Chapter 8

Chemical Reactivity

Major Concepts

1.1 Metal

1.2 Non-Metals

Time allocation	
Teaching periods	07
Assessment periods	02
Weightage	10%

Students Learning Outcomes

Students will be able to:

- Show how cation and anion are related to the terms metals and non-metals.
- Explain Alkali metals are not found in the free state in nature.
- Explain the differences in ionization energies of alkali and alkaline earth metals.
- Describe position of sodium metal in the periodic table its simple properties and uses.
- Position of calcium and magnesium in the periodic table, their simple properties and uses.
- Differentiate between soft and hard metals (iron and sodium)
- Describe the inertness of noble metals.
- Identify commercial value of silver, gold and platinum.
- Compile some important reactions of halogens.
- Name some elements that exist in nature in uncombined form.

Introduction

The different kinds of materials around us exist in variety of forms. Things like aeroplanes, trains, building frames, automobiles or even different machines and tools, are due to different properties of various metals. The non-metals exist as gases, liquids and soft or hard solids. They occupy upper right positions in the Periodic Table. Carbon, nitrogen, phosphorus, oxygen, sulphur, most of the halogens and the noble gases are non-metals. They show a variety of chemical reactivities. They form different ionic and covalent compounds, many of which are solids or gases.

8.1 METALS

Metals are the elements (except hydrogen) which are electropositive and form cations by losing electrons. Metals can be categorized.

a. Very reactive: potassium, sodium, calcium, magnesium and aluminium.

b. Moderately reactive : zinc, iron, tin and lead.

c. Least reactive or noble : copper, mercury, silver and gold.

Some common metals and non-metals in the periodic table are shown in figure 8.1.

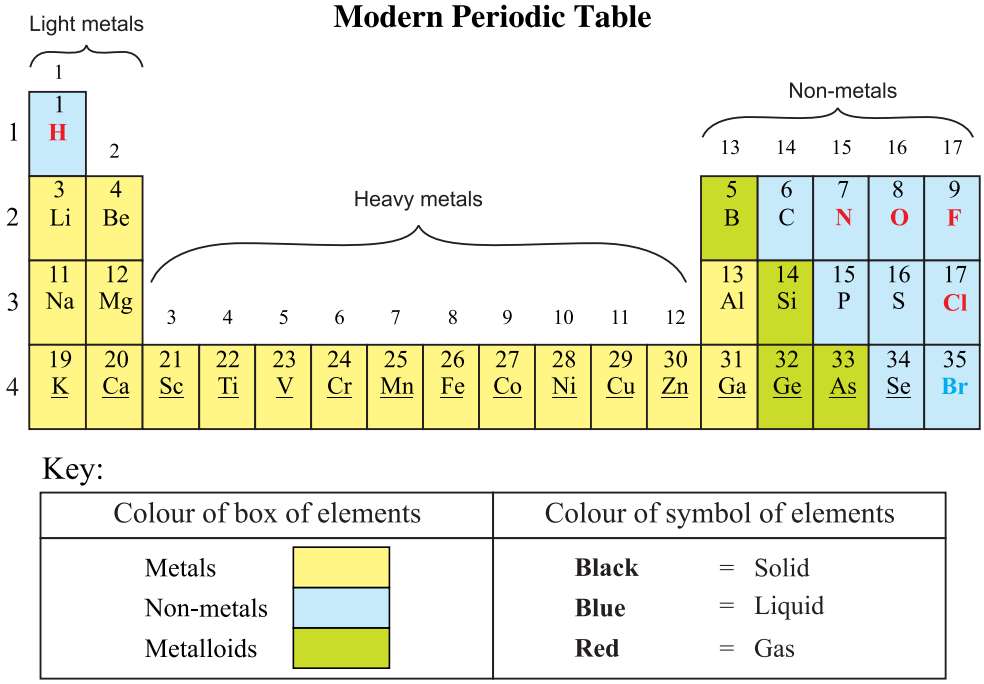


Fig. 8.1 Some common metals and non-metals.

