TALENT & OLYMPIAD

Synthetic Fibres and Plastics

Fibres

Fibres are fine hairlike structure of animal, vegetable, mineral or synthetic origin. Commercially available fibres have diameters ranging from less than 0.004 mm (0.00015 in) to 0.2 mm (0.008 in) and they come in several different forms: short fibres (known as staple or chopped), continuous single fibres (monofilament), untwisted bundles of continuous filaments (tow), and twisted bundles of continuous filaments (yarn). Fibres are classified according to their origin, chemical structure or both.

Animal Fibres

All animal fibres are complex proteins. They are resistant to most organic acids and to certain powerful mineral acids such as sulphuric acid (H₂SO₄). However, protein fibres are damaged by mild alkalies (basic substances) and may be dissolved in strong alkalies such as sodium hydroxide (NaOH).



Vegetable Fibres

Vegetable fibres are predominantly cellulose, which, unlike the protein of animal fibres, resists alkalies. Vegetable fibres resist most organic acids but are destroyed by strong mineral acids. Improper use of most bleaches can also weaken or destroy these fibres.



There are four major types of vegetable fibres: seed fibres, which are the soft hairs that surround the seeds of certain plants; bast fibres, the tough fibres that grow between the bark and stem of many dicotyledonous plants; vascular fibres, the tough fibres found in the leaves and stems of mono-cotyledons; and grass-stem fibres. Other fibre types, of limited utility, include strips of leaf skins, such as raffia; the fibre of fruit cases, such as coir; and palm fibres.

*

Mineral Fibres

Glass, which is made from silica sand, is the only inorganic (mineral) fibre widely used in commercial applications. There are two main forms of glass fibres: continuous and staple. Continuous glass fibre, which is made by drawing molten glass into threads, is used in textile materials. The use of air, steam, or gas to disrupt the flow of the molten glass stream produces staple fibres. These fibres can be fabricated into mats

or into bulk-molding and sheet-molding compounds with the use of resins, or organic binders. Quartz mineral is high silica, high-purity glass that is good for long-term use at temperatures as high as 1400° C (2552° F).



Synthetic Fibres

Synthetic fibres derived from natural cellulose were first developed at the end of the 19th century and became known as rayons. In a typical rayon-making process/natural cellulose made from wood pulp is treated with chemicals to form a thick liquid. This liquid is then extruded as filaments into a weak acid bath that converts the filaments back into pure cellulose. Rayons are not, therefore, completely synthetic but are actually regenerated fibres.



\diamond

Plastics

Plastics, materials made up of large, organic (carbon-containing) molecules that can be formed into a variety of products. The molecules that compose plastics are long carbon chains give plastics many of their useful properties. In general, materials that are made up of long, chain like molecules are called polymers. Plastics can be made hard as stone, strong as steel, transparent as glass, light as wood, and elastic as rubber. Plastics are also lightweight, waterproof, chemical resistant, and produced in almost any colour. More than 50 families of plastics have been produced, and new types are currently under development.

Uses of Plastics

Plastics are indispensable to our modern way of life. The cars we drive, the computers we use, the utensils we cook with, the recreational equipment we play with, and the houses and buildings we live and work in all include important plastic components. The average car contains almost 136 kg (almost 300 lb) of plastics nearly 12 percent of the vehicle's overall weight. Telephones, textiles, compact discs, paints, plumbing fixtures, boats, and furniture are other domestic products made of plastics. In 1979 the volume of plastics produced in the United States surpassed the volume of domestically produced steel. Plastics are used extensively by many key industries, including the automobile, aerospace, construction, packaging, and electrical industries. The aerospace industry uses plastics to make strategic military parts for missiles, rockets, and aircraft. Plastics are also used in specialized fields, such as the health industry, to make medical instruments, dental fillings, optical lenses, and biocompatible joints.

Types of Plastics

A wide variety of both thermoplastics and thermosetting plastics are manufactured. These plastics have a spectrum of properties that are derived from their chemical compositions. As a result, manufactured plastics can be used in applications ranging from contact lenses to jet body components. Thermoplastics: Thermoplastic materials are in high demand because they can be repeatedly softened and remolded. The most commonly manufactured thermoplastics are presented in this section in order of decreasing volume of production.

