

SCIENCE

Chapter 3: Cell – Synthetic Fibres and Plastics



Synthetic Fibres and Plastics

Introduction

- The clothes which we wear are made of fabrics.
- Fabrics are made of fibres obtained from natural or artificial sources.
- The fibres obtained from plants and animals are called natural fibres. Cotton, jute, wool and silk are natural fibres.
- The synthetic fibres are made by human beings. Rayon, nylon, polyester are synthetic fibres.

Synthetic Fibres

- A synthetic fibre is a long chain of small units joined together, and each small unit is actually a chemical substance.
- A **polymer** is a very big molecule formed by the combination of a large number of small molecules.
- The word polymer comes from two Greek words *poly* meaning many and *mer* meaning units.
- The small molecules which join to form a polymer are called **monomers**.

Types of Synthetic Fibres

Rayon

- Rayon is often regarded as artificial silk.
- It is a man-made fibre prepared from a natural raw material called cellulose by chemical treatment.
- The cellulose required for making rayon is obtained from wood pulp.
- So, rayon is obtained by the chemical treatment of wood pulp.

Uses:

- ✓ In the textile industry for making sarees and dresses
- ✓ To make carpets
- ✓ In the medical field for making bandages and surgical dressings
- ✓ In making bedsheets, curtains and blankets



Nylon

Nylon is the first fully synthetic fibre made by man without using any natural raw materials.

Properties:

- It is very strong, elastic, lightweight and lustrous.
- They absorb very little water, so clothes made of nylon are easy to wash and dry.
- It is wrinkle resistant.

Uses:

- In making socks, tents, toothbrushes, car seat belts and curtains
- For making parachute
- In making ropes for rock climbing.



Polyester

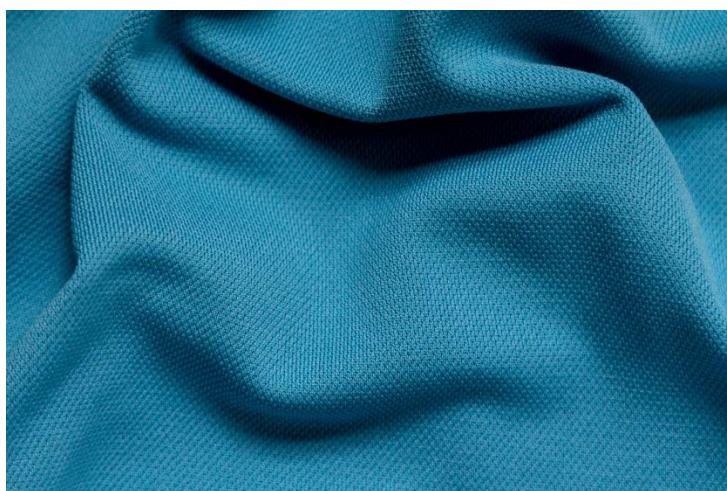
- Polyester is a synthetic fibre.
- Polyester (poly + ester) is made of repeating units of a chemical called an ester.
- Terylene is a popular polyester fibre.

- Polyester fabric is strong and wrinkle resistant.
- It is easy to wash and dry.
- Natural fibres (like cotton and wool) are also mixed with polyester to make blended fabrics like polycot or polywool. As the name suggests, these fabrics are made by blending two types of fibres.

Example: Polycot is a mixture of polyester and cotton. Similarly, polywool is a mixture of polyester and wool.

Uses:

- In making fabrics for sarees, dress materials and curtains
- For making PET bottles, utensils, films, wires and other useful PET products

**Acrylic**

Because of its wool-like feel, acrylic fibre is often used as a substitute for wool.

Properties:

- ✓ It is lightweight, soft and warm with a wool-like feel.
- ✓ It retains its shape and resists shrinkage and wrinkles.
- ✓ It is strong and durable.

Uses:

It is used for making sweaters, shawls, blankets, jackets, sportswear, socks, furnishing fabrics and carpets.



Characteristics of Synthetic Fibres


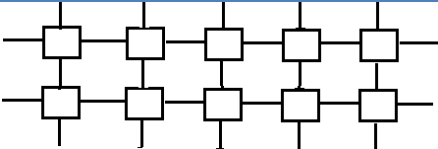
- Synthetic fibres are very strong and more durable.
- They absorb very little water and dry up quickly.
- They are wrinkle resistant and quite lightweight.
- They are less expensive and readily available.
- Clothes made of synthetic fibres are easy to maintain.

Disadvantages of Synthetic fibers

- 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

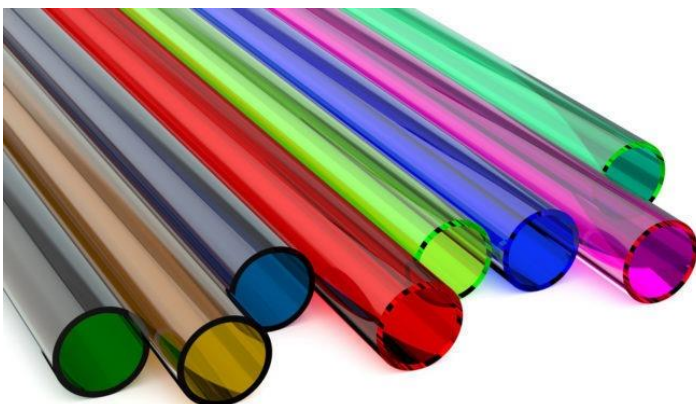
- Plastics are also polymers.
- It is a synthetic material which can be moulded into desired shape when soft and then hardened to produce a durable article.
- Plastics also consist of very long molecules made by joining many small molecules.
- Polythene (poly + ethene = polyethene) is an example of a plastic. It is obtained by polymerisation of a chemical compound known as ethene.
- Plastic does not have the same type of arrangement. Sometimes, it is linear, whereas in others, it is cross-linked.

	
Linear (Thermoplastics)	Cross-linked (Thermosetting plastics)

Plastics are of two types:

i. Thermoplastics

- A plastic which can be softened repeatedly by heating and can be moulded into different shapes again and again is called a thermoplastic.
- Polythene and PVC are examples of thermoplastics.
- Uses: In manufacturing toys, combs, various types of containers



ii. Thermosetting plastics

- A plastic which when set does not become soft on heating again and cannot be moulded a second time is called a thermosetting plastic.
- Bakelite and melamine are examples of thermosetting plastics.
- Bakelite is a poor conductor of heat and electricity. So, it is used for making electrical switches and handles of various utensils.



Properties of Plastics

- Plastics are chemically unreactive. They do not react with air and water. As a result, plastics are resistant to corrosion.
- As they can be easily moulded, they are used to make a large variety of articles with different shapes and sizes.
- Plastics do not conduct heat and electricity. So, they are used as electrical insulators.
- Because they have low density, they are lighter than metals. They also have good strength and are durable. Being lighter than metals, plastics are also used in cars, aircraft and spacecraft.
- Plastics are generally cheaper and can be made more easily than metals. So, they are widely used for making many household and industrial articles.

Plastics and Environment

- Articles made of plastics are non-biodegradable. This causes a great problem in the disposal of plastic wastes.
- The burning of plastic wastes gives out harmful gases in the atmosphere, causing air pollution.

Problems with excessive use of plastics

Plastics are non-biodegradable and do not decompose for several years. When plastics are burnt, toxic fumes are released into the atmosphere causing pollution.

How to Save the Environment?

- Avoid the use of plastics as far as possible and use bags made of cotton or jute.
- Biodegradable and non-biodegradable wastes should be collected and disposed separately.
- Most of the thermoplastic wastes can be recycled.
- As a responsible citizen, remember the 4R principle—Reduce, Reuse, Recycle and Recover.

500 million
tonnes of plastic are
produced annually worldwide

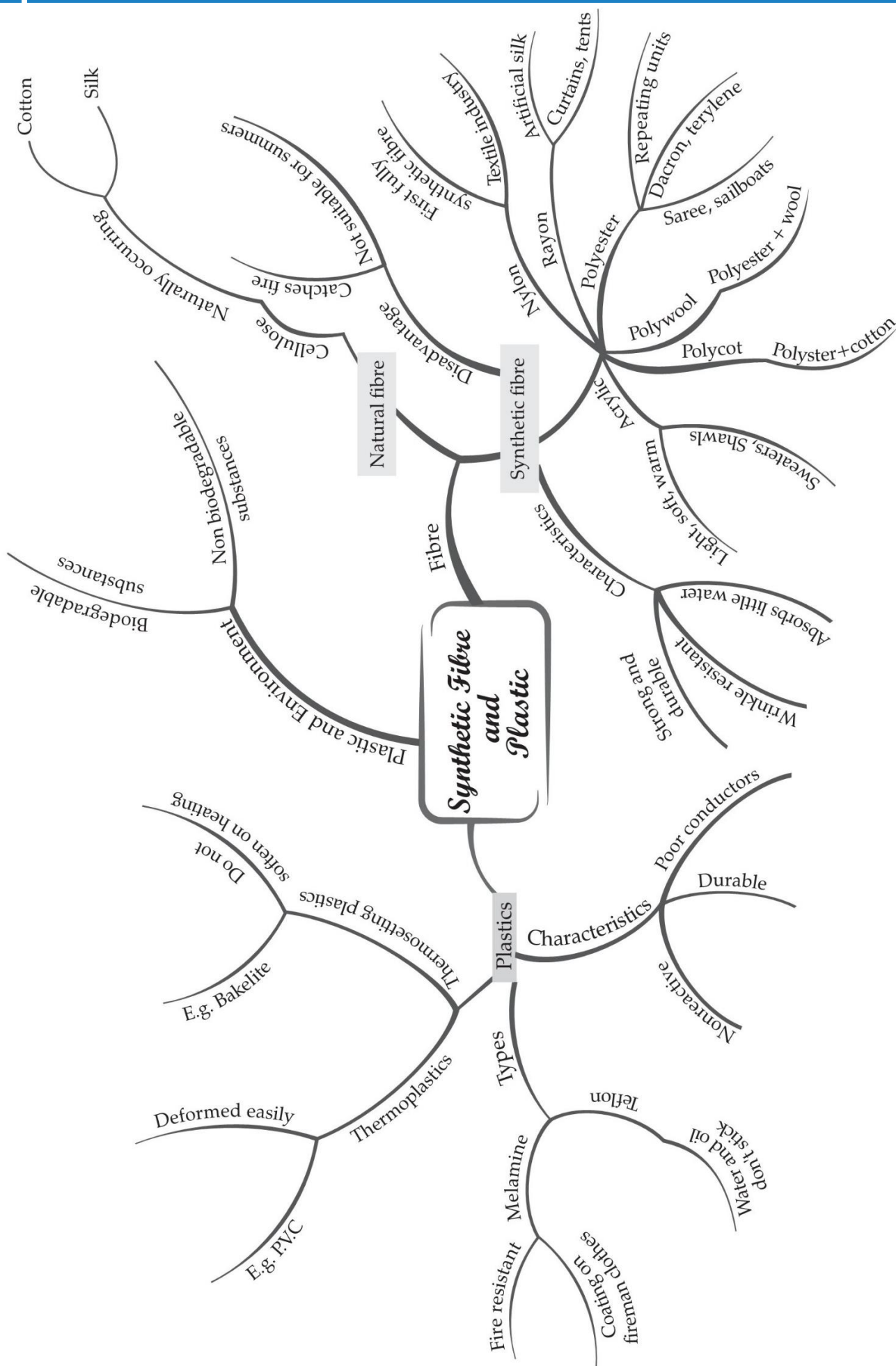
In 2020 we will generate
900% more
plastic than in 1980

By 2050
the oceans could contain
more plastics than fish



MIND MAP : LEARNING MADE SIMPLE

CHAPTER-1



Important Questions

Multiple Choice Questions-

Question 1. Cellulose is made up of a large number of units.

- (a) glucose
- (b) fructose
- (c) protein
- (d) none of these

Question 2. Synthetic fibres are:

- (a) strong
- (b) durable
- (c) hining
- (d) all of these

Question 3. Which of the following is not thermoplastics:

- (a) acrylic
- (b) polyethylene
- (c) polystyrene
- (d) melamine

Question 4. Wire made from which fibre is strongest:

- (a) nylon
- (b) cotton
- (c) wool
- (d) steel

Question 5. PET is form of:

- (a) steel
- (b) glass
- (c) polyester
- (d) nylon

Question 6. Which of the following is used to make non-stick cookwares:

- (a) polyester

(b) teflon

(c) rayon

(d) nylon

Question 7. Which of the following is used for making parachutes and stockings:

(a) polyester

(b) teflon

(c) rayon

(d) nylon

Question 8. Fabrics made of do not wrinkle easily.

(a) polyester

(b) teflon

(c) rayon

(d) nylon

Question 9. Wood pulp is used for preparation of:

(a) polyester

(b) teflon

(c) rayon

(d) nylon

Question 10. Which of the following softens on heating and then can be moulded into various shapes:

(a) thermosetting plastic

(b) thermoplastic

(c) polythene

(d) none of these

Question 11. Which of the following once set do not soften on heating:

(a) thermoplastic

(b) thermosetting plastic

(c) polythene

(d) none of these

Question 12. Food items are stored in plastic containers because they are:

- (a) corrosive
- (b) non-corrosive
- (c) easy to handle
- (d) all of these

Question 13. Bristles of tooth brush are made from:

- (a) thermoplastic
- (b) thermosetting plastic
- (c) nylon
- (d) PET

Question 14. Which of the following can be recycled:

- (a) carry bags
- (b) plastic chairs
- (c) telephone instruments
- (d) cooker handles

Question 15. Which of the following cannot be recycled:

- (a) plastic toys
- (b) plastic bowls
- (c) plastic covering on electric wires
- (d) ball point pens

Question 16. The fibre that burns readily with smell of burning paper is:

- (a) acrylic
- (b) polyester
- (c) cotton
- (d) rayon.

Question 17. Which of the following is a thermosetting plastic:

- (a) PVC
- (b) nylon
- (c) teflon

(d) bakelite

Question 18. Which of the following is obtained from hair of an animal:

(a) nylon

(b) silk

(c) cotton

(d) wool

Question 19. Which of these fibres is made from raw material obtained from plants:

(a) rayon

(b) nylon

(c) terylene

(d) polyester

Question 20. Which of the following fibre is synthetic:

(a) cotton

(b) jute

(c) nylon

(d) silk

Question 21. Which of the following fibre is natural polymer:

(a) rayon

(b) cotton

(c) polyester

(d) polythene

Question 22. Which of the following is not biodegradable:

(a) aluminium foil

(b) papers

(c) cow-dung

(d) rotten fruits

Question 23. Rayon is:

(a) artificial

(b) nylon

(c) artificial nylon

(d) none of these

Question 24. Polymer present in plants is:

(a) cellulose

(b) nylon

(c) rubber

(d) P.V.C.

Question 25. Natural substance is:

(a) plastics

(b) cement

(c) glass

(d) wood

Question 26. Polymer present in wood is:

(a) nylon

(b) cellulose

(c) polythene

(d) rubber

Question 27. Which of the following garbage is biodegradable:

(a) broken plastics things

(b) fruit peels

(c) cement

(d) iron wastes

Question 28. Polycot is a mixture of:

(a) polythene and cotton

(b) polyester and cotton

(c) polythene and wool

(d) polyester and wool

Question 29. Polywool is a mixture of:

(a) polythene and cotton

- (b) polyester and cotton
- (c) polythene and wool
- (d) polyester and wool

Question 30. A synthetic fibre resembling wool is:

- (a) rayon
- (b) nylon
- (c) acrylic
- (d) none of these

Very Short :

1. What are clothes made up of?
2. What are fabrics made up of?
3. How many types of sources of fibre are there?
4. What are natural fibres?
5. Give two examples of natural fibres.
6. What are synthetic fibres?
7. Name two man-made fibres.
8. What are polymers?
9. What is the word meaning of polymer?
10. Name a natural polymer.
11. What are the units of cellulose?
12. Name the fibre having properties similar to that of silk.
13. What is the common name of rayon?
14. How is rayon obtained?
15. Name a man-made fibre which is made without using natural raw materials.

Short Questions :

1. Differentiate between natural and artificial fibres.
2. Define polymer and give example of a polymer occurring in nature
3. What are the advantages of artificial silk over natural silk?
4. Explain the first "fully synthetic fibre".
5. Why nylon fibre became popular for making clothes?
6. Why nylon is used for making parachutes and ropes for rock climbing?

7. State the unique characteristic of polyester fabric and its applications
8. Name two polyester fabrics and their uses.
9. Name and explain a fibre which appears to resemble wool.
10. State the behaviour of natural fibre and synthetic fibre on burning.

Long Questions :

Question 1. Describe about nylon. Write its uses and properties.

Question 2. Write the advantages of synthetic fibres.

Question 3. List the common varieties of polyester. Also mention the natural fibres which are used for blending to enhance their properties.

Question 4. Explain the properties of plastics.

Question 5. 'Plastics are hazard to environment'. Explain this statement.

Question 6. List the strategies for plastic waste management.

ANSWER

1. Answer

(a) glucose

Cellulose is made up of a large number of glucose units.

2. Answer

(d) all of these

Synthetic fibres are strong, durable and shining

3. Answer

(d) melamine

Melamine is not thermoplastics, it is thermosetting plastic. Acrylic, polyethylene and polystyrene are thermoplastic.

4. Answer

(a) nylon

Wire made from nylon fibre is the strongest.

5. Answer

(c) polyester

PET is a form of polyester.

6. Answer

(b) teflon

Teflon is used to make non-stick cookwares.

7. Answer

(d) nylon

Nylon is used for making parachutes and stockings.

8. Answer

(d) nylon

Fabrics made of polyester do not wrinkle easily.

9. Answer

(c) rayon

Wood pulp is used for preparation of Rayon.

10. Answer

(b) thermoplastic

Thermoplastic softens on heating and then can be moulded into various shapes.

11. Answer

(b) thermosetting plastic

Thermosetting plastic once set do not soften on heating.

12. Answer

(b) non-corrosive

Food items are stored in plastic containers because they are non-corrosive.

13. Answer

(c) nylon

Bristles of tooth brush are made from nylon because it is soft, flexible and strong.

14. Answer

(c) telephone instruments

Telephone instruments can be recycled as it is made up of thermoplastics.

15. Answer

(c) plastic covering on electric wires

Plastic covering on electric wire cannot be recycled as it is made up of thermosetting plastics.

16. Answer

(c) cotton

Cotton fibre burns readily with smell of burning paper.

17. Answer

(d) bakelite

Bakelite is a thermosetting plastic.

18.Answer

(d) wool

Wool is obtained from hair of an animal (sheep).

19.Answer

(a) rayon

Rayon is made from cellulose obtained from wood pulp (plants).

20.Answer

(c) nylon

Nylon is synthetic whereas cotton, jute and silk are natural fibres.

21.Answer

(b)cotton

Cotton is natural polymer whereas rayon, polyester and polythene are synthetic polymers.

22.Answer

(a) artificial

Rayon is artificial silk

23.Answer

(a) cellulose

Polymer present in plants is cellulose.

24.Answer

(d) wood

Wood is a natural substance where as plastics, cement and glass are man-made substances.

25.Answer

(b) cellulose

Cellulose polymer is present in wood

26.Answer

(b) fruit peels

Fruit peels are biodegradable.

27.Answer

(b) polyester and cotton

Polycot is a mixture of polyester and cotton.

28. Answer

(d) polyester and wool

Polywool is a mixture of polyester and wool.

29. Answer

(c) acrylic

A synthetic fibre resembling wool is acrylic.

Very Short-

1. **Answer:** The clothes we wear are made of fabrics.

2. **Answer:** The fabrics are made of fibres.

3. **Answer:** There are two types of sources of fibres:

(i) Natural sources

(ii) Artificial sources.

4. **Answer:** The fibres obtained from plants or animals are called natural fibres.

5. **Answer:** (i) Cotton (ii) Jute.

6. **Answer:** The fibres made by human beings are called synthetic or man-made fibres.

7. **Answer:** (i) Nylon (ii) Rayon.

8. **Answer:** When a large number of small units combine to form a single large unit, then the large unit is called polymer.

9. **Answer:** Polymer consists of two words, poly and mer. Poly means many and mer means repeating units.

10. **Answer:** Cellulose.

11. **Answer:** Cellulose is made up of a large number of glucose units.

12. **Answer:** Rayon.

13. **Answer:** Rayon is known as artificial silk.

14. **Answer:** Rayon is obtained by chemical treatment of wood pulp.

15. **Answer:** Nylon.

Short Answer-

1. **Answer:**

Natural Fibres	Synthetic Fibres
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Comes from nature	Man-made fibres
Natural colour	Colour as per requirement is added in colour bath
During spinning process spinneret is not necessary	During spinning process spinneret is necessary for the production of filament
Chances of containing dust or impurities	No chance of any dust or impurities
Less durable than synthetic	More durable than natural

2. Answer: Synthetic fibres and plastics are made up of very large units called polymers, and polymers are made up of many smaller units. For example cotton is a polymer made up of cellulose and cellulose is made from large number of glucose units.
3. Answer: Advantages of artificial silk over natural silk are:
 - Artificial silk or rayon is cheaper than silk,
 - It can be dyed in a variety of colours
 - It can be used to make bed sheets on mixing with cotton, and on mixing with wool can be used to make carpets.
4. Answer: The first fully synthetic fibre was nylon. It was prepared from coal, water and air. It is very strong, elastic and light, very easy to wash and is used for making variety of things like socks, ropes, bags, curtains, parachutes etc.
5. Answer: The first fully synthetic fibre was nylon. It was prepared from coal, water and air. It is very strong, elastic and light, it is very easy to wash and used for making variety of things like socks, ropes, bags, curtains, parachutes etc.
6. Answer: Nylon thread is very strong infact it is stronger than steel wire, because of this property of nylon it is used for making parachutes and ropes for rock climbing.
7. Answer: Polyester fabrics do not get wrinkled easily and it remains crisp and can be washed easily than any other fabrics. Thus it is used to make dress, shirts etc. PET is one of the familiar form of polyester that is used to make bottles, utensils, wires and many other things
8. Answer: Terylene and PET are two widely used polyester fabrics. Terylene is used to make very fine yarn by which various dress materials are made. PET is one of the familiar form of polyester that is used to make bottles, utensils, wires and many other things
9. Answer: Acrylic fabric resembles wool, it is cheaper than wool and available is variety of colours. It is also more durable than wools.
10. Answer: On burning a natural fibre while on burning a synthetic fibre the fabric melts rapidly and in case of synthetic clothes it sticks to the body of person wearing it and cause

severe burn to that person, it is totally disastrous.

Long Answer-

1. Answer:

Nylon is the strongest amongst all the synthetic fibres. It is fully synthetic polymer which is prepared from coal, water and air. It is a polymer of amides. It was made in 1931 for the first time. It was used as a supplement of silk when silk got deficient during World War II for many military applications.

Uses of Nylon

- Nylon is used in toothbrushes, combs, etc.
- It is used to make parachutes, tents, ropes, etc.
- It is used to make socks and stockings as it is elastic.
- It is widely used for making clothes, carpets, etc.

Properties of Nylon

- It melts on heating.
- It absorbs less water.
- It is resistant to moths and fungi.
- It has high tensile strength.
- It is durable.

2. Answer:

Synthetic fibres has many advantages as compared to natural fibres.

Some of them are as follows:

- They are very strong and durable.
- They are cheaper in cost as compared to natural fibres.
- They absorb less water and are quick to dry.
- They do not shrink.
- They are very useful for saving our trees and animals as they are made up of chemicals.
- They are moth and insect resistant.

3. Answer

Polyester could be blended with natural fibres to enhance its properties.

The common varieties of polyester are:

- PET (Polyethylene terephthalate)
- Terrycot: It is made by blending polyester and cotton.

- Terrysilk: It is made by blending polyester and silk.
- Terrywool: It is made by blending polyester and wool.

4. Answer:

Plastics are those substances which are mostly synthetic in nature.

Following are the properties of plastics:

- Plastics are non-corrosive in nature, i.e., they do not react easily with air and water. They are unaffected by most of the chemicals in normal conditions.
- Plastics are the bad conductor of heat. They do not get heated up like metals.
- Plastics are non-biodegradable, i.e., they do not get decomposed by microorganisms.
- Plastics are very durable.

5. Answer:

Yes, plastics are hazard to environment. They make versatile materials but are very dangerous to the environment. Plastics are non-biodegradable in nature. It takes more than 100 years to decompose. If use of plastics are not reduced, our earth would turn into a big garbage bin.

The major problems due to plastics are:

- If plastics are burnt, they evolve poisonous gases. These gases destroy the ozone layer of the earth and also pollute the environment.
- If the plastics are disposed in drains, they choke the drains causing waterlogging.
- If these plastics are swallowed by the innocent animals along with their food, they harm their digestive system which leads to their death.
- They are manufactured by the consumption of a large amount of petroleum.

6. Answer:

Some of the strategies for plastic waste management are:

- We should use paper bags and jute bags instead of using plastic bags.
- The government should ban the use of plastic bags.
- Plastics should be recycled to make other useful products which do not harm the environment.
- We should use special garbage bins to dispose plastic wastes.
- We should not throw plastic wastes in water bodies.
- Practicing 4R's principle, i.e., Reuse, Recycle, Reduce and Recover should be encouraged.