Important physical characteristics of metals are listed below:

i. Almost all metals are solids (except mercury)

ii. They have high melting and boiling points, (except alkali metals)

iii. They possess metallic luster and can be polished.

iv. They are malleable (can be hammered into sheets), ductile (can be drawn into wires) and give off a tone when hit.

v. They are good conductor of heat and electricity.

vi. They have high densities.

vii. They are hard (except sodium and potassium).

Important chemical properties of metals are:

i. They easily lose electrons and form positive ions.

ii. They readily react with oxygen to form basic oxides.

iii. They usually form ionic compounds with non-metals.

iv. They have metallic bonding.

Do you know?

- *The most abundant metal is aluminium*
- *The most precious metal is platinum*
- *The most useable metal is iron*
- *The most reactive metal is cesium*
- *The most valuable metal is uranium*
- *The lightest metal is lithium ($d = 0.53\ g\ cm^{-3}$)*
- *The heaviest metal is osmium ($d = 22.5\ g\ cm^{-3}$)*
- *The least conductor of heat is lead.*
- *The best conductor metals are silver and gold*
- *The most ductile and malleable metals are gold and silver*

8.1.1 Electropositive Character

Metals have the tendency to lose their valance electrons. This property of a metal is termed as **electropositivity** or metallic character. The more easily a metal loses its electrons, the more electropositive it is. The number of electrons lost by an atom of a metal is called its valency. For example, sodium atom can lose 1 electron to form a positive ion

$$Na_{(s)} \longrightarrow Na^{+}_{(g)} + 1e^{-}$$

So the valency of sodium metal is 1.

Similarly zinc metal can lose 2 electrons from its valence shell. Therefore, its valency is 2.

$$Zn_{(s)} \longrightarrow Zn^{2+}_{(g)} + 2e^{-}$$

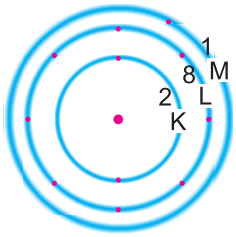
Trends of electropositivity

Electropositive character increases down the group because size of atoms increases. For example, lithium metal is less electropositive than sodium which is in turn less electropositive than potassium.

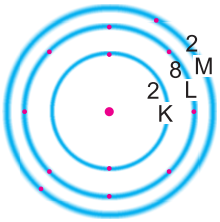
Electropositive character decreases across the period from left to right in the periodic table because atomic sizes decrease due to increase of nuclear charge. It means elements at the start of a period are more metallic. This character decreases as we move from left to right along the period.

Electropositivity and ionization energy

Electropositive character depends upon the ionization energy which in turn depends upon size and nuclear charge of the atom. Small sized atoms with high nuclear charge have high ionization energy value. In this way, atoms having high ionization energy are less electropositive or metallic. That is the reason alkali metals have the largest size and the lowest ionization energy in their respective periods. Therefore, they have the highest metallic character. For example, a comparison of sodium and magnesium metals is given below for understanding.



Sodium Atom
$3s^1$ electron configuration
having atomic size 186 pm,
and ionization energy 496 klmol^{-1}.



Magnesium Atom
$3s^2$ electron configuration
having atomic size 160pm,
and ionization energy 738 kJmo^{-1}.

The 1st ionization energy of magnesium is high but the 2nd ionization energy of magnesium is very high. It becomes very difficult to remove second electron from the Mg+ ion as nuclear charge attracts the remaining electrons strongly. As a result of this attraction size of the ion decreases.

Similarly, all the elements of alkaline earth metals have high ionization energies as compared to alkali metals as shown in table 8.1.

