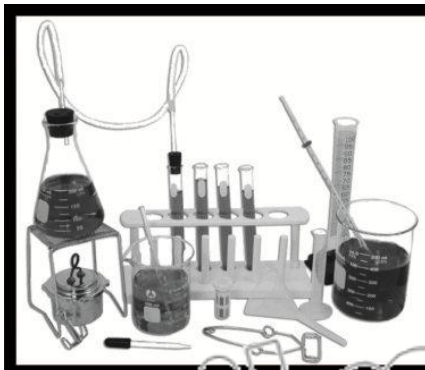

CHAPTER 8

CHEMICAL REACTIVITY

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INTRODUCTION

Q.1 What do you know about non-metals and their position in periodic table? *(K.B)*

Ans: **NON-METALS AND THEIR POSITION**

Definition:

*"The elements which are **electronegative** and form **anions** by **gaining electrons** are called non-metals"*

Examples:

Carbon, nitrogen, phosphorous, oxygen, sulphur, most of the **halogens** are non-metals.

Physical states:

The non-metals exist as **gases**, **liquid** and **soft** or **hard solids**.

Position in Periodic table:

They occupy **upper right position** in the periodic table.

Nature of Bonding:

They show a variety of chemical reactivities. They form different **ionic** and **covalent** compounds many of which are solid or gases.

INTRODUCTION

MULTIPLE CHOICE QUESTIONS

1. Which one of the following is non-metal? *(K.B)*

(A) Carbon (B) Oxygen (C) Sulphur (D) All of these

2. Non-metals occupy the position in periodic table: *(K.B)*

(A) Upper left (B) Lower left (C) Upper right (D) Lower right

8.1 METALS

Q.1 (A) What are metals? How are they categorized? *(U.B+K.B)*

(B) Write down physical and chemical properties of metals.

(SWL 2016, MTN 2016, BWP 2016, 17)*(K.B)*

Ans: (A) **METALS**

Definition:

*"The elements which are **electropositive** and form **cations** by **losing electrons** are called metals".*

Examples:

Iron, gold, silver, copper etc.

Importance of Metals:

Things like aeroplanes, trains, building frames, automobiles or even different machines and tools are due to different properties of various metals.

Position of Metals in Periodic Table:

They are present on the **lower** and **left side** of the periodic table.

CATEGORIES OF METALS

Metals can be categorized as:

Very Reactive:

Potassium (K), sodium (Na), calcium (Ca), magnesium (Mg) and aluminium (Al).

Moderately Reactive:

Zinc (Zn), iron (Fe), tin (Sn) and lead (Pb).

Least Reactive or Noble:

Copper (Cu), mercury (Hg), silver (Ag) and gold (Au).

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(B) **PROPERTIES OF METALS** **(FSD 2017 G-II)**

Physical Properties of Metals:

The physical properties of metals are as follows:

(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).

(v) They **give off tone** when hit.

(vi) They are **good conductor** of heat and electricity.

(vii) They have **high densities**.

(viii) They are **hard (except sodium and potassium)**.

(C) Chemical Properties of Metals: **(FSD 2016, SGD 2016,17, RWP 2017)**

Chemical properties of metals are as follows:

(i) They easily **lose electrons** and form **positive ions**.

(ii) They readily **react with oxygen** to form **basic oxide**.

$$2Mg + O_2 \longrightarrow 2MgO$$

Basic oxide

(iii) They usually form **ionic compounds** with **non-metals**.

$$2Na + Cl_2 \longrightarrow 2NaCl$$

Metal + Non-metal → Ionic compound

(iv) They have **metallic bonding**.

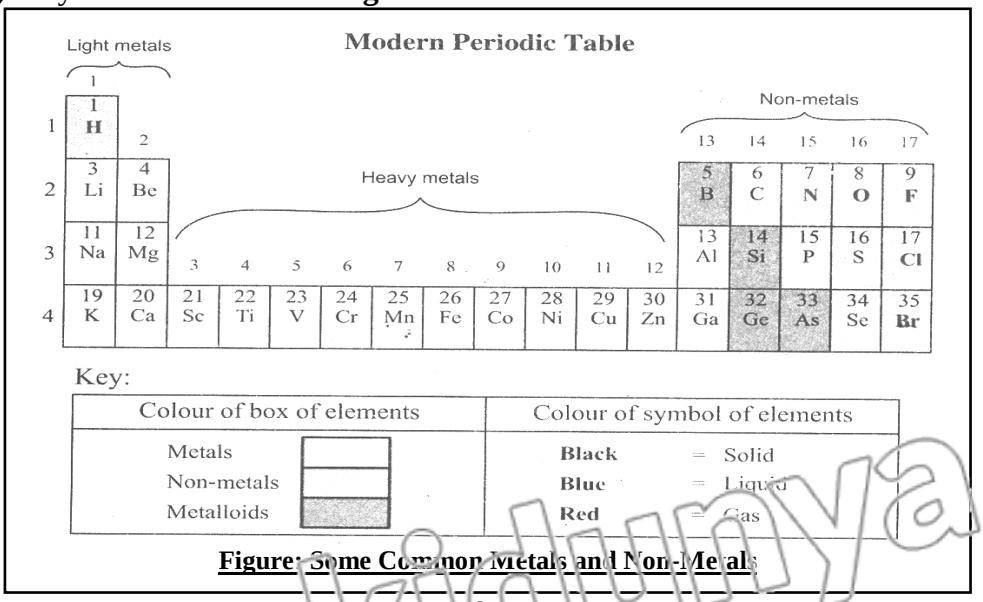

Figure: Some Common Metals and Non-Metals

Q.2 **Describe most important properties of metals with respect one another.**

(Do you know Pg. # 140) ***(K.B)***

Ans: **MOST IMPORTANT PROPERTIES**

- 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 ($d = 0.53\ g\ cm^{-3}$)**.

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- 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 METALS

SHORT QUESTIONS

Q.1 What are metals? **(RWP 2017, BWP 2016)*(K.B)***

Ans: *Answer given on pg # 277*

Q.2 Write importance of metals. ***(K.B)***

Ans:

IMPORTANCE OF METALS

Things like aeroplanes, trains, building frames, automobiles or even different machines and tools are due to different properties of various metals.

Q.3 How are metals categorized? ***(K.B)***

Ans:

CATEGORIZATION OF METAL

Metal are categorized into two types:

- Light metal
- Heavy metal

Q.4 Which one is the most abundant metal? **(Do you know Pg. # 140)*(K.B)***

Ans:

MOST ABUNDANT METAL

The most abundant metal is **aluminium**.

