



CHEMISTRY IN OUR LIFE



In This Chapter You Will Learn :

- ▶▶ metals and non-metals and their uses
- ▶▶ fertilizers and some other useful compounds
- ▶▶ solutions
- ▶▶ Noble metals
- ▶▶ alloys
- ▶▶ man-made materials

INTRODUCTION

The knowledge of chemistry plays a vital role in the development of human society and civilization. Directly or indirectly, all human activities depend on the knowledge of chemistry.

Nature is a vast reservoir of different kinds of substances. They need to be minutely observed and exploited for their proper use. Of these natural substances, metals and non-metals are the most important. Interaction between these two has given rise to a number of new substances, like alloys, cement, plaster of paris, fuels, plastics, fertilizers, medicines, soaps and detergents and many more. All these make our life comfortable and help in improving our national economy. In this unit you will learn about the properties and the uses of metals and non-metals and their various compounds.

Occurrence of metals and non-metals

- ▶ Most of the **metals** are reactive, so they do not occur in free state they are found in combined states as minerals in the **Earth's crust**, which is the major source of metals. The minerals from which metals can be extracted profitably are called ores.
- ▶ Sea water is also a source of a large number of metals such as sodium, potassium, magnesium, calcium, *etc.*, in the form of their salts.
- ▶ Gold, silver and Platinum being unreactive are found in free state in earth's crust and in river beds.

Non-metals occur in

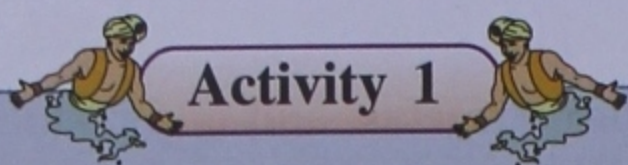
- ▶ Earth's crust in combined state as oxides, carbonates, sulphates, nitrates, phosphates *etc.*
- ▶ Atmosphere, both in free state as O_2 , N_2 and in combined state as CO_2 , H_2O .
- ▶ Noble gases occur only in free state.

You have already studied the properties of metals and non-metals in chapter 1. Here is a comparative study of properties of metals and non-metals in the following table.

USEFUL ELEMENTS

Table 7.1 : A comparative study of the general properties of metals and non-metals

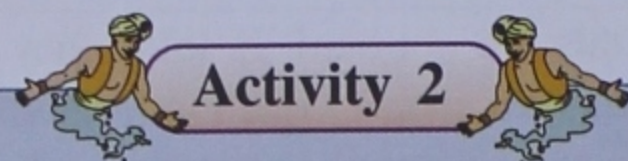
<i>Properties</i>	<i>Metals</i>	<i>Non-metals</i>
<i>State</i>	Metals are generally solids at room temperature, and they volatilize at very high temperatures (<i>Exception</i> : mercury and gallium are liquids).	Non-metals are either gases or solids (<i>Exception</i> : bromine is a liquid).
<i>Lustre</i>	Metals have lustre. That means they shine. They can be polished.	Non-metals have no lustre. They have a dull surface (<i>Exception</i> : graphite and iodine are lustrous).
<i>Density</i>	Metals have high density (<i>Exception</i> : sodium and potassium have low densities).	Non-metals generally have low density (Diamond has high density).
<i>Hardness</i>	Metals are hard solids (<i>Exception</i> : sodium and potassium are soft solids).	Non-metals are not hard. If solid, they are soft and brittle (<i>Exception</i> : diamond, a form of carbon, is the hardest naturally occurring substance).
<i>Melting point and Boiling point</i>	Metals have both high melting point and boiling point.	Non-metals have both low melting and low boiling points. (<i>Exception</i> : graphite, a form of carbon, and silicon, both have high melting points. Graphite and boron have high boiling points).
<i>Malleability</i>	Metals are usually malleable, which means they can be beaten into sheets. (<i>Exception</i> – Zinc is brittle).	All non-metals are non-malleable. Solid non-metals are brittle that means when beaten they break into pieces.
<i>Ductility</i>	Metals are ductile, <i>i.e.</i> , they can be drawn into wires (<i>Exception</i> : zinc).	Non-metals are not ductile.
<i>Tensile strength</i>	Metals have high tensile strength, <i>i.e.</i> , they can bear a lot of strain (<i>Exception</i> : zinc).	Non-metals have low tensile strength (<i>Exception</i> : carbon fibre).
<i>Thermal and electrical conductivity</i>	They are good conductors of heat and electricity. Silver is the best conductor (<i>Exception</i> : lead and tungsten are poor conductors).	Non-metals are bad conductors of heat and electricity. (<i>Exception</i> : graphite and gas-carbon are good conductors of heat and electricity).
<i>Sonority</i>	Metals produce a sound when struck with a hard object, <i>i.e.</i> , they are sonorous.	Solid non-metals do not produce a sound when struck.
<i>Alloy formation</i>	Metals combine with other metals to form homogenous solid mixtures, called alloys.	Non-metals generally do not form alloys (<i>Exception</i> : carbon forms an alloy with iron, <i>i.e.</i> , steel).
<i>Atomicity</i>	They are monoatomic elements, <i>i.e.</i> , their molecules contain just one atom.	Mostly they have more than one atom in their molecules. Gaseous non-metals mostly have diatomic molecules. (<i>Exception</i> : inert gases He, Ne, Ar, Kr, Xe, Rn).
<i>Solubility</i>	Metals are generally insoluble in water and other organic solvents.	These are both soluble and insoluble.



