

CHAPTER - 3

SYNTHETIC FIBRES AND PLASTICS

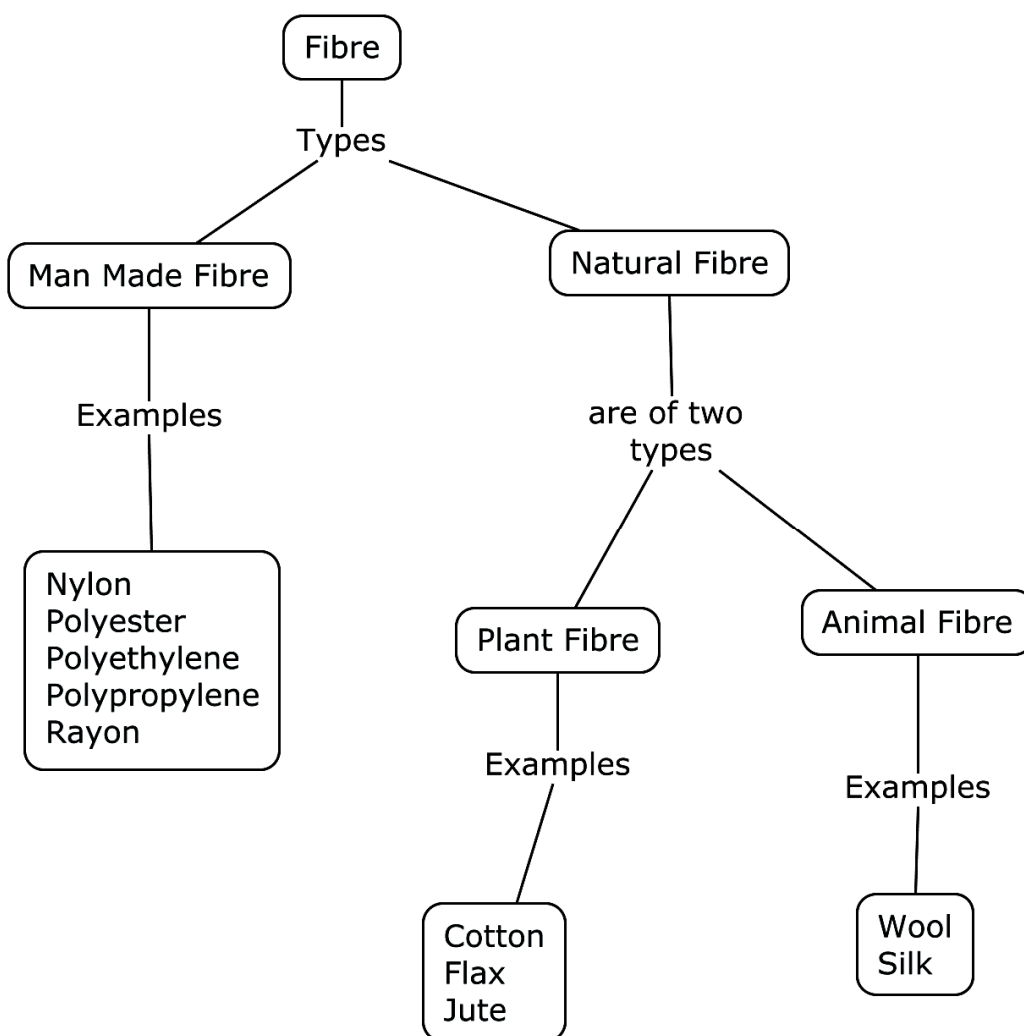
Cloth is one of our basic needs. Cloth protects us from heat, cold, rain, dust, insects, etc. Clothes also make one civilized and smart. Clothes are made of cloth. Cloth is also known as fabric. Fabric is made of fiber.

TYPES OF FIBRE

There are two types of fibre, viz. natural and man-made.

Natural fibers: Natural fibers are obtained from plants and animals; such as jute, cotton, wool, silk, etc.