Q.5 Write four very reactive metals. **(GRW 2017 G-II)*(K.B)***

Ans:

VERY REACTIVE METALS

Potassium (K), sodium (Na), calcium (Ca), magnesium (Mg)

8.1 METALS

MULTIPLE CHOICE QUESTIONS

1. The most precious metal is: **(Do you know Pg. # 146)*(K.B)***

(A) Platinum (B) Iron (C) Cesium (D) Uranium

2. The most valuable metal is: **(Do you know Pg. # 146)*(K.B)***

(A) Sodium (B) Magnesium (C) Iron (D) Uranium

3. The most _____ metal is cesium. **(Do you know Pg. # 146)*(K.B)***

(A) Reactive (B) Non-reactive (C) Precious (D) Valuable

4. The lightest metal is: **(Do you know Pg. # 146)*(K.B)***

(A) Li (B) Na (C) Ca (D) Mg

5. The _____ metal is osmium. **(Do you know Pg. # 146)*(K.B)***

(A) Heaviest (B) Soft (C) Hard (D) Reactive

6. The least conductor of heat is: **(Do you know Pg. # 146)*(K.B)***

(A) Lead (B) Iron (C) Silver (D) Calcium

7. The best conductor metals are silver and: **(Do you know Pg. # 146)*(K.B)***

(A) Gold (B) Platinum (C) Iron (D) Lead

8. Gold and silver metals are the most ductile and: **(Do you know Pg. # 146)*(K.B)***

(A) Malleable (B) Precious (C) Soft (D) Reactive

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9. Density of osmium is: **(Do you know Pg. # 146)*(K.B)***
(A) $0.53gcm^{-3}$ (B) $22.5gcm^{-3}$ (C) $5.3gcm^{-3}$ (D) $2.25gcm^{-3}$

10. Density of lithium is: **(Do you know Pg # 146)*(K.B)***
(A) $22.5gcm^{-3}$ (B) $0.53gcm^{-3}$ (C) $4.2gcm^{-3}$ (D) $7.3gcm^{-3}$

11. Which one of the following is less malleable? **(LHR 2014)*(K.B)***
(A) Sodium (B) Iron (C) Gold (D) Silver

12. The most useable metal is **(Do you know Pg. # 146)*(K.B)***
(A) Uranium (B) Gold (C) Iron (D) Calcium

13. The most reactive metal is: ***(K.B)***
(A) Sodium (B) Zinc (C) Copper (D) Gold

8.1.1 ELECTROPOSITIVE CHARACTER

Q.1 Write a comprehensive note on the electropositive character of metals.
(Ex-Q.11)(FSD 2016)*(U.B)*

Ans: **ELECTROPOSITIVE CHARACTER / METALLIC CHARACTER**

Definition:

*"Metals have the tendency to **lose** their **valance electrons**. This property of a metal is termed as **electropositivity** or **metallic character** or **electropositive character**".*

The **more easily** a metal **loses its electrons** the **more electropositive** it is.

Valency of Metals:

Definition:

*"The **number of electrons lost** by an atom of a metal is called its valency."*

Examples:

(i) Sodium (Na) atom can lose **1 electron** to form a positive ion

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

So the **valency** of sodium metal is**1**.

(ii) Zinc (Zn) metal can **lose 2 electrons** from its valence shell. Therefore, its **valency** is **2**.

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

Trends of Electropositivity:

(i) Trends in Groups:

Electropositive character **increases** down the group because size of atoms increases.

Example:

Lithium metal is **less electropositive than sodium** which is in turn **less electropositive than potassium**.

(ii) Trends in Periods:

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.

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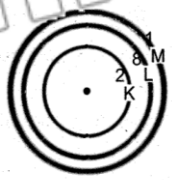
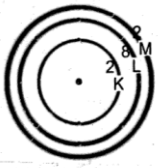
$$\text{Electropositivity} \propto \frac{\text{I}}{\text{Ionization energy}}$$

Comparison of 2nd I.E. and 1st I.E. of Alkaline Earth Metals:

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.



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



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

Q.2 Compare the ionization energies of alkali and alkaline earth metals. **(Ex-Q.12)*(U.B)***

Ans:

COMPARISON OF IONIZATION ENERGY

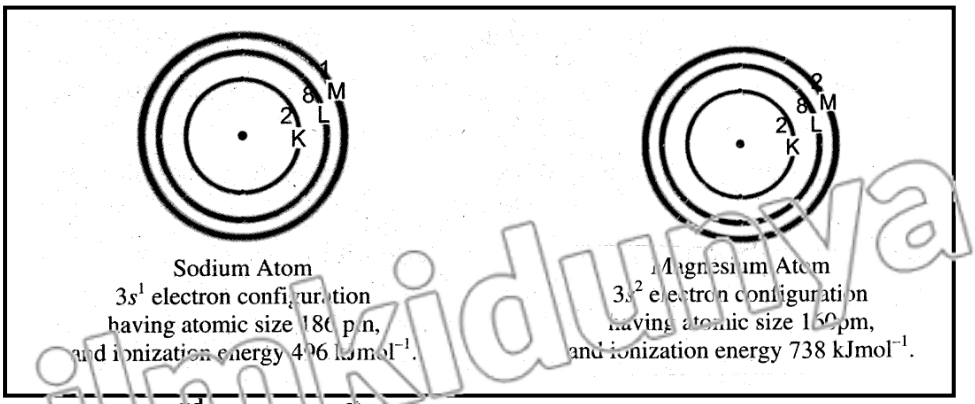
The **ionization energy of alkali metals are lower than alkaline earth metals** because ionization energy depend upon the size and nuclear charge of atom.

Example:

Sodium atom has **$3s^1$** valence shell electronic configuration having **atomic size 186 pm**. **Magnesium** atom has **$3s^2$** valence shell electronic configuration having **atomic size 160pm** that is the reason **ionization energy of sodium is 496 $kJmol^{-1}$** and **ionization energy of magnesium is 1450 $kJmol^{-1}$**.

Effect of I.E. on Reactivity:

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



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

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

Comparison of 2nd I.E. and 1st I.E. of Alkaline Earth Metals:

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.

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Table: Atomic Number, Electronic Configuration and Ionization Energies

Metal	Atomic Number	Electronic Configuration	IE	Metal	Atomic Number	Electronic Configuration	IE1	IE2
Li	3	[He] $2s^1$	520	Be	4	[He] $2s^2$	899	1787
Na	11	[Ne] $3s^1$	496	Mg	12	[Ne] $3s^2$	738	1450
K	19	[Ar] $4s^1$	419	Ca	20	[Ar] $4s^2$	590	1145
Rb	37	[Kr] $5s^1$	403	Sr	38	[Kr] $5s^2$	549	1064
Cs	55	[Xe] $6s^1$	376	Ba	56	[Xe] $6s^2$	503	965

8.1.1 ELECTROPOSITIVE CHARACTER

SHORT QUESTIONS

Q.1 What is a relationship between electropositivity and ionization energy? ***(U.B)***

Ans:

ELECTROPOSITIVITY AND IONIZATION ENERGY

Electropositivity 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. Atoms having high ionization energy are less electropositive or metallic.

$$\text{Electropositivity} \propto \frac{\text{I}}{\text{Ionization energy}}$$

Q.2 What is the atomic size and ionization energy of sodium? ***(K.B)***

Ans:

ATOMIC SIZE AND IONIZATON ENERGY

Atomic size of sodium is 186pm and ionization energy of sodium is $496 kJmol^{-1}$.

