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Chapter

1

SYNTHETIC FIBRES AND PLASTICS

INTRODUCTION

You have read in your previous classes that natural fibres like cotton, wool, silk, etc., are obtained from plants or animals. The synthetic fibres, on the other hand, are made by human beings. That is why these are called synthetic or man-made fibres. Man-made fibres are spun and woven into a huge number of consumer and industrial products, including garments such as shirts, scarves, and hosiery; home furnishings such as upholstery, carpets, and drapes; and industrial parts such as tire cord, flame-proof linings, and drive belts. The chemical compounds from which man-made fibres are produced are known as polymers. Many of the polymers that constitute man-made fibres are the same as or similar to compounds that make up plastics, rubbers, adhesives, and surface coatings. Indeed, polymers such as regenerated cellulose, polycaprolactam, and polyethylene terephthalate, which have become familiar household materials under the trade names rayon, nylon, and Dacron (trademark), respectively.

MAN MADE MATERIALS

Synthetic fibres and plastics consist of polymers. Normally the things you observe around you in your routine life are made of polymers, like shirts, jeans and clothing are made up of synthetic fabrics and kids playing toys, cable wires etc are made up of plastics. A **polymer** is a large molecule of high molecular mass formed by the repetitive bonding of many small molecules called monomers. The process by which the monomers are transformed into polymers is called **polymerisation**. As polymers are single big size molecules, they are also called **macromolecules**.

Classification of polymers on the basis of source:

- (a) **Natural polymers:** Proteins, cellulose, starch, resins and rubber.
- (b) **Semi-synthetic polymers:** Cellulose derivatives as cellulose acetate (rayon) and cellulose nitrate, etc.
- (c) **Synthetic polymers:** Plastic (polythene), synthetic fibres (nylon 6, 6) and synthetic rubbers (Buna – S).

As you have already studied about natural fibres (cotton, silk, wool, etc.) and their processing in earlier classes. Now we will discuss about synthetic fibres in detail.

SYNTHETIC FIBRES

Fibres which are man made and manufactured artificially from chemicals are called synthetic fibres.

A few commonly used synthetic fibres are rayon, nylon and polyester (terylene).

Characteristics of Synthetic Fibres

Clothes made from synthetic fibres are stronger and do not wrinkle easily. They also dry easily. But they have less air spaces in them than natural fibres and do not 'breathe' so well. They also cannot absorb sweat. These properties make them unsuitable for hot and humid weather.

Advantages of Synthetic Fibres:

- (i) They are tough and durable.
- (ii) They are water-resistant and easy to dry.
- (iii) They do not bleed colour when washed.
- (iv) Unlike natural fibres, they do not shrink on washing.
- (v) They do not wrinkle as they retain crease longer.
- (vi) They trap the heat in our body.
- (vii) They make us sweat.
- (viii) They are not very comfortable.

Disadvantages of Synthetic Fibres

A big disadvantage of synthetic fibres is that they melt on heating. If the cloths catch fire, it can be disastrous. They contain chemicals which may harm our skin. Another disadvantage is that the clothes made of synthetic fibres are not suitable to wear during hot summer weather.

RAYON

Rayon is first man-made fibre which was developed in France in 1884 to offer a cheaper alternative to silk textiles. Rayon resembles silk in appearance. Hence it is also known as artificial silk. It is produced from natural cellulose by its chemical treatment. The cellulose required for making rayon is obtained from wood pulp.

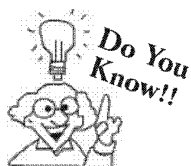
Wood pulp is first dissolved in an alkaline solution. The thick liquid produced is then passed through tiny holes of a metal cylinder which is known as spinneret to make fibres. The fibres are hardened by passing them into a bath of sulphuric acid. The fibres are then spun into yarn and woven into cloth.

Properties of Rayon

- (i) Low warmth, good to drape, not durable, creases easily and needs ironing.
- (ii) Rayon fibre has the same comfort property as natural fibres.
- (iii) Rayon can easily be dyed in variety of colours.
- (iv) Usual rayon fibres **recommended care** for dry cleaning purpose only.
- (v) Rayon fabrics are soft, smooth, cool, comfortable, and highly absorbent, but they do not insulate body heat, making them ideal for use in hot and humid climates.

Uses of Rayon

- (i) It is the most commonly used semi-synthetic fibre and is used in:
Textile industry for making textiles (fabrics)
 - Manufacture of tyres
 - Medical field for making *bandages* and *surgical dressing*.
- (ii) Rayon's thin fibres have ability to allow clothing to breathe more than other fabrics, which makes it a good choice for the design of sports wear and sundresses that are expected to provide coolness and comfort.
- (iii) Rayon when mixed with wool is used to make carpets.



Rayon was originally called artificial silk but now the name rayon is given to all fibres obtained by chemical treatment of cellulose. Thus, artificial silk is a polysaccharide i.e., cellulose derivative.

NYLON

It is the first man made completely synthetic fibre. First introduced by Wallace Carotters on 28th February 1935. The chemical compounds used in making nylon are now obtained from petroleum products called petrochemicals. Actually, nylon is made up of repeating units of a chemical called an amide. So, nylon is a polyamide. Nylon is a thermoplastic polymer. It was made simultaneously in New York (NY) and London (LON) thus it has derived the name NYLON.

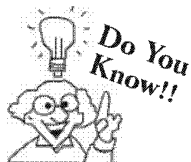
Properties of Nylon

- (i) It possesses good strength. Nylon is a very strong but light weight material. Its strength does not lost with age.
- (ii) It possesses good elasticity. It stretches but also regains its original shape easily.
- (iii) It is moth and alkali resistant
- (iv) It is inert to many chemicals and solvents
- (v) It is wrinkle resistant
- (vi) Nylon fibres absorb very little water. So nylon clothes are very easy to wash and dry.
- (vii) Nylon fabrics has low resistance to sunlight.

Uses of Nylon

It is used for making

- (i) fishing nets, car seat belts, strings for sports rackets etc
- (ii) ropes used for mountaineering parachute fibres, tyre cords etc.
- (iii) machine parts in form of plastics.
- (iv) material in dress socks, swim wear, shorts, track pants, active wear, wind breakers, draperies and bedspreads.
- (v) carpets, textile fibres, bristles for brushes, track suits, combat uniforms, swim wears and women stockings.
- (vi) a substitute for metals in ball bearings and gears.



High temperatures are able to melt nylon. Because of this fact, when ironing items made of nylon you should set your iron at a low setting and turn the item over onto the wrong side.

CHECK Point

Nylon is natural or synthetic fibre ?

SOLUTION

Nylon is a polyamide which are natural but nylon is a man made fibre.

POLYESTERS

It is a general name for synthetic fibres that contain many ester groups. Alcohols and organic acids react together to make compounds called esters which polymerises to form polyesters.

Terylene or Dacron is the best example. The chemical compounds used in making polyester fibres are made from petroleum products called petrochemicals. Like nylon polyester is also a thermoplastic polymer.

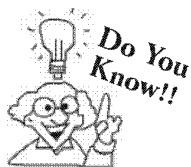
Polyster blended with cotton and wool are called polycot and polywool respectively. Polycot contain 55% polyesters and 45% wool.

Properties of Polyester

- (i) Polyester fabrics and fibres are extremely strong.
- (ii) Polyester is very durable; resistant to most chemicals, wrinkle resistant, mildew and abrasion resistant.
- (iii) Polyester is hydrophobic in nature and quick drying. It can be used for insulation by manufacturing hollow fibres.
- (iv) Polyester retains its shape and hence is good for making outdoor **clothing** for harsh climates.

Uses of Polyester

- (i) It is used for making shirts, trousers, sarees, and other dress materials.
- (ii) It is used for making sails for sailing boats.
- (iii) It is used for making fire-hoses and conveyer belts.
- (iv) Due to its strength and tenacity polyester was also used to make ropes in industries
- (v) Now a days PET bottles are one of the most popular uses of polyester
- (vi) Polyester is also used for making nets, thread, raincoats, jackets, clothing and medical textiles.