Activity 1

- Take samples of iron, copper, aluminium and magnesium. Note the appearance of each sample.
- Clean the surface of each sample by rubbing them with sand paper and note their appearance again.

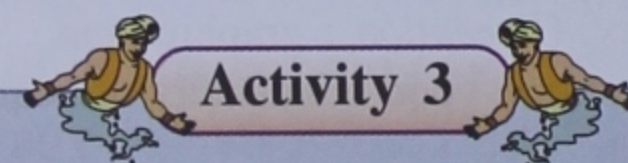
Property : Metals, in their pure state, have a shining surface. This property is called metallic lustre.



Activity 2

- Take small pieces of iron, copper, aluminium, and magnesium. Try to cut these metals with a sharp knife and note your observations.
- Hold a piece of sodium metal with a pair of tongs. Caution - Always handle sodium metal with care. Dry it by pressing between the folds of a filter paper.
- Put it on a watch-glass and try to cut it with a knife.
- What do you observe?

You will find that metals are generally hard.



Activity 3

- Take pieces of iron, zinc, lead and copper.
- Place any one metal on a block of iron and strike it four or five times with a hammer. What do you observe?
- Repeat with other metals.
- Record the change in the shape of these metals.

You will find that some metals can be beaten into their sheets. This property is called malleability. Did you know that gold and silver are the most malleable metals.

7.1 USES OF COMMON METALS

1. Gold (Au) : Gold is a shiny yellow metal. It is considered as a very precious substance for its beauty, scarcity and chemical stability. Due to its chemical stability, it does not react easily with other substances. Therefore, gold is a durable substance. Gold is highly malleable and resistant to corrosion, and it is also a very good conductor of electricity. Therefore, it is used :

- (i) in the manufacture of electronic devices, like computers, telephones, home appliances, *etc.*
- (ii) for making ornaments and coins.
- (iii) in dentistry, to fill in teeth cavities (in the form of an alloy, a mixture of gold and silver).

Pure gold is a very soft metal. In fact, it is the most malleable metal known to man. It is variously mixed with copper, nickel, silver, *etc.*, to make it harder and cheaper. 100% pure gold is 24 carat*. Generally, in India, 22 carat gold is used for making ornaments. It means that 22 parts of pure gold is alloyed with 2 parts of either copper or silver.

2. Silver (Ag) : Silver is an off white, lustrous metal. It is one of the the most ductile metal and also the best known conductor of electricity. Its chemical reactivity is more than gold. It is used :

- (i) for making jewellery.
- (ii) for filling in teeth cavities (in the form of a gold-mixed alloy).
- (iii) as a purifier of water.
- (iv) as an electrode metal, and in electroplating.

* CARAT is the measure of the purity of precious substances.

- (v) in photography in the form of silver bromide and silver nitrate.

Silver is not used for making electric wires, because it is a costly metal.

3. Platinum (Pt) : Platinum is lustrous and a very precious metal. Like gold, platinum too does not react easily with other substances. Platinum is also an excellent catalyst. It is used :

- (i) for making electrodes and electrolytic cells.
- (ii) for making expensive ornaments and watches.
- (iii) in 'flame test' and 'borax bead test' conducted for qualitative analysis.
- (iv) As a catalyst it is used in hydrogenation of unsaturated oil to prepare vanaspati *ghee*, in the manufacture of acids, *etc.*

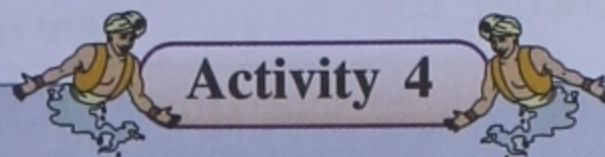
4. Iron (Fe) : Iron is the most useful metal of all. It is known to man since ancient times. It is a reactive metal and is found in combined state. Iron is used :

- (i) to make pipes, tanks, cylinders, agricultural tools, nails, wire meshes, railings, furniture, *etc.*
- (ii) to make bridges, ships, machine parts, buildings, utensils, *etc.* in the form of *steel*, an alloy containing carbons.
- (iii) in the construction of power transmission towers.

5. Copper (Cu) : Copper is a reddish brown metal. It is highly ductile and a very good conductor of heat and electricity. It finds applications in :

- (i) making electric wires and cables, utensils, and even semi-precious ornaments.

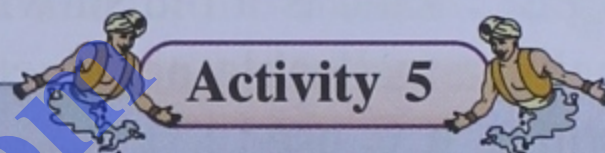
- (ii) making coins and statues in the form of its alloys called bronze and brass.
- (iii) electronic devices.



Activity 4

- Consider some metals such as iron, copper, aluminium, lead, *etc.*
- Which of the above metals are also available in the form of wires ?

The ability of metals to be drawn into thin wires is called ductility. Gold is the most ductile metal. You will be surprised to know that a wire of about 2 km length can be drawn from one gram of gold.



Activity 5

To find out metals are good conductors of heat.

Procedure : On a cold day, touch a metal rod and a wooden rod. Metal rod appears to be much more colder than the wooden rod though both are at the same temperature. This is due to the reason that metals are good conductors of heat and conduct heat from our body quickly, while wood being bad conductor of heat, does not conduct heat so quickly.