Q.3 What is second ionization energy of magnesium? ***(K.B)***

Ans:

IONIZATION ENERGY OF MAGNESIUM

Second ionization energy of magnesium is $1450 kJmol^{-1}$

Q.4 What is the trend of electropositivity in groups? **(MTN 2017)** ***(U.B)***

Ans: *Answer given on pg # 280*

Q.5 What is the trend of electropositivity in periods? **(DGK 2017)** ***(U.B)***

Ans: *Answer given on pg # 280*

8.1.1 ELECTROPOSITIVE CHARACTER

MULTIPLE CHOICE QUESTIONS

1. Atomic number of Cs is: ***(K.B)***

(A) 55 (B) 35 (C) 25 (D) 503

2. Metals lose their electron easily because: **(Ex-7)** ***(U.B)***

(A) They are electronegative (B) They have electron affinity

(C) They are electropositive (D) Good conductor of heat

3. Metals have generally: **(LHR 2015)** ***(U.B)***

(A) High ionization energy values (B) Low ionization energy values

(C) High electron affinity values (D) High electronegativity values

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4. Metals can form ions carrying charges: **(GRW 2016)** ***(U.B)***

(A) Uni-positive (B) Dipositive (C) Tri-positive (D) All of these

5. Ionization energy of sodium is less than: ***(U.B)***

(A) Al (B) Mg (C) Cu (D) All of these

6. Electropositivity is also known as: ***(K.B)***

(A) Metalloid character (B) Metallic character

(C) Non-metallic character (D) Both B and C

7. The more easily a metal _____ its electrons the more electropositive it is. ***(U.B)***

(A) Loses (B) Gains (C) Shares (D) Transfers

8. Electropositive character _____ across period due to _____ of nuclear charge. ***(U.B)***

(A) Increases, decrease (B) Increases, increase

(C) Decreases, increase (D) Decreases, decrease

9. Electropositive character increases down the group because size of atoms: ***(U.B)***

(A) Increases (B) Decreases (C) Remains constant (D) Both A and B

8.1 TEST YOURSELF

i. What type of elements are metals? **(FSD 2017)** ***(K.B)***

Ans:

METAL ELEMENTS

Definition:

*"The elements which are **electropositive** and form **cations** by losing electrons are metals".* They **form basic oxides** with oxygen, are good conductor of heat and electricity and are usually hard.

Examples:

(i) Sodium
(ii) Potassium
(iii) Calcium
(iv) Magnesium
(v) Aluminum

ii. Name a metal which exists in liquid form? ***(K.B)***

Ans:

METAL IN LIQUID FORM

The only metal which exist in liquid form at room temperature is **mercury (Hg)**.

iii. What is the nature of a metal oxide? ***(U.B+K.B)***

Ans:

NATURE OF METAL OXIDE

Metal oxides are basic in nature because they change red litmus paper to blue.

Examples:

Na_2O, CaO, K_2O, MgO

iv. Which group of metal is highly reactive? ***(K.B)***

Ans:

HIGHLY REACTIVE METAL

Alkali metals of group I **(Li, Na, K, Rb, Cs, Fr)** of the periodic table are **highly reactive** because they are **highly electropositive** in nature.

v. Why Sodium metal is more reactive than magnesium metal? ***(U.B)***

Ans:

REACTIVITY OF SODIUM AND MAGNESIUM

Sodium metal is more reactive than magnesium metal because **sodium has larger size,** low ionization energy than magnesium and thus can **lose electrons more easily** than magnesium.

vi. Name a metal which can be cut with knife? ***(K.B)***

Ans:

METAL CAN CUT WITH KNIFE

Sodium metal can be cut with knife, because it is soft due to **weak metallic bonding**.

vii. Name the best ductile and malleable metal? **(RWP 2017)*(K.B)***

Ans: **DUCTILE AND MALLEABLE METAL**

The best ductile and malleable metal is **gold**.

viii. Name the metal which is the poorest conductor of heat? ***(K.B)***

Ans: **POOREST CONDUCTOR METAL**

The poorest conductor of heat is lead **(Pb)**.

ix. What do you mean by malleable and ductile? ***(K.B)***

Ans: **MALLEABLE AND DUCTILE**

Malleable:

*"Malleability is the property of metals due to which they can be **beaten/hammered into sheets**".*

Ductile:

*"Ductility is the property of the metals due to which they can be **drawn into wires**".*

x. Why alkali metals are more reactive than alkaline earth metals? ***(U.B)***

Ans: **REACTIVITY OF ALKALI AND ALKALINE EARTH METALS**

Alkali metals are more reactive than alkaline earth metals because **alkali metals have the largest size** and the lowest ionization energy in their respective periods therefore alkali metals have highest metallic character, so these are more reactive than alkaline earth metals.

xi. What do you mean by metallic character? **(SGD 2017)*(U.B+K.B)***

OR

Define electropositivity. **(SWL 2016, BWP 2016)*(U.B+K.B)***

Ans: **ELECTROPOSITIVE CHARACTER / METALLIC CHARACTER**

*"Metals have the tendency to **lose** their **valance electrons**. This property of a metal is termed as **electropositivity** or **metallic character***

xii. Why metallic character decreases along a period and increases in a group? ***(U.B)***

Ans: **METALLIC CHARACTER**

Metallic character in a period because size of atom decreases and increases in a group because size of atom increases.

8.1.2 COMPARISON OF REACTIVITIES OF ALKALI AND ALKALINE EARTH METALS

Q.1 Compare and contrast the properties of alkali and alkaline earth metals. **(Ex-Q.1)*(U.B+K.B)***

Ans: **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

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• **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

Q.2 Describe reactivates of alkali and alkaline earth metals, ***(U.B+K.B)***

OR

Compare chemical properties and reactivates of alkali and alkaline earth metals? ***(U.B)***

Ans:

ALKALI METALS

Definition:

"The elements in ***Group 1 (Li, Na, K, Rb, Cs, Fr)*** *of the periodic table are called 'Alkali' metals".*

General Features:

The properties of alkali metals are as follows:

(i) Alkali metals are **extremely reactive** elements because of their **ns^1 valence shell electronic configuration**.

(ii) There is only **one valence electron**, it can be easily given out.

(iii) They are always found in nature as **cations** with **+1 oxidation state**. They readily **form salts** with **non-metals**.

ALKALINE EARTH METALS

Definition:

"*The elements in* ***group 2 (Be, Mg, Ca, Sr, Ba, Ra)*** *are called alkaline earth metals."*

General Features:

(i) The alkaline earth metal atoms are **smaller** and have **more nuclear charge**.

(ii) They have **two valence electrons**.

(iii) They are also reactive elements because of **ns^2 valence shell electronic configuration** but **less reactive than alkali metals** because of small size and **more nuclear charge**.

COMPARISON OF CHEMICAL PROPERTIES AND REACTIVITES

Comparison of chemical properties and reactivities are as follows:

Alkali Metals	Alkaline Earth Metals
Occurrence	
• They are **very reactive** and always occur in combined form.	• They are **fairly reactive** and also occur in combined form.
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**.
Reaction with Water	
They react with water **vigorously at room temperature** to give **strong alkaline solution** and **hydrogen gas**. $2Na+2H_2O \longrightarrow 2NaOH+H_2$	• They react with water **less vigorously** and **on heating** they produce **weak bases**. $Mg + H_2O \longrightarrow MgO + H_2$ $MgO + H_2O \longrightarrow Mg(OH)_2$

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Reaction with Oxygen	
• They **immediately tarnish in air** giving their oxides which form strong alkalies in water. $4Na + O_2 \longrightarrow 2Na_2O$ $Na_2O+H_2O \longrightarrow 2NaOH$	• They are **less reactive towards oxygen** and oxides are formed on heating. $2Mg+O_2 \longrightarrow 2MgO$
Reaction with Hydrogen	
• They form **ionic hydrides with H_2 at high temperature**. $2M+H_2 \longrightarrow 2MH$	• They give **hydrides under strong conditions** of temperature and pressure. $Ca + H_2 \longrightarrow CaH_2$
Reaction with Halogens	
• They react **violently with halogens at room temperature** to give halides. $2Na+Cl_2 \longrightarrow 2NaCI$	• They react **slowly with halogens** to give their halides. $Ca + Cl_2 \longrightarrow CaCl_2$
Reaction with Nitrogen	
• They **do not form nitrides directly**.	• They **form stable nitrides** with nitrogen. $3Mg+N_2 \longrightarrow Mg_3N_2$
Reaction with Carbon	
• They **do not react with carbon directly**.	• They **give stable carbides** on heating with carbon. $Ca+2C \longrightarrow CaC_2$

Q.2 Write down the uses of sodium, magnesium and calcium. ***(K.B)***
(GRW 2016 G-II, 2017 G-II, LHR 2016 G-II, FSD 2016, 2017, SGD 2016, 2017, SWL 2016, 2017, RWP 2016 G-I,2017, MTN 2016, DGK 2016, FSD 2016, RWP 2017)

Ans:

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 metal like Ti**.

