21

Materials in Our Daily Life

The basic aim of science is not only to study and understand natural phenomena but also to use this knowledge to make our lives more comfortable. Science and technology have enabled us to develop more economical and convenient methods to recover useful materials from nature and to put them to various uses. Chemistry has enabled us to synthesize new materials which have desired properties, thus, making them even better than natural materials.

We need different types of materials to meet our daily needs. Some of them are obtained from nature while others are prepared by man. The materials that we get from nature are called **natural materials**. Wood, silk, cotton, leather, rubber, coal, etc. are natural materials. However, some materials that we use are **man-made**. Synthetic textiles like terylene and nylon, cement, glass, plastics, dyes, soap, detergents, fertilizers, insecticides and pesticides are some man-made materials which are commonly used.

In this lesson, you will learn about the ways in which various materials are used in making common household items, in construction of houses and other buildings. You will learn about different polymers and their uses in our daily life. In addition, you will learn about the various medicines that help to cure different diseases and keep us healthy.

OBJECTIVES

After completing this lesson, you will be able to:

- differentiate between natural and man-made materials;
- name the materials used for making some common household items and for housing purposes;
- state the principles involved in preparation and properties of some man-made materials in our daily life;
- list various medicines used in some common diseases;
- explain harmful effects of man-made materials on the environment.

21.1 COMMON HOUSEHOLD ITEMS

We use many things in our house like candles in case of emergency lighting, ink to write, soaps and detergents to wash our clothes, matchbox to light gas stove or candles and many more. Let us now learn about these items of daily use.

21.1.1 Candles

We use candles as emergency light source and for decorative and ceremonial purposes. Usually they are made from a mixture of paraffin wax or some other slow-burning substance like tallow (stearic acid). They are commonly made in cylindrical form but are also made in fanciful designs. They contain a wick at their centre. When lighted with a matchstick heat from its flame liquefies the wax of the candle. This liquefied wax rises up along the wick where it is converted into vapour form, which then catches fire.

Now a days, candles are made in a variety of colours, shapes and sizes. Some candles are scented and their aroma spreads in the air when lighted while some others can float on water. Nainital (in Uttaranchal) is famous for the variety of beautiful and decorative candles manufactured here.

21.1.2 Inks

We all use inks in various writing instruments like fountain pens, ball pens, gel pens, roller pens, soft tip pens, etc. Have you ever thought what ink is?

Ink is a coloured fluid or a paste that is used for writing or printing. Earlier, black ink, also called *India ink*, was most widely used. It was made by mixing lamp black or carbon black in water or oil to which some gum was added which stabilized the mixture and also gave it better sticking property. This ink is used even these days but more commonly used inks are solutions of water or alcohol soluble dyes.

Inks used in printing are similar in nature but are in the form of thick paste, which has a better sticking property. This is an essential quality as it causes the ink to stick to the typefaces and to paper when it is pressed against it.

21.1.3 Soap and detergents

We use soap and detergents to wash our clothes. We wash our hands and take bath with soap. Soap and detergents help in removing dirt, oil and grease. How do soap and detergents remove the dirt and grease? What are the chemicals present in them? What is the difference in soaps and detergents?

21.1.3a Soap

Soap has been in use for at least last three thousand years. **Soaps** are sodium or potassium salts of long chain organic acids (called fatty acids) like stearic acid and palmitic acid.

How is soap manufactured?

Soap is made by heating oil with sodium hydroxide. The oil and sodium hydroxide solution are fed into an enclosed reaction vessel under high pressure and heated at high temperature. At this temperature, the reaction is completed in a few minutes. The mixture of soap and glycerol is cooled and a concentrated solution of sodium chloride is added. Glycerol dissolves readily in salt solution but soap does not. So, solid soap separates out from the mixture. It is then removed by centrifugation. While still hot it is sprayed into a hot vacuum chamber to dry it. Perfume is added and the particles are compressed into soap cake.

The basic materials used to manufacture soap are animal fats (*lard*) or vegetable oils (olive oil, neem oil, etc.) and an alkali, usually sodium hydroxide. Fats and oils are compounds of organic acids (containing 12–14 carbon atoms) and glycerol (commonly called glycerine). When the fat or oil is heated with sodium hydroxide solution, the acids are broken away from glycerol and are neutralized by the alkali to form soap.

