Man made Materials

EXERCISE [PAGE 121]

Exercise | Q 1.1 | Page 121

Try to find it

Plastic shows _____ property, hence it can be molded to any shape.

Solution: Plastic shows **plasticity** property, hence it can be molded to any shape.

Exercise | Q 1.2 | Page 121

Try to find it

Motor cars are coated with _____

Solution: Motor cars are coated with **Automotive paint.**

Exercise | Q 1.3 | Page 121

Try to find it

Thermocoal melts at _____°C.

Solution: Thermocoal melts at **more than 100**°C.

Exercise | Q 1.4 | Page 121

Try to find it

_____ glass dissolves in water.

Solution: **Alkali silicate** glass dissolves in water.

Exercise | Q 2 | Page 121

Who is my partner ?

'A' column	'B' column
a. Lead glass	i. Plates
b. Bakelite	ii. Mattresses
c. Thermocol	iii. Electric bulb
d. Optic glass	iv. Electric switch
e. Polypropylene	v. Lens

Solution:

'A' column	'B' column
a. Lead glass	i. Electric bulb
b. Bakelite	ii. Electric switch
c. Thermocol	iii. Plates
d. Optic glass	iv. Lens
e. Polypropylene	v. Mattresses

Exercise | Q 3.1 | Page 121

Answer the following.

Thermocol is produced from which matterial ?

Solution: Thermocol is produced from complex material called polystyrene. It transforms into liquid state on heating at more than 100^{o}c and returns to solid state on cooling.

Exercise | Q 3.2 | Page 121

Answer the following.

Write uses of PVC.

Solution: Uses of PVC(Polyvinyl chloride):

- It is used for making bottles.
- It is used for making material for pipes.
- It is used for making handbags.
- It is used for making electric cable insulation.
- It is used for making high quality furniture.
- It is used for making ropes.
- It is used for making toys.
- It is used for making raincoat.

Exercise | Q 3.3 | Page 121

Answer the following.

Write the natural or manmade row material of the following items.
Matteress, beaker, bangle, chair, gunny bag, knife, pen

Solution:

Substances	Material
Mattressplasticity	Thermoplastic(Polypropylene)
Beaker	Silica glass
Bangle	Gold, silver, platinum, glass, wood,plastic
Chair	Thermoplastic(Polypropylene)

Gunny bag	Hessian(burlap) formed from jute
broom	Plastic, corn husks
Knife	Carbon steel, stainless steel, cobalt and titanium alloys
Pen	Brass which is an alloy of copper and zinc

Exercise | Q 3.4 | Page 121

Answer the following.

Which are the main ingredients of glass ?

Solution: Main ingredients of glass are as follows:

- Sand or Silica
- Sodium Carbonate
- Lime or Calcium Oxide
- Other Additives
- Lead glass: mixture of sand, soda, limestone and lead oxide
- Silica glass: using silica only
- Borosilicate: mixture of sand, soda, boric acid, aluminium oxide
- Alkali silicate glass: mixture of sand, soda
- Optical glass: micture of sand, soda, limestone, barium oxide and boron
- Boron – this changes the thermal and electrical properties of the **glass** and is used to make Pyrex glassware which can withstand extremes of heat and cold.

Exercise | Q 3.5 | Page 121

Answer the following.

How the plastic is produced ?

Solution: Plastics are derived from natural, organic materials such as cellulose, coal, natural gas, salt and of crude oil. Crude oil is a complex mixture of thousands of compounds. The production of plastics begins with the distillation of crude oil in an oil refinery. This separates the heavy crude oil into groups of lighter components, called fractions. Each fraction is a mixture of hydrocarbon chains, which differ in terms of the size and structure of their molecules.
Two main processes are used to produce plastics - polymerisation and polycondensation. In a polymerisation reaction, monomers such as ethylene and propylene are linked together to form long polymer chains.In a polycondensation reaction, different monomer units are linked together to form long polymer chains. Each polymer has its own properties, structure and size depending on the nature of monomer different quality plastics are produced.
There are many different types of plastics, and they can be grouped into two main polymer families:

- Thermoplastics (which soften on heating and then harden again on cooling).
- Thermosets (which never soften once they have been moulded).

Exercise | Q 4.1 | Page 121

Distinguish between:

Manmade material and natural material

Solution: Natural materials:

1. Natural materials are those material, which occur in nature by its own.
2. They are both renewable and non-renewable in nature.
3. They help in the economic development of people.
4. They are eco-friendly.
5. They are not manufactured in factories.
4. Examples: wood, glass, plastic, thread, soil, metals, rubber etc.