Synthetic Fibre or Man-made fibers: Fibers that are synthesized in laboratory are called man-made fiber, such as terylene, terry-cotton, acrylic, etc.



Types of Natural fiber:

Natural fibers can be classified into two types – Plant fiber and Animal fiber.

Plant Fiber: Fiber obtained from plants is called plant fiber. For example – cotton, jute, flex, etc.

Animal Fiber: Fiber obtained from animals is called animal fiber. For example: wool and silk.

SYNTHETIC FIBRE

Fibres which are man-made are called synthetic fibres, e.g. nylon, acrylic, etc. A synthetic fibre is made of multiple units of a chemical substance. The units in a fibre are joined together like a chain.

Petrochemicals: Almost all synthetic fibres are made using raw materials from petroleum. Such raw materials which come from petroleum are called petrochemicals.

Polymer: A chain of a particular chemical substance is called a polymer. The individual unit in a polymer is called the monomer. Thus, a polymer is made up of many monomers. All synthetic fibres are polymers. Even cotton is a polymer.

TYPES OF SYNTHETIC FIBRE

Rayon: Rayon was discovered towards the end of the nineteenth century. It was made by chemical treatment of wood pulp and was the first synthetic fibre.

- Rayon is similar to silk but is cheaper than silk. Hence, rayon is also called ‘poor man’s silk’.
- Rayon can be dyed in various colours.
- Rayon is usually mixed with cotton to make bedsheet and dress materials.

Nylon: Nylon was made in 1931. The term ‘nylon’ has been derived from letters of ‘New York’ and ‘London’. No ingredient from plant or animal source was used in making nylon, as it is made from coal, water and air. Hence, nylon is called the first truly synthetic fibre.

- Nylon is strong, light and elastic.
- It is lustrous and easy to wash.
- Nylon is used in many articles; like socks, bags, toothbrush, rope, sneakers, parachute, etc.
- For the same thickness, a nylon thread is stronger than a steel wire.



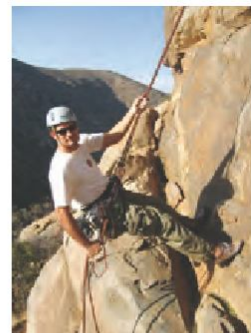
(a) Socks



(b) Toothbrush
bristles



(c) Parachute



(d) Climbing ropes

Some of the uses of nylon fibres

Polyester: Polyester is made of repeating units of a chemical called ester.

- Terylene is a popular polyester which is used in dress materials.
- PET (Poly Ethylene Terephthalate) is another example of polyester. It is used for making bottles, utensils, films, wires and many other items.
- Polyester fabrics do not wrinkle easily and are easy to wash.

Acrylic: Acrylic resembled wool and hence is also called synthetic wool. It is cheaper and more durable than wool, and is easier to wash and maintain.

- It can also be dyed very well in a variety of color.
- Strong & warm, acrylic fiber is often used for making sweaters and tracksuits and as linings for boots and gloves as well as in furnishing fabrics and carpets.
- It is used in craft yarns, boat sails and vehicle covers.

Characteristics of Synthetic Fibres:

- They are stronger, more elastic and make tough and durable fabrics.
- They are color- resistant and do not bleed color when washed.
- They are easy to wash and dry.
- They do not shrink when washed.
- They are resistant to attack by moths.

Disadvantages of Synthetic Fibres:

- Synthetic fibers cannot absorb moisture. This makes them unsuitable to be worn during summers when our body sweats.
- It is dangerous to wear them while near fire, as they catch fire easily.
- They cannot be easily ironed as they melt very easily.

PLASTICS

Plastic too is a polymer. But arrangement of units is different in different types of plastic. In some plastics, the individual units are linked in a linear fashion. In some other plastics, the individual units are cross-linked.