Polyethylene: Polyethylene (PE) resins are milky white, translucent substances derived from ethylene. Polyethylene is made in low- and high-density forms. Low-density polyethylene (LDPE) has a density ranging from 0.91 to 0.93 g / cu.cm (0.60 to 0.61 oz/cu in). LDPE is the most widely used of all plastics, because it is inexpensive, flexible, extremely tough, and chemical-resistant. LDPE is molded into bottles, garment bags, frozen food packages, and plastic toys.



High-density polyethylene (HDPE) has a density that ranges from 0.94 to 0.97 g/cu.cm (0.62 to 0.64 oz/cu in). HDPE is stiffer, stronger, and less translucent than low-density polyethylene. HDPE is molded into grocery bags, car fuel tanks, packaging, and piping.

Polyvinyl Chloride: Polyvinyl chloride (PVC) is prepared from the organic compound vinyl chloride. PVC is the most widely used of the amorphous plastics. PVC is lightweight, durable, and waterproof. Chlorine atoms bonded to the carbon backbone of its molecules give PVC its hard and flame-resistant properties.



In its rigid form, PVC is weather-resistant and is extruded into pipe, house siding, and gutters. Rigid PVC is also blown into clear bottles and is used to form other consumer products, including compact discs and computer casings.





A very thin, threadlike strand from which clothe is made, is known as:(a) Fibres(b) Yarns(c) Plastics(d) Fabrics

(e) None of these **Answer: (a)**



Which one of the following is a man made fibre?

(a) Cotton

(b) Jute (d) Nylon

(c) Rayon (e) None of these

Answer: (c)

SUMMARY



- Fibers are hairlike structure of animal, vegetable, mineral or synthetic origin.
- Animal fibres are resistant to most organic acid.
- Synthetic fibres are produced from chemical substances.
- Rayon is a man-made fibre prepared from cellulose
- Thermoplastics can be repeatedly softened and remolded.

Self Evaluation TEST



Which one of the following is a natural fiber? 1.

(a) Rayon

- (b) Cotton
- (c) Polyester (d) Nylon
- (e) None of these

2. Which one of the following is a synthetic fiber?

- (a) Jute
- (c) Acrylic
- (e) Both (b) and (c)

Which one of the following synthetic fibres is obtained from wood pulp? 3.

(a) Rayon

(b) Nylon (d) Acrylic

(b) Nylon

(d) Both (a) and (b)

- (c) Polyester
- (e) None of these

4. Which one of the following not correct about plastics?

- (a) Plastics can be moulded into different shapes
- (b) Plastics are good conductor of heat and electricity
- (c) Plastics are chemically unreactive
- (d) Plastics are light, strong and durable
- (e) None of these

Which one of the following statements is correct? 5.

Statement 1: Polywool is a mixture of polyester and wool Statement 2: Polycot is a mixture of polyester and cotton

(a) Statement 1

- (b) Statement 2
- (c) Both statements are correct
- (d) Both statements are incorrect.

6. Which one of the following is correct about nylon fibers?

- (a) Nylon fibres are very strong
- (b) Nylon fibres absorbs very little water (d) All of these
- (c) Nylon fibres are fairly elastic
- (e) None of these

7.	Which one of the following statements is correct? Statement 1: Terylene is a popular fiber									
	Statement 2: Polyester fabric is wrinkle resistant									
	(a) Statement 1	(b) Statement 2								
	(c) Both statements are correct	(d) Both statements are incorrect.								
8.	Which one of the following is an example of thermoplastic?									
	(a) Polythene	(b) Polyvinyl chloride								
	(c) Melamine	(d) Both(a)and B								
	(e) Both (b) and (c)									
9.	Which one of the following statements is correct?									
	Statement 1: Plastics are also polymers									
	Statement 2: Bakelite is a very hard plastic									
	(a) Statement 1	(b) Statement 2								
	(c) Both statements are correct	(d) Both statements are incorrect.								
10	Which one of the following is a fire-resistant plastic?									
	(a) Polythene	(b) Polyvenyl chlorode								
	(c) Melamine	(d) Bakelite								
	(e) None of these	(d) butche								

Answers – Self Evaluation Test																		
1.	В	2.	Е	3.	А	4.	В	5.	С	6.	D	7.	С	8.	D	9.	С	10. C