Among synthetic fibres the polyesters, are most widely used. They account for about one-half of all synthetic fibres.

ACRYLIC

Acrylic is a synthetic fibre. This is made from a chemical called 'acrylonitrile' through Polymerisation. **Acrylic** is a commonly used clothing material. It is light weight, soft and warm, has a wool-like feel, can be easily dyed, does not shrink or wrinkle and also insect resistant.

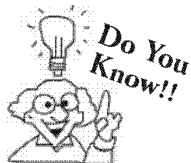
It is easy to maintain and is often used as an alternative to expensive woolen fabrics like cashmere. It tends to form fuzz and is not as pure wool.

Properties of Acrylic

- (i) It is more flexible and shock resistant than glass.
- (ii) It is abrasion resistant and resistant to UV and chemical damage.
- (iii) Acrylic can transmit or filter ultraviolet light and is easily cleaned.
- (iv) It is easily cut, corrosion resistant and a good insulator.

Uses of Acrylic

The application of acrylic include; windows, aircraft canopies, automobile tail lights, hobby crafts, sunscreens, lighting fixtures, **furniture**; table tops, sign boards, decorating panels, windshields, camera lenses, aquariums, toys, incubators, appliances and security shields.



Acryline is extremely strong. If it breaks or gets damaged, it will not shatter.

PLASTICS

A **plastic** is a synthetic material, which can be moulded or set into any desired shape when soft, and then harden to produce articles. Some plastic have linear and some have cross links. They are usually synthetic, most commonly derived from petrochemicals, but many are partially natural.

The first man-made plastic was created by Alexander Parkes who publicly demonstrated it at the 1862 in Great International Exhibition in London.

Plastic is an organic material of high molecular weight with specific properties. Most of the plastics are polymers having long chains.

Classification of Plastics

Plastics can be broadly classified as :

(i) Thermoplastic and (ii) Thermosetting Plastics.

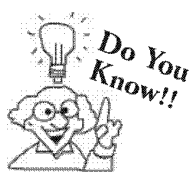
(i) **Thermoplastic material** : A plastic material that can be melted repeatedly by heating and can be moulded again and again into different shapes is called **thermoplastic material**.

A **thermoplastic material** becomes soft on heating and hard on cooling. These plastics can be moulded into toys, beads, buckets, telephone and television cases. Examples of thermoplastics are polythene, polyvinyl chloride (PVC) and polystyrene. Shower curtains, and pipes are most often made of PVC.

(ii) **Thermosetting Plastics** : A plastic substance, which once set, does not soften on heating is known as thermosetting plastic. A **thermosetting plastic** can be used only once. They are used in a situation where resistance to heat is important. Examples of thermosetting plastics are bakelite, melamine and urea formaldehyde resin. They are used in a situation where resistance to heat is important.

Differences between Thermoplastics and Thermosetting Plastics

Property	Thermoplastics	Thermosetting Plastics
1. Effect of heat	Soften at 70°C to 90°C	Do not soften easily
2. Strength	Comparatively weaker	Comparatively stronger
3. Reusability	Can be reused after melting	Can not be remelted or reused.
4. Flexibility	They are flexible	They are hard and rigid.



Plasticizers are non volatile liquids which are added to a polymer such as PVC to make it soft and readily workable on heating.

Knowledge ENHANCER

As polymeric chains in the thermosetting plastic form cross links, this in turn prevents the plastic from melting once heated after initial forming and cooling. If you again heat it a lot it would burn, not melt. So using it in a kettle is good because it won't rust, it is electrically safe and it won't go soft and floppy when hot. Whereas thermoplastics possesses intermolecular forces this property allows thermoplastics to be remolded because the intermolecular interactions spontaneously reform upon cooling.

Applications of Some Routine Thermoplastic and Thermosetting Materials

Name of plastic	Type of plastic	Uses of plastic
1. (a) LDPE (Low density polyethene)	Thermoplastic	It is used in insulation of electricity carrying wires and manufacture of squeeze bottles, toys, flexible pipes (it is chemically inert, tough, flexible and poor conductor of electricity)
(b) HDPE (High density polyethene)	Thermoplastic	It is used for making buckets, dustbins, bottles, pipes, etc. (it is comparatively more chemically inert, tougher and harder)
2. Polytetrafluoro ethene (Teflon)	Thermoplastic	It is used in making oil seals and gaskets and also used for non-stick surface coated utensils as it is chemically inert and resistant to attack by corrosive reagents.
3. Polyacrylonitrile (PAN)	Thermoplastic	It is used as a substitute for wool in making commercial fibres as orlon or acrilan.
4. Polyproprene	Thermoplastic	It is used in manufacture of ropes, toys, pipes, fibres, etc.
5. Polystyrene	Thermoplastic	It is used as an insulator, wrapping material in manufacture of toys, radio and television cabinets.
6. Polyvinyl chloride (PVC)	Thermoplastic	It is used in manufacture of rain coats, hand bags, vinyl flooring, water pipes, etc.
7. Bakelite	Thermosetting	It is used in making combs, phonograph records, electrical switches and handles of various utensils, etc.
8. Melamine	Thermosetting	It is used in manufacture of unbreakable crockery



idea box

Visit your nearby market with your friends. Go to various shops which have plastic or plastic containing objects. Make a list of those objects and observe them carefully. Now discuss with your friends and make a list of objects which can be remoulded or reused.

CHECK Point

Why thermosetting plastics can not be remelted or reused ?

SOLUTION

It is because once it is melted it forms strong cross linked bonds on cooling which posses great strength.

PLASTICS – A NEW AGE MATERIAL

Plastic materials display properties that are unique when compared to other materials and have contributed greatly to quality of our everyday life. Thus plastic can easily replace other important products including wood, metals, glass etc. Consumers like it because of its versatility, durability, light weight and other qualities.

Demerits associated with other materials makes plastic such important material. For example, if plastic bottles would have to be replaced by glass. Glass is much heavier and can break. Broken glass can be dangerous when stepped on or touched. Plastics have also replaced wood items. We use plastics because they are more affordable and can be long lasting when compared with wood.

General Properties of Synthetic Plastics :

- Most plastics are waterproof and are unaffected by weather. They are non-biodegradable.
- They are not affected by water, strong acids and alkalies. Some are however soluble in certain organic solvents.

- (iii) Plastic is tough and can withstand high pressure. It is stretchable and its tensile strength is many times than natural fibre. Even a fine synthetic fibre is not easily breakable.
- (iv) Plastic is easily moulded to any shape or even passed through a fine pore forming a fibre.
- (v) Plastics may be transparent, translucent or opaque.
- (vi) Plastics are non-conductors of heat and electricity and hence used as insulators.
- (vii) Most plastics catch fire easily. They are inflammable.

Uses of Plastics:

- (i) For making water bottles and waterproof containers.
- (ii) For making plastic wrap materials, which is used to keep food fresh in refrigerators.
- (iii) As packing materials.
- (iv) For making table cloths, bathroom curtains, raincoats, waterproof shoes and fashionable footwear.
- (v) Glass-reinforced plastic (GRP) or Glass fibre-reinforced plastic (GFRP) is a fibre reinforced polymer made of a plastic matrix reinforced by fine fibres made of glass. Simply known as fibre glass.

Disadvantages of Plastic

- (i) A large part of our household wastes are made of plastics. We throw away plastic bags, in which we buy foodstuffs, vegetables, clothes and other materials. The plastic bags used for packing is not biodegradable and takes thousands of years for a plastic bag to disintegrate.
- (ii) When burnt, plastics give off poisonous fumes. PVC on burning gives fumes of hydrogen chloride.
- (iii) Recycling plastic is expensive.
- (iv) They are non-renewable resources.
- (v) The poisonous gaseous product produced by the decomposition of plastic can cause cancer.
- (vi) They harm the environment by choking the drains.