Table 8.1 Atomic Number, Electronic Configurations and Ionization Energies (kj/mol) of Alkali and Alkaline Earth Metals

Metal	Atomic Number	Electronic Configuration	IE	Metal	Atomic Number	Electronic Configuration	IE_1	IE_2
Li	3	[He] 2 s^1	520	Be	4	[He] 2 s^2	899	1787
Na	11	[Ne] 3 s^1	496	Mg	12	[Ne] 3 s^2	738	1450
K	19	[Ar] 4 s^1	419	Ca	20	[Ar] 4 s^2	590	1145
Rb	37	[Kr] 5 s^1	403	Sr	38	[Kr] 5 s^2	549	1064
Cs	55	[Xe] 6 s^1	377	Ba	56	[Xe] 6 s^2	503	965

Low ionization energies of alkali metals make them more reactive than alkaline earth metals.

Test yourself 8.1

i. What type of elements are metals?
ii. Name a metal which exists in liquid form?
iii. What is the nature of metal oxide?
iv. Which group of metals is highly reactive?
v. Why sodium metal is more reactive than magnesium metal?
vi. Name a metal which can be cut with knife?
vii. Name the best ductile and malleable metal?
viii. Name the metal which is the poorest conductor of heat?
ix. What do you mean by malleable and ductile?
x. Why alkali metals are more reactive than alkaline earth metals?
xi. What do you mean by metallic character?
xii. Why metallic character decreases along a period and increases in a group?

8.1.2 Comparison of Reactivities of Alkali and Alkaline Earth Metals

A comparison of physicals properties of alkali metals and alkaline earth metals is given table 8.2

Table 8.2 Comparison of Physical Properties of Alkali and Alkaline Earth Metals

Property	Sodium	Magnesium	Calcium
Appearance	Silvery white having a metallic luster, very soft and can be cut with knife	Silvery white and hard	Silvery grey and fairly harder
Atomic size, ionic size (pm)	186, 102	160, 72	197, 99
Relative density	0.98 g cm^{-3} Floats on water	1.74 g cm^{-3}	1.55 g cm^{-3}
Malleability	very malleable and ductile	Malleable and ductile	Malleable and ductile
Conductivity	Good conductor of heat and electricity	Good conductor of heat and electricity	Good conductor of heat and electricity
M.P	97 °C	650 °C	839 °C
B.P	883 °C	1090 °C	1484 °C
Ionization energy	496 kJ/mol	738, 1450 kJ/mol	590,1145 kJ/mol
Flame in air	Golden yellow	Brilliant white	Brick red

The elements in first two groups of the periodic table Group 1 and Group 2 are called '*Alkali*' and '*Alkaline earth*' metals, respectively. Alkali metals are extremely reactive elements because of their ns^1 valence shell electronic configuration. As there is only one electron in their valence shell, it can be easily given out. It is the reason that they are always found in nature as cations with +1 oxidation state. Therefore, they readily form salts with non-metals.

The alkaline earth metals atoms are smaller and have more nuclear charge. They have two electrons in their valence shells i.e. ns^2. They are also reactive but less than alkali metals.

A comparison of chemical properties and reactivities of alkali metals and alkaline earth metals is given in table 8.3