Soaps produce lather (foam) with soft water. With hard water, which contains calcium and magnesium salts in it, they do not produce lather. Instead they themselves are precipitated as insoluble salts of calcium and magnesium.

21.1.3b Detergents

Animal fats and vegetable oils are important foodstuffs and ideally should not be used for making something even as important as soap. In their place, long chain sulphonic acids (usually C_8 to C_{22}) are used. Sodium or potassium salts of these sulphonic acids are known as detergents. Detergents can be manufactured in solid form (for washing powders) or in liquid form (for shampoos and liquid soaps). Unlike soaps detergents can be used with soft as well as hard water. This is because their calcium and magnesium salts are water soluble.

ACTIVITY 21.1

Aim : To compare the lather forming ability of soap and detergent in soft and hard water.

What is required? Four test tubes, two small pieces of soap and detergent cakes.

What to do?

Take four test tubes. In two of them take some amount of ordinary tap water which is soft water. In one of them add a small piece of soap while in the other add a small amount of some detergent (a small piece or a small amount of powder). Shake both the test tubes.

What do you observe?

- Lather is formed in both the test tubes.
- Now repeat the above procedure with hard water from a hand pump or a well.
- You will find that soap does not form lather but detergent does form lather even with hard water.

21.1.3c Cleansing action of soap and detergent

Soaps and detergents form lather or foam with water. Lather removes grease and dirt particles from clothes. Water by itself cannot do it as it does not wet oily or greasy dirt. Addition of soap or detergents improves the wetting property of water and thus helps in removing oily or greasy dirt.

21.1.4 Matchboxes

In every house you will find a matchbox. Can you imagine life without it? How would you light up a candle or gas stove without it?

Do you know how a matchstick catches fire? The head of matchstick consists of a mixture of potassium chlorate and antimony trisulphide bound together by glue. The striking surface on the matchbox is a mixture of red phosphorus and powdered glass held by glue. When a matchstick is struck against the coated surface of the matchbox, some heat is produced that makes the chemicals in the match head react. The heat of this reaction ignites the wood.

Be careful

Matches must be used carefully. While lighting, it should not be struck so hard on the side of the matchbox that it's burning head breaks and flies away. This can result in an accident. After using a matchstick, we should not throw it anywhere carelessly. Even when its flame is blown off, the tip of the stick continues to burn slowly as can be seen by the dull red glow at the tip. This is known as **after glow.** Many accidental fires may occur by this after glow. Therefore, while throwing away a matchstick you should always check that it is completely extinguished and there is no after glow. Sometimes matchsticks are dipped in a solution of borax or sodium carbonate (*karborized matches*) and dried as a first step in the manufacture of matches. Matchsticks thus treated are completely extinguished when blown away and are safer to use.

CHECK YOUR PROGRESS 21.1

1. Give two examples each of natural and man-made materials?
2. Name the substances used for making candles.
3. What are soaps?
4. Can soap be used with hard water to wash clothes?
5. Which type of matches do we use today?

21.2 HOUSING MATERIALS

In the last section, we learned about some common household items. In this section, we will learn about two important housing materials – cement and glass.

21.2.1 Cement

Do you know what cement is made of and how is it manufactured?

a) **Raw materials required:** Three main raw materials required for manufacture of cement are as follows:
   - Limestone which is calcium carbonate, $CaCO_3$
   - Clay which is mainly a mixture of aluminium silicates containing alumina, Al_2O_3 and silica, SiO_2
   - Gypsum which is $CaSO_4.2H_2O$

b) **Manufacture:** Limestone and clay are mixed in definite proportion and ground to a fine powdery state. This dry powder is used as such or mixed with water to form a paste and heated in a rotary kiln (a type of furnace). It is slowly made to pass through the kiln wherein limestone and clay combine chemically and form a mixture of calcium silicate, $CaSiO_3$ and calcium aluminate, $CaAl_2O_3$. This mixture is in the form of small greenish black or grey-coloured

hard balls known as **clinkers**. These clinkers are allowed to cool down and then ground to very fine powder. To this powder, 2-3% gypsum is added and the mixture is again ground to obtain a grayish coloured powder, which is cement. It is then packed in airtight bags to exclude the moisture. Gypsum is added to decrease the setting time of cement.

c) **Uses:** Cement is one of the most important building materials. It is employed in the construction of buildings, roads, bridges, dams, etc. For general uses like plastering or laying of bricks, this powder is mixed with sand and water and the resulting thick paste is used for construction purposes. As a result of chemical reactions between water and cement this mixture sets into a hard mass.