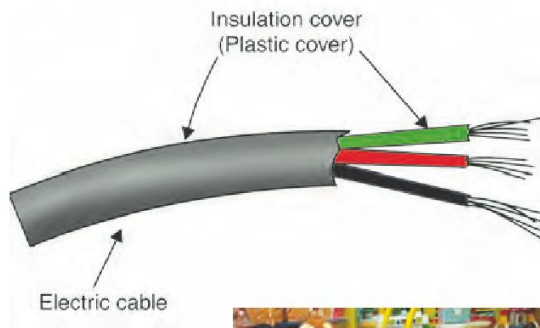


Some of the articles (or things) made of plastics which are used in our everyday life.

TYPES OF PLASTIC:

Thermoplastic: Some plastics easily get deformed on heating, and can be easily bent and reshaped by heating. Such plastics can be made soft and hard again and again. ***A plastic which can be softened repeatedly by heating and can be moulded into different shapes again and again, is called a thermoplastic.***

Thermoplastics are flexible so they can be bent easily (without breaking). Thermoplastics are also known as thermosoftening plastics. Some of the examples of thermoplastics are : Polythene and Polyvinyl chloride (PVC).



Some of the articles (or objects) made of thermoplastics (or thermosoftening plastics).

Thermosetting Plastic: Some plastics do not get deformed on heating, and cannot be re-molded into a new shape. Such plastics are called thermosetting plastic. Bakelite and melamine are examples of thermosetting plastic. Bakelite is used for making electrical switches and switchboards because it is a poor conductor of heat and electricity. Melamine is resistant to fire and is hence used for making utensils.



Some of the articles (or objects) made of thermosetting plastics.

Reasons for popularity of plastic:

- Plastic is non-reactive: Unlike iron; plastic does not react with air to form rust. Due to this, plastic has replaced iron from many articles. Plastic does not react with many chemicals, and so, plastic containers are used for keeping many materials and chemicals.
- Plastic is light, strong and durable: Plastic is lightweight, strong and durable. Plastic chairs have replaced wooden chairs in most of the households. Wooden crates have been replaced by plastic crates; for keeping milk and cold drinks. Most of the warehouses now use plastic pellets for keeping goods.
- Plastic is poor conductor of heat and electricity: Because of poor conductivity to heat and electricity; plastic is used for making switches and many components of electrical appliances. Handles of utensils are made of plastic because such handles do not heat up.

PLASTIC AND THE ENVIRONMENT

Biodegradable: A material which can be decomposed by microbes is called a biodegradable material, e.g. jute, cotton, paper, leftover food, etc.

Non-biodegradable: A material which cannot be decomposed by microbes is called a non-biodegradable material, e.g. plastic, iron, copper, etc.

The non-biodegradable nature of plastic poses a big problem. Plastic has become very popular due to many of its inherent benefits. But popularity of plastic is proving to be a curse for the environment. Plastic waste is getting accumulated all around us, in the street, on sidewalk, in drains, on garbage dumping sites, etc. This is creating a burden of plastic waste on the earth.

Nuisance of plastic bags:

- Plastic bag keeps on accumulating in the environment.
- It chokes drains.
- A stray animal can die if it accidentally swallows plastic bag.

How to tackle the problem of plastic waste?

- Follow the principles of three Rs, i.e. Reduce, Reuse and Recycle.
- Use recyclable plastic or use shopping bags of cloth or jute.
- Do not throw plastic bags on roads or in drains.
- Reuse plastic containers for keeping household items.

NCERT EXERCISE QUESTIONS AND ANSWERS

1. Explain why some fibres are called synthetic.

Answer: Some fibres are made in factories or laboratories. Hence, they are called synthetic fibres.

2. 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

Answer: (b) It is obtained from wood pulp

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 _____.

Answer: (a) man-made, artificial, (b) petrochemicals, (c) polymer

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

Answer: Nylon is used for making parachutes. A parachute needs to be strong as it has to withstand high speed wind and huge amount of air pressure. Nylon ropes are used by mountaineers. A mountaineer's life highly depends on the strength of ropes he is using. These examples show that nylon fibres are very strong.