6. Aluminium (Al) : Aluminium is the most abundant metal found in the earth's crust, and the second most useful metal after iron. It is silvery white in colour. It is malleable and ductile, and it is a very good conductor of heat and electricity. Therefore, it is used :

- (i) as a substitute for copper to make electric wires, because it is cheaper.
- (ii) to make utensils, cans for drinks, furniture, window frames, *etc.*

- (iii) for packaging foodstuffs and wrappers of medicines in the form of aluminium foil.
- (iv) as a paint to prevent rust in the form of a powder foil.

Aluminium is light and strong. It is mixed with other metals to make it stronger, and then it is used to make the bodies of aircraft and automobiles, machine parts and tools.



Do You Know ?

Sodium metal is always kept in kerosene as it reacts vigorously when it comes in contact with air or water.

7. Zinc (Zn) : Zinc is a bluish-white metal. It is neither malleable nor ductile; rather it is brittle. It is used :

- (i) as an electrode metal.
- (ii) for making alloys like brass and bronze.
- (iii) to make dry cells.
- (iv) to coat iron sheets through the process of *galvanization*, which protects iron from rusting.

8. Mercury (Hg) : Mercury is a silvery white, liquid metal. It does not moisten glass, and it expands a lot on heating. Therefore, it is used :

- (i) in thermometers as thermometric liquid.
- (ii) in barometers and other scientific apparatus.
- (iii) in dentistry, for filling up cavities in teeth in the form of alloys known as *silver amalgam* and *gold amalgam*.

9. Tin (Sn) : It is a silvery white metal. It is highly malleable but not ductile. It does not rust. It is used :

- (i) for making cans to keep foodstuffs, especially grains.
- (ii) for tinning of food cans and utensils made of other metals.

10. Magnesium (Mg) : It is available in the form of ribbons. It is used :

- (i) in fireworks, because it burns with a dazzling light.
- (ii) for making fuse wire and an alloy called *magnalium*.



Do You Know ?

The various colours we see in fireworks are mainly produced by metals like magnesium, strontium and barium. Magnesium produces a brilliant white light, strontium compounds produce crimson and barium compounds produce green colour



NOTE : Magnesium is very vital for life. The green pigment chlorophyll, present in the plants contains magnesium compounds which help to capture the energy in sunlight for photosynthesis.

11. Lead (Pb) : Lead is a very heavy, silvery grey metal. It is used for :

- (i) making storage batteries.
- (ii) making sanitary pipes, tips of bullets, tin roofs, and fusible alloy (solder — a mixture of 50% tin and 50% lead).

12. Noble metals : Some metals remain unaffected in air, water, acidic solution or alkaline solution and are found in free state. They are chemically unreactive. They are known as noble metals or inert metals - gold, silver and platinum are noble metals. And they have metallic lustre for long time.

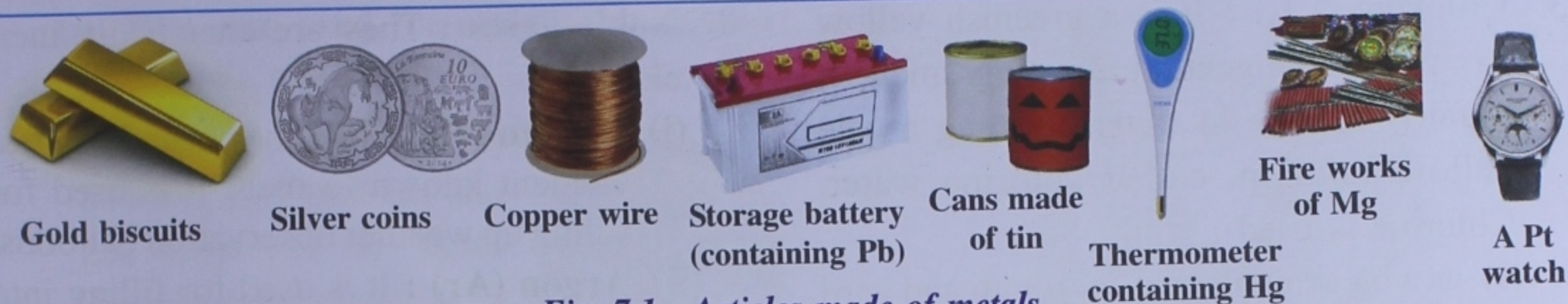


Fig. 7.1 : Articles made of metals

7.2 USES OF COMMON NON-METALS

The non-metals important to us are oxygen, hydrogen, carbon, iodine, chlorine, some inert gases, *etc.* They give us many useful products. Some of the non-metals and their uses are discussed below.

1. Carbon (C) : Carbon is one of the most important and widely distributed elements. It mainly occurs as coal, graphite and diamond in *free state*, while in a *combined state* it is present in all living organisms as food nutrients like carbohydrates, proteins, vitamins, *etc.* In the atmosphere it is present as carbon dioxide.

(a) Coal : Coal is mostly used as a fuel in homes and industries. Many trains still run on coal. It is used in the pharmaceutical and textile sectors, as a source of synthetic chemicals and textiles.



(b) Graphite : It is a crystalline, black, lustrous substance. It is soft and soapy, and it turns paper black. Graphite is used :



- (i) in the leads of pencils.
- (ii) as electrode material in electrolytic cells because it is a good conductor of electricity.
- (iii) as a lubricant for machine parts.