Table 8.3 Comparison of Chemical Properties and Reactivities

	Alkali Metals	Alkaline Earth Metals
1	**Occurrence**	
	They are very reactive and always occur in combined form.	They are fairly reactive and also occur in combined form
2	**Electropositivity**	
	These are highly electropositive. They have ionization energy values ranging from 520 $kJmol^{-1}$ for Li to 376 $kJmol^{-1}$ for Cs.	They are less electropositive. They have ionization energy values ranging from 1757 $kJmol^{-1}$ for Be to 965 $kJmol^{-1}$ for Ba.
3	**Reaction with water**	
	They react with water vigorously at room temperature to give strong alkaline solution and hydrogen gas. $2Na+2H_2O \longrightarrow 2Na\,OH+H_2$	They react with water less vigorously and on heating they produce weak bases. $Mg + H_2O \longrightarrow MgO + H_2$ $MgO + H_2O \longrightarrow Mg(OH)_2$
4	**Reaction with O_2**	
	They immediately tarnish in air giving their oxides which form strong alkalies in water $4Na+ O_2 \longrightarrow 2Na_2O$ $Na_2O+H_2O \longrightarrow 2Na\,OH$	They are less reactive towards oxygen and oxides are formed on heating $2Mg+O_2 \longrightarrow 2MgO$
5	**Reaction with Hydrogen**	
	They form ionic hydrides with H_2 at high temperature $2Na + H_2 \longrightarrow 2NaH$	They give hydrides under strong conditions of temperature and pressure $Ca+ H_2 \longrightarrow CaH_2$
6	**Reaction with Halogens**	
	They react violently with halogens at room temperature to give halides $2Na+Cl_2 \longrightarrow 2NaCl$	They react slowly with halogen to give their halides $Ca+Cl_2 \longrightarrow CaCl_2$
7	**Reaction with Nitrogen**	
	They do not form nitrides directly	They form stable nitrides when heated with nitrogen $3Mg+N_2 \longrightarrow Mg_3N_2$
8	**Reaction with Carbon**	
	They do not react with carbon directly	They give stable carbide on heating with carbon. $Ca+2C \longrightarrow CaC_2$

Uses of sodium

i. Sodium-potassium alloy is used as a coolant in nuclear reactors.

ii. It is used to produce yellow light in sodium vapour lamps.

iii. It is used as a reducing agent in the extraction of metals like Ti.

Uses of magnesium

i. Magnesium is used in flash light bulbs and in fireworks.

ii. It is used in the manufacture of light alloys.

iii. Magnesium ribbon is used in Thermite process to ignite aluminium powder

iv. Magnesium is used as anode for prevention of corrosion.

Uses of calcium

i. It is used to remove sulphur from petroleum products.

ii. It is used as reducing agent to produce Cr, U and Zr.

Inertness of Noble Metals

The elements in which *d*-orbital are in the process of filling, constitute a group of metals called transition metals or *d*-group elements. They exhibit a variety of oxidation states. Figure 8.2 shows 'transition metals' of 4th, 5th and the 6th period of the periodic table. There are three series of transition elements; each series consisting of ten elements.

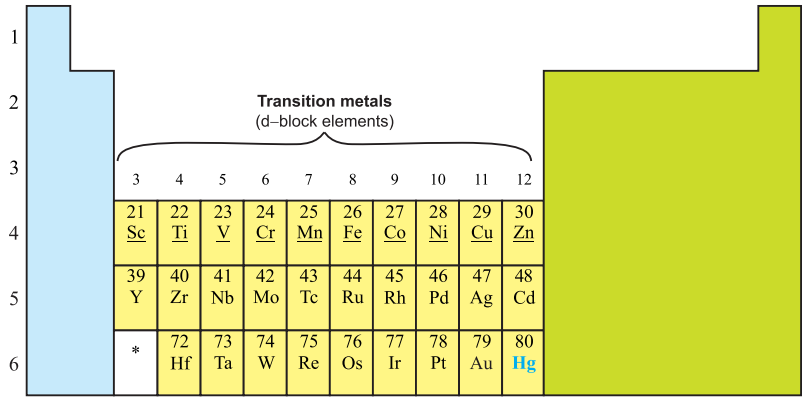


Fig. 8.2 The Transition Elements in the Periodic Table.

Chemical behaviour of the first transition series is similar to active metals except copper. Three transition metals belonging to group 11 are copper, silver and gold. Out of them gold and silver are relatively inactive metals because they do not lose electrons easily.

Silver is white lustrous metal. It is an excellent conductor of heat and electricity. It is also highly ductile and malleable metal. Its polished surfaces are good reflectors of light. Formation of thin layer of oxide or sulphide on its surface makes it relatively unreactive. Under normal conditions of atmosphere, air does not affect

silver. It tarnishes in presence of sulphur containing compounds like H_2S.

Being very soft metal, it is rarely used as such. Alloys of silver with copper are widely used in making coins, silver-ware and ornaments. Compounds of silver are widely used in photographic films and dental preparations. Silver also has important applications in mirror industry.