PLASTICS AND THE ENVIRONMENT

The extensive and wide use of plastic has now become a big threat for our environment. The next time you go for shopping and carry home the things in a cute, comfy plastic carry-bag, think you are contributing your share to a deadly pollution whose ill-effects are irreversible and capable of reaching out to numerous generations to come. Plastic is one of the major toxic pollutants. Being a non-biodegradable substance, composed of toxic chemicals, plastic pollutes earth, air and water.

Plastic waste is a major environmental issue and cause of public health problems. Plastic shopping or carrier bags are one of the main sources of plastic waste in our country. Besides this visual pollution, plastic bag wastes contribute to blockage of drains and gutters, plastic bags are a threat to aquatic life when they find their way to water bodies and are harmful for aquatic animals in many ways. Furthermore, when filled with rainwater, plastic bags become breeding grounds for mosquitoes, which cause malaria. Plastic bags along with food waste can be eaten by animals and as they don't break down this can cause digestive problems in them.

When plastics are burnt, they emit toxic gases and smoke full of carbon particles. Plastics that get buried under the soil prevent the percolation of rainwater and the run away water into the soil.

Indiscriminate dumping of plastic waste on land makes the land infertile.

Like all solid waste, the primary strategy for effectively managing plastics are reduce, reuse, recycle and recover.

Reduction of plastic waste can be done by using

- (i) products with less plastic packaging
- (ii) jute or paper bags instead of plastic bags.

Recycling of plastic waste should be emphasized. House hold plastic waste should be collected and forwarded for recycling. One should support and promote plastic recycling schemes in their local area.

Reuse the plastic materials. Used plastic bags and bottles should not be thrown away they should be reused if possible.

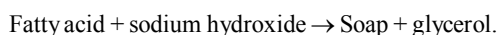
The fourth R is to recover material which cannot be reused or recycled should be recovered.

CONNECTING TOPIC

In addition to fibre and plastic there are many other important man-made materials and substances which we use in our routine life. Medicines for health care, kitchen crockery made up of glass. Rubber used in tyres and detergents for washing and cleaning purposes. These materials are discussed one by one in brief.

SOAPS AND DETERGENTS

Soap : Fatty acid salts of sodium and potassium are known as soaps. These are prepared by the action of fatty acids with sodium hydroxide or potassium hydroxide.



Detergents are sodium salt of long chain sulphonic acids or alkyl hydrogen sulphate.

Advantages of detergents over soaps

- (i) Detergents can be used for laundering even with hard water as they are soluble even in hard water.
- (ii) Detergents possess better cleansing properties than soaps.

Disadvantages of detergents over soap.

Detergents are prepared from hydrocarbons, while soaps are prepared from edible fatty oils. Thus they are non biodegradable.

Saponification

It is the process of making of soap by the hydrolysis of fats and oils with alkalies. Both soaps and detergents are soluble in water and act as **surfactants** which reduce the surface tension of water to a great extent. This increases the water - fabric interaction as a consequence of which dirt particles, grease spots etc are washed away effectively. In other words soaps and detergents enhance the cleansing action of water.

RUBBERS

Natural rubber : It is naturally occurring polymer of high molecular weight obtained from rubber trees. It possesses more than 300 percent elasticity. Natural rubber contains deniable bonds. It is a polymer of monomer called isoprene.

Natural rubber is a poly cis-isoprene. It is prepared from latex (obtained from rubber tree by coagulation with acetic acid). It is a soft and tacky material. Gutta percha on the other hand is poly-isoprene. It is a hard and horny material.

Synthetic rubber : It is identical to natural rubber but possesses better properties. The two important forms of artificial rubber are.

- (i) Thiokol and (ii) Neoprene

Thiokol is produced by chemical reaction of dichloroethane with sodium polysulphide.

Neoprene is produced by polymerisation of 2-Chloro-butadiene.

Vulcanization of rubber : The process of heating natural rubber with sulphur is known as vulcanization of rubber. The cross linking of rubber molecules, improves strength and elasticity of rubber considerably.

Natural rubber is soft, sticky and possesses low strength where as vulcanized rubber is comparatively hard, non-sticky and shows better strength. It possesses good elasticity and is abrasion resistant.

The tensile strength of natural rubber is low but of vulcanized rubber is high.

Natural rubber can be used in the temperature range of 10-60°C whereas vulcanised rubber can be used in the range of 45°C to 110°C.

The elasticity of vulcanised rubber is high whereas that of natural rubber is low.

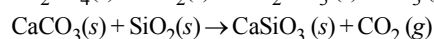
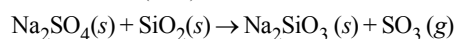
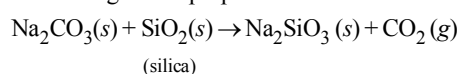
Natural rubber is soluble in organic solvents like ether, petrol and carbon disulphide whereas vulcanised rubber is practically insoluble in organic solvents.

GLASS

It consists of a mixture of two or more silicates.

Preparation of Glass :

Common glass (or soft glass) : It is used to make bottles, glass wares etc. and is obtained by heating together silica (in the form of sand), sodium carbonate or sodium sulphate and chalk or lime stone (calcium carbonate). Some broken glass and a little coke are usually added. The glass so prepared consists of silicates of sodium and calcium.



Hard glass : For preparation of hard glass K_2CO_3 is used in place of Na_2CO_3 . It consists of a mixture of calcium and potassium silicates.

Physical Properties of Glass

Hard, rigid, high viscosity, bad conductor of heat and electricity, Brittle etc.

Chemical Properties of Glass

- (i) It is resistant to action of air and acids except hydrofluoric acid.
- (ii) It is alkaline in nature.
- (iii) It slowly reacts with water to form alkaline solution.

Types of Glass :

- (i) **Silica glass :** For this type of glass the raw material used is 100% pure form of *quartz*. It is quite *expensive*. It is used in the manufacture of laboratory apparatus. It has low thermal expansion. Its softening point is very high and it is resistant to a wide variety of chemicals.
- (ii) **Alkali silicate glass :** For it the raw materials used are sand and soda. It is also called **water glass** because it is soluble in water and used only as a solution. It is generally used to make gums and adhesives.
- (iii) **Lead glass :** For this type of glass lead oxide is added to ordinary glass. The addition of lead oxide increases the density and also the refractive index. This type of glass is used for the manufacture of ornamental glass ware, decorative articles etc.
- (iv) **Optical glass :** This type of glass is used in the manufacture of optical instruments like binoculars, spectacles, lenses, prisms, telescopes, microscopes etc. It is transparent and can be grounded into the required shape. It generally contains phosphorus, and lead silicates with little cerium oxide which absorbs UV radiations.
- (v) **Processed glass :** The properties and applications of glass also depend upon the processing of glass.
Some types of processed glass and their applications are given here :

Processed glass	Applications
(a) Laminated glass	Used for doors and windows of automobiles. (It has high strength)
(b) Fibre glass	Used for reinforcing purpose (It has enough tensile strength)
(c) Foam glass	Used for civil construction and insulation purposes (it is light weight).
(d) Opaque glass	In it non transparent glass filters the light entering into it. Thus provides an aesthetic look

- (vi) **Borosilicate glass :** It contains silica and boron oxide and small amount of oxides of sodium and aluminium. It is resistant to a wide variety of chemicals due to this property it is used in the manufacture of laboratory ware.

Etching of Glass :

HF dissolves glass due to formation of soluble fluorosilicates. The glass surface is coated with wax and the places where design is to be made, are exposed to aqueous HF by removing the wax surface. Aqueous HF is poured on the exposed part. After some time it is poured out and wax is removed from the surface. The exposed part of glass is engraved.

MEDICINES

Drug

Chemical substances used for curing, diagnosing and treatment of diseases are called drugs. The branch of chemistry which deals with the treatment of diseases using suitable chemicals is known as chemotherapy.