- (iv) for making heat resistant crucibles for keeping molten metals because of its high melting point and good conductivity of heat.
- (v) in nuclear reactors (to control the speed of nuclear reactions).

(c) Diamond : It is one of the crystalline forms of carbon. It shines brilliantly and is the hardest naturally occurring substance known to us.



- (i) Pure diamond is used as a precious gem in jewellery.
- (ii) Impure diamond is used for cutting glass and grinding hard substances, and in drilling heads.

(d) Charcoal : It is used as a decolourising agent in sugar industry.

2. Iodine (I₂) : Iodine is a dark grey, crystalline solid, with a metallic lustre. It is insoluble in water but soluble in alcohol and potassium iodide solutions. It is used :

- (i) in a very small quantity in the form of iodized salt for the healthy growth of the human body. Iodine deficiency causes goitre.
- (ii) in photographic films in the form of potassium iodide.
- (iii) to make *tincture of iodine* and *iodox*, which are used as a disinfectant and pain reliever (analgesic), respectively.

3. Chlorine (Cl_2) : It is a greenish yellow gas with a pungent, suffocating smell. It is fairly soluble in water, forming a pale yellow solution, called chlorine water. Chlorine is used :

- (i) as a bleaching agent for rough and hard fibres like jute and cotton.
- (ii) as a disinfectant for sterilizing both drinking water and swimming pool water.
- (iii) in the manufacture of chemicals like D.D.T., B.H.C. and bleaching powder, which are used as insecticide, pesticide and disinfectant, respectively.
- (iv) in the manufacture of mineral acids like hydrochloric acid.

4. Nitrogen :

- (i) It is used in food canning and in electrical bulbs.
- (ii) Used for producing compounds which are used as fertilizers.

5. Oxygen :

- (i) Human beings and animals use oxygen of air for breathing.
- (ii) In hospitals, it is given to serious patients.
- (iii) It has many industrial uses.
- (iv) It is important for combustion.

6. Sulphur :

- (i) It is used as fungicide and insecticide.
- (ii) It is used in the manufacture & sulphuric acid.

7. Hydrogen :

- (i) It is used as a reducing agent.
- (ii) It is used for converting vegetable oils into ghee.
- (iii) It is used for making fertilizers by ammonia.

8. Noble gases : They are chemically inert elements.

- (i) **Helium (He) :** It is the second lightest element known to man. It is used for filling up weather observation balloons.
- (ii) **Argon (Ar) :** It is used for filling into electric bulbs so as to provide an inert atmosphere to the heating filament. It improves the quality of the bulb.
- (iii) **Neon (Ne) :** It is used in advertising signboards.
- (iv) **Radon (Rn) :** It is used for cancer therapy.
- (v) **Xenon (Xe) and Krypton (Kr) :** They find application in photography.

7.3 ALLOYS

An alloy is a homogeneous solid mixture of two or more metals fused together in a molten state.

Some alloys also contain non-metal along with metals like stainless steel contain carbon.

The purpose of an alloy formation is to make metals more useful.

Some important alloys are as follows :

1. Brass : Brass contains 60% copper and 40% zinc. It is stronger than either of these metals, and does not corrode. It can be easily cast because it is more malleable and ductile compared to zinc and copper.

- (i) Brass is used to make electrical equipments, and also some parts of musical instruments, ships, decorative objects, etc.



- (ii) It is also used for making household utensils and statues.

2. Bronze : Bronze contains 80% copper, 18% tin and 2% zinc. It is hard, though it is brittle. It is resistant to corrosion and easily takes up a polish. It is used for :



- (i) making utensils and statues.
- (ii) making medals and coins.

3. Duralumin : It contains 95% aluminium, 4% copper, 0.5% magnesium and 0.5% manganese.



It is light and strong, and is resistant to corrosion. It is as hard as steel. It is used for :

- (i) making the bodies of aeroplanes, automobiles, spacecraft and ships.
- (ii) making household articles like pressure-cookers and casseroles.

4. Stainless steel : It is made of 75% iron, 15% chromium, 9–9.5% nickel and 0.5–1% carbon. It has a brilliant, silvery grey lustre.



It is very strong and does not rust, and it is not affected by acids and alkalis. It is used :

- (i) for making household utensils and cutlery.
- (ii) for making automobile parts, surgical instruments and ornamental articles.

5. Gold alloys : Gold is mixed with metals like silver, copper and nickel to make it stronger, harder and cheaper.

A mixture containing 92% gold and 8% of other metals is called 22 carat gold. This gold is used to make ornaments. Pure gold cannot be used for making ornaments, since it is a very soft metal.

6. German silver : It is made up of copper, zinc, nickel. It has high electrical resistance. It is used in making utensils, resistors and electric heaters.

[Solder, an alloy of lead and tin (Pb and Sn), has a low melting point and is used for welding electrical wires together]

EXERCISE – I

1. Name a metal

- (a) that is most malleable,
- (b) that is brittle,
- (c) as precious as gold,

- (d) that can be cut with knife,
- (e) used in making electric cables,
- (f) used as a thermometric liquid.