Man-made materials:

1. Man-made materials are a type of material that doesn't occur naturally and is made by humans.
2. They are non-renewable in nature.
3. They help in economic as well as social development
4. They are not environmentally friendly.
5. They are not manufactured in factories.
4. Examples: glass, plastic, artificial thread, thermocol, etc.

Exercise | Q 4.2 | Page 121

Distinguish between

Thermoplastic and thermosetting plastic.

Solution:

Thermoplastic polymers	Thermosetting polymers
These are formed by addition polymerisation	These are formed by condensation polymerization
Generally more expensive than thermosettings	Cost effective
Monomer used in these is generally bifunctional	In this monomer used is tri, tetra or polyfunctional
Aesthetically-superior finishes	More difficult to surface finish

They are long chain linear polymer with negligible cross links	These have three- dimensional network structure with number of cross links
less resistant to high temperatures	More resistant to high temperatures than thermoplastics
They have low molecular wt.	They have high molecular wt
They are soft, weak , brittle	They,are hard, strong and more brittle
Highly recyclable	Cannot be recycled
They can be softened and reshaped and reused.	They cannot be softened and reshaped again once again.Highly flexible design
High-impact resistance	Low-impact resistance
Remolding/reshaping capabilities	Cannot be remolded or reshaped
Eco-friendly manufacturing	Eco-foe manufacturing
e.g.- polyethtlene , polystyrene , PVC , PVA etc.	e.g.- phenol formaldehyde, ureaformaldehyde, nylon 6:6 etc.

Exercise | Q 5.1 | Page 121

Answer the following in your words.

Explain the effect of following materials on environment and human health.
1. Plastic
2.Glass
3.Thermocol.

Solution: a.Effects of plastic:

Health problem:
The manufacture of plastic, as well as its destruction by incineration, pollutes air, land and water and exposes workers to toxic chemicals, including carcinogenic.It is poisonous in nature,
Land pollution :
Plastic packaging – especially plastic bag – is a significant source of landfill waste.It just sits and accumulates in landfills or pollutes the environment. Plastics have become a municipal waste nightmare, prompting local governments all over the world to implement plastic bag, and increasingly polystyrene(styrofoam), bans.
Water pollution:
Plastic is non-biodegeradable. It choked the sewage system and creating problemd for local bodies like danger to life, water borne diseases etc.
Danger to aquatic species and land animals:
It is regularly eaten by numerous marine and land animals, to fatal consequences. Synthetic plastic is non-biodegradable.It creates digestive problem for all living organisms.
It upset food chain: It disturbs the food chain, which may affect the ecological balance.
Other factors :

Plastic pollution may not even be visible to the naked eye as research is showing that microscopic plastic particles are present in the air at various locations throughout the world and in all major oceans. Plastic is now ubiquitous in our terrestrial, aquatic and airborne environments - that is, it's everywhere.

b.Effects of glass:

During production of glass, mixture needs to be heated at very high temperature. Which will result in evolution of green house gases like sulphur dioxide, nitrogen dioxide, carbon dioxide.

- The combustion of natural gas/fuel oil and the decomposition of raw materials during the melting lead to the emission of CO2. This is the only greenhouse gas emitted during the production of glass. And finally leads to the cause of green house effect.
- Nitrogen oxides (NO2) due to the high melting temperatures and in some cases due to decomposition of nitrogen compounds contribute to acidification.
- Glasses is non-biodegradable because it is photolysis resistant. Glasses donot degrade naturally in the environment. Hence, glasses is burnt to reduce the waste but incinerating glasse is more harmful.
- Evaporation from the molten glass and raw materials can cause release of particles in the atmosphere.
- Sulphur dioxide (SO2) from the fuel and/or from decomposition of sulphate in the batch materials can contribute to acidification and formation of SMOG.
- Glass is a non-degradable, if pieces of broken glass material flow into water body, it may affect the ecosystem.
- Sometimes, drainage system may be blocked due to aggregation of broken parts of glasses.

c.Effects of thermocol:

1. It is a carcinogen:
Some research on cancer has showed that styrene may contain carcinogens and increase the risks of cancer in humans and can cause lymphoma and leukemia cancer upon prolonged exposure.

2. It is non-biodegradable:
Thermocol is non-biodegradable because it is photolysis resistant. Thermocol needs a very long time to degrade naturally in the environment. Hence, thermocol is burnt to reduce the waste but incinerating thermocol is more harmful.

3. It contaminates the food and drinks:
Even though food and drinks are served on thermocol plates and cups, these actually contaminate the food and beverages and affect the health and the reproductive systems of humans. When food are reheated while they are still in thermocol container the harmful effect on humans' health are seen.