Requirements of a Substances to act like a Drug

- (i) Its target should be localised at the site of action.
- (ii) It should not make host tissue resistant against the effect of drug after use for some time.
- (iii) It should not produce any side effects of long term use.
- (iv) It should be effective within therapeutic range.

Types of Drugs

(i) Antipyretics :

Those drugs which are used to bring down body temperature during fever. e.g., Paracetamol, Aspirin etc.

(ii) Antacids :

Those substances which neutralize the excess acid and raise the pH to an appropriate level in stomach are called antacids. e.g., magnesium hydroxide, aluminium hydroxide gel etc.

(iii) Antihistamines :

The drugs which interfere with the natural action of histamine. These are widely used for treatment of hay fever, conjunctivitis, sneezing, itching of eyes, nose and throat etc. e.g., diphenylhydramine, promethazine etc.

(iv) Tranquillizers :

Drugs which are used for the treatment of stress, fatigue, mild and severe mental diseases are called tranquillizers. e.g., equanil, valium, serotonin, barbituric acid, luminal, seconal etc.

(v) Analgesics :

Drugs which reduce pain without reducing consciousness, mental confusion, paralysis or some other disturbance of the nervous system are called analgesics. e.g., aspirin, paracetamol, morphine diacetate etc.

(vi) Antimicrobials :

Drugs used to cure diseases caused by microorganisms such as bacteria, viruses, fungi etc., are called antimicrobials. e.g., sulphanilamide

(vii) Antibiotics :

These are chemical substances which are produced by some microorganism and can be used to either inhibit the growth or even kill other microorganism which cause infections. e.g., penicillin, chloramphenicol, erythromycin etc.

(viii) Antiseptics :

Those chemical substances which prevent the growth of micro-organism or may even kill them. They are safe to be applied on living tissues. e.g., furacin, soframycin, boric acid, iodine, bithional etc.

(ix) Disinfectants :

Those chemical substances which kill micro-organisms but are not safe to be applied on the living tissues. These are generally used to kill the micro-organism present in the drains, toilets, floors etc. e.g., 0.2% solution of phenol acts as an antiseptic whereas 1% solution acts as a disinfectant.

(x) Antifertility drugs :

Chemical substances used to check pregnancy in women are known as anti-fertility drugs or oral contraceptives. e.g., Norethindrone, Mifepristone etc.

SUMMARY

- ◆ There are two types of fibre - One which are obtained from natural sources and other which are man-made.
- ◆ Fibres which are obtained from natural sources are called natural fibres. E.g. cotton, silk, wool, etc.
- ◆ Fibres which are manufactured artificially are called synthetic fibres e.g. rayon, nylon, polyester etc.

Rayon : It is a semi-synthetic fibre. It is prepared from natural cellulose. It is also known as artificial silk.

- ◆ Types of rayon

(i) Viscose rayon (ii) Cuprammonium rayon (iii) Acetate rayon

- ◆ **Nylon :** It is a polyamide. It is manufactured by using adipic acid and hexamethylenediamine. Since both compounds used contain six carbon atoms in the molecule so it is referred as **Nylon 6,6**. It is a condensation polymer.

- ◆ Nylon is used in making of different types of clothes, ropes, socks, curtains, sleeping bags, parachutes, etc. The fibre of nylon is stronger than a steel wire of same thickness.

- ◆ **Polyester :** It is the general name for synthetic fibre that contains many ester groups. $\left[\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{O}- \end{array} \right]$

- ◆ Terylene is one of the most famous types of polyester.
- ◆ Fabrics made from polyester fibre are almost wrinkle-free, easy to wash and have shiny appearance.
- ◆ PET (Polyethylene terephthalate) is very famous term for polyester.
- ◆ Acrylic: Acrylic is man-made fibre. Since, acrylic resembles wool so it is also known as artificial wool or synthetic wool.
- ◆ Acrylic is cheaper than natural wool and can be dyed in various colour.
- ◆ Acrylic is used in making sweaters, blanket, and other many clothes.



- ◆ **Plastics :** A **plastic** is a synthetic material, which can be moulded or set into any desired shape when soft and then hardened to produce articles.
- ◆ **Classification of plastics**
 - (i) Thermoplastic materials
 - (ii) Thermosetting materials
- ◆ Plastics which can be easily bent or deform on heating are known as thermoplastic. PVC and Polythene are the examples of thermoplastics.
- ◆ Plastics which do not get deformed or softened on heating when mold once, are called thermosetting plastics. Bakelite and melamine are the examples of thermosetting plastics.
- ◆ Substances which get decomposed through the natural processes, such as action of bacteria, etc. are called biodegradable substances. For example; potato peels, peels of other vegetable, food stuffs, fruit, paper, cotton cloths, wood, etc.
- ◆ Substances which either do not decompose or take many years to get decomposed through the natural process, are called non-biodegradable substance, e.g. tin, aluminium, plastics, etc.
- ◆ Plastic is a non-biodegradable substance. If it is left or thrown, it takes many years to get decomposed or either does not get decomposed.
- ◆ Burning the plastic can result in release of many harmful gases in the atmosphere. This can lead to air pollution.
- ◆ For dealing with the menace of plastic waste, we need to follow the three Rs, i.e. Reduce, Reuse and Recycle.

1 EXERCISE

Fill in the Blanks :

DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

- is called artificial silk.
- A thermosetting plastic can be used
- Base raw material for rayon is
- Tensile strength of nylon is than that of cotton.
- Melamine is a thermo plastic.
- is the synthetic fibre used as wool.
- The synthetic fibres are also known as fibres
- The first fully synthetic fibre was
- A plastic used for making crockery is

True / False :

DIRECTIONS : Read the following statements and write your answer as true or false.

- Rayon is a semi-synthetic fibre
- Nylon is corrosion resistant
- PVC is a thermo-setting plastic.
- Bakelite is thermosetting plastic.
- Polyester is a thermoplastic.
- Common name of PETE is terylene
- Polystyrene foam is used as an insulating and packaging material
- Plastics do not corrode or rust.
- Most plastics are biodegradable
- Plastic melamine is fire resistant.
- Bakelite is a soft and flexible plastic.
- Polysters are purely synthetic fibres.
- Rayons are derived from cellulose.
- Acrylics are crimped and are a substitute for natural wool.
- Synthetic fibres are generally hydrophilic.
- We can mould plastics into various shapes because of the property of elasticity in them.

Match the Following :

DIRECTIONS : Following question contains statements given in two columns which have to be matched. Statements (A, B, C and D) in column I have to be matched with statements (p, q, r and s) in column II.

- Match Column-I with Column-II and select the correct answer using the code given below in the columns.

Column-I

- (A) Rayon
(B) Nylon
(C) Polyester
(D) Polystyrene

Column-II

- (p) Polymer of diacid and diamine
(q) Terylene
(r) Regenerated cellulose
(s) Light foam used for insulating and packing.

- (a) A – (r); B – (p); C – (q); D – (s)
(b) A – (s); B – (p); C – (q); D – (r)
(c) A – (r); B – (q); C – (p); D – (s)
(d) A – (r); B – (s); C – (q); D – (p)

- Match Column-I with Column-II and select the correct answer using the code given below the columns.

Column-I

- (A) Thermoplastics
(B) Glass fibre
(C) Thermosetting plastics
(D) Optical fibre

Column-II

- (p) Endoscopes
(q) Bakelite
(r) polypropylene
(s) Used in making space suits

- (a) A – (p); B – (s); C – (q); D – (r)
(b) A – (r); B – (s); C – (q); D – (p)
(c) A – (s); B – (r); C – (q); D – (p)
(d) A – (r); B – (s); C – (p); D – (q)

- Match Column-I with Column-II and select the correct answer using the code given below the columns.