Gold is a yellow soft metal. It is most malleable and ductile of all the metals. One gram of gold can be drawn into a wire of one and a half kilometre long. Gold is very non-reactive or inert metal. It is not affected by atmosphere. It is not even affected by any single mineral acid or base.

Because of its inertness in atmosphere, it is an ornamental metal as well as used in making coins. Gold is too soft to be used as such. It is always alloyed with copper, silver or some other metal.

Do you know?

Purity of gold is shown by carats that indicates the number of parts by weight of gold that is present in 24 parts of alloy. Twenty four carat gold is pure. 22 carats gold means that 22 parts pure gold is alloyed with 2 parts of either silver or copper for making ornaments and jewelry. White gold is its alloy with palladium, nickel or zinc.

Platinum is used to make jewelry items because of its unique characteristics like colour, beauty, strength, flexibility and resistance to tarnish. It provides a secure setting for diamonds and other gemstones, enhancing their brilliance.

An alloy of platinum, palladium and rhodium is used as catalyst in automobiles as catalytic converter. It converts most of the toxic gases (CO, NO_2) being emitted by vehicles into less harmful carbon dioxide, nitrogen and water vapour.

Platinum is used in the production of hard disk drive coatings and fibre optic cables. Platinum is used in the manufacturing of fibre glass reinforced plastic and glass for liquid crystal displays (LCD).

Test yourself 8.2

i. Give the applications of silver?
ii. Why is silver not used in pure form?
iii. What do you mean by 24 carat gold?
iv. Why is gold used to make jewelry?
v. Why is platinum used for making jewelry?
vi. What is difference between steel and stainless steel?
vii. How is platinum used as a catalyst in automobiles and what are advantages of this use?

8.2 NON-METALS

Non-metals *form negative ions (anions) by gaining electrons.* In this way, non-metals are electronegative in nature and form acidic oxides. The valency of some non-metals depend upon the number of electrons accepted by them. For example, valency of chlorine atom is 1, as it accepts only 1 electron in its outermost shell.

$$Cl + 1e^- \longrightarrow Cl^-$$

Similarly, oxygen atom can accept 2 electrons, therefore, its valency is 2.

$$O + 2e^- \longrightarrow O^{-2}$$

The non-metallic character depends upon the electron affinity and electronegativity of the atom. Small sized elements having high nuclear charge are electronegative in nature. They have high electron affinity. Therefore, they possess non-metallic character. Hence, non-metallic character decreases in a group downward and increases in a period from left to right up to halogens. Fluorine is the most non-metallic element.

The non-metals are, therefore, elements in Group-14(Carbon), Group-15 (nitrogen and phosphorus), Group-16 (oxygen, sulphur and selenium) and in Group-17 halogens (fluorine, chorine, bromine and iodine) of the periodic table. Figure 8.3 shows position of non-metals in the periodic table.

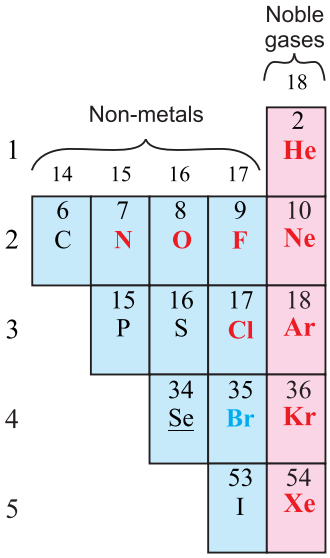


Fig. 8.3 The Non-Metals in Period Table

Important physical properties of non-metals are as follows:

Physical properties of non-metals change gradually but uniquely in a group of non-metals. Non-metals usually exist in all three physical states of matter. The non-metals at the top of the group are usually gases while others are either liquids or solids.

i. Solids non-metals are brittle (break easily).

ii. Non-metals are bad conductors of heat and electricity (except graphite).

iii. They are not shiny, they are dull except iodine (it is lustrous like metals).

iv. They are generally soft (except diamond).

v. They have low melting and boiling points (except silicon, graphite and diamond).

vi. They have low densities.