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

Answer: Plastic does not react with most of the substances. Hence, food kept in plastic container remains fresh for longer duration. Due to this, plastic containers are preferred for storing food.

6. Explain the difference between the thermoplastic and thermosetting plastics.

Thermoplastic	Thermosetting plastic
Can be remolded.	Cannot be remolded.
It is not fire-resistant.	It is fire-resistant.
Used for making toys, buckets, mugs, etc.	Used for making switches, switchboards, utensils, etc.

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

(a) Saucepan handles

Answer: Thermosetting plastic is fire-resistant and can withstand very high temperature. Due to this, saucepan handles are made of thermosetting plastic. Such handles do not heat up during cooking.

(b) Electric plugs/switches/plug boards

Answer: Thermosetting plastic is bad conductor of electricity and heat. Hence, electric plugs, switches and plug boards are made of thermosetting plastic.

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.

Answer: Can be recycled: plastic toys, ball point pens, plastic bowls, plastic chairs

Cannot be recycled: Telephone instruments, cooker handles, carry bags, plastic covering on electrical wires, electrical switches

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

Answer: A shirt made from synthetic materials does not allow air to pass through it. On the other hand, a shirt made from cotton allows air to pass through it. Due to this, a cotton shirt keeps the body temperature lower. Hence, a cotton shirt is more comfortable than a shirt made from synthetic material. This shows that Rana should buy a cotton shirt.

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

Answer: We know that acids and bases are corrosive in nature. Now-a-days, many acids and bases are stored in plastic containers. This is possible because of non-corrosive nature of plastic. A plastic chair does not get rusted; unlike an iron chair. This also happens because of non-corrosive nature of plastic.

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

Answer: Purpose of the handle of a toothbrush is different from the purpose of bristles of the toothbrush. The handle needs to be strong and less flexible. The bristles need to be highly flexible, soft yet durable. Hence, bristles need to be made up of different material than the material of toothbrush handle.

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

Answer: We know that plastic is non-biodegradable. This means that plastic waste is getting accumulated in our environment. Accumulation of plastic waste is creating a huge

problem for us. Hence, we should avoid plastic as far as possible. We should switch over to biodegradable alternatives wherever possible. For example; we should use shopping bags made up of jute or cloth instead of plastic.

13. Match the terms of column I correctly with the phrases given in column II.

Column I	Column II
(a) Polyester	(1) Prepared by using wood pulp
(b) Teflon	(2) Used for making parachutes and stockings
(c) Rayon	(3) Used to make non-stick cookwares
(d) Nylon	(4) Fabrics do not wrinkle easily

Answer: a → 4, b → 3, c → 1, d → 2

14. 'Manufacturing synthetic fibres is actually helping conservation of forests'. Comment.

Answer: Synthetic fibres have replaced natural fibres for most uses. It has resulted in reducing our dependency on natural fibres. Many natural fibres come from plants and hence plants need to be cut to obtain these fibres. Less demand for natural fibres means there is reduced need to cut trees. It has helped in conservation of forests. Hence, it can be said that manufacturing synthetic fibres is actually helping conservation of forests.

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

Answer: For this, take a small piece of thermoplastic, some copper wires, two electric cells (from torch) and an electric bulb (from torch).

- Connect the bulb with the battery, and attach the thermosetting plastic to wires; to make a circuit.
- It is observed that the bulb does not glow.
- When thermosetting plastic is replaced with a metal rod in the circuit, the bulb begins to glow.
- This shows that thermosetting plastic is a poor conductor of electricity.