Column-I

- (A) Natural fibre
(B) Synthetic fibre
(C) Semisynthetic fibre
(D) Rubber

Column-II

- (p) Terylene
(q) Rain coats
(r) Wool
(s) Terry wool

- (a) A – (r); B – (p); C – (s); D – (q)
(b) A – (q); B – (p); C – (s); D – (r)
(c) A – (r); B – (p); C – (q); D – (s)
(d) A – (s); B – (p); C – (r); D – (q)

4. Which of the following represents the correct match for items in Column I with those in Column II

Column-I

Column-II

- | | |
|-------------------------------|---------------------------|
| (A) Nylon | (p) Thermoplastic |
| (B) PVC | (q) Thermosetting plastic |
| (C) Bakelite | (r) Fibre |
| (a) A – (q), B – (r), C – (p) | |
| (b) A – (q), B – (p), C – (r) | |
| (c) A – (r), B – (p), C – (q) | |
| (d) A – (r), B – (q), C – (p) | |

Very Short Answer Questions:

DIRECTIONS : Give answer in one word or one sentence.

- What is a monomer?
- What is a polymer?
- Define polymerisation.
- Define tensile strength of a material.
- Name any one synthetic polyamide fibre.
- Give two examples of thermosetting plastics.
- Give an important use of nylon.
- Name any two commonly used plastics.
- What is the common name of rayon ?
- Name a man-made fibre which was made without using natural raw materials.
- Name two articles made by rayon.
- How many types of arrangement of units in plastics ? Name them.
- Why plastics are not ecofriendly ?
- What are 4Rs?

Short Answer Questions :

DIRECTIONS : Give answer in 2-3 sentences.

- What is plastic? Name different types of plastics.
- Give the uses of thermosetting plastics.
- Why have synthetic fibres became so popular?
- How is rayon prepared?
- What is rayon ? Why is it called an artificial silk?
- Why is Polyester quite suitable for making dress materials ?
- Why should we not wear synthetic clothes while working in kitchen ?
- Why is it convenient to store plastic containers than metals?
- Write the uses of plastics in health care industry.
- Say no for polythene bags and say yes for paper bags. Comment on this slogan.

Long Answer Questions :

DIRECTIONS : Answer the following questions in detail.

- Explain thermoplastics and thermosetting plastics with examples.
- Write down the name of any 5 fibres/plastics and also mention one use of each.

S.No.	Fibres/Plastics	Uses
1		
2		
3		
4		
5		

2 EXERCISE

Text-Book Exercise :

- Explain why some fibres are called synthetic.
- Mark (✓) the correct answer.
Rayon is different from synthetic fibres because
 - it has a silk like appearance
 - it is obtained from wood pulp
 - its fibres can also be woven like those of natural fibres
- Fill in the blanks with appropriate words:
 - Synthetic fibres are also called _____ or _____ fibres.
 - Synthetic fibres are synthesised from raw material called _____.
 - Like synthetic fibres, plastic is also a _____.
- Give examples which indicate that nylon fibres are very strong.
- Explain why plastic containers are favoured for storing food.
- Explain the difference between the thermoplastic and thermosetting plastics.
- Explain why the following are made of thermosetting plastics.
 - Saucepan handles
 - Electric plugs/switches/plug boards
- 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.
- Rana wants to buy shirts for summer. Should he buy cotton shirts or shirts made from synthetic material? Advise Rana, giving your reason.
- Give examples to show that plastics are noncorrosive in nature.
- Should the handle and bristles of a tooth brush be made of the same material? Explain your answer.
- 'Avoid plastics as far as possible'. Comment on this advice.
- Match the terms of column I correctly with the phrases given in column II.

Column-I

- Polyester
- Teflon
- Rayon
- Nylon

Column-II

- Prepared by using wood pulp
- Used for making parachutes and stockings
- Used to make non-stick cookwares
- Fabrics do not wrinkle easily

- 'Manufacturing synthetic fibres is actually helping for conservation of forests'.
Comment.
- Describe an activity to show that thermoplastic is a poor conductor of electricity.

Exemplar Questions :

- Plastic is used for making a large variety of articles of daily use and these articles are very attractive. But it is advised to avoid the use of plastic as far as possible. Why ?
- A lady went to the market to buy a blanket. The shopkeeper showed her blankets made of acrylic fibres as well as made of wool. She preferred to buy an acrylic blanket. Can you guess why ?
- Terrycot is made by mixing two types of fibres. Write the names of the fibres.
- Rohit took with him some nylon ropes, when he was going for rock climbing. Can you tell why he selected nylon ropes instead of ropes made of cotton or jute ?
- Despite being very useful it is advised to restrict the use of plastic. Why is it so ? Can you suggest some methods to limit its consumption ?

HOTS Questions :

- Why is rayon called a regenerated fibre?
- Why is nylon called a polyamide?
- What is the application of nylon in medical field ?
- Give the names of two articles made by nylon.
- Why is the name nylon given to the first fully synthetic fibre ?
- Why is thermosetting plastic stronger than thermoplastic?

3

EXERCISE

Multiple Choice Questions :

DIRECTIONS : This section contains 23 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

- Which of the following statements is true for thermoplastic and thermosetting plastic?
 - Thermosettings are permanent setting resins but thermoplastics are not, since they can be softened on cooling.
 - Thermoplastics are less brittle as compared to thermosettings because of the absence of long chain polymers.
 - Thermosettings are more brittle as compared to thermoplastics because of the presence of strong bonds.
 - The chemical nature of thermoplastics can be changed by repeated heating and cooling.
- Select the one that is a natural polymer.
 - Nylon 6,6
 - Polyester
 - Cellulose
 - none of these
- Select the synthetic polymer whose filament was first obtained that could be stretched several times its original length.
 - Nylon
 - polyester
 - Acrylic
 - none of these.
- The hard plastic covers of telephones are made of polymers of
 - styrene
 - acrylonitrile
 - ethene
 - none of these
- Plastics are
 - salts
 - acids
 - polymers
 - solvents
- For which of the following is polythene not used?
 - construction materials of plastics
 - Plastic pipes
 - Bread - wrappers
 - candles
- Which of the following are synthetic fibres:
 - Orlon, polypropylene and nylon
 - Jute, ramie and hemp
 - Wool, silk and cotton
 - All of these
- A synthetic fibre obtained from renewable resources is
 - Nylon.
 - Polyester.
 - Rayon.
 - Acrylic.
- The major raw materials for rayon is obtained from
 - wood.
 - coal.
 - petroleum.
 - both coal and petroleum.
- Which of the following are advantages of synthetic fibres:
 - They are tough and durable.
 - They are water resistant and easy to dry.
 - They do not wrinkle.
 - All of these.
- Terrywool is obtained by mixing
 - polyester and wool.
 - cotton and wool.
 - polyester and cotton.
 - cotton and silk.
- Plastics
 - are light.
 - can be spun into fibres to make cloth and carpets.
 - can be coloured and moulded into any desired shape.
 - (a), (b) and (c).
- Synthetic fibres are obtained from
 - plants
 - animals
 - petroleum
 - All of these
- Which of these fabrics will you prefer on a hot and humid day?
 - Nylon
 - Silk
 - Cotton
 - Wool
- Natural fibres are
 - Nylon and Rayon
 - Nylon only
 - Rayon silk
 - None of these
- Synthetic fibres are
 - Rayon and Cotton
 - Nylon, Polyester and Jute
 - Rayon, Nylon, and Polyester
 - None of these
- Correct full form of abbreviation PETE is
 - Polyethylene terephthalate
 - Polyethane terephthalate
 - Polyethene terephthalate
 - None of these

18. Which of the following synthetic fibre is good absorbent?
(a) Nylon (b) Rayon
(c) Polyester (d) Acrylic
19. Which of the following is thermosetting plastics?
(a) Polyvinyl chloride (b) Polyester
(c) Polypropylene (d) Bakelite
20. Polycot is obtained by mixing
(a) polyester and cotton
(b) polyester and wool
(c) cotton and wool
(d) None of these
21. The first man made fibre is
(a) Nylon (b) Polyester
(c) Rayon (d) Cotton
22. The plastics which do not remould again on heating are called
(a) Thermosetting plastics
(b) Thermoplastics
(c) Both of these
(d) None of these
23. Which of the following groups contain all synthetic substances ?
(a) Nylon, Terylene, Wool
(b) PVC, Polythene, Bakelite
(c) Cotton, Polycot, Rayon
(d) Acrylic, Silk, Wool

More than One Option Correct :

DIRECTIONS : This section contains 5 Multiple Choice Questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONE OR MORE may be correct.