USES OF MAGNESIUM

(i) Magnesium is used in **flash lights** 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 **Zn**.

Q.3 Explain transition metals and inertness of noble metals. ***(U.B+K.B)***

Ans:

TRANSITIONS METALS

Definition:

"*The elements in which **d-orbital are in the process of filling**, constitute a group of metals called transition metals".*

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Inertness of Nobel Metals:

Chemical behavior of the first transition series is **similar to active metals except copper**. Three transition metals belonging to **group 11** are **copper**, **silver** and **gold**.

Gold and **silver** are **relatively inactive** metals because **they do not lose electrons easily** and are called **noble metals**.

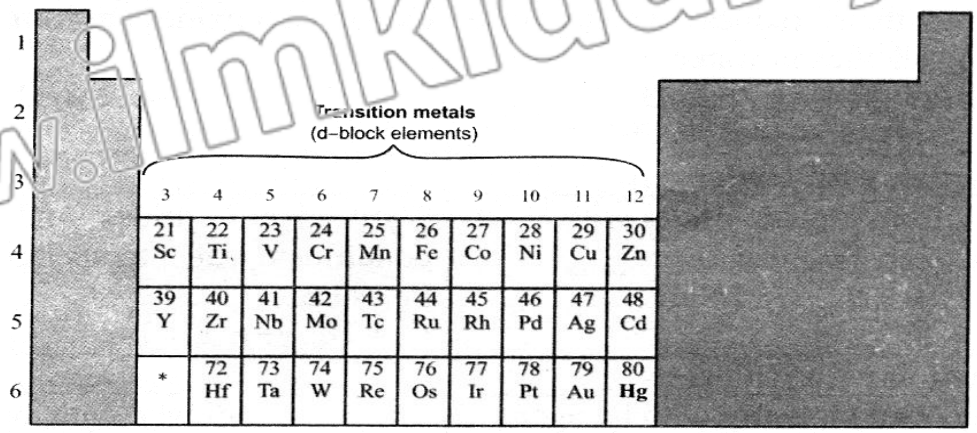

Figure: The Transition Elements in the Periodic Table

Q.4 Write a note on properties and uses of silver, gold and platinum. ***(K.B)***

Ans:

PROPERTIES AND USES OF METALS

(A) SILVER

Properties:

- It 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.

Uses:

(i) Being **very soft metal**, it is rarely used as such.

(ii)Alloys of silver with copper are widely used in making **coins**, **silver-ware** and **ornaments**.

(iii) Compounds of silver are widely used in **photographic films** and **dental preparations**.

(iv) Silver also has important applications in **mirror industry**.

(B) GOLD

Properties:

- It 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 kilo meter long.**
- Gold is **very non-reactive** or **inert** metal.
- It is **not affected by atmosphere**.
- It is even **not affected by** any single **mineral acid** or **base**.

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Uses:

(i) Because of its inertness in atmosphere, it is an **ornamental metal** as well as used in making **coins**.

(ii) Gold is **too soft** to be used as such.

(iii) It is always **alloyed with copper, silver** or some other metal.

(C) PLATINUM

(DGK 2016, FSD 2016, MTN 2016 FSD 2017 G-I)

Properties and Uses:

- It 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.
- Platinum **alloyed with palladium** and **rhodium** are used as **catalyst in auto-mobiles as catalytic convertor**.
- They **convert** most of the **gases** 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)**.

8.1.2 COMPARISON OF REACTIVITIES OF ALKALI AND ALKALINE EARTH METALS

SHORT QUESTIONS

Q.1 Describe reactivities of alkaline earth metals. **(RWP 2016)*(U.B+K.B)***

Ans: **ALKALINE EARTH METALS**

They are also reactive elements because of **ns^2 valence shell electronic** configuration but **less reactive than alkali metals** because of **small size** and **more nuclear charge**.

Q.2 Write uses of sodium.

(FSD 2016, RWP 2016, FSD 2017, SGD 2017, SWL 2016, GRW 2016 G-II, LHR 2016 G-II)*(K.B)*

Ans: *Answer given on pg # 286*

Q.3 Write uses of magnesium. **(MTN 2016, DGK 2016, SWL 2017, DGK 2017)*(K.B)***

Ans: *Answer given on pg # 286*

Q.4 Write uses of calcium. ***(K.B)***

(FSD 2016, SGD 2016, RWP 2017, SWL 2017, BWP 2017, GRW 2017 G-II, RWP 2016 G-I)

Ans: *Answer given on pg # 286*

Q.5 What is the color of flame of calcium in air? **(FSD 2017)*(K.B)***

Ans: **FLAME COLOR OF CALCIUM**

The flame of calcium in air is "brick red".

Q.6 Write uses of silver. **(RWP 2016, DGK 2017, BWP 2017)*(K.B)***

Ans: *Answer given on pg # 287*

Q.7 What is the composition of pure gold? **(Do you know Pg. # 145)*(K.B)***

Ans: **COMPOSITION OF PURE GOLD**

Pure gold is 24 carats gold.

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8.1.2 COMPARISON OF REACTIVITIES OF ALKALI AND ALKALINE EARTH METALS

MULTIPLE CHOICE QUESTIONS

1. Which one is used in flash light bulbs and fireworks? *(K.B)*
(A) Mg (B) Na (C) Ca (D) Li

2. Alkali metals have valence shell electronic configuration: *(K.B)*
(A) ns^2 (B) np^6 (C) np^1 (D) ns^1

3. Alkaline earth metals have valence shell electronic configuration: *(K.B)*
(A) ns^2 (B) np^5 (C) ns^1 (D) np^1

4 Atomic size and ionic size of sodium is: *(K.B)*
(A) 160,72 (B) 197, 99 (C) 186, 102 (D) 187, 102

5. The melting point of sodium metal is: **(LHR 2015, SGD 2017 G-I)** *(K.B)*
(A) 97°C (B) 100°C (C) 110°C (D) 200°C

6. Colour of calcium flame in air is: **(GRW 2016)** *(K.B)*
(A) Green (B) White (C) Golden (D) Brick-red

7. All metals are solid except: *(K.B)*
(A) Na (B) Mg (C) Hg (D) Au

8. Sodium does not react with: *(K.B)*
(A) Carbon (B) Nitrogen (C) Hydrogen (D) Both a and b

9. Which metal burn with golden yellow flame? **(GRW 2017 G-II)** *(K.B)*
(A) Calcium (B) Barium (C) Sodium (D) Potassium