Important chemical properties of non-metals are as follows:

i. Their valence shells are deficient of electrons, therefore, they readily accept electrons to complete their valence shells and become stable.

ii. They form ionic compounds with metals and covalent compounds by reacting with other non-metals e.g. CO_2, NO_2, etc.

iii. Non-metals usually do not react with water.

iv. They do not react with dilute acids because non-metals are itself electron acceptors.

Electonegativity of first member of group 14, 15, 16 and 17 are higher than that of other members of the group decreasing trend of electronegativity is shown below

F > O > Cl > N > Br > S > C > I > P

8.2.1 Comparison of Reactivity of the Halogens

Elements of Group-17 of the periodic table consist of fluorine, chlorine, bromine, iodine and astatine. They are collectively called **halogens**. Fluorine and chlorine exist as diatomic gases at room temperature. Interestingly, the intermolecular forces of attraction increase downward in the group due to the increase in the size of atom. Due to this reason bromine exists as a liquid and iodine as solid. Some physical properties of halogens are shown in Table 8.4

Table 8.4 Some Physical Characteristics of Halogens

Element	Atomic No.	Electronic Configuration	Colour	Melting Point (K)	Boiling Point (K)	Electro negativities
F	9	$[He]2s^2\ 2p^5$	Pale Yellow	53	85	4.0
Cl	17	$[Ne]3s^2\ 3p^5$	Greenish yellow	172	238	3.2
Br	35	$[Ar]4s^2\ 4p^5$	Redish Brown	266	332	3.0
I	53	$[Kr]5s^25p^5$	Purple Black	387	457	2.7

In general, their valence shell electronic configuration is $ns^2\ np^5$. Since halogens have only one electron deficit in their valence shell; either they can readily accept an electron from a metal or they can share an electron with other non-metals. Thus halogens form ionic bonds with metals and covalent bond with non-metals.

8.2.2 Important Reactions of Halogens

1) Oxidizing properties

All halogens are oxidizing agents. Fluorine is the strongest oxidizing element while iodine is the least i.e is mild oxidizing agent. Fluorine will oxidize any of halide ion (X^-) in solution and changes itself to F^- ion. Similarly, chlorine will displace Br^- and I^- ion s from their salt solutions and oxidize them to bromine and iodine.

$$F_2 + 2KCl \longrightarrow 2KF + Cl_2$$

$$F_2 + 2Cl^- \longrightarrow 2F^- + Cl_2$$

$$Cl_2 + 2KBr \longrightarrow 2KCl + Br_2$$

Solution turns from colourless to reddish brown.

Similarly, $Br_2 + 2KI \longrightarrow 2KBr + I_2$

2) Reaction with hydrogen

All halogens (X_2) combine with hydrogen to give hydrogen halides (HX). However the chemical affinity for H_2 decreases down the group from F_2 to I_2. Fluorine combines with hydrogen even in the dark and cold state. Chlorine reacts with hydrogen only in the presence of sunlight. Bromine and iodine react with hydrogen only on heating.

$$H_2 + F_2 \xrightarrow[state]{dark\ and\ cold} 2HF$$

$$H_2 + Cl_2 \xrightarrow{sunlight} 2HCl$$

$$H_2 + Br_2 \xrightarrow{only\ on\ heating} 2HBr$$

$$H_2 + I_2 \xrightarrow[and\ catalyst]{heating} 2HI$$

3) Reaction with water

Fluorine (F_2) decomposes water in cold state and in dark. Chlorine decomposes water in presence of sunlight. Bromine only react with water under special conditions. Iodine does not give this reaction.