1. Plastics
(a) are organic material of high molecular weight
(b) are polymers having long chains
(c) are made by the process of polymerisation
(d) only (a) and (b) are correct
2. Pick out natural fibres out of the following ?
(a) Cotton (b) Jute
(c) Nylon (d) Wool
3. Which of the following are thermo plastic polymer?
(a) Melamine (b) PVC
(c) Polythene (d) Nylon
4. Which of the following is/are common properties of plastics?
(a) Non-reactive (b) Durable
(c) Light in weight (d) Good conductor of electricity

5. Which of the following is/are synthetic fibres
(a) Angora (b) Rayon
(c) Nylon (d) Polyester

Passage Based Questions :

DIRECTIONS : Study the given paragraph(s) and answer the following questions.

Passage-1

Synthetic fibres are the result of extensive research by scientists to improve on naturally occurring animal and plant fibres. Before synthetic fibres were developed, artificially manufactured fibres were made from cellulose, which comes from plants. These fibres are called cellulose fibres. Synthetic fibres account for about half of all fibre usage, with applications in every field of fibre and textile technology. Although many classes of fibre based on synthetic polymers have been evaluated as potentially valuable commercial products, four of them - Nylon, polyester, acrylic and polyolefin - dominate the market. These four account for approximately 98 percent by volume of synthetic fibre production, with polyester alone accounting for around 60 percent.

1. Synthetic fibres are result of extensive research on
(a) Natural fibres
(b) Glass fibres
(c) Semi-synthetic fibres
(d) Optical fibres
2. Which of the following is a semi-synthetic fibre?
(a) Nylon (b) Polyester
(c) Cellulose acetate (d) Acrylic
3. Which of the following synthetic fibre has most wide applications?
(a) Nylon (b) Polyester
(c) Acrylic (d) Polyolefin

Passage-2

Rahul one day thought to clean his messy room while cleaning he found items like old T-shirts, cable wire, cycle tyres, bottle of shaving foam, table cloth, broken toys, pain killer strips, stop cork of glass bottle and tube of face wash.

4. Which of the following is a synthetic fibre ?
(a) table cloth (b) broken toys
(c) pain killer strips (d) stop cork of glass bottle
5. Which of the following comes under category of plastic?
(a) pain killer strips (b) cycle tyre
(c) broken toys (d) old T-shirts
6. Which of the following is/are polyester(s) ?
(a) T-shirts (b) pain killer strip
(c) cycle tyre (d) broken toys

Assertion & Reason :

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
- (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
- (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
- (d) If **Assertion** is **incorrect** but **Reason** is **correct**.
- Assertion :** Clothes made up of synthetic fibre are unsuitable for hot and humid weather.
Reason : Synthetic clothes not breathe so well
 - Assertion :** Bakelite is used for making electric switches and plugs.
Reason : It is a thermosetting polymer and an insulator.
 - Assertion :** Acrylic fabrics are used in making socks and shawls.
Reason : Acrylic fabrics are replacement of wool.
 - Assertion :** Plastics are non-biodegradable.
Reason : They cannot be decomposed by microorganisms.
 - Assertion :** Synthetic fibres are polymers that are synthesised by human beings by chemical process.
Reason : Polymers occur in nature also.
 - Assertion :** Nylon is used for making rock climbing ropes, parachutes, car seat belts and fishing nets.
Reason : Nylon is a very strong fibre.

- Assertion :** Handles of utensils are made up of thermoplastics.

Reason : Thermoplastics get soften on heating.

- Assertion :** Plastic being light in weight and easy to handle is used as a substitute for glass and metal.

Reason : We should avoid plastics as far as possible.

Multiple Matching Questions :

DIRECTIONS : Following question has four statements (A, B, C and D) given in Column I and four statements (p, q, r and s) in Column II. Any given statement in Column I can have correct matching with one or more statement(s) given in Column II. Match the entries in column I with entries in column II.

- | 1. Column-I | Column-II |
|---------------------|--------------------------|
| (A) Rayon | (p) Polymer |
| (B) Nylon | (q) Semi-synthetic fibre |
| (C) Artificial silk | (r) Synthetic fibre |
| (D) Polyester | (s) Regenerated fibre. |

Integer Type Questions :

DIRECTIONS : Following are integer based questions. Each question, when worked out will result in one integer from 0 to 9 (both inclusive).

- Number of synthetic fibres among the following
Nylon, Jute, Wool, Cotton.
- Among the following number of materials that cannot be recycled.
Cooker handles, Electrical switches, Plastic chairs, Plastic toys, Plastic bowls.

4 ADVANCED EXERCISE

BASED ON CONNECTING TOPICS

DIRECTIONS (Qs. 1-15) : This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

- Which of the following statements, is not correct, about glass.
 - Because of its high viscosity glass exists in solid state
 - There is no definite melting point for glass.
 - The silicate units in glass are arranged in a way that is quite similar to the arrangement found in liquids.
 - Glass is a solid because it has a regular crystalline arrangement.
- One of the properties of glass is its transparency. This property of glass is due to
 - its high viscosity
 - regular arrangement of silicate units in glass.
 - irregular arrangement of silicate units in glass.
 - its high coefficient of thermal expansion.
- Washing soaps are potassium and sodium salts of
 - Dicarboxylic acids
 - fatty acids
 - mineral acids
 - none of these
- Natural rubber is soft but vulcanized rubber is hard. Vulcanised rubber also resists.
 - drops of acid rain
 - cold temperatures
 - jerked movements
 - wear and tear due to friction
- When glass is heated, it
 - does not melt at a fixed temperature
 - vapourises
 - melts only above 1000°C
 - None of these
- Glass is a transparent substance obtained by heating silica with oxides or carbonates of metals. Glass is a mixture of
 - phosphates
 - sulphates
 - oxides
 - silicates
- Which of the following is tranquilizer ?
 - aspirin
 - paracetamol
 - equanil
 - diphenylhydramine
- Which of the following drug will behave like analgesics as well as antipyretic ?
 - Boric acid
 - Aspirin
 - Sulphanilamide
 - Penicillin
- Which substance can act like antiseptic as well as disinfectant ?
 - Furacin
 - Phenol

(c) Aluminium hydroxide gel

(d) Penicillin

- Soft soaps are
 - sodium and potassium salt
 - sodium salt of fatty acids
 - potassium salt of fatty acids
 - potassium salt of sulphonic acids
- An antibiotic with a broad spectrum
 - Kills the antibodies
 - Acts on a specific antigen
 - Acts on different antigens
 - Acts on both the antigens and antibodies
- Washing soap can be prepared by saponification with alkali of which of the following oil
 - Rose oil
 - Paraffin oil
 - Groundnut oil
 - Kerosene oil
- Which of the statements about glass are correct?
 - Glass is a super-cooled liquid having infinite viscosity.
 - Violet coloured glass is obtained by adding MnO_2 .
 - Glass is a man-made silicate.
 - Glass is a crystalline substance.
 Select the correct answer using the codes given below.
 - 1, 2 and 4
 - 2, 3 and 4
 - 1, 2 and 3
 - 1 and 3
- The major component used in preparation of different types of glasses is
 - silica
 - sodium borate
 - calcium silicate
 - sodium silicate
- Consider the following statements
 - Soap cannot be used in acidic water.
 - Ionic part of a soap is $\text{—COO}^- \cdot \text{Na}^+$.
 - Soap dissolves in water faster than detergent.
 Which of the statements given above is/are correct?
 - 1 and 2
 - 2 and 3
 - 3 only
 - 1 only

DIRECTIONS (Qs. 16-21) : This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which **ONE OR MORE** may be correct.