10. Which metal is used for making mirrors? *(K.B)*
(A) Lead (B) Iron (C) Silver (D) Lithium

11. Gold is always alloyed with one among the following metals: *(K.B)*
(A) Sodium (B) Mercury (C) Copper (D) Calcium

12. How many series of d-block elements are there in the periodic table? *(K.B)*
(A) Three (B) Four (C) Five (D) Two

13. Three transition elements, Cu, Ag and Au constitute group number: *(K.B)*
(A) 9 (B) 10 (C) 11 (D) 12

14. The flame color imparted by Mg in air is: *(K.B)*
(A) Golden yellow (B) Brilliant white (C) Black (D) Brick red

15. Platinum is used in manufacturing of: *(K.B)*
(A) LCD (B) Photographic film (C) Dental preparation (D) Mirror

16. Thin layer of oxide makes silver relatively: *(K.B)*
(A) Reactive (B) Stable (C) Unreactive (D) Inert

17. Which one is used in dental preparations? *(K.B)*
(A) Gold (B) Silver (C) Platinum (D) Copper

18. Ornamental metal is: *(K.B)*
(A) Sodium (B) Potassium (C) Platinum (D) Gold

19. White gold is alloyed with: *(K.B)*
(A) Palladium (B) Nickle (C) Zinc (D) All of these

20. Which one of the following reacts with water vigorously? *(K.B)*
(A) Alkaline earth metal (B) Alkali metals
(C) Halogens (D) Noble gases

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8.2 TEST YOURSELF

i. Give the applications of silver? **(RWP 2016, DGK 2017, BWP 2017)** ***(K.B)***

Ans:

APPLICATIONS OF SILVER

Following are the important applications of silver:

- Alloys of silver with copper are used in making coins, silver ware and ornaments.
- Compounds of silver are used in photographic films, sun glasses, burn care medicines and dental preparations.
- It is also used in mirror industry.

ii. Why silver is not used in pure form? **(FSD 2017)** ***(U.B+K.B)***

Ans:

SILVER IS NOT USEABLE IN PURE FORM

Silver is not used in pure form because it is **very soft metal**. It is **alloyed with copper**.

iii. What do you mean by 24-carat gold? ***(K.B)***

Ans:

24 - CARAT GOLD

Purity of gold is shown by carat that indicates the number of parts by weight of gold that is present in 24 parts of alloy. Twenty four carat gold means pure gold.

iv. Why gold is used to make jewelry? ***(U.B)***

Ans:

GOLD IN JEWELRY MAKING

Gold is the most malleable and ductile of all the metals. It is not affected by atmosphere even by single mineral acid or base. It has beautiful yellow colour. All these properties of gold are responsible for its use in making jewelry.

v. Why platinum is used for making jewelry? **(FSD 2017)** ***(K.B)***

Ans:

USES OF PLATINUM IN JEWELRY MAKING

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.

vi. What is difference between steel and stainless steel? ***(U.B)***

Ans:

DIFFERENTIATION

The differences between steel and stainless steel are as follows:

Steel	Stainless Steel
Steel is an alloy of iron containing 0.25 to 2.5% of carbon and traces of S, P, Si and Mn.	Stainless steel is an alloy of iron with chromium and nickel.

vii. How platinum is used as a catalyst in automobiles and what are the advantages of this use? **(RWP 2017, SGD 17)** ***(U.B)***

Ans:

PLATINUM AS CATALYST

Platinum alloyed with palladium and rhodium is used as catalyst in automobiles as catalytic converter. They convert most of the toxic harmful gases (NO_2, CO) emitted by the vehicles into less harmful CO_2, N_2 and H_2O vapours.

8.2 NON-METALS

Q.1 What are non-metals? Explain electronegative characteristics of non-metals. **(SWL 2017)** ***(U.B+K.B)***

Ans:

NON-METALS

Definition:

*"The elements which are **electronegative** and **negative ions (anions)** by **gaining electrons** are called non-metals".*

Non-metals are **electronegative** in nature and **form acidic oxides**.

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Examples:

- Oxygen
- Sulphur
- Phosphorus
- Nitrogen

ELECTRONEGATIVE CHARACTER

"*The **tendency** of an element **to gain electrons** and from **negative ions** is called **non-metallic character** or **electronegative character** or **electronegativity**.*"

Valency of Non-metals:

The valency of some non-metals depends upon the **number of electrons accepted by them**.

Examples:

(i) Valency of **chlorine** atom is **1**, as it accepts only 1 electron in its outermost shell.

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

(ii) Oxygen atom can accept 2 electrons, therefore, its **valency is 2**.

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

Dependence of Non-metallic Character:

Non-metallic character ∝ Electronegativity

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** nature.

Trend of Non-metallic Character:

(i) Trends in Groups:

Non-metallic character **decreases** in a group downward.

(ii) Trends in Periods:

It **increases** in a period from left to right up to halogens. That is the reason **fluorine** is the **most non-metallic** in character.

Examples of Non-Metals:

The non-metals are elements in **Group-14 (carbon)**, **Group-15 (nitrogen and phosphorus), Group-I6 (oxygen, sulphur and selenium**) and in **Group-17 halogens (fluorine, chorine, bromine and iodine)** of the periodic table.

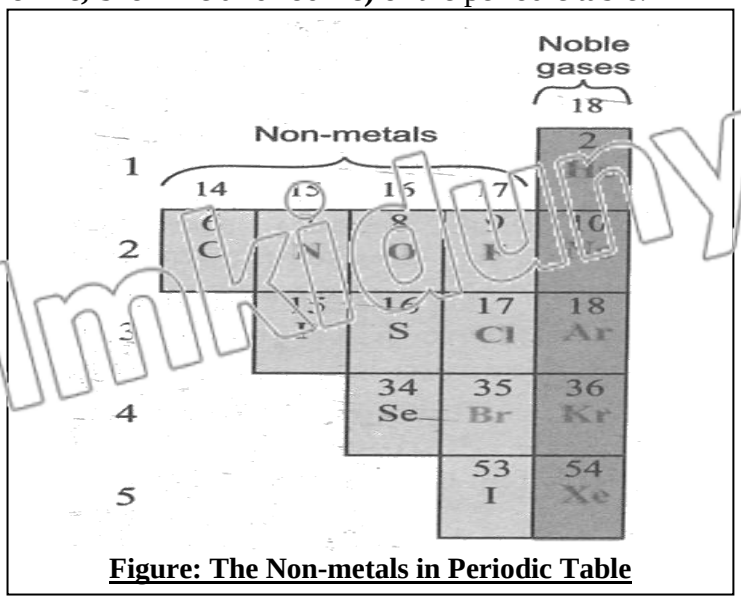

Figure: The Non-metals in Periodic Table

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Q.2 What are physical and chemical properties of non-metals?
(DGK 2016, BWP 2017, SGD 2016, 2017, BWP 2017, LHR 2017 G-I)*(K.B)*

Ans:

PHYSICAL PROPERTIES OF NON-METALS

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**.

The important physical properties of non-metals are as follows:

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

CHEMICAL PROPERTIES OF NON-METALS

The 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 themselves electron acceptors.
(v) They form **acidic oxides**.

Trend of Electronegativity of Non-metal:

- Electronegativity of first member of **group 14, 15, 16** and **17** are higher than that of other members of the group decreasing their electro negativity.
- The **decreasing order** of electronegativity is as under.