QUESTION BANK (SET 01)

- Rayon is different from truly synthetic fibres because :
 - it has a silk-like appearance.
 - it is obtained from wood pulp,
 - its fibres can be woven like those of natural fibres.
 - it can be dyed in wide variety of colours.
- The synthetic material which can be used for making fabrics as well as shatterproof bottles and jars is :
 - nylon
 - rayon
 - polyester
 - acrylic
- Which of the following has cross-linked polymer chains ?
 - bakelite
 - polyester
 - PVC
 - nylon
- The man-made fibre made from the cellulose polymer is :
 - nylon
 - acrylic
 - rayon
 - polyester
- Which of the following is not a thermoplastic polymer ?
 - polyester
 - melamine
 - nylon
 - polyvinyl chloride
- The synthetic polymer which can be used as a substitute for wool for making sweaters and shawls, etc.,
 - nylon
 - polyester
 - terylene
 - acrylic
- Which of the following is not a synthetic fibre ?
 - nylon
 - flax
 - acrylic
 - polyester
- The synthetic fibre which contains the organic groups similar to those which give fruits their 'sweet smell' is
 - nylon
 - acrylic
 - terylene
 - rayon
- The man-made fibre rayon is chemically identical to :
 - wool
 - silk
 - jute
 - cotton
- One of the following man-made fibre is not prepared from raw materials obtained from petrochemicals. This one is :
 - polyester
 - nylon
 - rayon
 - acrylic
- Which of the following plastics do not have cross-links between their polymer chains ?
 - Nylon
 - Melamine
 - Terylene
 - Bakelite
 - A and B
 - B and C
 - A and C
 - C and D
- The clothes of a person working in the kitchen catch fire accidentally causing severe burns. The person is most likely wearing clothes made of :
 - flax
 - rayon
 - terylene
 - cotton
- The plastic which is coated on the uniforms of firemen to make them fire-resistant is :
 - bakelite
 - polythene
 - teflon
 - melamine
- Which of the following is a man-made fibre prepared from Wood-pulp ?
 - flax
 - nylon
 - acrylic
 - rayon

15. The manufacture of one of the following artificial fibres contributes to deforestation. This fibre is :
(a) nylon (b) rayon (c) terylene (d) acrylic
16. The non-stick coating on frying pans is that of a plastic called :
(a) polyvinyl chloride (b) melamine (c) bakelite (d) teflon
17. Which of the following plastics is used for making electric switches ?
(a) teflon (b) melamine (c) PET (d) bakelite
18. Which of the following are thermosetting polymers ?
A. Melamine B. Terylene C. Polythene D. Bakelite
(a) A and B (b) B and C (c) A and D (d) B and D
19. The similarity between artificial silk and cotton is that :
(a) both are non-biodegradable (b) both melt on heating
(c) both are amide polymers (d) both are cellulose polymers
20. Which of the following plastic objects can be recycled ?
A. Electric socket B. Polythene bag C. PVC pipe D. Ashtray
(a) A and B (b) B and C (c) A and D (d) C and D
21. Fill in the following blanks with suitable words :
- (a) Synthetic fibres are also called _____ or _____ fibres.
- (b) Synthetic fibres are made from raw materials called _____
- (c) Like synthetic fibres, plastic is also a _____
- (d) The use of plastics can be reduced by using bags made of _____ or _____ instead of polythene bags
22. Name the units of which cellulose polymer is made.
23. Name the man-made fibre prepared from natural materials.
24. Name the man-made fibre which is regarded as artificial silk.
25. Name the fibre obtained by the chemical treatment of wood pulp (or cellulose).
26. Name the first fully synthetic fibre.
27. Name the fibre used for making parachutes and rock climbing ropes.
28. Which synthetic fibre contains the organic group similar to those which give fruits their sweet smell ?
29. Which synthetic fibre feels like wool and used as a substitute for wool?
30. To which kind of synthetic fibres does terylene belong ?
31. State one disadvantage of using synthetic fibres for making clothes.
32. Name the form of polyester which is replacing materials like glass and used for making bottles and jars
33. Name four different plastics.
34. Give one use of teflon.
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35. Which of the two is a thermosetting plastic : PVC or bakelite ?
 36. What is a polymer ? Name the natural polymer of which cotton is made.
 37. State the characteristics of synthetic fibres.
 38. What is nylon ? State the important properties of nylon.
 39. Give the important uses of nylon.
 40. What is polyester ? Name a popular polyester.
 41. Arrange the following fibres in the order of increasing strength (keeping the fibre of least strength first)
Nylon, Cotton, Wool, Polyester, Silk
 42. What is acrylic ? State one important property of acrylic.
 43. Write the uses of acrylic fibres.
 44. Why should we not wear clothes made of synthetic fibres (like nylon or polyester) while working in the kitchen ?
 45. What type of shirts should we buy for summer : cotton shirts or shirts made from synthetic materials (like polyester) ? Give reason for your answer.
 46. Explain how, manufacturing of synthetic fibres is actually helping in the conservation of forests.
 47. What are plastics ? Name any five commonly used articles made of plastics.
 48. What are the various types of plastics ? Give two examples of each type of plastics.
 49. Why are thermoplastics not used for making frying pan handles ?
 50. Explain why, frying pan handles are made of thermosetting plastics.
 51. Why are electric switches, plugs and sockets made of thermosetting plastics ?
 52. Explain the difference between thermoplastics and thermosetting plastics.
 53. Should the handle and bristles of a toothbrush be made of the same type of plastic material ?
Explain your answer.
 54. Explain why, plastic containers are preferred for storing food.
 55. Choose the thermoplastics and thermosetting plastics from the following :
Melamine, Polythene, Bakelite, Polyvinyl chloride
 56. State two uses of polythene.
 57. Write the full form of PVC. Is it thermoplastic or thermosetting plastic ?
 58. Write two uses of bakelite.
 59. State two uses of melamine.
 60. Give two uses of PVC.
 61. Write some of the uses of plastics in healthcare industry.
 62. Classify the following as biodegradable and non—biodegradable materials :
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- 63.** Woollen clothes, Polythene bags, Paper, Aluminium cans, Toothbrush, Peels of vegetables and fruits, Cotton cloth, Jute bag, Electric switch, Frying pan handle
- 64.** State whether plastic is biodegradable or non-biodegradable ? Give reasons for your answer
- 65.** Explain how, the use of plastics has a bad effect on the environment.
- 66.** Explain why, the disposal of plastic wastes is a major problem. Give two reasons only.
- 67.** What are the various ways to save the environment from excessive plastic wastes ?
- 68.** How do carelessly thrown plastic bags (polythene bags) affect :
- 69.** (a) dirty water drains and sewers ?
- 70.** (b) animals (such as cows) ?
- 71.** What is meant by the 3R's principle in the context of use of plastics ?
- 72.** State the various ways in which we can avoid (or minimise) the use of plastics.



QUESTION BANK (SET 02)

- Pick the synthetic fibre out of the following?
(a) Cotton (c) Jute
(b) Nylon (d) Wool
- Which of the following is a source of rayon?
(a) Wool (c) Wood pulp
(b) PET (d) Silk
- Polycot is obtained by mixing
(a) nylon and wool (c) nylon and cotton
(b) polyester and wool (d) polyester and cotton
- Which is a thermosetting plastic?
(a) Melamine (c) PVC
(b) Polythene (d) Nylon
- The material similar to silk in appearance is
(a) Nylon (c) Polyester
(b) Rayon (d) Terylene
- The most suitable material for the preparation of handles of cooking utensils is
(a) Polythene (c) Nylon
(b) PVC (d) Bakelite
- Which of the following is not a common property of plastics?
(a) Non-reactive (c) Durable
(b) Light in weight (d) Good conductor of electricity
- Which of the following groups contain all synthetic substances?
(a) Nylon, Terylene, Wool (c) PVC, Polythene, Bakelite
(b) Cotton, Polycot, Rayon (d) Acrylic, Silk, Wool
- The material which is commonly used for making kitchen containers is
(a) PVC (c) Teflon
(b) Acrylic (d) PET
- The purest natural form of cellulose obtained from plants is
(a) rayon
(b) cotton
(c) wool
(d) silk
- The first synthetic fibre produced chemically is
(a) rayon
(b) nylon
(c) polyester
(d) acrylon
- The synthetic plastic used for making insulation cover in electrical wires/cables is
(a) bakelite (b) melamine (c) polyvinyl chloride (d) polystyrene