Concrete is a mixture of cement, sand, gravel or small pieces of stone and water. It sets to an extremely hard structure. It is used for making floors and roads. Concrete may be further strengthened by filling it around or over a network of steel rods and allowing it to set. It is known as **reinforced concrete cement or R.C.C.** Such structures are very strong and are used in construction of pillars, roofs of buildings, roads, bridges and dams.

21.2.2 Glass

Glass is used for various purposes. You must have seen glasses fitted in windows and doors, looking mirrors, windscreens of vehicles, reading glasses, sunglasses, etc. Have you ever wondered how is glass prepared? What are the raw materials required for manufacturing of different types of glasses?

a) **Raw materials required:** The basic raw materials needed for making glass are:
   - Washing soda which is sodium carbonate, $Na_2 CO_3$.
   - Limestone which is calcium carbonate, $CaCO_3$.
   - Sand which is silica, SiO_2.

b) **Manufacture:** The raw materials are mixed in a definite proportion. These are then ground and the mixture is heated in a furnace. Sometimes scrap glass is also mixed with other raw materials. By doing so glass can be recycled and it also helps in melting of the mixture. The fused mixture is then allowed to cool. The glass so produced is transparent, non-crystalline and brittle.

c) **Types of glass and their uses:** There are various types of glasses depending upon their composition and the purpose of their use.
   - **Soda-lime glass:** The glass produced as given above is called **soda-lime glass** or soft glass. It is used for manufacture of bottles ordinary crockery, ordinary laboratory glass apparatus like soda glass test tubes etc.
   - **Hard glass:** If instead of sodium carbonate, potassium carbonate is used for making glass another variety of glass known as hard glass is produced. It can withstand very high temperatures. It is used for making hard glass laboratory apparatus like hard glass test tubes, beakers, conical flasks etc.

- **Borosilicate glass:** It is sodium aluminium borosilicate. It can withstand rapid heating and cooling without breaking. It is used for making kitchenware and laboratory apparatus. It is sold under the trade names Borosil and Pyrex.
- **Flint or optical glass:** It is used for making lenses, prisms, spectacles, etc. because of its excellent optical properties. It is composed of alkalis, lead oxide and silica. It is also known as **flint glass.** A superior variety of optical glasses is made by adding cerium oxide. It cuts harmful ultra violet rays that are harmful to eyes. It is known as **Crooke's glass**.
- **Coloured glass:** It is made by adding small quantities of oxides of different metals to basic ingredients. Blue glass contains traces of cobalt or copper oxide, green glass contains chromium ferrous oxide, red glass contains selenium oxide.
- **Fibre glass:** It is produced by passing molten glass through rotating spinners when it gets converted into fine threads. It is used as an insulating material for heat, electricity and sound in different equipment like electric ovens, geysers, refrigerators, etc. It is also used for reinforcing plastics and rubber to make bodies of cars and scooters and safety helmets.

CHECK YOUR PROGRESS 21.2

1. What is mixed with cement before using it for construction purposes?
2. Which type of glass can withstand rapid heating and cooling without breaking?
3. What is the role of small pieces of stone that are added to cement when it is used to make floor or roads?
4. How is coloured glass made?

21.3 SOME IMPORTANT CHEMICALS

A large number of chemicals are used in industry and in our homes for various purposes. In this section we would learn about some such useful chemicals.

