulded into a permanent shape.
 6. The polymer used in bubblegums is poly(styrene-butadiene), in Thermocol it is polystyrene, and in synthetic erasers, it is vinyl rubber.
 7. Three polymers that can be obtained by using chemicals derived from natural gas are polythene, acrylics and bakelite.
 8. The pulling stress required to break a material is called its tensile strength. The greater the tensile strength of a fibre, the greater is the load its yarn can bear.
 9. (a) Natural fibres are hydrophilic, i.e., they absorb moisture.
(b) Synthetic fibres are hydrophobic, i.e., they repel moisture.

- B.
1. Acrylic fibres decompose without melting. So, they are dissolved in a suitable solvent and the solution is forced through spinnerets to obtain filaments. The filaments can be cut into staples and the staples spun into yarns.
 2. Thermoplastics retain their plasticity even after repeated heating and cooling. So they can be moulded over and over again. But thermosetting plastics, once set after being melted, cannot be moulded again.
 3. Acetylene is used for making polythene, polyvinyl chloride (PVC), and acrylics. Propylene is used to make polypropylene (a plastic). Of these, polythene is used to make packaging materials, bottles, etc., and PVC is used to make pipes and insulation.

- C.
1. Polymers are classified into three types—natural, semisynthetic and synthetic. Many substances in living organisms are polymers. Cellulose, a polymer of glucose, is a natural polymer. Semisynthetic polymers, like rayons, are made by using natural polymers as the starting material. Purely synthetic polymers are made from chemicals. The chemical raw materials used to manufacture synthetic polymers are obtained directly or indirectly from natural gas and petroleum.

Natural gas contains mainly methane. Methane can be converted into acetylene and formaldehyde. Acetylene is used for making polythene, polyvinyl chloride (PVC), and acrylics, while formaldehyde is used for making bakelite.

By the fractional distillation of petroleum and cracking of the fractions, we get acetylene, propylene, benzene, naphthalene, etc. Propylene is used to make polypropylene (a plastic). Benzene is used for making nylon. Naphthalene is converted into phthalic acid, which is used for making polyester.

2. Advantages

- (i) Synthetic fibres do not depend either on an agricultural crop as cotton, flax and jute do, or on animal farming as silk and wool do.
- (ii) They are much stronger and hence more durable than natural fibres.
- (iii) They are not easily acted upon by moisture, chemicals or bacteria.

Disadvantages

- (i) Synthetic fibres do not absorb water easily. So clothes made of such fibres are not comfortable to wear.
- (ii) Synthetic fibres melt before burning. So clothes made of such fibres stick to the skin when they come in contact with a flame, causing burns.
- (iii) Some electrical charges accumulate on synthetic fibres due to which they cling together as well as to the skin. The electrical charges irritate the skin.

3. The greater the tensile strength of a fibre, the greater is the load its yarn can bear. In respect of fibres, tensile strength is expressed in g/tex, where tex is the mass in grams of 1000 m of the fibre or its yarn. The tensile strengths of different fibres can be compared in the following way. Tie one end of a cotton thread to a hook fixed to a rigid body and the other end to a pan of a balance. Put some weights on the pan and increase the weight in small steps, till the thread breaks. Note the total weight, including that of the pan, required to break the thread. Repeat the activity with other kinds of fibres, e.g., wool, silk, nylon and polyester, of similar thickness and the same length. The different weights required to break the threads will give comparative values of their tensile strength.

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| D. | 1. Acrylic | 2. block | 3. nondegradable | 4. harmful | 5. higher | 6. melt |
| E. | 1. (c) | 2. (a) | 3. (d) | 4. (c) | 5. (a) | |
| F. | (a) (v) | (b) (iv) | (c) (i) | (d) (ii) | (e) (iii) | |