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

8.2 NON-METALS

SHORT QUESTIONS

Q.1 What is the trend of electronegativity of non-metals? **(FSD 2016)*(U.B)***

Ans:

TREND OF ELECTRONEGATIVITY

Electro negativity of first member of group 14, 15, 16 and 17 are higher than that of other members of the group decreasing their electronegativity.

The **decreasing order** of electronegativity is as under.

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

Q.2 What is non-metallic character? **(RWP 2016)*(U.B)***

Ans:

NON-METALLIC CHARACTER

"*The tendency of an element to gain electrons and form negative ions is called non-metallic character or electronegative character*".

Trends in Periodic Table:

Non-metallic character decreases in a group and increases in a period

Q.3 Which factors affect the nonmetallic character? **(RWP 2017 G-I)*(U.B)***

Ans:

FACTORS AFFECTING NONMETALLIC CHARACTER

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 nature.

Non-metallic character × Electronegativity

8.2 NON-METALS

MULTIPLE CHOICE QUESTIONS

1. Which one of the following halogens has lowest electronegativity? (LHR 2015)*(K.B)*
(A) Chlorine (B) Iodine (C) Bromine (D) Fluorine

2. **Which one of the following non-metals is lustrous?** **(GRW 2017 G-I)***(K.B)*
(A) Sulphur (B) Phosphorus (C) Iodine (D) Carbon

3. **Non-metals are generally soft but which one of the following is extremely hard?** *(K.B)*
(A) Graphite (B) Phosphorous (C) Iodine (D) Diamond

4. **In the group non-metallic character:** *(U.B)*
(A) Increases (B) Decreases (C) Remains same (D) None of these

5. **Non-metals do not react with:** *(K.B)*
(A) Dilute acids (B) Concentrated acids (C) Water (D) Both A and C

6. **Small sized atoms have:** *(U.B)*
(A) High nuclear charge (B) Low nuclear charge
(C) Low ionization energy (D) All of these

8.2.1 COMPARISON OF REACTIVITIES OF THE HALOGENS

Q.1 What are halogens? Compare the reactivity of the halogens in detail? **(SWL 2017)***(U.B+K.B)*

Ans:

HALOGENS

*"Elements of **Group-I7** of the periodic table consist of **fluorine, chlorine, bromine, iodine** and **astatine**. They are collectively called halogens."*

Physical States:

- **Fluorine** and **chlorine** exist as **diatomic gases** at room temperature.
- **Bromine** exists as a **liquid**.
- **Iodine** exists as **solid**.

The **intermolecular forces of attraction increase downward in the group due to the increase in the size of atom**.

Table: Physical Properties 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
CI	17	$[Ne]3s^2 3p^5$	Greenish Yellow	172	238	3.2
Br	35	$[Ar]4s^2 4p^5$	Reddish Brown	266	332	3.0
I	53	$[Kr]5s^2 5p^5$	Purple Black	387	457	2.7

General Characteristics:

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

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Q.2 Give the chemical properties of halogens. ***(U.B+K.B)***

OR

Describe important reactions of halogens. ***(U.B+K.B)***

Ans: **REACTIONS OF HALOGENS**

Order of reactivity of halogens is as follows:

F > Cl > Br > I

(i) Oxidizing Properties:

*"A substance that **oxidizes another substance by taking its electrons** is called an oxidizing agent".*

All halogens are oxidizing agent. **Fluorine** is the **strongest oxidizing element** while **iodine** is the **least** i.e. **mild oxidizing agent**. Fluorine will oxidize any of halide ion (X^{-1}) in solution and changes itself to F^- ion. Chlorine will displace Br^- and I^- ion from their salt solutions and oxidize them to bromine and iodine.

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

More reactive Less reactive

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

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

Solution turns from colourless to reddish brown.

Similarly, $Br_2 + 2Kl \longrightarrow 2KBr + 1_2$.

Actually a **more reactive halogen** can **displace** and **oxidize** the **less reactive halogen**.

(ii) Reaction with Hydrogen:

All halogens (X_2) combine with hydrogen to give **hydrogen halides (HX)**.

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

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

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

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

Trend of Chemical Reactivity:

- The **chemical affinity of halogens for H_2 decreases down the group** from F_2 to Br_2.
- **Fluorine** combines **with hydrogen** even in the **dark** and **cold state**. **Chlorine reacts with hydrogen** in the **presence of sunlight**.
- **Bromine** and **iodine react with hydrogen** only **on heating**.

(iii) Reaction with Water:

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

$$2F_2 + 2H_2O \xrightarrow[\text{Cold state}]{\text{Dark and}} 4HF + O_2$$

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

$$Br_2 + H_2O \xrightarrow{\text{heat}} HBr + BOBr$$

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

(iv) Reaction with Methane:

F_2 > Cl_2 > Br > I_2

(A) Reaction with Fluorine:

Fluorine (F_2) reacts **violently with methane (CH_4) in dark**.

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(B) Reaction with Chlorine:

In dark: Chlorine (Cl_2) **does not react with methane** in dark.

In Bright Sunlight: In the presence of bright sunlight the reaction is **violent**.

$$CH_4 + 2Cl_2 \xrightarrow{\text{Bright sunlight}} C + 4HCl$$

In Diffused Sunlight: In the presence of diffused sunlight the reaction of chlorine with methane is **slow and gives series of compounds** e.g. **CH_3Cl, CH_2Cl_2, $CHCl_3$** and **CCl_4**.

$$CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$$

$$CH_3Cl + Cl_2 \longrightarrow CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \longrightarrow CHCl_3 + HCl$$

$$CHCl_3 + Cl_2 \longrightarrow CCl_4 + HCl$$

(v) Reaction with Sodium Hydroxide: Chlorine reacts with **cold dilute NaOH** to give **sodium hypochlorite** and **sodium chloride**.

$$2NaOH + Cl_2 \longrightarrow NaCl + NaOCl + H_2O$$
$$\text{Cold (dilute)}$$

Cl_2 reacts with **hot concentrated NaOH** to give **sodium chloride** and **sodium chlorate**.

$$6NaOH + 3Cl_2 \longrightarrow 5NaCl + NaClO_3 + 3H_2O$$
$$\text{Hot (conc.)}$$

8.2.1 COMPARISON OF REACTIVITIES OF THE HALOGENS

TOPIC SHORT QUESTIONS

Q.1 Define halogen. ***(K.B)***

Ans: *Answer given on pg # 293*

Q.2 How halogens react with methane? ***(U.B)***

Ans: *Answer given on pg # 295*

Q.3 Write two chemical properties of halogens. **(LHR 2016 G-II, 2017 G-I)*(U.B+K.B)***

Ans: **CHEMICAL PROPERTIES OF HALOGENS**

(i) Reaction with Hydrogen: All **halogens (X_2)** combine with hydrogen to give hydrogen halides (HX).

