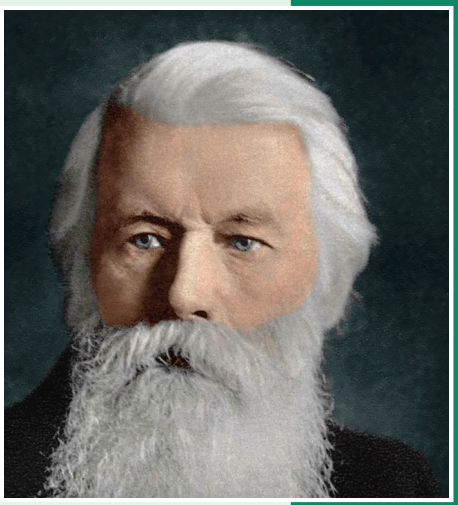
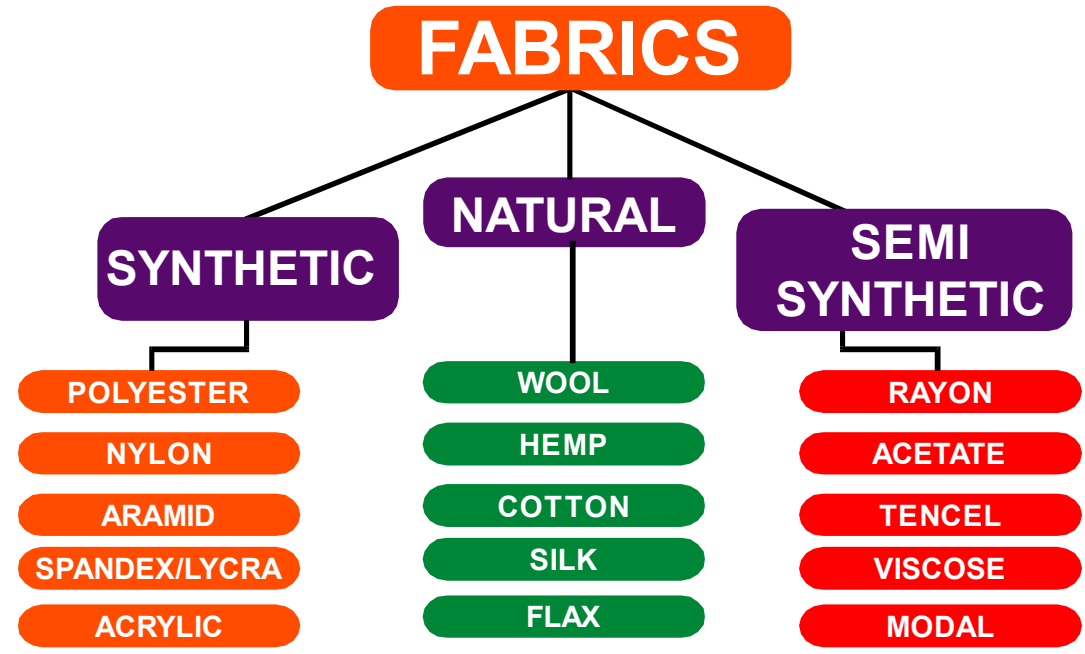
1 SYNTHETIC FIBRES AND PLASTICS

Joseph Wilson Swan invented the first synthetic fibre in the early 1880s. His fibre was drawn from a cellulose liquid, formed by chemically modifying the fibre contained in tree bark. The synthetic fibre produced through this process was chemically similar in its potential applications to the carbon filament Swan had developed for his incandescent light bulb, but Swan soon realized the potential of the fibre to revolutionise textile manufacturing.



CONCEPT MAP



Concept 1

Fabrics are made by weaving fibres (or threads) obtained from natural or artificial sources. They can be of two types:

Natural fibres and synthetic fibres

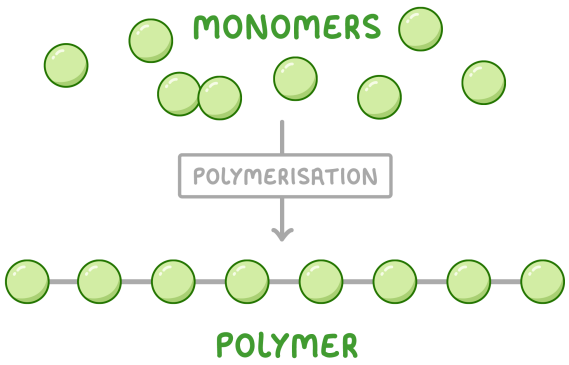
Natural fibres are obtained from natural sources e.g. Cotton, silk, wool and other is synthetic fibres which are man-made for example – rayon, nylon, acrylic etc.

A synthetic fibre, as well as plastic, is made up of a chain of small units (called monomers) which combine to form polymers.

Monomers: A monomer is a single molecule that can bond with other identical molecules to form polymers through a process called polymerisation.

Polymers: Polymer is a Greek word in which 'poly' means 'many' and 'mer' means units. Hence, polymers are large molecule made up of several molecules (or monomers) linked together.

Polymerisation: Polymerization is defined as the chemical process in which the monomers are joined together to form polymers. Normally, it takes several thousands of monomers.



Example of Polymers:

All synthetic fibres, such as rayon and nylon, are polymers.

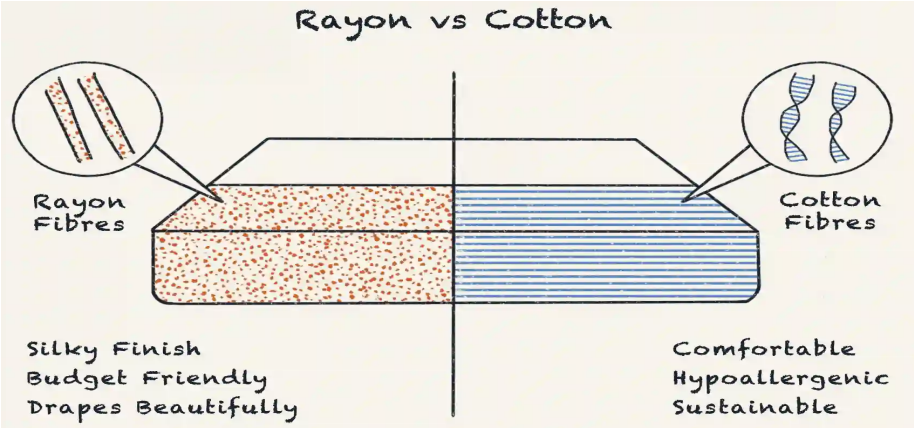
Polymers are also found in nature. 'Cotton' is a polymer called 'cellulose'. 'Cellulose' is made up of a number of single units (or monomers) called 'glucose'.

$$\underset{\text{Glucose(Monomer)}}{nC_6H_{12}O_6} \longrightarrow \underset{\text{Cellulose(Polymer)}}{-(C_6H_{10}O_5)_n-}$$

Types of Synthetic Fibres:

Rayon:

Rayon is a versatile fibre and can imitate the feel and texture of silk, wool, cotton and linen with drape and slipperiness akin to nylon.



Rayon Vs Cotton

Why is Rayon called Artificial Silk?

Rayon resembles silk in appearance, texture and shine. Hence, it is also known as artificial silk.

Rayon is considered a semi-synthetic fibre because it is made from natural source (wood pulp) but undergoes a significant chemical process to transform into a usable textile fibre meaning combines characteristics of both natural and synthetic materials.

Silk fibre was discovered in China and made from silkworms. It had a beautiful texture and was very costly.

By the end of the 19th century, scientists managed to make an artificial silk like fibre made by treating wood pulp chemically.

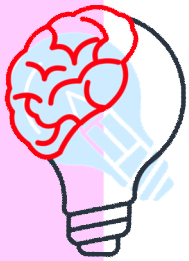
Uses of Rayon:

This man-made fibre uses natural material (wood pulp) and can be woven like silk fibre. It is cheaper than silk and can be dyed in a variety of colours. It can be:

- Make apparels like suits, slacks, jackets etc.
- Make automobile tyre cords (because of its strength)
- Mixed with cotton to make bedsheets and bedspreads
- Mixed with wool to make carpets and blankets
- Used to make other home furnishings, such as curtains and tablecloths

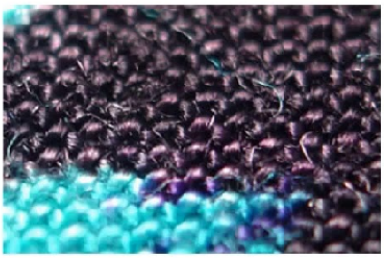
Knowledge Box

Rayon can absorb moisture like cotton but feels like silk. That's why some sports jerseys are made from rayon to absorb sweat!



RAYON

- Rayon was the first synthetic fibre produced artificially.
- Obtained from cellulose.
- It is considered a synthetic fibre because cellulose needs extensive chemical treatment to form rayon.
- Rayon has been producing since the 1880 in France.
- Is a cheap alternative to silk fibre.
- Also called artificial silk as it has silk like appearance.
- **PROPERTIES OF RAYON:-**
- A good absorbent
- Does not shrinks.
- Cool to



Nylon:

Nylon is the first synthetic fibre to be prepared without using any natural raw materials (materials produced by plants and animals).

$$-\left(C_{12}H_{22}N_2O_2\right)_n-$$

Nylon 66

Which properties make Nylon suitable for:

Making Ropes used for Rock Climbing: Strong fibre, lightweight, weather resistant

Making Fishing Nets: Strong, elastic, water resistant

Making Tents: Strong, light, does not absorb much water, dries quickly

Uses of Nylon:

Developed in 1931, this thermoplastic silky material is strong, elastic, light, lustrous and easy to wash. A nylon thread is, in fact, stronger than a steel wire. Hence, it is used to:

- Make clothes (including socks)
- Make parachutes as well as ropes for rock climbing
- Make ropes, toothbrushes, and car seat belts etc.
- Make tents, curtains, and sleeping bags.


WATERPROOF CLOTHING

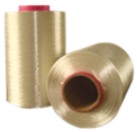

NUTS AND BOLTS


CLIPS


BAGS / HOLDALLS


BEARINGS


GEARS / PULLEYS


YARN / STRING

CLASSROOM DISCUSSION QUESTIONS CDQ 01

1. What are fabrics made of?

(A) Wood pulp

(B) Synthetic fibres only

(C) Weaving plastics

(D) Weaving fibres obtained from natural or artificial sources

2. What are monomers?

(A) Large molecules made up of several molecules

(B) Single molecules that can bond with other identical molecules

(C) Fibres obtained from natural sources

(D) Large chains of glucose

3. What is the process of linking small monomers together to form polymers called?

(A) Weaving

(B) Polymerisation

(C) Cellulose formation

(D) Fiberization

4. Which natural fibre is mentioned as a polymer in the passage?

(A) Silk (B) Wool

(C) Cotton (D) Rayon

5. Why is rayon called "artificial silk"?

(A) Because it is cheaper than silk

(B) Because it is made from wood pulp

(C) Because it resembles silk in appearance, texture, and shine

(D) Because it is stronger than silk

6. What are the properties of nylon that make it suitable for making fishing nets?

(A) Lightweight and weather-resistant

(B) Strong, elastic, and water-resistant

(C) Strong and light

(D) Does not absorb much water and dries quickly

7. What is a nylon thread stronger than, according to the passage?

(A) Polyester

(B) Silk

(C) Cotton

(D) Steel wire

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken ☐ Minutes

1 Ⓐ Ⓑ Ⓒ Ⓓ	2 Ⓐ Ⓑ Ⓒ Ⓓ	3 Ⓐ Ⓑ Ⓒ Ⓓ	4 Ⓐ Ⓑ Ⓒ Ⓓ	5 Ⓐ Ⓑ Ⓒ Ⓓ
6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

Concept 2

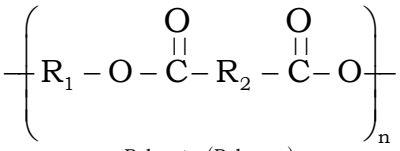
Polyester:

Polyester fibre does not get wrinkled easily. Hence, a fabric made from this fibre is easy to wash and does not need to be ironed - which makes it suitable for dress material.

Polyester is made up of two words - 'poly' which means many, and 'ester' which is a chemical.

Polyester is a type of polymer with an ester functional group in each repeat unit of the main chain.

Esters are chemicals which give fruits their smell.



Polyester(Polymer)

Misconception :

Misconception: Polyester is only used for making clothes!
Correction: Nope! Polyester is also used in bottles, car parts, and tents.

Some Popular Polyester Fibres are:

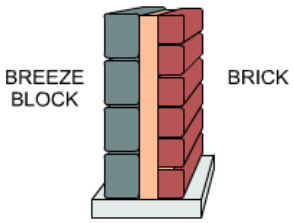
Terylene (often known by brand name dacron) which can be drawn into a very fine fibre and can be woven like any other yarn.

Polyethylene terephthalate (P.E.T.) is used for making wires, films, bottles, utensils and other products.

PET/PETE GRANULES

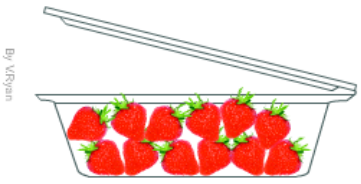
DRINKING BOTTLES

ASSORTED CONTAINERS



WALL INSULATION

MICROWAVABLE TRAYS



FRUIT CONTAINERS

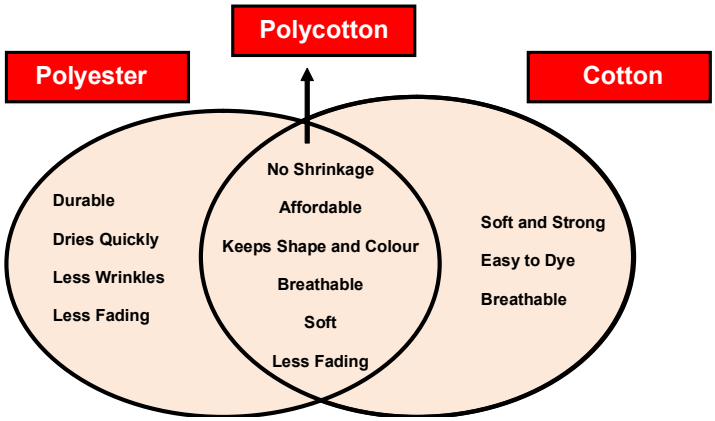
Type 1 - PETE Polyethylene Terephthalate (PET)

What are Blended Fibres?

Blended fibres are formed by mixing natural and synthetic fibres. Polyester is often used in blended fibres. For Example,

Polycot is made my mixing polyester and cotton.

Fibres are blended together to combine the best properties of two or more fibres in a single fabric. No single fibre (natural or synthetic) is perfect on its own, so blending improves comfort, strength, durability, appearance, and cost.



Terrycot is made by mixing terylene and cotton.

Polywool is made by mixing polyester and wool.

Uses of Polyester:

Since polyester is strong, wrinkle-resistant and water-resistant, it has several uses.

It can be used to:

- Make a variety of textiles (including sarees, curtains, dress materials etc.) and can be blended with natural fibres (like cotton and wool)
- Make films, magnetic recording tapes, etc (as Mylar)
- Make sails of sailboats
- Make water hoses for firefighting purposes

Acrylic:

Acrylic is a strong, lightweight and warm synthetic fibre that resembles wool. It is available in a number of colours and is more durable and affordable than natural wool.

$$\underset{\text{Monomer}}{nCH_2 = CH - C \equiv N} \longrightarrow \underset{\text{Polyacrylonitrile(polymer)}}{\left(CH_2\,CH(C^{\circ}N) \right)_n}$$

Riddle

I look like wool but don't come from sheep,
Soft and warm, I help you sleep!
Cheap and light, I'm made in a mill,
Tell me now, what's my skill?

Acrylic fibre, fabric, plastic or paint are all made from acrylic acid. The word 'acrylic' means "containing acryl or acrolein". Acrolein is the sharp and bitter liquid in onions and has its roots in two Latin words - 'acer' which means 'sharp', and 'olere' which means 'to smell'.

Why storage of acrylic clothes is easier than woollen clothes?

Woollen clothes need naphthalene balls to protect them from attack by insects. Acrylic is synthetic wool and is hence, resistant to the action of moths and insects.

Uses of Acrylic Fibre:

Acrylic can mimic wool as well as cotton at times and is hypoallergenic in nature. It means that people who have sensitive skin can wear it easily. Some acrylic fibres are very resilient – more than other natural or synthetic fibres. It can be used to:

Make woollen clothes like hats, scarves, gloves, sweaters, blankets, and other home-furnishing fabrics.

Make fake fur used for making toys and fur accessories.

Make garments for babies (as the fabric is machine-washable).

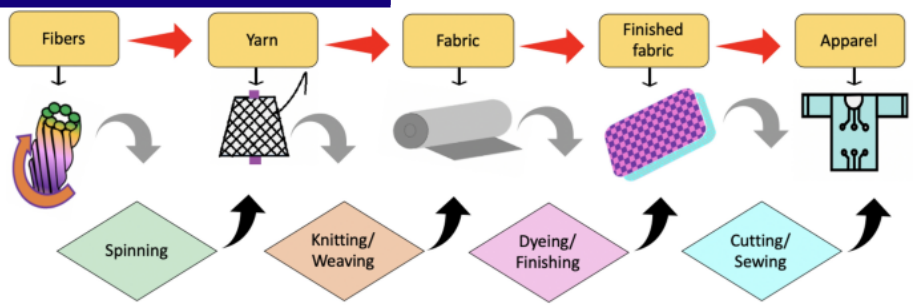
Synthetic Fibres:

All the synthetic fibres are manufactured by processing raw materials of petroleum origin in a number of ways. The raw materials of petroleum origin are called **Petrochemicals**.

Characteristics of Synthetic Fibres:

- **Durable:** Synthetic fibres are strong and can withstand heavy loads without breaking
- **Inexpensive:** Synthetic fibres are cheaper than natural fibres.
- **Lightweight:** Synthetic fibres are smooth and soft.
- **Easy to maintain:** Synthetic fibres are easy to wash and dry.
- **Resistant to wrinkles:** Synthetic fibres are resilient to wrinkles.
- **Non-biodegradable:** Synthetic fibres do not easily decompose in the environment.
- **Resistant to chemicals, sunlight, and moisture:** Synthetic fibres are resistant to chemicals, sunlight, and moisture
- **Dry quickly:** Synthetic fibres dry quickly as they do not absorb water easily.

Fabric Manufacturing Process:



- **Why should we not wear synthetic clothes in the kitchen?**

Synthetic fibres melt on heating. If the clothes catch fire, the fabric made up of synthetic fibres will melt and stick to one's body. Hence, it is recommended that one should not wear synthetic clothes while working in the kitchen or laboratory.

Note: Synthetic fibres are essentially made from some polymers as plastic, which is why some synthetic fabrics can be less environmentally friendly.

CLASSROOM DISCUSSION QUESTIONS CDQ 02

1. Why is polyester considered suitable for dress material?

(A) It is expensive

(B) It is difficult to wash

(C) It does not get wrinkled easily and does not need ironing

(D) It is not durable

2. What are esters known for in fruits?

(A) Giving them their taste

(B) Giving them their colour

(C) Giving them their smell

(D) Giving them their shape

3. What is Terylene commonly known as?

(A) Mylar (B) Dacron

(C) Polycot (D) Polywool

4. Why is acrylic fibre easier to store compared to woollen clothes?

(A) Acrylic fibre is cheaper than wool

(B) Acrylic fibre does not require protection from insects

(C) Acrylic fibre is heavier than wool

(D) Acrylic fibre is natural and biodegradable

5. What is a common use of mylar, a form of polyester?

(A) Making synthetic wool

(B) Making films and magnetic recording tapes

(C) Making kitchen utensils

(D) Making blended fibres like Polycot

6. Why is it not recommended to wear synthetic clothes in the kitchen?

(A) They are too expensive

(B) They catch fire easily and melt

(C) They are difficult to clean

(D) They are uncomfortable

7. What are petrochemicals?

(A) Raw materials derived from coal

(B) Raw materials derived from petroleum origin

(C) Raw materials derived from natural gas

(D) Raw materials derived from synthetic fibres

8. Which of the following is a blended fibre made by mixing polyester and cotton?

(A) Terrycot (B) Polycot

(C) Polywool (D) Acrylic

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken ☐ Minutes

1 Ⓐ Ⓑ Ⓒ Ⓓ	2 Ⓐ Ⓑ Ⓒ Ⓓ	3 Ⓐ Ⓑ Ⓒ Ⓓ	4 Ⓐ Ⓑ Ⓒ Ⓓ	5 Ⓐ Ⓑ Ⓒ Ⓓ
6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

Concept 3

Plastics:

Plastic is a polymer (like the synthetic fibre) which can be moulded into different shapes. The word 'plastic' originates from the Greek word 'plastikos' which means 'that can be moulded or shaped'. Plastic polymers can have different types of arrangement of monomers:

Plastic is a material made from organic polymers like polyethylene, nylon and polyvinyl chloride.

Misconception :

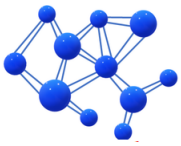
Misconception: Rubber and plastic are the same because both are polymers!

Correction: Nope! Rubber is elastic and comes from trees (natural polymer), while most plastics are synthetic and don't stretch easily.

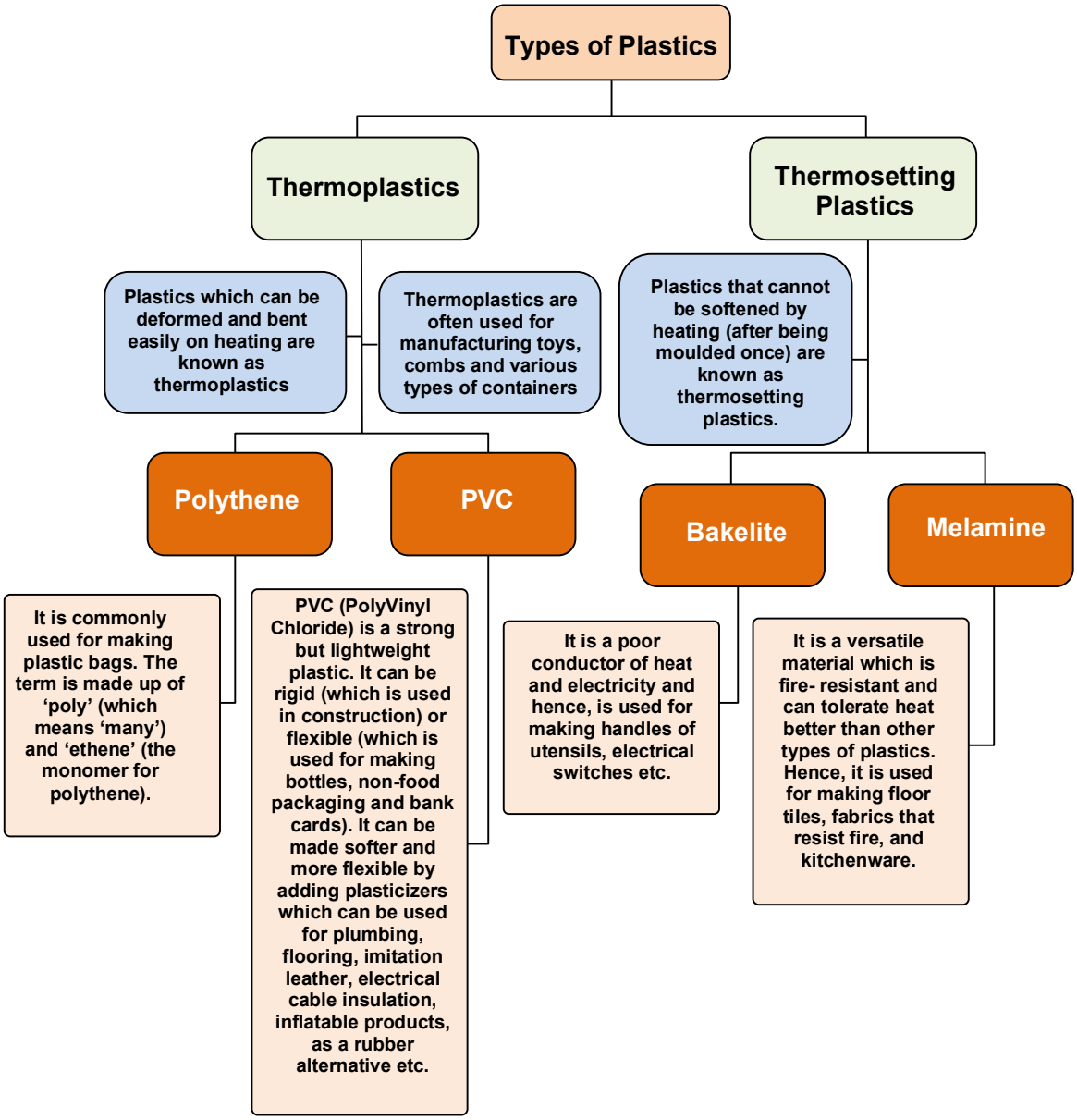
Plastic can be recycled and used. It can also be melted, rolled into sheets, made into wires, and coloured.

In the context of plastics, "linear", "branched", "cross-linked" and "network" polymers refer to different structural arrangement of polymer chains, with linear being a simple straight chain, branched having side chains of the main chain, cross-linked having chains connected forming a network, and network polymers being a fully inter-connected 3D-structure created by extensive cross-linking.

Essentially the key difference lies in how the polymer chains are connected to each other, impacting the material's, properties like flexibility, strength and melting point.

Polymer	Structure	Example
Linear polymer		HDPE
Branched polymer		LDPE
Cross-linked polymer		Vulcanized rubber
Network polymer		Bakelite

Some popular types of plastics are:



Characteristics of Plastic:

Plastics as Materials of Choice due to:

- Lightweight
- Lower price
- Good strength
- Easy handling
- Mouldable: Plastics can be easily moulded into a different shapes and sizes.

Riddle

I am stretchy like a band,
From tree sap or factory hand,
Used in shoes and tires too,
Tell me, what's my name?

- Poor conductor of heat and electricity.
- Non-corrosive: Not-reactive (does not rust like iron when exposed to water and air, and does not corrode easily).
- Impact resistant: Plastics are resistant to impact.

Give Reasons Why:

Buckets are made of Plastic these days:

Plastic buckets are strong, lightweight, and do not rust.

Bakelite Plastic is used to make Electrical Switches:

Bakelite is a poor conductor of heat and electricity. Hence, they would not give anyone an electric shock when someone touches the switch.

Melamine is used to make Crockery:

Melamine is unbreakable, fire resistant, and tolerates heat better than plastics. Hence, it can be used to make crockery that can hold hot liquids or dishes served in it.

Plastics are used in Cars, Aircraft and Spacecraft:

Plastics are strong, durable, lightweight, and corrosion-resistant.

Chemicals are stored in Plastic Bottles:

Plastic bottles are lightweight, unbreakable, corrosion-resistant, and are resistant to the action of chemicals. Hence, they are suitable for storing chemicals.

Which Plastic is used to make:

Non-stick coating on cookware	:	Teflon
Insulation covering on wires	:	PVC
Polythene bags	:	Polythene
Flame-resistant uniforms	:	Melamine

Special uses of Plastic:

Besides being used in packaging for food and non-food items and several daily-used items (such as furniture, electrical switches, slippers etc.), plastic also has special uses such as:

Used in the healthcare industry for packaging of tablets, syringes, doctor's gloves, a number of medical instruments, and threads for stitching wounds.

Used to make cookware used in microwave ovens

Used as a non-stick coating on cookware (made of a special plastic called teflon is used on which oil and water do not stick)

Used to make the fire-resistant uniform for firefighters (made of melamine)

CLASSROOM DISCUSSION QUESTIONS CDQ 03

1. What is the origin of the word 'plastic'?

(A) Latin word 'plasticus'

(B) Greek word 'plastikos'

(C) Roman word 'plastus'

(D) French word 'plastique'

2. Why is PVC (polyvinyl chloride) used in construction?

(A) It is a good conductor of heat and electricity

(B) It is strong but lightweight

(C) It is very expensive

(D) It cannot be made flexible

3. What makes bakelite suitable for making electrical switches?

(A) It is flexible

(B) It is a good conductor of electricity

(C) It is a poor conductor of heat and electricity

(D) It is very lightweight

4. Which plastic is known for being fire-resistant and used for making floor tiles and kitchenware?

(A) Polystyrene

(B) PVC

(C) Polyethylene

(D) Melamine

5. Which plastic is commonly used to make plastic bags?

(A) PVC (B) Polystyrene

(C) Polyethylene (D) Bakelite

6. Why are plastic buckets preferred over metal buckets?

(A) They are heavier and more expensive

(B) They are strong, lightweight, and do not rust

(C) They are good conductors of electricity

(D) They react easily with water and air

7. What are some advantages of plastics as materials of choice?

(A) They are heavy and expensive

(B) They are lightweight, have good strength, and are poor conductors of heat and electricity

(C) They rust and corrode easily

(D) They are reactive with most chemicals

8. What special property does teflon have that makes it useful for non-stick cookware?

(A) It conducts heat well

(B) Oil and water do not stick to it

(C) It is very flexible

(D) It is highly reactive

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken ☐ Minutes

1 Ⓐ Ⓑ Ⓒ Ⓓ	2 Ⓐ Ⓑ Ⓒ Ⓓ	3 Ⓐ Ⓑ Ⓒ Ⓓ	4 Ⓐ Ⓑ Ⓒ Ⓓ	5 Ⓐ Ⓑ Ⓒ Ⓓ
6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

Concept 4

Plastics by the Numbers:

The well-recognized "chasing arrows" symbol we see on plastic containers and products does not mean the product is recyclable. The little number inside the triangle tells the real story.

Polyethylene Terephthalate	High-Density Polyethylene	Polyvinyl Chloride	Low-Density Polyethylene	Polypropylene	Polystyrene	Other Plastic
01 PET	2 HDPE	03 PVC	4 LDPE	5 PP	6 PS	7 OTHER
Drink bottles, polyester fabrics, food packaging	Chemical containers, toys, milk bottles	Pipes, window frames, disposable gloves	Plastic bags, shrink wrap, pallet wrap	Food containers, rugs, medical items	Packaging, car parts, appliance parts	Car parts, bottles, safety equipment, food containers
Usually Recycled	Generally Recycled	Occasionally Recycled	Sometimes Recycled	Generally Recycled	Occasionally Recycled	Rarely Recycled
Light, clear	Solvent Resistant, UV resistant	Electric Insulator, durable, flame retardant	Impact Resistant, Chemical resistant	Hinges, heat resistant	Heat resistant	Impact Resistant, Soluble, UV resistant

Within each chasing arrows triangle, there is a number which ranges from one to seven.

The purpose of the number is to identify the type of plastic used for the product, and not all plastics are recyclable or even reusable. There are numerous plastic-based products that cannot break down and cannot be recycled.

Knowledge Box

The world produces over 400 million tons of plastic every year! That's enough to cover the Earth with plastic sheets!

1 – PET (Polyethylene Terephthalate)

PET is one of the most commonly used plastics in consumer products, and is found in most water and pop bottles, and some packaging.

2 – HDPE (High-Density Polyethylene)

HDPE plastic is the stiff plastic used to make milk jugs, detergent and oil bottles, toys, and some plastic bags. HDPE is the most commonly recycled plastic and is considered one of the safest forms of plastic.

3 – PVC (Polyvinyl Chloride)

PVC is a soft, flexible plastic used to make clear plastic food wrapping, cooking oil bottles, teething rings, children's and pets' toys, and blister packaging for myriad consumer products. It is commonly used as the sheathing material for computer cables, to make plastic pipes and parts for plumbing, and in garden hoses.

4 – LDPE (Low-Density Polyethylene)

LDPE is often found in shrink wraps, dry cleaner garment bags, squeezable bottles, and the type of plastic bags used to package bread. The plastic grocery bags used in most stores today are made using LDPE plastic. Some clothing and furniture also use this type of plastic.

5 – PP (Polypropylene)

Polypropylene plastic is tough and lightweight and has excellent heat-resistance qualities. It serves as a barrier against moisture, grease and chemicals. When you try to open the thin plastic liner in a cereal box, it is polypropylene. This keeps your cereal dry and fresh. PP is also commonly used for disposable diapers, pails, plastic bottle tops, margarine and yogurt containers, potato chip bags, straws, packing tape and rope.

Did You Know?
Only 14% of plastic is recycled. Recycling plastic reduces carbon emissions. Plastic makes up around 75% of marine litter.

6 – PS (Polystyrene)

Polystyrene is an inexpensive, lightweight and easily formed plastic with a wide variety of uses. It is most often used to make disposable styrofoam drinking cups, take-out "clamshell" food containers, egg cartons, plastic picnic cutlery, foam packaging and those ubiquitous "peanut" foam chips used to fill shipping boxes to protect the contents. Polystyrene is also widely used to make rigid foam insulation and underlay sheeting for laminate flooring used in home construction.

7 – Other (BPA, Polycarbonate and LEXAN)

The 7 category was designed as a catch-all for polycarbonate (PC) and other plastics, so reuse and recycling protocols are not standardized within this category.

Plastic and the Environment:

Plastic is a threat to the environment as it is non-biodegradable. Its disposal is a big problem.

Biodegradable: Material which gets decomposed through natural processes (such as bacterial action) is called Biodegradable.

Non-biodegradable: Material which cannot be easily decomposed by natural processes is called non-biodegradable.

How do plastics cause environmental pollution?

Plastics cause pollution as they are:

- Non-biodegradable
- Release toxic fumes when burnt (and hence, cause air pollution).

5 R's to Minimize the Environmental Damage caused by Plastic:

The 5 R's principle is a waste management strategy that can help reduce the environmental damage caused by plastic.

How can we Minimize Pollution caused by Plastics at Home?

We should use jute, cotton, or paper bags instead of plastics. We also need to minimize the use of plastic in our daily lives (such as using a steel lunch box instead of a plastic one). Also, we should not throw plastics on the road or in the water bodies.

CLASSROOM DISCUSSION QUESTIONS CDQ 04

1. What does the number inside the recycling symbol on a plastic product indicate?

(A) The cost of the plastic

(B) The type of plastic used

(C) The size of the product

(D) The colour of the plastic

2. Which type of plastic is commonly used to make water and pop bottles?

(A) HDPE (B) PVC

(C) PET (D) LDPE

3. What is HDPE plastic most commonly used for making?

(A) Clear plastic food wrapping

(B) Milk jugs, detergent and oil bottles

(C) Water and pop bottles

(D) Disposable styrofoam cups

4. Which plastic type is used for making clear plastic food wrapping and teething rings?

(A) PET (B) HDPE

(C) PVC (D) PP

5. What are the common uses of LDPE plastic?

(A) Making disposable diapers and plastic bottle tops

(B) Making shrink wraps, dry cleaner garment bags, and squeezable bottles

(C) Making milk jugs and detergent bottles

(D) Making styrofoam drinking cups and egg cartons

6. Which plastic is used to make the thin plastic liner in cereal boxes?

(A) PET (B) PVC

(C) PP (D) All of these

7. What type of plastic is used to make disposable styrofoam cups and foam packaging?

(A) HDPE (B) PS

(C) LDPE (D) PP

8. Which category of plastics includes polycarbonate and BPA?

(A) 1 - PET (B) 3 - PVC

(C) 6 - PS (D) 7 - Other

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken ☐ Minutes

1 Ⓐ Ⓑ Ⓒ Ⓓ	2 Ⓐ Ⓑ Ⓒ Ⓓ	3 Ⓐ Ⓑ Ⓒ Ⓓ	4 Ⓐ Ⓑ Ⓒ Ⓓ	5 Ⓐ Ⓑ Ⓒ Ⓓ
6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

C.D.F. (Concepts, Definitions and Formulae)

1. All fabrics are materials made from many fibres, which are obtained from natural or artificial sources.
2. Cotton is a natural fibre obtained from the cotton plant. All synthetic fibres are man-made fibres that are prepared by a number of processes using raw material of petroleum origin, called **petrochemicals**.
3. Synthetic fibres consist of many small units or monomers combine to form a larger unit called a **polymer**.
4. A polymer is made up of many repeating units called **monomers**.
5. **Rayon:** Fibre obtained by chemically treating wood pulp is called **rayon** or **artificial silk**. Rayon cannot be called a natural fibre as it is man-made.
6. **Nylon:** Nylon is a synthetic fibre made from coal, water and air. It is elastic, very lustrous and easy to wash. It dries quickly and retains its shape.
7. **Polyester:** Polyester is a synthetic fibre, derived from coal, air, water and petroleum.
8. Polycot is a mixture of polyester and cotton and polywool is a mixture of polyester and wool.
9. **Acrylic:** Acrylic is a synthetic polymer of methyl methacrylate. Fabric made from acrylic is warm to wear, retains its shape and is durable.
10. Synthetic material catches fire, the fabric melts and sticks to the body of the person wearing it. This is extremely dangerous, so it is important not to wear synthetic clothes in the kitchen or laboratory.
11. A material which is easily decomposed by natural process is called **bio-degradable**, and one which is not decomposed by natural processes is called **non-bio degradable**.
12. The purpose of giving the number on plastic tools is to identify the type of plastic used for the product, and not all plastics are recyclable or even reusable.
13. 5 R's to minimize the environmental damage caused by plastics are: Refuse, Reduce, Reuse, Repurpose and Recycle.