2. Name a non-metal
 - (a) that is a good conductor of heat and electricity,
 - (b) that is hardest naturally occurring substance,
 - (c) that is used to kill germs in water,
 - (d) that is lustrous,
 - (e) that is used for filling into electric bulbs,
 - (f) that is used for cancer therapy.
3. Mention *two* uses of following metals and non-metals

(a) Iron	(b) Aluminium
(c) Gold	(d) Oxygen
(e) Iodine	
4. What are alloys ? Give *one* use of each of the following alloys

(a) duralumin	(b) stainless steel
(c) brass	

5. Give reasons :-
 - (a) Magnesium is used in fire works.
 - (b) Aluminium is used in making aircrafts.
 - (c) Copper is used in making electric cables.
 - (d) Graphite is used in the leads of pencils.
 - (e) Impure diamond is used to cut glass.
 - (f) Gold is mixed with copper and nickel.
6. Name the metals present in the following alloys

(a) Brass	(b) Bronze
(c) Duralumin	(d) Stainless steel
7. Give *four* differences between metals and non-metals with reference to their
 - (a) Melting point and boiling point,
 - (b) Conductivity of heat and electricity,
 - (c) Malleability
 - (d) Solubility

7.4 SOME USEFUL COMPOUNDS

There are millions of compounds known to us. All of them are useful in some or the other way. They are either naturally occurring or artificially prepared. Compounds are broadly classified into *two* types on the basis of composition. They are,

- (a) Inorganic compounds and
- (b) Organic compounds

Inorganic compounds are those which are obtained from minerals such as common salt, hydrochloric acid, sulphuric acid, caustic soda, slaked lime etc.

Organic compounds are those which are obtained from living organisms, plants and animals. They all contain carbon in them carbonates, and oxides of carbon are not organic.

Use of few compounds are mentioned below :-

(A) Inorganic compounds :

1. **Limestone and marble (CaCO_3)*** : They are naturally occurring calcium carbonate rocks.

(a) **Limestone** is used in the manufacture of :

- (i) quicklime (CaO), which is used as mortar in the construction of buildings, in white washing, *etc.*
- (ii) glass and cement
- (iii) as a source of flux for extraction of iron from its ore.

(b) **Marble** tiles are used to cover the walls and the floors of buildings, and in the laboratory to prepare carbon dioxide gas. Taj Mahal is made from marble.

2. (a) **Gypsum** : Gypsum is the common name

* Marble is a metamorphosed form of limestone, though the chemical composition remains the same.

for chemically hydrated calcium sulphate [$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$]. It is used to :

- (i) neutralize the soil.
- (ii) prepare plaster of Paris.

(b) Plaster of Paris : It is the common name for calcium sulphate with water of crystallization [$\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$]. It is obtained by heating gypsum at a very low temperature. It is used for :

- (i) preparing masks, statues, toys, etc.
- (ii) making chalk and wall plastering, and for plastering the fractured parts of the human body.

3. Zinc oxide (ZnO) : It occurs in nature in the form of an ore, called zincite. It is obtained also by strong heating of zinc-carbonate. It is used as a paint and for the extraction of zinc.

4. Blue vitriol : Blue vitriol is hydrated copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$). It is obtained by the action of sulphuric acid on copper oxide or on copper hydroxide. It is used :

- (i) in electroplating, electrotyping and electrorefining of copper.
- (ii) as fungicide for fruit trees in the form of Bordeaux mixture that also contains milk of lime.
- (iii) to test water in its anhydrous** form.

5. Sand : It is a naturally occurring oxide of silicon. It is used in the manufacture of cement and glass.

7.5 FERTILIZERS

Fertilizers are organic or inorganic materials added to the soil to replenish its deficiency of essential nutrients for plants.

** Anhydrous : A substance is said to be anhydrous if it contains no water.

Artificial fertilizers are either water soluble inorganic salts or organic compounds rich in one or more nutrients essential for the growth of plants.

Artificial fertilizers are mainly of *three* types :

- (a) Nitrogenous fertilizers
- (b) Potash fertilizers
- (c) Phosphatic fertilizers

(a) Nitrogenous fertilizers : Nitrogen is very important for the growth of plants, because proteins cannot be made in the absence of nitrogen. And without proteins, plants cannot survive. The lack of nitrogen in plants causes a change in the colour of their leaves from green to yellow which indicates a definite decay. Some important nitrogenous fertilizers are :

- (i) sodium nitrate [NaNO_3]
- (ii) calcium nitrate [$\text{Ca}(\text{NO}_3)_2$]
- (iii) ammonium nitrate [NH_4NO_3]
- (iv) ammonium sulphate [$(\text{NH}_4)_2\text{SO}_4$]
- (v) urea [$(\text{NH}_2)_2\text{CO}$]

Among these fertilizers, urea contains the highest amount of nitrogen. However, continuous use of urea makes the soil acidic.

(b) Potash fertilizers : Potassium is essential for plants in the early stages of their growth. It helps in the formation of sugars, starch, proteins, fats and some other important substances. Potassium gives strength to wheat stalk and other grain plants so that they can withstand plant diseases and adverse weather conditions.

Some common potash fertilizers are :

- (i) potassium chloride [KCl]
- (ii) potassium sulphate [K_2SO_4]
- (iii) potassium nitrate [KNO_3]

(c) Phosphatic fertilizers : Phosphorus is absolutely essential for plants, because it is required for cell division. Phosphatic nutrients are used by plants in the early stages of their growth. They are necessary for the development of the root. Thus, phosphatic fertilizers should be given especially to root crops. Phosphorous increases the sugar content in beet root and starch content in potatoes.

Also, phosphates quicken the ripening of fruits and grains and improve the quality of plant fibre. They protect plants from diseases. The important phosphatic fertilizers are :

- (i) super phosphate (a mixture of phosphates).
- (ii) triammonium phosphate $(\text{NH}_4)_3\text{PO}_4$

7.6 SOME ORGANIC COMPOUNDS USED AS FOOD AND FUEL

1. Carbohydrates : They are compounds of carbon, hydrogen and oxygen. They form a group of important food nutrients.

Examples :

- (i) glucose $(\text{C}_6\text{H}_{12}\text{O}_6)$
- (ii) sucrose $(\text{C}_{12}\text{H}_{22}\text{O}_{11})$
- (iii) starch $[(\text{C}_5\text{H}_{10}\text{O}_5)_n]$

Carbohydrates are the energy-giving food, and they are present mainly in cereals, sugar and potatoes. The simplest carbohydrate is glucose. In our bodies, the complex molecules of carbohydrate break up into glucose, which then breaks down by the action of oxygen to release energy along with carbon dioxide and water.

2. Fats : They form another important group of food nutrients. Fats also contain carbon, hydrogen and oxygen, but their

* Acids that are obtained from animal fats and vegetable oils are called fatty acids.

molecular structures are more complex than that of carbohydrates. Fats store up a large amount of energy, in fact, for the same amount of fat and carbohydrate, the energy produced by fat is just double the energy produced by carbohydrates. Fats are present in butter, oils, nuts, *etc.*

3. Proteins : Proteins contain carbon, hydrogen, oxygen and nitrogen. They are complex nitrogenous compounds, forming a group of food nutrients that are absolutely necessary for the proper growth and development of plants, animals and human beings. Sometimes they also contain sulphur, phosphorus, iron, magnesium, *etc.*

Proteins help in the repair of body cells that suffer damage due to injury. Proteins provide structural stability and strength to the bodies of all living things — plants as well as animals. Life cannot be imagined without proteins.

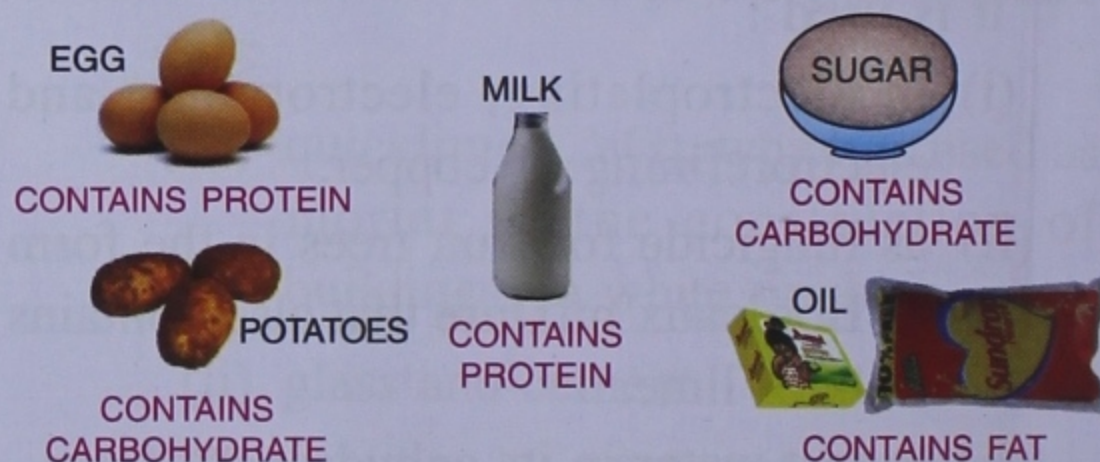


Fig. : Some food items containing food nutrients.

4. Methane : It is a colourless, odourless gas belonging to a class of compounds known as hydrocarbons that contain carbon and hydrogen only. It is the simplest compound of this class, with the molecular formula CH_4 .

- (i) Methane forms natural gas and biogas.
- (ii) It is an excellent fuel, because it leaves

no residue after burning and produces no smoke.

- (iii) It is used to prepare carbon-black that is used in printer's ink, paints, tyres, etc.

Compressed natural gas (CNG) mainly contains methane and is used as a fuel for automobiles.

7.7 MAN-MADE MATERIALS

1. Soaps and detergents

Soaps : Soaps are the sodium or the potassium salts of higher fatty acids* like palmitic and stearic acids.

Soaps are used for cleaning with soft water only, since they are ineffective in hard water. Soaps are used for cleaning our body, clothes and utensils, and for sanitation, food processing, etc.

Detergents : These are the sodium or the potassium salts of **aromatic** sulphonic acids.

They are used for washing purposes in both soft water and hard water. A detergent is a better cleansing agent compared to soap, and is often called *soapless soap*.

2. Medicines : Medicines help to cure diseases by their physiological actions. In ancient times, people were dependent mainly on plants for the cure of different diseases.

Now-a-days the chemical compounds that are formed with the help of these medicinal plants are called **drugs**. There are many kinds of drugs, depending upon both the nature of their actions and the type of infection for which they are used. Some of them are as follows :

- (i) **Antipyretics** : They are used to reduce fevers, viz. antipyrine, paracetamol.

- (ii) **Analgesics** : They are used as painkillers, viz. combiflam, nimuslide, aspirin, etc.