21.3.1 Washing soda

Washing soda is used for washing of clothes. It is because of this chemical used that the clothes washed by a washerman appear so white. Chemically, washing soda is sodium carbonate decahydrate ($Na_2CO_3.10H_2O$). It is an important chemical required as basic raw material in hundreds of industries. Now let us learn about the raw materials used in its manufacture and how is it manufactured.

a) **Raw materials required:** The raw materials required to manufacture washing soda are
   - Lime stone is calcium carbonate ($CaCO_3$)
   - Sodium chloride (NaCl) in the form of brine
   - Ammonia (NH_3)

b) **Manufacture:** Washing soda is manufactured by Solvay process. In this process, firstly, carbon dioxide is obtained by heating limestone strongly.

$$\underset{\text{lime stone}}{CaCO_3} \longrightarrow \underset{\text{quick lime}}{CaO} + \underset{\text{carbon dioxide}}{CO_2}$$

It is then passed through cold brine (a solution of concentrated NaCl in water), which has previously been saturated with ammonia.

$$NaCl(aq) + CO_2(g) + NH_3(g) + H_2O(l) \longrightarrow NaHCO_3(s) + NH_4Cl(aq)$$

Sodium chloride — ammonia — sodium hydrogen carbonate — ammonium chloride

$NaHCO_3$ being sparingly soluble in water, crystallizes out. It is calcinated (heated strongly in a furnace) to get sodium carbonate.

$$2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O$$

Ammonia used in this process is regenerated by first converting the quicklime obtained earlier with water and then reacting it with ammonium chloride obtained from carbonating tower.

$$\underset{\text{quick lime}}{CaO} + H_2O \longrightarrow \underset{\text{slaked lime}}{Ca(OH)_2}$$

$$Ca(OH)_2 + \underset{\text{ammonium chloride}}{2NH_4Cl} \longrightarrow \underset{\text{calcium chloride}}{CaCl_2} + 2NH_3 + 2H_2O$$

c) **Uses**: Washing soda is used in the manufacture of glass, water glass, caustic soda, borax and soap powders. It is also used for the softening of water, as laboratory reagent and as a starting material for the preparation of a number of other sodium compounds. Of course, its most common use in laundry is for washing of fabrics and clothes from which it gets its name.

21.3.2 Baking soda

You must have seen your mother using baking soda while cooking some *dals*. If you ask her why she uses it, she would tell that it helps in cooking some items faster which otherwise would take much longer time. Chemically, baking soda is sodium hydrogen carbonate or sodium bicarbonate and its formula is $NaHCO_3$.

a) **Manufacture:** You have already learned in the previous section that it is the primary product of the Solvay process used to manufacture washing soda.

It gives small white crystals sparingly soluble in water. Its solution in water is alkaline in nature.

b) **Uses:** Baking soda is mainly used in the baking industry. When sodium hydrogen carbonate or its solution is heated, it gives off carbon dioxide.

It is this carbon dioxide which raises the dough during baking. The sodium carbonate produced during the heating of sodium hydrogen carbonate gives bitter taste. Therefore, usually baking powder is used, which is a mixture of baking soda, $NaHCO_3$ and an acid like tartaric acid. The latter is added to neutralize the sodium carbonate formed in the reaction given above, to avoid its bitter taste. You must have eaten cakes. They are made so soft and fluffy by using baking powder. Baking soda is also used in medicines to neutralize the excessive acidity in the stomach. Mixed with a solid acid such as citric or tartaric acid, it finds use in effervescent drinks used to cure indigestion.

Another important use of baking soda is in certain types of fire extinguishers about which you have already learned in lesson 14.

21.3.3 Bleaching powder

Have you ever wondered at the whiteness of a new white cloth? How is it made so white?

It is done by bleaching the cloth at the time of its manufacture. **Bleaching** is a process of removing colour from a cloth to make it whiter. Bleaching powder has been used for this purpose since long. Chemically, it is calcium oxychloride and its formula is $CaOCl_2$. Now we shall learn about the raw materials required for its manufacture and how it is manufactured from them.

a) **Raw materials required:** The raw materials required for manufacture of bleaching powder are
   - Slaked lime, $Ca(OH)_2$
   - Chlorine gas, Cl_2

b) **Manufacture:** It is prepared in a vertical tower made of cast iron with inlets for chlorine and hot air near the base. The dry slaked lime, calcium hydroxide, is fed into the chlorinating tower from the top. It moves downward slowly and meets the upcoming current of chlorine. As a result of the reaction between them it is converted into bleaching powder which collects at the bottom.

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

c) **Uses:** It is used mainly for bleaching cotton, linen and wood pulp in textile and paper factories. Apart from this, it is used as a disinfectant and germicide for the sterilization of water, in rendering wool unshrinkable and for the manufacture of chloroform. It also finds use as an oxidizing agent in many chemical industries.

21.3.4 Plaster of Paris

You must have seen beautiful designs made on the ceiling and walls of rooms in many houses. They are made with Plaster of Paris, also called POP.

a) **Manufacture:** It is manufactured from gypsum which is hydrated calcium sulphate ($CaSO_4.2H_2O$) found in nature. When gypsum is heated at about 325 K, it loses part of its water of crystallization to form $CaSO_4.\ ½H_2O$ or $2CaSO_4.H_2O$ which is plaster of Paris. When made into a paste with a little water, Plaster of Paris sets to a hard mass, which expand with hardening.

b) **Uses:** Plaster of Paris finds use in making casts and patterns. It is used for making plaster casts to hold fractured bones in position while they set. It is also used for making chalks for writing on blackboard. Now a days it is increasingly being used for plastering the walls, pillars and ceilings and to make ornamental patterns on them.

CHECK YOUR PROGRESS 21.3

1. What is the common name of $NaHCO_3$?
2. Name the process used for manufacture of washing soda?
3. Which chemical can be used for removing stains of ink from clothes?
4. What is the chemical formula of Plaster of Paris?

21.4 FIBRES: NATURAL AND SYNTHETIC

Fibre is a fine thread like material, like cotton, which is woven or knitted into a cloth. We need different types of clothes, such as cotton, silk, nylon, polyester, etc. to suit different weather conditions. Fibres are made of polymers. Cotton consists of cellulose. Some of these like cotton, wool and silk are obtained from nature. They are called **natural fibres**. Many of them are **man-made** like nylon, polyester, terylene, liakra, etc. They are called **synthetic fibres**.

21.4.1 Polymers

Many things that we see around us and use are polymers. We use plastic buckets, containers, electrical switches, etc. The clothes that we wear are made of polymers like cotton, wool, terylene, etc. **Polymers** are big molecules which are formed when a large number of small molecules join one another. The word polymer means many parts. The small molecules which make a polymer are called **monomers.** For example, ethene (C_2H_4) molecules join together and form the polymer known as polythene.

a) **Nylon:** Nylon is a polymer of small monomeric units called amide (-CO-NH-) i.e. it is a **polyamide**. It is prepared by reaction of adipic acid and hexamethylenediamine. Terylene is crease resistant, durable and is not damaged by insects like moths and by mildew (fungi that form a white growth on plants and materials like cloth and paper).

b) **Polysters:** Polyesters are another category of polymers. One important member of this family is dacron which is also known as terylene. It is prepared by reaction between terephthalic acid and ethylene glycol. It is crease resistant, durable and is not damaged by insects like moths and mildew. Therefore, it is suitable for making garments because they can be set into permanent creases and pleats. It has also been used to repair or replace segments of blood vessels. In the form of thin sheets it is used for manufacture of adhesive tapes and recording tapes.

21.4.2 Rubber

a) **Natural rubber:** Natural rubber is chemically poly-cis-isoprene which is formed from the monomer isoprene. It comes from the sap of the Para rubber tree, *Hevea brasiliensis*. Trees are tapped by making a spiral cut through the bark. The sap is called **latex**. It is a white milky liquid. It is a suspension of tiny particles of rubber in water. These particles can be separated when acid is added to it and solid rubber is obtained.

   Raw rubber is soft and pliable i.e. it can be easily bent. It does not possess the main property that we associate with rubber, **elasticity** i.e. the ability to return to its original shape after stretching. Rubber is made elastic by heating it with a small amount (1 to 3%) of sulphur. This process is known as **vulcanization.** Apart from sulphur other substances are also added to natural rubber to modify its properties. Carbon black is added to make it stronger, flexible and more resistant to wear and tear. For making car tyres, 2 parts of rubber are mixed

with 1 part carbon black. If flexibility is not important fillers, such as clay or chalk, are added to make rubber hard and stiff. Rubber for floor tiles and mats contains fillers of this type.

b) **Synthetic rubber:** Synthetic rubber supplements the natural rubber and helps save precious trees. Its properties are similar and sometimes better than those of natural rubber. The most common variety of synthetic rubber is made from the monomer butadiene $CH_2CH.CH.CH_2$. It can be vulcanized just like natural rubber. It has particularly good resistance to wear and tear, which makes it especially useful for making tyres. Other types of synthetic rubbers are made by mixing other monomers like styrene and chloroprene (commonly known as neoprene) with butadiene.

21.4.3 Plastics

You must be using comb, toothbrush, jars and buckets in your house. All these items of daily use are made of plastic. Plastics are synthetic or man-made polymers. Let us learn about some of these.

a) **Polythene** is a polymer made from ethene ($CH_2=CH_2$). It is one of the most commonly used materials. It is a soft plastic, which softens on heating. It is used for making bottles, buckets, and pipes, as covering for electrical wires and cables and as film for making bags.

b) **Polyvinyl chloride (PVC)** is made from the monomer vinyl chloride ($CH_2=CHCl$). It is used for making rain coats, handbags, toys including dolls, electrical goods and as a covering of electrical wires.

c) **Bakelite (Phenol-formaldehyde resin)** is made by reacting phenol and formaldehyde. It is hard and quite a strong material. It is used for making combs, electrical switches, and plugs and for making handles of many kitchen utensils and electrical appliances like pans, pressure cookers, electric irons, kettles, and toasters.

CHECK YOUR PROGRESS 21.4

1. What is a monomer?
2. What is the name of monomeric unit of natural rubber?
3. Why is sulphur added to rubber?
4. What is the full form of PVC?

21.5 MEDICINES

Whenever we feel sick, we go to the doctor for medicines (also called drugs). **Medicine** is a substance used for treating diseases or illness. Let us study about some common types of medicines.

21.5.1 Anaesthetics

Anaesthetics are drugs which produce a loss of sensation and consciousness. **General anaesthetics** result in loss of sensation and consciousness in the entire

body. Examples are divinyl ethers, cyclopropane, etc. They are used during major surgical operations. Some anaesthetics like Novocain and Xylocaine which show their effect in a limited area are called **local anaesthetics.** They are used during small surgical operations and tooth extraction.

21.5.2 Antibiotics

Antibiotics are medicines which are used to kill bacteria, fungi and moulds. The first antibiotic discovered was penicillin which is very effective for pneumonia, bronchitis, sore throat, etc. Ampicillin is a slight modification of penicillin. It has wider applications. Other commonly used antibiotics are streptomycin, tetracycline and chloramphenicol.

21.5.3 Analgesics

Analgesics are used for relieving pain. Aspirin, paracetamol, morphine are some examples of analgesics. They must be used only under medical supervision.

21.5.4 Antacids

Antacids are used to treat acidity in stomach. Digene, ranitidine and omeprazole are some examples of antacids.

21.5.5 Antipyretics

Antipyretics are the medicines which are used to bring down body temperature in high fever. Their administration leads to perspiration which brings down the temperature. Common examples are aspirin, paracetamol, analgin and phenacetin.

In this section you learned about some important types of medicines. However, it must be remembered that medicines should always be taken on the advice of a doctor.

CHECK YOUR PROGRESS 21.5

1. What is the use of the drug paracetamol?
2. What is the use of ranitidine?
3. Name an antibiotic.
4. Which types of medicines are used for relieving pain?

21.6 HARMFUL EFFECTS OF MAN-MADE MATERIALS

In this lesson you have learnt about various materials that are useful to us. Many of them are obtained from natural resources while a large number of them are man-made. These days the latter are being used extensively. However, after use their disposal becomes a problem. Many of them are toxic in nature and pollute air and water. Some of them are so stable that they are not degraded easily and they get accumulated in the environment. Such materials should be recycled in order to avoid such problems. In the next lesson you will learn about the harmful effects of man-made materials and the related environmental problems in detail.