$$2F_2 + 2H_2O \xrightarrow[cold\ state]{dark\ and} 4HF + O_2$$

$$Cl_2 + H_2O \xrightarrow{sunlight} HCl + HOCl$$

$$Br_2 + H_2O \xrightarrow{heat} HBr + HOBr$$

$$I_2 + H_2O \longrightarrow \text{No reaction}$$

4) Reaction with methane

Fluorine (F_2) reacts violently with methane (CH_4) in dark, while chlorine (CI_2) does not react with methane in dark. However, the presence of bright sunlight the reaction is violent.

$$CH_4 + 2Cl_2 \longrightarrow C + 4HCl$$

In presence of diffused sunlight the reaction of chlorine with methane is slow and gives series of compounds i.e CH_3C_1, CH_2CI_2, $CHCI_3$ and CCI_4.

5) Reaction with Sodium hydroxide

Chlorine reacts with cold ditute NaOH to give sodium hypochlorite and sodium chloride

$$2NaOH + Cl_2 \longrightarrow NaCl + NaOCl + H_2O$$

Cl_2 reacts with hot cone NaOH to give sodium chloride and sodium chlorate

$$6NaOH + 3Cl_2 \longrightarrow 5NaCl + NaClO_3 + 3H_2O$$

8.2.3 Significance of Non-metals

Although non-metals are fewer than metals, yet they are highly significant. They are equally important for human beings, animals and plants. In fact, life would not have been possible without the presence of non-metals on earth.

i. Major components of earth's crust, oceans and atmosphere (as shown in table 1.1) are non-metals: oxygen has the highest percentage in earth's crust (47%) and oceans (86%) and it is second (21%) to nitrogen in atmosphere. It indicates the importance of oxygen in nature. To maintain the balance for the amount of non-metals in nature, different cycles like water cycle, nitrogen cycle, etc have been established naturally.

ii. Non-metals are essential part of the body structure of all living things. Human body is made up of about 28 elements. But about 96% of the mass of the human body is made up of just 4 elements i.e. oxygen 65%, carbon 18%, hydrogen 10% and nitrogen 3%. Similarly, plant bodies are made up of cellulose, which is composed of carbon, hydrogen and oxygen.

iii. Life owes to non-metals as without O_2 and CO_2 (essential gases for respiration of animals and plants, respectively), life would not have been possible. In fact, these gases are essential for the **existence of life**.

iv. All eatables like carbohydrates, proteins, fats, vitamins, water, milk etc which are necessary for the growth and development of body that are made up of non-metals; carbon, hydrogen and oxygen. Its shows non- metals play a vital role for the **maintenance of life**.

v. The essential compound for the **survival of life** of both animals and plants is water, which is made up of non-metals. Water is not only the major part by mass of animals and plants bodies, but it is also essential to maintain the life. We can survive without water for days but not for a long period; its shortage may cause death.

vi. Another important non-metal is nitrogen, which is 78% in atmosphere, is necessary for the **safety of life** on earth. It controls the fire and combustion processes, otherwise all the things around us could burn with a single flame.

vii. Non-metals are playing essential role for the **communication in life**. All fossil fuels which are major source of energy; coal, petroleum and gas are made up of carbon and hydrogen. Even the essential component of combustion of fossil fuels, oxygen is also a non-metal.

viii. Non-metals protect us in a way, the clothes we wear are made of cellulose (natural fibre) or polymer (synthetic fibre).

ix. In addition to all of these, other items used in daily life such as wooden or plastic furniture, plastic sheets and bags, plastic pipes and utensils are made of non-metallic elements. Even all the pesticides, insecticides, fungicides and germicides consist of non-metals as major constituents.

Test yourself 8.3

i. Why valency of chlorine is I?
ii. Which factor controls the non-metallic character of the elements?
iii. Why fluorine is more non-metallic than chlorine?
iv. Iodine exists in solid state, can it be beaten with hammer to form sheets?
v. Can liquids and gases be brittle?
vi. Why the oxygen is called non-metal?
vii. Name two non-metals which are both brittle and non-ductile
viii. Name the most abundant non-metal in the earth's crust
ix. Give the non-metallic trend in halogens
x. Why do the non-metals accept electrons readily?
xi. Why non-metals do not react with dilute acids while metals do react?
xii. How can we distinguish a metal from a non-metal by simple physical methods?
xiii. How we can distinguish a substance is metal or non-metal with the help of an acid?
xiv. Why is HF a weak acid?