- (iii) **Anti-malarial drugs** : They are used to treat malaria. The roots and the leaves of certain plants, such as sequoia, are the source of these drugs. Quinine, primaquine and chloroquine are well-known anti-malarial drugs.

- (iv) **Antibiotics** : They inhibit the growth of germs that cause diseases. Penicillin, streptomycin, tetramycine, etc., are well-known antibiotics.

- (v) **Antiseptics** : They prevent the growth of germs near burns, cuts and wounds, viz. tincture of iodine, etc.

- (vi) **Antacids** : They are used to remove excess acid from the stomach. Common antacids are omeprazole, lansoprazole and milk of magnesia.

- (vii) **Antihistamines** : These drugs are also called anti-allergy drugs. They are used to treat skin rashes, conjunctivitis, nasal discharge, itching etc. Common examples are chloropheniramine, diphenylhydramine, etc.

- (viii) **Tranquillizers & hypnotics** : They are used to reduce anxiety by acting on nerve centres and inducing deep sleep. Common examples are luminal, seconal, veronal, etc.

3. Paints and Enamels : They are either lead and aluminium compounds or organic substances. They are used :

- (i) to protect metals and other objects from corrosion and decay.
- (ii) to improve the appearance of some objects.

► Painting is generally done on heavy iron

* Fatty acids are carboxylic acids with long hydrocarbon chains.

parts of vehicles, machinery, building *etc.* for better look and to avoid corrosion. *E.g.* : red lead, aluminium, paint, *etc.*

- ▶ Enamelling is done on domestic articles like pots, pans, stoves, refrigerators, *etc.* *E.g.* : organic compounds, silicates.

4. Dyes : Dyes are coloured organic substances which can be obtained from plants or can be prepared artificially. They are used to impart permanent colour to textiles, silk, wool, *etc.* Now-a-days all the dyes in use are synthetic. They are available in all colours and shades. *E.g.* : indigo blue, alizarin (red), martius yellow, *etc.*

5. Silicones : Silicones are a special kind of substances prepared from silicon with extensive uses. They are chemically inert, good electrical insulators, water-proof and highly resistant to the effects of heating. Silicones are used:

- ▶ to make insulation materials for wiring in electric motors.
- ▶ to make water proof motors.
- ▶ for making non-stick pans because it prevents things from sticking together.
- ▶ as a lubricant for automobiles and in waxes and polishes for furniture and floors.

6. Carbon fibres : Carbon fibres are the recently developed materials from carbon with the help of modern technology. They are stronger than steel, stiffer than titanium and lighter than aluminium. That is why they have become very important and find wide applications in various sectors. They are used :

- (i) to manufacture sports goods
- (ii) in the biomedical field to make components of bone plates, ligaments, and hydraulic motors for artificial heart transplants.
- (iii) to prepare air filters and gas masks
- (iv) to prepare parts of jet aircraft, rockets, missiles, nuclear reactor, *etc.*

7. Cement : It is a grey powder made from quicklime, clay, gypsum and coal dust. It quickly forms a hard mass with water. It is used :

- (i) for levelling a concrete surface smoothly.
- (ii) for joining bricks and for plastering in the form of *mortar*, which is a mixture of cement and sand in the ratio of 1 : 4.
- (iii) for roofing and for making of bridge pillars, railway sleepers and electric poles in the form of *concrete*, which is a mixture of cement, gravel and sand in the ratio of 1 : 2 : 3.

8. Plastics : Plastics are chemically known as polymers. There are many kinds of plastics. A very common example is *polythene*. Plastics are easily moulded. They are used for :

- (i) keeping things, packaging and covering up objects.
- (ii) for making household things like mugs, jars, buckets, toys, bottles, pipes, *etc.*



Other examples of plastic are polyvinyl chloride (PVC), bakelite, *etc.*

9. Synthetic fibres : These are also types of polymers. Common examples are nylon, terylene, dacron, orlon, acrylon *etc.* They are widely used in textile industry to prepare fabrics.

10. Glass : Glass is a substance formed by the solidification of a liquid without crystallization. It is thus rightly called a *supercooled liquid*.

Glass is formed by a combination of sand (silica), sodium carbonate, lime or limestone, lead monoxide, borax, aluminium oxide and some colouring matter. Some important types of glass are mentioned below :

- (i) *Soft glass* : It is used for making ordinary glassware.
- (ii) *Hard glass* : It is used for making hard glass apparatuses.
- (iii) *Pyrex glass* : It is used for making laboratory apparatuses, coffee flasks, baking bowls, *etc.* It is heat proof.
- (iv) *Water glass* : It is a concentrated and viscous solution of sodium or potassium silicate in water. It is used as an adhesive and a protective covering, especially for eggs.
- (v) *Optical glass* : It is used for making the lenses of spectacles and telescopes.
- (vi) *Safety glass* : It is made by placing a thin sheet of transparent plastic between two glass sheets. Even when the glass breaks, they do not fly off, rather they stick to the plastic (adhesive) used. It is used to make bulletproof screens and windshields of automobiles and aeroplanes.

(vii) *Lead crystal glass* : It is a type of glass in which lead oxide is mixed to make it shine brilliantly. It is also called cut glass because its surface is also cut for decorative purposes.



Crystal glass



Ordinary glass



Pyrex glass

(ix) *Glass wool* : It is used for making fireproof clothing.

Glasses are available in different colours. The colour of glass comes from the chemicals present in it.