13. A synthetic polymer called polythene is prepared from
- (a) ethylene
 - (b) ethene
 - (c) ethanol
 - (d) ethane
14. Teflon is a long chain polymer of a chemical substance called _____.
- (a) aldehyde
 - (b) tetra fluoroethene
 - (c) alcohol
 - (d) ethene
15. The fibre that burns readily with smell of burning paper is —
- (a) Polyester
 - (b) Cotton
 - (c) Rayon
 - (d) Acrylic
16. Nylon is a polymer which is termed as —
- (a) Polyamide
 - (b) Polyester
 - (c) Polyamine
 - (d) Polyvinyl
17. Which of the following is a polymer of tetrafluoroethene ?
- (a) PVC
 - (b) Teflon
 - (c) Bakelite
 - (d) Nylon
18. Which of the following is a thermosetting plastic ?
- (a) PVC
 - (b) Teflon
 - (c) Bakelite
 - (d) Nylon
19. Which of these fibres is made from raw material obtained from plants ?
- (a) Rayon
 - (b) Nylon
 - (c) Terylene
 - (d) Polyester
20. _____ is obtained from hair of an animal.
- (a) Silk
 - (b) Nylon
 - (c) Cotton
 - (d) Wool
21. Fill in the blanks.
- (a) _____ is a thermosetting polymer.
 - (b) Polyesters are made from _____ products.
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- (c) Synthetic fibres are not good absorbers of _____.
- (d) _____ burns vigorously and leaves very little ash.
- (e) _____ is a superior synthetic polyamide fibre used to manufacture type cords.
- (f) All polymers/plastics are _____.
- (g) Synthetic fibres do not absorb _____.
- (h) Thermoplastics can be _____ ; while thermosetting polymers can not be _____.
- (i) The chemical name of Teflon is _____.
- (j) Careless disposal of used plastic bags produces _____.
- (k) The simplest molecule of a polymer is called _____.
- (l) Polymer of vinyl chloride is _____.
- (m) _____ has anti – stick property and used as a coating on the surface of frying pan.
- (n) The rayon is obtained from _____ solution.

22. Write True for the correct statement and False for the incorrect statement.

- (a) Polyester is prepared from petroleum products. _____
- (b) Rayon is made from methanol. _____
- (c) Structure of a polymer can be compared to that of a gemstone in a ring. _____
- (d) Bakelite is a poor conductor of electricity. _____
- (e) Polymers can have a cross-linked arrangement of molecules. _____

23. Give one word answer.

- (a) The process of formation of polymers by joining of monomers. _____
- (b) Chemical molecules formed naturally like silk, cotton, etc. _____
- (c) A kind of expanded polystyrene. _____
- (d) Strength of the fibre. _____

24. Cotton is a natural polymer. What is its chemical name?

25. A synthetic fiber which looks like silk is obtained by chemical treatment of wood pulp. It is, therefore, known as artificial silk. What is its common name?

26. Terrycot is made by mixing two types of fibres. Write the names of the fibres.

27. Plastic articles are available in all possible shapes and sizes. Can you tell why?

28. 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?

29. Why is it not advisable to burn plastic and synthetic fabrics?

30. Select the articles from the following list which are biodegradable.

- (a) paper (c) wood (b) woolen clothes (d) aluminium can
- (e) plastic bag (f) peels of vegetables

31. A bucket made of plastic does not rust like a bucket made of iron. Why?

32. Differentiate between:

- (a) Thermosetting plastic and thermoplastic.
- (b) Biodegradable and non-biodegradable material.