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

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

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

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

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

$$2F_2 + 2H_2O \xrightarrow[\text{Cold state}]{\text{Dark and}} 4HF + O_2$$

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

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

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

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8.2.1 COMPARISON OF REACTIVITIES OF THE HALOGENS

MULTIPLE CHOICE QUESTIONS

1. Which one of the following halogen has pale yellow colour? ***(K.B)***
(A) F_2 (B) Cl_2 (C) Br_2 (D) I_2

2. The least electronegative element among the halogens is: ***(K.B)***
(A) Fluorine (B) Chlorine (C) Bromine (D) Iodine

3.* The most electronegative element among the halogens is** ***(K.B)
(A) Fluorine (B) Chlorine (C) Bromine (D) Iodine

4. Atomic number of iodine is: ***(K.B)***
(A) 35 (B) 53 (C) 52 (D) 54

5. At room temperature F and Cl exist as: ***(K.B)***
(A) Monoatomic (B) Diatomic (C) Triatomic (D) Polyatomic

6. Br exist as: ***(K.B)***
(A) Liquid (B) Gas (C) Solid (D) Both A and C

7. Colour of iodine is: ***(K.B)***
(A) Pale yellow (B) Purple (C) Red (D) Black

8. Noble gas electronic configuration of F is: ***(U.B)***
(A) $[He]2s^2, 2p^5$ (B) $[Ne]\ 3s^2, 3p^5$ (C) $[Ar]4s^2, 4p^5$ (D) $[Kr]5s^2, 5p^5$

9. Which one of the following makes covalent bond with halogens? ***(U.B)***
(A) Na (B) K (C) O (D) Mg

10. Which one among the halogens has least affinity with hydrogen? ***(K.B)***
(A) F_2 (B) Cl_2 (C) Br_2 (D) I_2

11. In diffused sunlight chlorine reacts with methane to form: ***(K.B)***
(A) CH_3Cl (B) CH_2Cl_2 (C) CCl_4 (D) All of these

12. Which halogen react with water in dark and cold state? ***(K.B)***
(A) F_2 (B) Cl_2 (C) Br_2 (D) I_2

13. Which one of the following is strongest oxidizing agent? ***(K.B)***
(A) Chlorine (B) Fluorine (C) Bromine (D) Iodine

14. Which halogen does not react with water? ***(K.B)***
(A) Chlorine (B) Bromine (C) Fluorine (D) Iodine

8.2.3 SIGNIFICANCE OF NON-METALS

Q.1 What is the significance of non-metals in daily life? **(RWP 2016, LHR 2017 G-I)** ***(K.B+A.B)***

Ans:

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:

Major components of earth's crust, oceans and atmosphere are non-metals: **oxygen** has the highest percentage in **earth' crust (47%)** and **oceans (86%)** and it is **second (21%) to nitrogen in atmosphere**. It indicates the importance of oxygen in nature.

(ii) Maintenance of Balance of Non-metals:

To maintain the balance for the amount of non-metals in nature, different cycles like **water cycle**, **nitrogen cycle** etc. have been established naturally.

(iii) Essential Component of Body:

Non-metals are essential part of the body structure of all living things.

Examples:

- 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%**
- **Plant bodies are made up of cellulose**, which is composed of **carbon, hydrogen** and **oxygen**.

(iv) Essential for Existence of Life:

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.

(v) Maintenance of Life:

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

(vi) Survival of Life:

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.

(vii) Safety of Life:

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

(viii) Communication in Life:

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.**

(ix) Clothing:

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

(x) Manufacture of Industrial Goods:

In addition to all 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.

8.2.3 SIGNIFICANCE OF NON-METALS

SHORT QUESTIONS

Q.1 Which non-metals are essential parts of the body? ***(K.B)***

Ans: *Answer given on pg # 297*

Q.2 How non-metals play a vital role for the maintenance of life? ***(U.B+A.B)***

Ans: *Answer given on pg # 297*

Q.3 How non-metal is necessary for safety life on earth? ***(A.B)***

Ans: *Answer given on pg # 297*

8.2.3 SIGNIFICANCE OF NON-METALS

MULTIPLE CHOICE QUESTIONS

1. Human body nearly composed of _____ elements (GRW 2014) *(K.B)*

(A) 28 (B) 26 (C) 27 (D) 25

2. In Earth crust the highest %age of oxygen is: *(K.B)*

(A) 47% (B) 86% (C) 90% (D) 24%

3. The %age of oxygen in oceans is: *(K.B)*

(A) 47% (B) 86% (C) 90% (D) 24%

4. The %age of oxygen in air is: *(K.B)*

(A) 21% (B) 24% (C) 26% (D) 30%

5. The %age of nitrogen in atmosphere is: *(K.B)*

(A) 89% (B) 78% (C) 70% (D) 85%

6. Oxygen is: *(K.B)*

(A) Metal (B) Non-metal (C) Metalloids (D) None of these

8.3 TEST YOURSELF

i. Why valency of chlorine is 1? *(U.B)*

Ans: **VALENCY OF CHLORINE**

Valency of chlorine is one because chlorine has seven electrons in its valence shell and it can accept only one electron to complete its valence shell or octet.

ii. Which factor controls the non-metallic character of the elements? *(U.B)*

Ans: **FACTORS CONTROLLING NON-METALLIC CHARACTER**

The non-metallic character of elements is controlled by electron affinity and electronegativity of atoms. Greater the electron affinity and electronegativity, more non-metallic character of elements will be.

iii. Why fluorine is more non-metallic than chlorine? *(U.B)*

Ans: **NON-METALLIC CHARACTER**

Fluorine is more non-metallic than chlorine because it has smaller size and more nuclear attraction to valance electrons. Non-metallic depends upon electronegativity and Fluorine electronegativity is more than Chlorine, therefore Fluorine is more non-metallic than Chlorine.

iv. Iodine exists in solid state, can it be beaten with hammer to form sheets? *(U.B)*

Ans: **IODINE A NON-METAL**

No, only solid things or metals have the characteristics to be beaten with hammer to form sheets. Iodine is a non-metal and brittle.

v. Can liquids and gases be brittle? *(U.B)*

Ans: **BRITTLENESS OF LIQUIDS AND GASES**

Liquid and gases cannot be brittle because it is only the property of solids especially ionic solids.

vi. Why the oxygen is called non-metal? *(U.B)*

Ans: **OXYGEN IS CALLED NON-METAL**

Oxygen is non-metal because it form negative ion by gaining electrons like other non-metals.

vii. Name two non-metals which are both brittle and non-ductile. *(K.B)*

Ans: **BRITTLE AND NON-DUCTILE NON-METAL**

Graphite and iodine are two non-metals which are brittle and non-ductile in nature.

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viii. Name the most abundant non-metal in the Earth's crust. *(K.B)*

Ans:

ABUNDANT NON-METAL IN THE EARTH

The most abundant non-mental in the Earth's crust is oxygen. It is 47 % of Earth's crust.

ix. Give the non-metallic trend in halogens. **(RWP 2018)** *(U.B)*

Ans:

NON-METALLIC TREND IN HALOGENS

The non-metallic trend in halogens decreases from top to bottom because of increasing atomic sizes.

$$F > Cl > Br > I$$

x. Why do the non-metals accept electrons readily? *(U.B)*

Ans:

ACCEPTANCE OF ELECTRON

Non-metals accept electrons readily because they are more electronegative and are usually electron deficient in nature. So they form anions by gaining electrons.