Key Points

- Formation of cations of alkali and alkaline earth metals is due to their electropositive behavior.
- The chemical reactivity of alkali and alkaline earth metals, is quite different.
- Calcium and magnesium are less reactive than sodium.
- Halogens form very stable compounds with alkali metals.
- Mercury and gold exist in free elemental form in nature.

EXERCISE

Multiple Choice Questions

Put a (✓) on the correct answer

1. Metals can form ions carrying charges:
(a) Uni-positive (b) Di-positive (c) Tri-positive (d) All of them

2. Which one of the following metal burns with a brick red flame?
(a) Sodium (b) Magnesium (c) Iron (d) Calcium

3. Sodium is extremely reactive metal, but it does not react with:
(a) Hydrogen (b) Nitrogen (c) Sulphur (d) Phosphorus

4. Which one of the following is the lightest metal?
(a) Calcium (b) Magnesium (c) Lithium (d) Sodium

5. Pure alkali metals can be cut simply by knife but iron cannot because of alkali metals have:
(a) Strong metallic bonding (b) Weak metallic bonding
(c) Non-metallic bonding (d) Moderate metallic bonding

6. Which of the following is less malleable?
(a) Sodium (b) Iron (c) Gold (d) Silver

7. Metals lose their electrons easily because:
(a) They are electronegative (b) They have electron affinity
(c) They are electropositive (d) Good conductors of heat

8. **Which one of the following is brittle?**
   (a) Sodium (b) Aluminium (c) Selenium (d) Magnesium
9. **Which one of the following non-metal is lustrous?**
   (a) Sulphur (b) Phosphorus (c) Iodine (d) Carbon
10. **Non-metals are generally soft, but which one of the following is extremely hard?**
   (a) Graphite (b) Phosphorus (c) Iodine (d) Diamond
11. **Which one of the following will not react with dilute HC1?**
   (a) Sodium (b) Potassium (c) Calcium (d) Carbon

Short answer questions.

1. Why reactivity of metals increases down the group?
2. State the physical properties of metals.
3. Why nitrogen forms compounds with alkaline earth metals directly?
4. Why the second ionization energy of magnesium is higher than the first one?
5. How oxygen reacts with group II A metals?
6. What is relationship between electropositivity and ionization energy?
7. Why electropositivity decreases from left to right in a period?
8. How electropositivity depends upon size and nuclear charge of an atom?
9. Why ionization energies of alkaline earth metals are higher than alkali metals?
10. Why silver and gold are least reactive?
11. Can pure gold be used for making ornaments? If not why?
12. Why copper is used for making electrical wires?
13. What is the trend of variation in densities of alkali metals?
14. Which metal is used for metal work?
15. Why magnesium is harder than sodium?
16. Why calcium is more electropositive than magnesium?
17. Why ionization energy of Na is less than Mg?
18. Why the ionization energy of Na is more than K?

Long Answer Questions

1. Compare and contrast the properties of alkali and alkaline earth metals.
2. Discuss the inert character of silver and gold.
3. Why cations are smaller and anions are bigger in size than their respective neutral atoms.
4. Discuss why hardness and softness of a metal depends upon its metallic bonding.
5. Give the reaction of sodium with: H_2O, O_2, CI_2 and H_2.
6. What are physical properties of calcium metal? Give its uses.
7. Write down the chemical properties of the non-metals?
8. Compare the physical properties of metals and non-metals.
9. How you can compare the softness and hardness of metals?
10. Give the chemical properties of magnesium and its uses.
11. Write a comprehensive note on the electropositive character of metals?
12. Compare the ionization energies of alkali and alkaline earth metals.