LET US REVISE

- Of all the materials that we see around us some are obtained from nature while others are prepared by man.
- Candles are made from a mixture of paraffin wax and stearic acid.
- Inks are coloured fluids or pastes that are used for writing or printing.
- Soaps are sodium or potassium salts of long chain fatty acids while detergents are sodium or potassium salts of long chain sulphonic acids. Detergents can give lather even with hard water whereas soaps cannot.
- Safety matches have a mixture of potassium chlorate and antimony trisulphide and glue at the head of match sticks and a mixture of red phosphorus and powdered glass on the striking surface. The heat generated when the match stick is struck starts the ignition.
- Cement is one of the most important building material manufactured from limestone, clay and gypsum.
- Concrete is a mixture of cement, sand gravel and water. It sets to an extremely hard structure.
- Glass is prepared by heating a mixture of washing soda, limestone and sand in a furnace.
- Soda glass is used for manufacture of bottles, ordinary crockery, laboratory apparatus, etc.
- Hard glass is made by using potassium carbonate in place of sodium carbonate. It can withstand very high temperatures and is used for making laboratory apparatus.
- Borosilicate glass is sodium aluminium borosilicate and can withstand rapid heating and cooling. It is used for making kitchen and laboratory ware.
- Flint glass is used for making lenses, prisms, spectacles, etc.
- Coloured glass is made by adding small quantities of oxides of different metals.
- Fibre glass is a mass of fine threads of glass used as an insulating material for heat, electricity and sound and reinforcing plastics and rubber.
- Washing soda ($Na_2CO_3.10H_2O$) is prepared by Solvay process. It is used in the manufacture of glass, caustic soda, borax and soap powders. It is used for softening of water, as a laboratory reagent and as a starting material for many sodium compounds.
- Baking soda ($NaHCO_3$) is the primary product of Solvay process. It is mainly used in baking industry and in fire extinguishers.
- Baking powder is a mixture of baking soda and tartaric acid.
- Bleaching powder ($CaOCl_2$) is prepared by mixing chlorine and slaked lime. It is used for bleaching cotton, linen and wood pulp and for sterilization of water.
- Plaster of Paris ($CaSO_4.\frac{1}{2}H_2O$) is prepared by heating gypsum ($CaSO_4.2H_2O$). It is used for making casts and patterns and for plastering the walls, pillars and ceilings and to make ornamental patterns on them.

- Polymers are big molecules formed when a large number of small molecules join together. Cotton, wool, terylene, etc. are some polymers. Nylon, polyesters, rubber and plastics are some important polymers.
- Medicine is a substance used for treating diseases or illness. Anaesthetics, antibiotics, analgesics, antacids and antipyretics are some important types of drugs that are used.

TERMINAL EXERCISES

A. Multiple choice type questions.

Choose the correct answer of the following:

1. The glass that can withstand rapid heating and cooling without breaking is
   (a) hard (b) soda-lime glass (c) borosilicate (d) flint
2. Novocain is an
   (a) antipyretic (b) analgesic (c) anaesthetic (d) antibiotic
3. Chloramphenicol is an
   (a) antibiotic (b) antipyretic (c) antacid (d) analgesic
4. Which of the following is not a raw material required for manufacture of washing soda?
   (a) Lime stone (b) Ammonia (c) Slaked lime (d) Sodium chloride
5. Which of the following is a man-made material?
   (a) Glass (b) Wood (c) Leather (d) Silk

B. Descriptive type questions.

1. What are candles made of ?
2. What are the basic materials used for the manufacture of soaps?
3. What is concrete?
4. Mention two uses of bleaching powder.
5. Name the two substances used for making nylon.
6. For printing purpose why is ink used in the form of thick paste?
7. How striking the matchstick on the side of the matchbox helps in lighting it?
8. Why is gypsum added to the powdered clinkers during manufacture of cement?
9. Mention four uses of washing soda.
10. Give two examples each of antibiotics and analgesics.
11. What is an antipyretic? Give two examples.
12. What is vulcanization process? Why is natural rubber vulcanized?
13. List the raw materials required for manufacture of bleaching powder and describe its process of manufacture.
14. How is Plaster of Paris manufactured? Give its two uses.
15. Name three plastics and give one use of each one of them.
16. What is a candle made of? Explain the process of lighting it.

17. Differentiate between soaps and detergents. Why soaps do not form lather with hard water while detergents can?
18. List the raw materials required for the manufacture of cement. Describe the process of manufacture of cement briefly.
19. How is soda-lime glass manufactured? Describe briefly. What changes are made in the raw materials in the manufacture of optical glass and Borosil glass? How is colour imparted to glass?
20. Describe the process of manufacture of washing soda giving appropriate chemical equations. Mention two of its uses.
21. What are the monomeric units of polythene and polyvinyl chloride? Give three uses of each of these.

ANSWERS TO CHECK YOUR PROGRESS

21.1

1. Natural materials: Any two of the following – wood, silk, cotton, leather and rubber

   Man-made materials: Any two of the following – synthetic textiles like terylene and nylon, cement, glass, plastics, dyes, soap, detergents, fertilizers, insecticides and pesticides.
2. Candles are made from mixtures of paraffin wax and stearic acid.
3. Soaps are sodium or potassium salts of fatty acids.
4. No, because soap is precipitated out as salts of calcium and potassium in hard water.
5. Safety matches

21.2

1. Sand and water
2. Borosilicate glass
3. To increase the strength of cement
4. By adding small quantities of different metals

21.3

1. Baking soda
2. Solvay process
3. Bleaching powder
4. $CaSO_4$. H_2O or $CaSO_4$.$1/2H_2O$

21.4

1. Monomer is a substance whose small molecules combine with one another and make a polymer.
2. Isoprene
3. To make rubber elastic
4. Polyvinyl chloride

21.5

1. As an antipyretic or to get relief from fever
2. It is an antacid used to reduce acidity
3. Ampicillin or penicillin
4. Analgin or analgesic

GLOSSARY

Analgesics: Medicines which are used for relieving pain.

Antacids: Medicines which are used to treat acidity in stomach.

Antibiotics: Medicines which are used to kill bacteria, fungi and moulds.

Antipyretics: Medicines which are used to bring down body temperature in high fever.

Bakelite: Phenol-formaldehyde resin made by reacting phenol and formaldehyde.

Baking powder: Mixture of baking soda and tartaric acid.

Baking soda: Common name of $NaHCO_{3.}$

Bleaching powder: Common name of $CaOCl_{2.}$

Borosilicate glass (Borosil glass): Sodium aluminium borosilicate and can withstand rapid heating and cooling.

Concrete: Mixture of cement, sand, gravel and water.

Dacron: Polyester prepared by reaction between terephthalic acid and ethylene glycol.

Detergents: Sodium or potassium salts of long chain sulphonic acids.

Fibre glass: Mass of fine threads of glass used as an insulating material for heat, electricity and sound and reinforcing plastics and rubber.

Flint or optical glass: Lead-potash lime glass which is used for making lenses, prisms, spectacles, etc.

General anaesthetics: Those drugs which result in loss of sensation and consciousness in the entire body.

Hard glass: Variety of glass that can withstand very high temperatures.

Ink: Coloured fluid or a paste, which is used for writing or printing.

Local anaesthetics: Drugs which show their effect in a limited area.

Man-made materials: Materials which are prepared by man.

Medicine: Substance used for treating diseases or illness.

Monomers: Small molecules which make a polymer by joining one another.

Natural materials: Materials which we get from nature.

Nylon: Polymer of small monomeric units called amide (-CO-NH-) i.e. it is a polyamide

Plaster of Paris: Common name of $CaSO_4$ $\frac{1}{2}H_2O$.

Polymers: Big molecules formed when a large number of small molecules join together.

Polythene: Polymer made from ethene ($CH_2=CH_2$).

Polyvinyl chloride (PVC): Polymer is made from the monomer vinyl chloride ($CH_2=CHCl$).

Reinforced Concrete Cement (RCC): Concrete that is strengthened by filling it around or over a network of steel rods and allowing it to set.

Rubber: Chemically poly-*cis*-isoprene which is formed from the monomer isoprene.

Soaps: Sodium or potassium salts of long chain fatty acids.

Synthetic rubber: Made from the monomer butadiene ($CH_2CH.CH.CH_2$).

Vulcanization: The rocess of heating of rubber with a small amount (1-3%) of sulphur to make it elastic.

Washing soda: Common name of $Na_2CO_310H_2O$