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

xi. Why non-metals do not react with dilute acids while metals do react? *(U.B)*

Ans:

NON-METALS DO NOT REACT WITH ACIDS

Non-metals do not react with dilute acids because non-metals are itself electron acceptors while metals react readily because they lose electrons readily.

xii. How can we distinguish a metal from a non-metal by simple physical methods? *(U.B)*

Ans:

DIFFERENTIATION

The differences between metals and non-metals are as follows:

Metals	Non-metals
Electrical Conductivity	
• Metals are good conductor of heat and electricity.	• Non-metals are bad conductor of heat and electricity.
Melting and Boiling Points	
• Metals possess high melting and boiling points.	• Non-metals, possess low melting and boiling points.
Density	
• They have high density.	• They have low density

xiii. How we can distinguish a substance is metal or non-metals with the help of an acid? *(U.B)*

Ans:

DIFFERENTIATION

The metals and non-metals can be distinguished by the following methods:

Metal	Non metals
• Metals react with dilute acids easily because metals are itself electron donors. $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$ $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$	• Non-metals usually do not react with dilute acids because non-metals are itself electron acceptors.

xiv. Why is HF a weak acid? **(MTN 2016)** *(U.B)*

Ans:

HF WEAK ACID

HF is a weak acid because it does not release its proton easily due to presence of strong hydrogen bonding and it ionizes to a small extent in aqueous solution.

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ANSWER KEYS

INTRODUCTION

Q	D	2	C

8.1 METALS

1	A	2	D	3	A	4	A	5	A	6	A		
7	A	8	A	9	B	10	B	11	B	12	C	13	A

8.1.1 ELECTROPOSITIVE CHARACTER

1	A	2	C	3	B	4	D	5	B
6	B	7	A	8	C	9	A		

8.1.2 COMPARISON OF REACTIVITIES OF ALKALI AND ALKALINE EARTH METALS

1	B	2	D	3	A	4	C	5	A	6	D	7	C	8	D	9	C	10	C
11	C	12	D	13	C	14	B	15	A	16	C	17	B	18	D	19	D	20	B

8.2 NON-METALS

1	B	2	C	3	D	4	B	5	A	6	A

8.2.1 COMPARISON OF REACTIVITIES OF THE HALOGENS

1	A	2	D	3	A	4	B	5	B	6	A	7	B
8	A	9	C	10	D	11	D	12	A	13	B	14	D

8.2.3 SIGNIFICANCE OF NON-METALS

1	A	2	A	3	B	4	A	5	B	6	B

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EXERCISE SOLUTION

MULTIPLE CHOICE QUESTIONS

1. Metals can form ions carrying charges: **(GRW 2016 G-I, BWP 2016 G-I, MTN 2016 G-I)** ***(U.B)***

(A) Uni-positive (B) Di-positive
(C) Tri-positive (D) All of these

2. Which one of the following metals burn with brick red flame when heated in air?
(FSD 2016 G-I, 2017 G-II, BWP 2017 G-I, MTN 2017 G-I, SGD 2016 G-I) ***(K.B)***

(A) Sodium (B) Magnesium
(C) Iron (D) Calcium

3. Sodium is extremely reactive metal, but it does not react with: **(RWP 2017 G-I, FSD 2017 G-II)** ***(U.B+K.B)***

(A) Hydrogen (B) Nitrogen
(C) Sulphur (D) Phosphorus

4. Which one of the following is the lightest and floats on water?
(RWP 2017 G-I, FSD 2017 G-I) ***(K.B)***

(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: ***(U.B)***

(A) Strong metallic bonding (B) Weak metallic bonding
(C) Non-metallic bonding (D) Moderate metallic bonding

6. Which of the following is less malleable? **(DGK 2017 G-II)** ***(K.B)***

(A) Sodium (B) Iron
(C) Gold (D) Silver

7. Metals lose their electrons easily because: ***(U.B)***

(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? **(BWP 2017 G-II, MTN 2017 G-II, SWL 2017 G-II)** ***(K.B)***

(A) Sodium (B) Aluminium
(C) Selenium (D) Magnesium

9. Which one of the following non-metals is lustrous?
(GRW 2016 G-I, BWP 2016 G-I, RWP 2016 G-I) ***(K.B)***

(A) Sulphur (B) Phosphorus
(C) Iodine (D) Carbon

10. Non-metals are generally soft, but which one of the following is extremely hard? ***(K.B)***

(A) Graphite (B) Phosphorus
(C) Iodine (D) Diamond

11. Which one of the following will not react with dilute HCl?
(SWL 2017 G-I, 2016 G-II, SGD 2016 G-I, LHR 2016, 17 G-I,II 2016 G-I, II) ***(K.B)***

(A) Sodium (B) Potassium
(C) Calcium (D) Carbon

ANSWER KEY

1	**d**	**3**	**b**	**5**	**b**	**7**	**c**	**9**	**c**	**11**	**d**
2	**d**	**4**	**d**	**6**	**b**	**8**	**c**	**10**	**d**		

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EXERCISE SHORT QUESTIONS

1. Why reactivity of metals increases down the group? (BWP 2017 G-9)*(U.B)*

Ans: **REACTIVITY OF METAL IN GROUP**

Reactivity of metals depends upon its tendency to lose electrons which is dependent upon the size of atoms. Thus reactivity of metals increases down the group because of increasing atomic size and decreasing ionization energy.

2. State the physical properties of metals (SWL 2016, MTN 2016, BWP 2016, 2017)*(K.B)*

3. Why nitrogen forms compounds with alkaline earth metals directly? (SGD 2016)*(U.B)*

Ans: **FORMATION OF NITROGEN COMPOUNDS**

Nitrogen forms compounds with alkaline earth metals directly because alkaline earth metals form di positive cations (M^{++}). They have high charge density and polarization power. They can polarize nitrogen atoms easily and produce stable covalent nitrides with nitrogen.

$$3Mg + N_2 \longrightarrow Mg_3N_2$$

4. Why the second ionization energy of magnesium is higher than the first one? (GRW 2016 G-I, SWL 2017)(U.B)

Ans: **2nd IONIZATION ENERGY OF MAGNESIUM**

Second Ionization energy of magnesium is higher than the first one because after the removal of its electron nuclear charge increases and atomic size decreases. The remaining electrons will be attracted by the nucleus more strongly.

5. How oxygen reacts with group II-A metals? *(U.B)*

Ans: **REACTION OF OXYGEN WITH GROUP IIA METALS**

They are less reactive towards oxygen and they form oxides on heating.

$$2Mg + O_2 \xrightarrow{Heat} 2MgO$$

6. What is relationship between electropositivity and ionization energy? *(U.B)*

Ans: **RELATIONSHIP BETWEEN ELECTROPOSITIVITY AND IONIZATION ENERGY**

Electropositivity 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. Atoms having high ionization energy are less electropositive or metallic.

7. Why electro positivity decreases from left to right in a period? *(U.B)*

Ans: **ELECTROPOSITIVITY IN PERIOD**

Electropositivity decreases from left to right in a period of the periodic table because size of atoms decreases due to increase in nuclear charges.

8. How electro positivity depends upon size and nuclear charge of an atom? *(U.B)*

Ans: **DEPENDENCE OF ELECTROPOSITIVITY UPON SIZE AND NUCLEAR CHARGE**

Electropositivity depends upon size and nuclear charge of an atom because when the size of atoms increases, electropositivity increases as it becomes easier to lose electrons. It also depends upon nuclear charge. If nuclear charge increases the electropositivity decreases because it becomes difficult to remove the electrons from outermost shell.

9. Why ionization energies of alkaline earth metals are higher than alkali metals? *(U.B)*

Ans: **IONIZATION ENERGY**

Ionization energies of alkaline earth metals are higher than alkali metals because the atomic size of alkaline earth metals is smaller and have greater nuclear charge.

10. