

Introduction to Fibres

We all have a little shopping diva within us. We all love to shop.

When someone says shopping; the very first picture that comes to our mind are that of clothes. So what are clothes? What're they made of?

What are the different types of fibres? Let us study more about this below.

Definition of Fibres

Long strands of molecules interwoven to form a linear, string-like structure are known as 'Fibres'. Fibers are natural or man-made such as cotton, silk, jute, etc.



Fibers were discovered when early people realized the need to cover and protect their own hair and skin from the weather. Since early people would live in cold climate they hunted animals with skins (fur and food) that kept them warm. When used continuously this skin becomes harder and made it hard for the early men to hunt and hence later they started to treat this skin to maintain its softness. In a much later time, they started using the bones of animals as needle and nerves as the thread to stitch. And now decades later we finally know how to grow our own fibres and make clothes or [fabrics](#) out of them.

Characteristics of Fibers

Fibers used in clothing are used to cover the body, to protect our body, etc. Everyone wears clothes for different reasons. Some of the other characteristics of fibres are:

- Fibers can be repeatedly stretched more than 500% of its original size and can also recover back; immediately to its original size and shape once the tension is relaxed.
- In comparison to rubber, it is stronger and more durable.
- It is lightweight.

Natural Fibres

Fibres obtained from plants and animals that can be spun into filament, thread or rope are termed as 'Natural fibres'. They may be woven, knitted, matted or bonded.

Decades later even though the methods used to make **fabrics** from fibres may have changed greatly, their functions remain the same:

- Most natural fibres are still used to make clothing and containers.
- To insulate, soften and decorate our spaces.

Cotton

The journey of a cotton plant starts on a farm where a dry breeze blows across the endless stretch of fields as the woolly cotton seeds are planted in neat rows. When the crops are ready to harvest, the plants are first intensely watered up to 200 days. **Cotton** is almost pure cellulose. The length of cotton varies from 10 to 65 mm, and the diameter from 11 to 22 microns. Since cotton absorbs moisture easily, it is the most obvious choice as a fabric for clothes.

Wool

Wool is made from shearing a sheep, after which its quality is checked and is later prepared for spinning. This **wool** is spun into long strands. The strands are then woven into a fabric. Since wool holds moisture without feeling

wet it is a great thermal insulator. The diameter of a wool ranges from 16 microns to more than 40 microns.

Solved Example For You

Q. Which one of the following fibres contains protein units in its molecules?

- a. Cotton
- b. Wool
- c. Rayon
- d. Nylon

Sol: b. Wool

Wool is one of the fibres which contains protein units in its molecules. It falls under the type of natural protein fibres, which are formed through condensation of α -amino acids, to form repeating polyamide units.

Synthetic Fibres

Why don't we use paper bags anymore? Why do we always carry a plastic bag for shopping? What makes these [plastics](#) so durable? How's it that our bags go on for years without any damage? Where do they come from? Plastics come from 'Synthetic fibres'. In fact, did you know that almost 75% of things we use come from synthetic fibres? But what are synthetic fibres? Let us find out more below.

Synthetic fibres and Semi-synthetic fibres

Fibres that are man-made are termed as 'synthetic fibres'. Mostly these fibres are made using raw materials from petroleum and these materials are known as 'petrochemicals'. These fibres are made out of small units termed as 'polymer' and each polymer is made up of an individual unit known as 'monomer'.

fibres which are originally deriving from naturally-occurring fibres, and occurring through a chemical process are known as ‘semi-synthetic fibres’. The naturally occurring fibre is harvested, broken down, and then reconstructed. This is usually done using cellulose. Cellulose is a component that is abundant in plants. This cellulose is extracted from the plants, made soluble, and then spun into fibre.

Advantages of Synthetic fibres

- Synthetic fibres have good elasticity.
- They don't wrinkle up easily.
- Fabrics from synthetic fibres are less expensive, durable and readily available in comparison to natural fibres.
- Synthetic fibres can handle the heavy load without breaking.
- They don't shrink.
- Synthetic fibres blend well with other fibres.
- They're very absorbent.

Can you list some more advantages?

Disadvantages of Synthetic fibres

- Synthetic fibres require attention while ironing since they tend to melt away easily.
- Most of these fibres absorb very little and hence it sticks to the body while sweating on hot summer days making it uncomfortable to wear during such days.
- Synthetic fibres are prone to catch fire very easily.
- These fibres are non-biodegradable.

Have you noticed more disadvantages? If so, write them down and add to the list.

Rayon



- Rayon is the first synthetic fibre that was discovered towards the end of the nineteenth century. It comes from the chemical treatment of wood pulp.
- Since rayon is similar to silk but is cheaper than silk, it is therefore called ‘poor man’s silk’.
- Bedsheets and dress materials are made from a combination of rayon with cotton.
- Rayon is soft, absorbent and comfortable.
- Carpets are made from a combination of rayon with wool.

Nylon



- We get the term ‘Nylon’ from the letters of ‘New York’ and ‘London’ and was coined in 1931. Nylon comes from coal, water, and air.
- It is very lustrous, easy to wash and elastic.
- Nylon dries up quickly and maintains its shape.
- Things such as seat belts of the car, sleeping bags, socks, ropes, etc.

Polyester

- Polyester comes from coal, water, air and petroleum.
- It is made from repeating units of a chemical termed as esters.
- It is very easy to wash and it remains wrinkle-free.

- Terylene, a type of polyester is used in making dress materials.
- Polyester maintains its shape and remains crisp.

Study [Plastics as Material of Choice](#) here.

Solved Example For You

Q. Synthetic fibres are also calledor fibres.

a. Man-made

b. Artificial

c. Both a. and b.

d. None of the above

Sol: c. Both a. and b.

There are some fibres that are prepared by human beings using chemicals. These are called synthetic fibres. They are made of small

units that join together to form long chains. Hence, man-made or artificial.

Plastics

Have you noticed how everything nowadays is derived from plastics? The plates we use, our cell phones, etc. Everything is plastic! Why is plastic so popular? What are the various types of plastics? Let us study in-depth about it below.

What are Plastics?



Any synthetic or semi-synthetic polymers are ‘plastics’. Plastics used for industrial work come from petrochemicals. Plastic refers to its

ability to deform without breaking. The **polymer** used in making a plastics are usually a combination of additives, colorants, plasticizers, stabilizers, fillers, and reinforcements. These additives affect the chemical composition, properties, and mechanical properties of plastics and affect its cost.

The two types of plastics are Thermoplastics and thermosetting polymers.

Thermoplastics and Thermosetting Polymers

Thermoplastics can be remoulded over and over again after heating. Some of these polymers are amorphous and some carry a partially crystalline structure. Thermosetting polymers are those polymers that solidify into a permanent shape. These polymers too are amorphous and have infinite molecular weight.

Physical Properties of Plastics

- Properties of plastics vary depending on the chemical composition, arrangements and the processing method of its subunits.
- Plastics come from polymers, hence all plastics are polymers, but not all polymers are plastic.

- Plastics may be amorphous solids, crystalline solids, or semicrystalline solids (crystallites) or any other form of solids.
- They are poor conductors of **heat** and **electricity**. The plastics that act as insulators mostly have a high dielectric strength.
- Plastics have a slow rate of degradation and tend to be durable.

Can you think of more such properties?

Composition and Structure of Plastics

Plastics are mostly carbon-based atoms. Silicones are an exception since they are based on the silicon atom. The carbon atom is capable of linking to other atoms with up to four chemical bonds. In plastics, the carbon atoms also link to hydrogen, oxygen, nitrogen, chlorine, or sulfur. When the linking of these atoms results in long chains, like pearls on a string of pearls, the polymer is termed as 'Thermoplastic'. Thermoplastics are meltable. All thermoplastics have repeating units, i.e. the smallest identical section of the chain. About vast majority of plastics are 92% thermoplastics.

To make unit cells a group of atoms is used called 'Monomers'. Upon the combination of monomers, we get polymers or plastics. All the

monomers contain double bonds between carbon atoms such that the carbon atoms can subsequently react to form polymers.

The plastic behavior of polymers is influenced by their arrangement of molecules on a large scale. In other words, polymers are either amorphous or crystalline. The arrangement of molecules in the amorphous state is random and are intertwined. In crystalline state, the arrangement of molecules is in a closely identifiable manner. On the other hand, semicrystalline materials exhibit crystalline regions, called crystallites, within an amorphous matrix.

The chemical structure of the plastics can change, with the use of copolymers, and the chemical binding of different elements and compounds and on the other hand, the use of crystallizability can change the processing, aesthetic, and performance properties of plastics. Alteration of plastics can also happen by adding additives.

Solved Examples For You

Q. Telephone instruments, plastic toys, ballpoint pens, plastic bowls are examples of :

- a. Thermoplastics
- b. Thermosetting plastics
- c. Polyester
- d. None of the above

Sol: a. Thermoplastics

Telephone instruments, plastic toys, ballpoint pens, plastic bowls are thermoplastics and so can be recycled.

Cooker handles carry bags, plastic covering on an electric wire, plastic chains etc are thermosetting plastics and so cannot be recycled.

Plastics as Material of Choice

You know what's the latest trend in fashion? No, it's not Gucci, Chanel or Vero Moda. It's a priceless brand that'll go on years and years. You can deform it, yet it'll remain brand new. Its named 'Plastics'. Quite fancy, isn't it? So what makes the plastic material so

special? And why is it slowly becoming a habit? Let us answer these questions below.

Environmental Effects of Plastic Material



Plastics have shaped the society more than a better politician would shape the society; it is everywhere. From cell phones and computers to plates, bags, pens we write with. If on one side plastics have made and continue to make our lives easier and better, on the other hand, these plastics have left harmful imprints on the environment and perhaps even human health. The usage of plastics keeps increasing as the days go by. And if we believe the reports soon instead of looking at the natural beauty we'd be looking at 'plastics' ugliness.

Harmful Effects

If we look at environmentally, plastic is indeed a growing disaster. These synthetic polymers are made from petroleum or natural gas, non-renewable resources and then processed using energy-intensive techniques that damage fragile ecosystems. The manufacture of these plastics and its destruction by any means pollutes air, land, and water and exposes the living to toxic chemicals, including carcinogens.

Plastic packaging –especially the plastic bag – is a prominent source of landfill waste and it is regularly eaten by various marine and land animals, that lead to fatal consequences. Plastics do not biodegrade. It just accumulates in the landfills or pollutes the environment. Pollution from plastics may not be visible to us through naked eye but there are microscopic particles of plastics that are present in the air throughout the world.

Plastics are treated with chemicals and these chemicals are absorbed by the living. Some of the components in these chemicals can alter hormones or have other potential health effects. Floating plastic waste can survive for decades in water, and therefore it serves as mini transportation devices for invasive species, that disrupt other habitats.

Plastics in landfills can leach harmful chemicals that spread into groundwater. So it's high time we start going back to our roots and start going organic.

Remedies for pollution caused by Plastic Material

If we start today at this very moment, there's a little hope that on a span of few years the production and usage of plastics will go down by 50%. So, here are the top tips one can stop plastic pollution:

Go Green

We've come a long way from using plastic bags to overusing them. Its time we throw these plastics away and replace them with reusable bags that can save a lot of space and money too. These reusable bags are compact and fit literally anywhere making them portable.

Say 'No' to bottled water

One should drink 8-10 glasses of water every day and bottled water factories have taken full advantage of this fact. Since in order to stay hydrated bottled water is the best way. One can carry it anywhere and dispose of it anywhere. However, most of these are only recommended for single use, and that means that every time someone finishes a bottle it goes into the trash. And eventually, this trash fills

the landfills and releases toxic gases. So instead one can carry water from home or have it from filters in offices or schools.

Spread Awareness

Spread the word on awareness about plastic material on as many platforms as possible. Speak to local restaurants and businesses about options on how can they can switch from plastics to organic and reduce plastic pollution. At the same time educate them on how they can market the same.

Recycle Everything

Try and recycle these plastics as much as possible.

Solved Example For You

Q. Which of the following are uses of plastics in the healthcare industry?

- a. The packaging of tablets

- b. Stitching wounds

c. Syringes

d. All of the above

Sol: d. All of the above

Plastics in the healthcare industry are used in packaging of medicines; plastic threads are used for stitching wounds. Also, syringes, gloves and any kind of medical instruments are made up of plastic.