4. It affects the health of workers who work in thermocol manufacturing plants:
Thermocol, more particularly styrene, adversely affects the health of the workers in the

thermocol manufacturing units. The workers working for a prolonged period complain of eyes, skin, and respiratory tract irritation as well as gastrointestinal complications. Thermocol plant workers also complain of problems in liver, kidneys, respiratory, and nervous systems. It has been found responsible for natural abortions in pregnant women. Exposure to liquid styrene can result in burns.

5. Replete with pollutants:
Thermocol is replete with several pollutants that pollute our environment and are toxic to the human health.
Some of these pollutants include:

a) Hydrofluorocarbon: One of the major contributors to global warming, the use of hydroflurocarbon has been curtailed. However, it is still in use although it is increasingly replaced by pentane and carbon dioxide in the production of thermocol.

b) Benzene: Benzene is one of the major carcinogens and has been found to cause severe leukemia cancers in patients.

c) Dioxins: Dioxins are responsible for problems found in hormonal changes and immune levels and also affect the development of fetus.

Exercise | Q 5.2 | Page 121

Which measures will you arrange to minimize the environmental problems arising due to non-degradable plastic ?

Solution: measures will you arrange to minimize the environmental problems arising due to non-degradable plastic are as follows:

1. We must reduce our plastic dependency:

We use an incredible quantity of single-use plastic items, such as straws, plastic bags, packaging, plastic cups, plates and cutlery. We must put an end to it. An increasing number of countries have now imposed a ban on disposable plastics and plastic bags, or established concrete targets for reducing plastic consumption and waste.

2. Increase fees and taxes on polluting plastics:

Most of the plastics used today are produced from oil, and are a source of both climate emissions and pollution. Governments need to investigate and implement a tax or fee on polluting plastics. The fees must be changed so that recycled plastic becomes cheaper than fossil.

3. Increased waste management where the problem is greatest:

The bulk of plastic waste comes from developing countries. Rapid population growth

and a swelling middle class means the consumption of plastic is increasing faster than the capacity to handle the plastic waste, and therefore much of the excess ends up in the sea. lished to develop waste management and recycling infrastructure.

4. Increased mapping, surveillance and research:

There is still much we do not know about the plastic problem. Researchers estimate that more than 70 percent of the plastic ends up on the sea floor. Over time, it breaks down into tiny particles, but we do not know what happens to this material or how to get rid of it. The efforts to map and monitor, as well as conduct research on the negative effects, must be strengthened.

5. Stop the flow of plastic waste into the sea:

the plastic in the ocean is suspected to come from activities and industry on land. This can include everything from car tyres, technical sports equipment and fleece clothing, to cigarette butts and cotton buds. Everyone should contribute to the solution. For example, you can participate in clean-up operations, cut your own plastic consumption and of course always pick up any garbage you find along your way.

6. Increased funds for clean-up:

To solve the plastic problem, we must ensure that action and clean-up operations are undertaken in areas where the problem is the greatest. Much of the work, however, is hampered due to the lack of financial resources. By establishing a global ocean fund, with waste management and clean-up of marine areas high on the agenda, we will be one step closer towards the goal: a future without plastic and marine pollution in our ocean.

Exercise | Q 6.1 | Page 121

Write short notes.

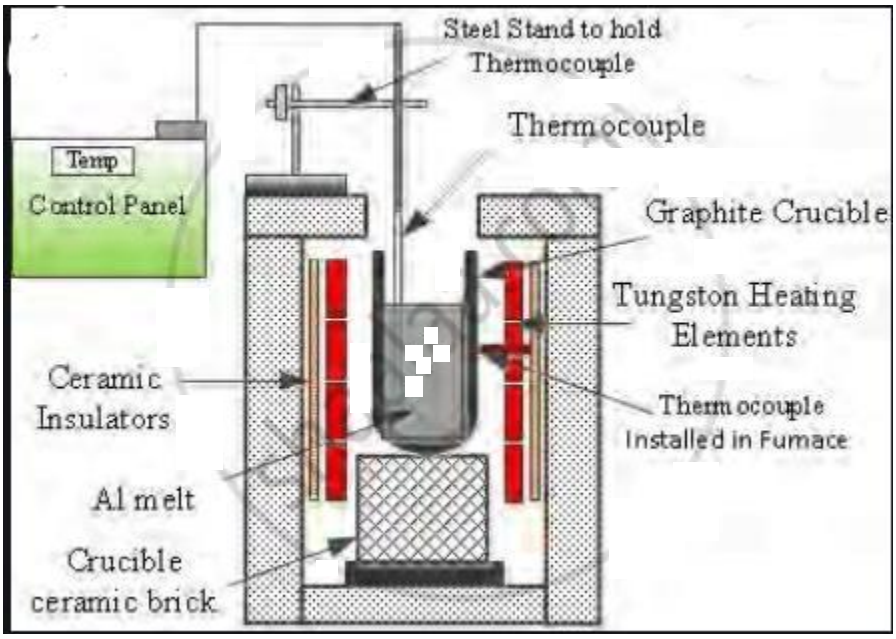
Glass production.

Solution: Glass production:

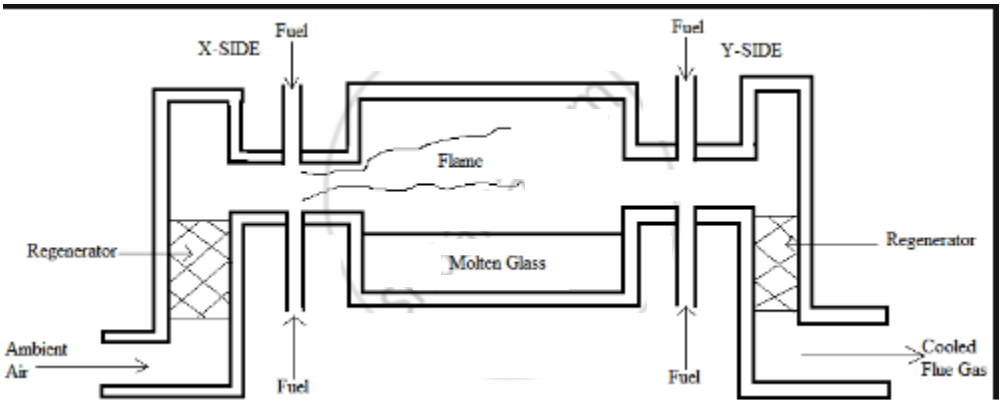
The manufacturing process of glass consists of four major operations:
(1) Melting, (2) Shaping, (3) Annealing, (4) Finishing. Each operation is being discussed briefly as follows:

1. Melting: The ingredients called batch materials are mixed in the appropriate proportion and heated to fusion in a furnace.For glass production, mixture of sand(silicon dioxide), lime and small quantity of magnesium oxide is added. The two most commonly used furnaces are: (i) Pot furnace and (ii) Tank furnace.

i. **Pot Furnace**: In this furnace, the charge is fused in fire clay pots. The pots may be opened or closed. The closed pots are used when the-glass is to be protected from the products of combustion.



(ii)**Tank Furnace**: It consists of a large rectangular tank built of fire clay blocks. The batch materials are fed into the tank and producer gas is used as a fuel in the furnace.



2. Shaping: The plastic glass formed in the furnace is next shaped or formed into the desired articles. It is accomplished by blowing from mouth or by means of a machine.

Shapinq of glass lump.

3. Annealing: It is a process of cooling slowly the newly shaped articles. If they are cooled quickly they become brittle on account of the high internal strain. Annealing allows the molecules to arrange themselves in such a way that there is no internal strain when the mass is cooled. Annealing is done in a tunnel like oven called lehr

4. Finishing: The articles obtained from the lehr are subjected to a number of operations such as cleaning, polishing, grinding, rounding edges, etc., for bringing them to a useable form.

Exercise | Q 6.2 | Page 121

Write short notes.

Optic glass

Solution: Optic glass is high-quality, homogeneous, color-free glass, as flint or crown glass, having specified refractive properties, used in lenses and other components of optical systems.

Optic glass is produced, when we mixed sand(silicon dioxide), soda, limestone, barium oxide and boron.

These glasses are useful in the production of microscopeic lenses, spectacle4s, lenses etc.

Exercise | Q 6.3 | Page 121

Write short notes.

Uses of plastic.

Solution: 1. Melamine is used in domestically useful items like cup, saucers, plates, trey, spare parts of airplane engine and sound insulating coverings etc.

2.Polyurethane is used in surfing boards, small boats, furniture, seats in vehicles etc.

3.Bakelite is used for making cabinets of radio, T.V., telephones, electric switches, toys, coverings over handles of cookers etc.

4.Polyester is used for making fiber glass, toners of laser printers, textile industry etc.

5.Polypropylene is used for making parts of loudspeakers & vehicles, ropes, mattresses, laboratory appliances stc.

6.Polyethylene is used for making milk bags, packing bags, flexible garden pipes etc.

7. polystyrene is used for making thermo-insulating parts of electric appliances like refrigerators, gears of machine, toys, protective coverings like covers of CD and DVD etc.

8.Polyvinyl chloride is used for making bottles, raincoat, pipes, handbags, shoes, electric cable insulation, furniture, ropes, toys etc.