Advanced Worksheet

LEVEL 1

Single Correct Answer Type (S.C.A.T.):

1. Which of the following is TRUE about rayon?

(A) It is completely natural

(B) It is completely synthetic

(C) It imitates the feel and texture of silk, wool, cotton and linen

(D) It cannot be dyed in different colours

2. Plastic that can be melted and remoulded is called:

A) Thermosetting plastic

B) Thermoplastic

C) Conductive plastic

D) Transparent plastic

3. What is the process of linking small monomers together to form polymers called?

A) Cellulose formation

B) Weaving

C) Polymerisation

D) Fiberization

4. Which one of the following is a natural fibre?

(A) Rayon

(B) Cotton

(C) Polyester

(D) Nylon

5. Which one of the following is a synthetic fibre?

(A) Jute

(B) Nylon

(C) Acrylic

(D) Both B and C

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

(A) Rayon (B) Nylon

(C) Polyester (D) Acrylic

7. Which one of the following is correct about nylon fibres?

(A) Nylon fibres are very strong

(B) Nylon fibres absorb very little water

(C) Nylon fibres are fairly elastic

(D) All of these

8. Which one of the following is a fire-resistant plastic?

(A) Polythene

(B) Polyvinyl chloride

(C) Melamine

(D) PET

9. Pick the synthetic fibre out of the following.

(A) Cotton

(B) Jute

(C) Nylon

(D) Wool

10. Polycot is obtained by mixing:

(A) Nylon and wool

(B) Nylon and cotton

(C) Polyester and wool

(D) Polyester and cotton

11. Which is a thermosetting plastic?

(A) Melamine

(B) PVC

(C) Polythene

(D) Nylon

12. The material similar to silk in appearance is:

(A) Nylon

(B) Polyester

(C) Rayon

(D) Terylene

13. The most suitable material for the preparation of handles of cooking utensils is:

(A) Polythene

(B) Nylon

(C) PVC

(D) Bakelite

14. Fibre obtained by chemical treatment of wood pulp is called:

(A) Natural silk

(B) Rayon

(C) Nylon

(D) Polyester

15. Nylon is obtained by _____.

(A) Treating wood pulp

(B) Solidifying water

(C) Mixing coal, air and water

(D) Mixing chemicals

16. Polyester is repeating units of:

(A) Ether

(B) Beads

(C) Carbon

(D) Ester

17. _____ is used commonly for making parachute ropes.

(A) Polyethene

(B) Polyester

(C) Nylon

(D) Silk

18. _____ is a popular polyester.

(A) Plastic

(B) Polyethene

(C) Rayon

(D) Terylene

19. The first fully synthetic fibre (man-made fibre) is:

(A) Nylon

(B) Polyester

(C) Rayon

(D) Cotton

20. Plastic bags are generally made from which plastic?

(A) PET

(B) Polythene

(C) Bakelite

(D) Melamine

21. Which material is used for making bottles and jars?

(A) PET

(B) Polythene

(C) Bakelite

(D) Melamine

22. The purest natural form of cellulose is:

(A) Rayon

(B) Cotton

(C) Wool

(D) Silk

23. The plastics which do not remould again on heating are called:

(A) Thermosetting plastics

(B) Thermoplast plastics

(C) Both of these

(D) None of these

24. A synthetic fibre which works like wool:

(A) Nylon

(B) Polyester

(C) Acrylic

(D) PVC

25. The non-stick coating on pans and other cooking utensils is made from:

(A) Rayon

(B) Teflon

(C) Melamine

(D) PVC

26. Which of the following is not a part of 5R's formula?

(A) Reduce

(B) Recycle

(C) Recover

(D) Reinvent

27. Acrylic fibres are advantageous over:

(A) Cotton

(B) Wool

(C) Silk

(D) Jute

LEVEL 2

Multi Correct Answer Type (M.C.A.T.):

28. Choose the correct statements from the following.

A) Thermosetting plastics are heat resistant and do not melt easily

B) Thermosetting plastics used for making electric plugs and switches.

C) Metals and plastics both can conduct electricity

D) Synthetic fibres donot easily decompose in the environment

29. Which of the following are blended fibres?

A) Polycot

B) Polyester

C) Terrycot

D) Polywool

30. Which of the following are synthetic fibres?

(A) Rayon

(B) Nylon

(C) Jute

(D) Polyester

31. Plastics are mainly used by everyone because they:

(A) Are cheap

(B) Can be easily handled

(C) Do not react easily

(D) Are light in weight

32. Which one of the following is an example of thermoplastic?

(A) Polythene

(B) PVC

(C) Melamine

(D) Bakelite

33. Synthetic plastics lead to:

(A) Water pollution

(B) Air pollution

(C) Solid waste pollution

(D) Water purification

Comprehension Passage Type (C.P.T.):

PASSAGE-1

Synthetic fibres and plastic utensils are playing a very important role in our daily life. We are replacing many of the tools made of natural substances with these synthetic fibres and plastics.

34. Which one of the following is not correct about plastics?

(A) Plastics can be moulded into different shapes

(B) Plastics are good conductor of heat and electricity

(C) Plastics are chemically unreactive

(D) Plastics are light, strong and durable

35. 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

36. Match of the following and choose the correct answer.

Column A	**Column B**
I. Nylon	**(i) Thermoplastic**
II. PVC	**(ii) Thermosetting**
III. Bakelite	**(iii) Fibre**

(A) I-(ii), II-(iii), III-(i)

(B) I-(ii), II-(i), III-(iii)

(C) I-(iii), II-(i), III-(ii)

(D) I-(iii), II-(ii), III-(i)

PASSAGE-II

In order to improve upon naturally occurring fibres-plant and animal fibres, scientists carried out extensive research. This led to the invention of synthetic fibres, which find extensive use in fibre and textile technology.

37. Synthetic fibres are the result of extensive research on:

(A) Natural fibres

(B) Glass fibres

(C) Semi-synthetic fibres

(D) Optical fibres

38. Which of the following fibres has the most widespread application?

(A) Acrylic

(B) Rayon

(C) Polyester

(D) Polyolefin

39. Earliest synthetic fibres were obtained from:

(A) Leaves

(B) Wood pulp

(C) Bark

(D) None of these

Matrix Matching Type (M.M.T.):

SET-I

COLUMN - I

40. Nylon

41. Rayon

42. Teflon

43. PET

COLUMN - II

(A) Non-stick coating

(B) Polyester

(C) Parachutes

(D) Artificial silk

SET-II

COLUMN - I

44. PET

45. Nylon

46. Acrylic

47. Polyester

COLUMN - II

(A) Sweaters

(B) Sarees

(C) Utensils

(D) Socks

Assertion Reason Type (A.R.T.):

(A) Both assertion and reason are true and reason is the correct explanation of assertion

(B) Both assertion and reason are true but reason is not the correct explanation of assertion

(C) Assertion is true but reason is false

(D) Assertion is false but reason is true

48. Assertion: Nylon threads are used to make parachutes.

Reason: Nylon is strong, elastic and light weight.

49. Assertion: Acrylic fabrics are used in making socks & shawls.

Reason: Acrylic fabrics are replacement of wool.

50. Assertion: Thermosetting plastic cannot be remoulded again.

Reason: They have cross-linked arrangement of molecules and does not deformed on heating.

Statement Type (S.T.):

(A) Both statements are correct

(B) Both statements are incorrect

(C) Statement I is correct statement II is incorrect

(D) Statement I is incorrect statement II is correct

51. Statement I: Terylene is a popular fibre.

Statement II: Polyester fabric is wrinkle resistant.

52. Statement-I: Polycotton is a blended fibre formed by a mixing polyester and cotton.

Statement-II: Fibres can be blended to allow manufacturers to combine the desirable properties of different fibre types.

Integer Type (I.T.Q.):

53. If a country produces 100 million plastic bottles per year, and only 20% of them are recycled. How many plastic bottles are not recycled?

54. What is the sum of the recycling numbers for one PET bottle, one HDPE bottle, and one PVC pipe?

55. In a recycling plant, the number of HDPE items is 3 times that of PET items. If the number of HDPE items is 18, how many PET items are present?

Figure Based Questions (F.B.Q.):

56. Which of the following articles is made by using only man-made substances?

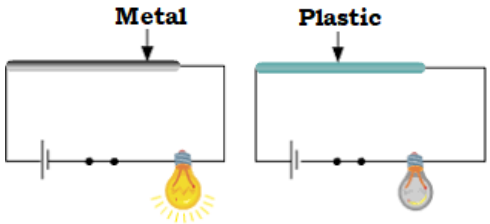
(A) 

(B) 

(C) 

(D) 

57. What can we conclude from circuits shown in the following figure?



(A) Metals can conduct electricity.

(B) Plastics are poor conductors of electricity.

(C) Metals and Plastics both can conduct electricity.

(D) Both A and B are correct.

58. Unscramble the jumbled words given below, related to synthetic materials.

(A) anory : _____

(B) lopmery : _____

(C) relyteen : _____

(D) laspict : _____

(E) yespolter : _____

(F) Felton : _____

Analytical Approach Type (A.A.T.):

59. Mark the incorrect combination from the following.

(A) Chair – Plastic

(B) Parachute – Cotton

(C) Electrical switches – Bakelite

(D) Carpet - Rayon

60. A plastic carry bag thrown into a drain blocks the flow of water and causes flooding during rains. This problem mainly arises because plastics are:

(A) Light in weight

(B) Chemically reactive

(C) Non-biodegradable

(D) Transparent

61. Which situation best explains why plastic is more harmful than paper waste in the environment?

(A) Plastic absorbs more water

(B) Plastic is heavier than paper

(C) Plastic remains unchanged for years

(D) Plastic is colorful

62. A family burns plastic waste in their backyard to "reduce waste volume. What is the most harmful consequence of this action?

(A) Plastic disappears faster

(B) New plastic can be made easily

(C) Toxic fumes are released, causing air pollution

(D) Soil fertility increases.

63. A shop replaces plastic bags with cloth bags. Each cloth bag can be used 40 times, whereas each plastic bag is used only once. Which conclusion is most accurate?

(A) Plastic bags are more economical

(B) Cloth bags reduce waste by increasing reusability

(C) Cloth bags create more pollution

(D) Plastic bags follow the 5R's rule better.

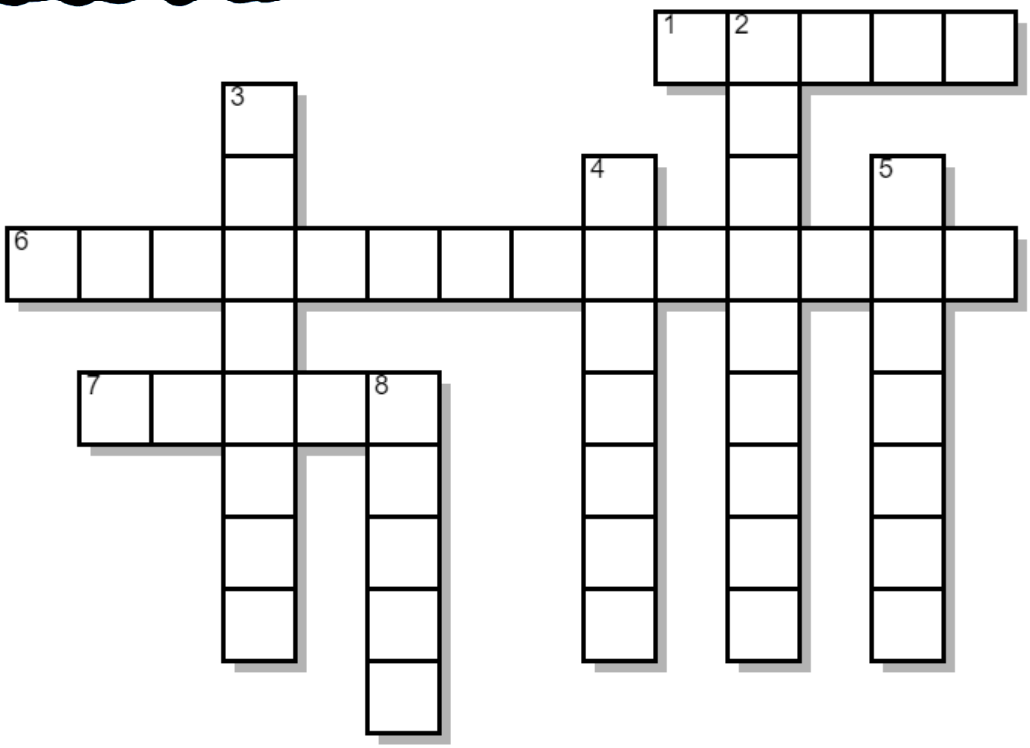
64. Why are jute and cotton bags considered environmentally friendly alternatives to plastic?

(A) They are colorful

(B) They are waterproof

(C) They are biodegradable

(D) They release gases



***Across*: (→)**

1. Polyester is made of repeating units called _____.
6. The plastics which can be easily get deformed are called _____.
7. _____ is called artificial silk or poor man's silk.

***Down*: (↓)**

2. The fibres which are made artificially by human beings are called _____ fibres.
3. _____ is a fabric made after mixing of terylene and cotton.
4. Fibres which are obtained from plants and animals are called _____ fibres.
5. _____ is also called synthetic wool.
8. _____ is the strongest synthetic fabric.