- (a) *Red glass* – It contains cuprous oxide.
- (b) *Yellow glass* – It contains both copper oxide and chromium trioxide.
- (c) *Blue glass* – It contains both copper oxide and cobaltous oxide.

7.8 IMPORTANT PROPERTIES OF GLASS

1. It is transparent.
2. It does not react with strong acids and bases.
3. It is a bad conductor of heat and electricity.
4. It can be easily moulded into desired shapes and sizes.
5. It is easy to clean, dry and can be re-used.

7.9 USES OF SOME COMMON SOLUTIONS

The term *solution* is used for a homogeneous mixtures that contains a substance dissolved in a liquid.

Solutions play an important role in the survival of all living organisms. All plants, animals and human beings absorb food and other necessary materials in a dissolved state, *i.e.*, in the form of solutions.

Sometimes, our body requires liquid solutions in large quantities. At times when we suddenly feel weak, solutions are needed immediately to gain energy. Some of the energy-giving solutions that can be administered conveniently to the human body are :

1. **Saline water with glucose** : This is a solution containing both salt and glucose

in appropriate amounts. It can be consumed orally or injected, when a person is suffering from water loss due to dysentery or diarrhoea. It provides food to living cells and thus helps in the quick recovery of patients.

2. **Soda water** : It is prepared by dissolving carbon dioxide in water under high pressure. When sugar flavour and some colours are added, it forms the soft drinks, sold under various trade names.

3. **Syrup** : It is a highly concentrated sugar solution available in the market under different trade names. It contains a specific flavour. It is an energy rich drink which can be diluted with water before it is consumed.

RECAPITULATION

- ☛ Metals are known to man from ancient times. Metals are used to make our life comfortable. Some of the important, commonly used metals are iron, copper, aluminium, gold, silver, mercury, zinc, tin, etc.
- ☛ Non-metals form another class of elements. Common non-metals are hydrogen, oxygen, carbon, chlorine, iodine, etc. They are used for various purposes.
- ☛ Alloys are homogeneous solid mixtures containing two or more metals (sometimes a non-metal same *e.g.* : steel contains carbon with iron). They make metals more durable and thus more useful. Examples are steel, brass, bronze, duralumin, etc.
- ☛ Common salt, hydrochloric acid, carbohydrates, fats, proteins, vitamins, etc., occur naturally and can also be prepared artificially. Hydrochloric acid is secreted in our stomach to digest food, while the other substances mentioned are important food nutrients required by our body.
- ☛ Fertilizers are artificially prepared substances, which are necessary for the proper growth of crops. They increase the yield also. The important fertilizers are nitrogen, potash and phosphate-based compounds.
- ☛ There are a number of man-made materials that are used in our daily life for various purposes. Cement is used as plaster, glass is used for making utensils, apparatus, and window panes, and plastics find use in the making of pipes (PVC), buckets, containers, etc. Soaps and detergents are used for cleaning, and silicones form the waterproof objects and non-stick pans.
- ☛ Medicines are used to cure diseases.

EXERCISE – II

1. Give the chemical names and formulae of the following :-
(a) limestone (b) gypsum
(c) blue vitriol (d) marble
(e) sand
2. Define fertilizers. Give *two* examples for each of the following :
(a) nitrogenous fertilizers
(b) potash fertilizers
(c) phosphatic fertilizers
3. (a) What is the biological importance of a solution?
(b) What is a syrup ?
4. What is glass ? Why is it important ? Give the uses of soft glass, pyrex glass, safety glass.
5. What is carbon fibre ? Why it has wide applications ? State its *two* uses.
6. Give *two* uses of :-
(a) silicones (b) cement
(c) plastic (d) methane
(e) soaps and detergents.
7. Give *two* examples for each of the following :-
(a) antibiotics (b) dyes
(c) antipyretics (d) analgesics
(e) tranquillizers.
8. Differentiate between :-
(a) soaps and detergents
(b) carbohydrates and fat

OBJECTIVE TYPE QUESTIONS

1. Fill in the blanks :
(a) Urea is a fertilizer.
(b) The most ductile metal is
(c) is used for preparing mortar.
(d) and are energy giving food nutrients.
(e) An alloy is a mixture.
2. Match the following :

Column A	Column B
Antibiotic	(a) Omeprazole
Dyes	(b) Alizarin
Plastic	(c) Tetramycin
Antacid	(d) Ammonium nitrate
Fertilizer	(e) Bakelite
3. Write '*true*' or '*false*' for the following statements:-
(a) silver is used to make electric cables.
(b) Iodine acts as an antiseptic in the form of tincture of iodine.
(c) Brass is an alloy of copper and tin.
(d) sodium chloride is used to add flavour to our food.

- (e) Detergents are better than soaps in their action.
- (f) Pyrex glass is not heat resistant.

MULTIPLE CHOICE QUESTION

1. Fire proof clothings are made from :
(a) glass wool (b) optical glass
(c) pyrex glass (d) hard glass.
2. This compound is an excellent fuel :
(a) Methane (b) Sugar
(c) Carbon-dioxide (d) Syrup.
3. Eggs contain
(a) Protein (b) Fat
(c) both protein and fat
(d) none of the above
4. The noble gas used in advertising signboards is
(a) Helium (b) Neon
(c) Argon (d) Krypton
5. It is a grey powder made from quicklime, clay, gypsum and coal dust.
(a) Cement (b) Chalk
(c) Silicone (d) Washing soda