- Alkali silicate glass
 - is also called silicate glass
 - is also called water glass
 - is generally used to make gums and adhesives.
 - None of the above is correct.

17. Which statement(s) is/are correct for silica glass?
 (a) For it the raw material used is 100% quartz.
 (b) It is quite cheap
 (c) Its softening point is very high
 (d) It has a very high thermal expansion
18. In the manufacture of lead glass
 (a) Oxide of lead is added to ordinary glass
 (b) Oxide of lead increases the density of glass
 (c) Oxide of lead increases the refractive index of glass
 (d) None of the above is correct.
19. Vulcanisation of rubber
 (a) involves heating of natural rubber with sulphur.
 (b) improves strength and elasticity of natural rubber to a great extent
 (c) increases the tensile strength of natural rubber.
 (d) results in cross - linking of rubber molecules.
20. Aspirin is an example of
 (a) analgesic (b) antifertility drug
 (c) antipyretics drug (d) tranquilizers
21. Vulcanised rubber
 (a) is natural rubber heated with sulphur
 (b) can be used in the range of 45° to 110°C
 (c) can be used in the range of 10-60°C
 (d) natural rubber is heated with silicon.

DIRECTIONS (Qs. 22-24) : Study the given paragraph(s) and answer the following questions.

Passage

Like other living beings, plants require food for their growth. A wide variety of elements are required for many different purposes for the nourishment of plants. Among these carbon, oxygen and hydrogen are principal nutrients. Nitrogen, phosphorus, potassium, magnesium, sulphur, calcium and iron play significant role for the growth and development of plants. These elements are called major plant nutrients. Some other elements like manganese, molybdenum, copper, zinc, iron, chlorine are used by the field crops in very small quantities. These are called minor plant nutrients.

22. Which of the following is/are a minor plant nutrient.
 (a) manganese (b) magnesium

- (c) molybdenum (d) calcium
23. Select the principal nutrient(s) out of the following
 (a) Hydrogen (b) Copper
 (c) Nitrogen (d) None of these
24. Select the major plant nutrient(s) out of the following
 (a) nitrogen (b) phosphorus
 (c) potassium (d) zinc

DIRECTIONS (Qs. 25-26) : Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
 (b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
 (c) If **Assertion** is **correct** but **Reason** is **incorrect**.
 (d) If **Assertion** is **incorrect** but **Reason** is **correct**.
25. **Assertion :** Glass is not a solid.
Reason : Its molecules are randomly arranged
26. **Assertion :** For silica glass the raw material used is 100% pure form of quartz.
Reason : Silica glass is very expensive

DIRECTIONS (Q. 27) : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.

Column-I	Column-II
A. Phenol solution	(p) Antiseptic
B. Aspirin	(q) Medicine
C. Bithronal	(r) Antipyretic
D. Aluminium hydroxide gel	(s) Disinfectants
	(t) Analgesic

DIRECTIONS (Q. 28) : Following are integer based questions. Each question, when worked out will result in one integer from 0 to 9 (both inclusive).

28. How many of them are processed glass?
 Lead glass, laminated glass, opaque glass, silica glass

SOLUTIONS

Brief Explanations of Selected Questions

1 EXERCISE

Fill in the Blanks :

1. Rayon. 2. Only once. 3. cotton
4. more 5. set 6. acrylic
7. man-made 8. nylon 9. melamine

True / False :

1. True 2. True 3. False 4. True
5. True 6. True 7. True 8. True
9. False 10. True 11. False 12. True
13. True 14. True 15. False 16. False

Match the Following :

1. (a) A – (r); B – (p); C – (q); D – (s)
2. (b) A – (r); B – (s); C – (q); D – (p)
3. (a) A – (r); B – (p); C – (s); D – (q)
4. (c) A – (r); B – (p); C – (q)

Very Short Answer Questions :

1. A monomer is a molecule that forms the basic unit for Polymer.
2. Polymers are very large molecules that are made up of thousands of monomer unit that are bonded together in a repeating pattern.
3. A chemical process that combines several monomers to form a polymer or polymeric compound.
4. The tensile strength of a material is the maximum amount of tensile stress that it can take before failure.
5. Nylon 6,6.
6. Bakelite and melamine.
7. It is used for making fabrics in textile industry.
8. Polyethylene (PE) and Polystyrene (PS)
9. Rayon is known as artificial silk.
10. Nylon
11. Socks and tents
12. There are two types of arrangement of units in plastics Linear and cross-linked.
13. Plastics take several years to decomposes, so are not ecofriendly.
14. 4Rs stands for Reduce, Reuse, Recycle and Recovers.

Short Answer Questions :

1. Plastic is a material consisting of a wide range of synthetic or semi-synthetic organic compounds that are malleable and can be molded into solid objects.
Types of plastics : Polythylene (PE), Polystyrene(PS), Polyvinyl Chloride(PVC), PETE etc.
2. In making telephone receivers, radio, television and photographic goods, ice-cube trays etc.
3. Because synthetic fibres are lighter, cheaper, easily washable, fast dryable etc.

4. Rayon is a natural-based material that is made from the cellulose of wood pulp or cotton.
5. Rayon is synthetic fibre having properties similar to that of silk. So it is called artificial silk. It is obtained by chemical treatment of wood pulp.
6. Polyester is a synthetic fibre which is quite suitable to make dresses and other clothes due to its properties. It does not wrinkle easily. It remains crisp and is easy to wash. It is light and durable. It takes very less time to dry.
7. Synthetic fibres melt very soon on heating. If the clothes catch fire, it can be disastrous. The fabrics melt and stick to the body of person wearing it. We should therefore not wear synthetic clothes while working in the kitchen.
8. Plastic containers seem most convenient than metal containers. This is because of their light weight, lower price, good strength and easy handling. Being lighter as compared to metals, plastics are used in cars, aircrafts and spacecrafts also.
9. Plastics are used as drug delivery devices, capsules, blood bags, catheters, as lenses, and also in knee replacement therapy.
10. Plastic is a non degradable substance. It remains in environment for thousands of year where as paper is a degradable substance which degrades. Plastic has a very bad effect on our environment as it is a hazardous substance. So we must use paper bag instead of plastic bag.

Long Answer Questions :

1. There are following two type of plastics :
(i) Thermoplastics (ii) Thermosetting plastics.
(i) **Thermoplastics** : The plastics which get deformed easily by heating and can be bent easily are known as thermoplastics. Polythene and PVC are the examples of some thermoplastics.
(ii) **Thermosetting plastics** : The plastics which when moulded once cannot be softened again by heating are called thermosetting plastics. Bakelite and Melamine are two most common examples of thermosetting plastics.
- 2.

S.No.	Fibres/plastics	Uses
1	Terylene	Shirts and other dresses
2	Polyethylene Terephthalate (PET)	Bottles and Utensils
3	Teflon	Non stick cook wares
4	Bakelite	Electrical switches and handles of utensils
5	Melamine	Floor tiles and Kitchen wares

2 EXERCISE

Text-Book Exercise :

1. Some fibres are not obtained from plants or animals, instead of that they are made by human beings by chemical

processes. That is why these kind of fibres are called synthetic fibres. These are made of small units that join together to form long chains called polymers. Polyester, rayon, nylon, acrylic etc., are some examples of synthetic fibres.

2. (b) Rayon is obtained from wood pulp.
3. (a) artificial, man-made
(b) petrochemicals
(c) polymer
4. Nylon fibres are very strong fibres that is why nylon is used for making rock climbing ropes, parachutes, car seat belts etc. A nylon thread is stronger than steel wire of same thickness or diameter.
5. Plastic containers are favoured for storing food because of their :
(i) light weight
(ii) lower price
(iii) good strength
(iv) easy handling

6. Property	Thermoplastics	Thermosetting
1. Effect of heat	Soften at 70°C to 90°C	Do not soften easily comparatively stronger.
2. Strength	Comparatively weaker	Comparatively stronger
3. Reusability	Can be reused after melting	Can not be remelted or reused.
4. Flexibility	They are flexible	They are hard and rigid.

7. (a) Thermosetting plastics are used for making saucepan handles because these plastics are poor conductors of heat and do not get softened on heating.
(b) Electric plugs/switches/plug boards are made up of thermosetting plastics because these plastics are poor conductors of heat and electricity. Therefore prevent the flow of current through it.

8. Can be recycled	Cannot be recycled
1. Plastic toys	1. Cooker handles
2. Carry bags	2. Electrical switches
3. Ball point pens	3. Telephone instruments
4. Plastic covering on electrical wires	
5. Plastic bowls	

9. Rana should buy cotton shirts for summer because shirts made of synthetic material do not absorb sweat easily and uncomfortable to wear in summer whereas cotton being a good absorber of water can soak the sweat easily and pores in it allow evaporation and keeps our body cool.
10. Plastics are noncorrosive in nature that is why they are used to make various containers, utensils and laboratory equipments to store food, chemicals etc.
11. Handle and bristles of a toothbrush should be made of different materials. The handle of toothbrush should be hard and strong so that it can give firm grip whereas bristles should be made of soft and flexible material.
12. Plastics are not environment friendly. They take several

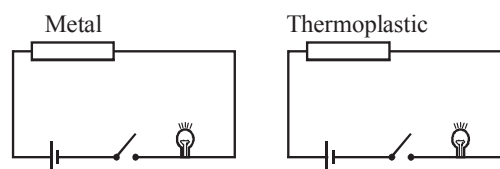
years to decompose. They do not burn completely. During burning of plastics lots of poisonous fumes are released into the atmosphere causing air pollution.

Polythene bags, carelessly thrown in garbage can be eaten by cow and other animals may choke their respiratory system and even cause death.

The polythene bags carelessly thrown here and there are responsible for clogging the drains.

The only solution to reduce these problems is to reduce the use of plastics. Therefore, we should avoid plastics as far as possible.

13. (i) - (d), (ii) - (c), (iii) - (a), (iv) - (b)
14. Synthetic fibres are man-made fibres. They are obtained by chemical processing of petrochemicals and do not require cutting of trees or hunting of animals. Therefore manufacturing synthetic fibres is actually helping for conservation of forests.
15. To show that thermoplastic is a poor conductor of electricity design a circuit by taking a small piece of thermoplastic material, a bulb, wires, a piece of metal and a battery. Set up the circuit (as shown below) first with the metal and then with the thermoplastic material.



On passing current, bulb in case of metal glows, but not in case of thermoplastic. This proves that thermoplastic is a poor conductor of electricity.

Exemplar Questions :

1. Due to its non-biodegradable nature it causes environmental pollution.
2. Acrylic blankets are cheap, light in weight, more durable and are available in variety of colours and designs. They can be easily washed at home.
3. Terylene and cotton.
4. Nylon ropes are strong elastic and lighter as compared to cotton or jute ropes.
5. Plastic is a non-biodegradable material and as such it causes land pollution. At the same time burning such materials in the form of garbage causes serious air pollution.

Some ways to limit its consumption are :

1. Reducing the use of plastics whenever possible use paper bag.
2. Reusing it for some other purpose thereby decreasing its consumption.
3. Recycling of plastic. It requires the plastic to be collected, sorted, chopped, melted and remoulded.

HOTS Questions :

1. Rayon is called regenerated fibre, because starting material is a natural product i.e. wood or paper pulp.
2. Since nylon contains many amide groups in each molecule so it is called a polyamide.
3. It is used for making bandages and surgical dressings.

4. Parachutes, ropes for rock climbing
5. Since the fibre was synthesized simultaneously in New York and London, it was called nylon based on the initial letters of the names of cities.
6. Due to presence of cross linked arrangement of units it is difficult to break apart the units in thermosetting plastic, while due to lack of cross linkages thermoplastics are soft and weaker.

3 EXERCISE

Multiple Choice Questions :

1. (c) Thermoset plastics are usually harder, stronger and more brittle than thermoplastics.
2. (c) Cellulose, proteins, starch etc., are natural polymer.
3. (a) Nylon is more stretchy.
4. (d) These are made of phenol formaldehyde resins.
5. (c) Plastics are polymer
6. (d) Candles are hydrocarbon of higher group
7. (a) Orlon, polypropylene and nylon are prepared synthetically by chemical methods thus they are synthetic fibres.
8. (c) Rayon as it is obtained from cellulose
9. (a) Wood is the major raw material of rayon
10. (d)
11. (a) Terrywool is obtained by mixing polyester (synthetic fibre) and wool (natural fibre)
12. (d) All are correct options
13. (c) Nylon and polyester are synthetic fibres obtained from plastic material we get mainly from petroleum.
14. (c) Wool retains air between the fibres. That is why it is fluffy. This enables it to retain body heat. Woolen clothes are therefore, good for wearing in cold weather.
15. (d) None of the above is natural, all are synthetic fibres.
16. (c) Rayon, Nylon and Polyester are synthetic fibres.
17. (a) Polyethylene terephthalate
18. (b) Rayon have appreciable absorbent properties.
19. (d) Bakelite is a thermosetting plastics
20. (a) Polyester + Cotton = Polycot
21. (c) 22. (a) 23. (b)

More Than One Option Correct :

1. (a, b, c) 2. (a, b, d) 3. (b, c, d)
4. (a, b, c)
5. (b, c, d)
Angora wools is obtained from angora goats, which are found in hilly areas like Jammu and Kashmir. It is a natural fibre.

Passage Based Questions :

1. (a) 2. (c)
3. (b) polyester alone accounts for around 60% use of synthetic fibre
4. (a) 5. (c) 6. (a, b)

Assertion & Reason :

1. (a) Clothes made up of synthetic fibres have less air spaces in them than the natural fibres and do not 'breathe' so well.

2. (a) Bakelite is used for making electrical switches and plugs because it is an insulator.
3. (a) Acrylic fabric is synthetic wool which is also called orlon.
4. (a)
5. (b) Synthetic fibres are man-made polymers. Polymers also occur in nature for e.g., cotton is a polymer called cellulose which is made up of a large number of glucose units.
6. (a) Being a strong fibre nylon has strong load bearing capacity that is why nylon is used to make rock climbing ropes, parachutes, car seat belts and fishing nets.
7. (d) Handles of utensils are made up of thermosetting plastics because they do not soften on heating.
8. (b) Plastics are non-biodegradable and take several years to decompose. They adversely affect our ecosystem. Thus we should avoid plastics as far as possible.

Multiple Matching Questions :

1. $A \rightarrow (p, q, s), B \rightarrow (p, r), C \rightarrow (p, q, s), D \rightarrow (p, r)$

Integer Type Questions :

1. 1
Nylon
2. 2
Cooker handles and Electrical switches.

4 EXERCISE

1. (d) Glasses are amorphous.
2. (c) 3. (b)
4. (d) Due to this it is used in tyres.
5. (a) 6. (d)
7. (c) Equanil is a tranquilizer
8. (b) 9. (b) 10. (c)
11. (c) Broad spectrum antibiotics act on different antigens.
12. (c) Any oils which are good for eating or cooking, can be used in making soap. One of the best is said to be Coconut oil. Groundnut, Shea butter, Cocoa butter, Sun flower and many other vegetable oils are also used.
13. (d) Glass is an amorphous substance.
14. (a) The major component used in the preparation of different types of glasses is silica.
15. (a) Detergent dissolves in water faster than soap.
16. (a, b, c) 17. (a, c) 18. (a, b, c)
19. (a, b, c, d) 20. (a, c) 21. (a, b)
22. (a, c) 23. (a) 24. (a, b, c)
25. (a) 26. (b)
27. $A \rightarrow (p, q, s), B \rightarrow (q, r, t), C \rightarrow (p, q), D \rightarrow (q)$
28. 2
Laminated glass and opaque glass are type of processed glass.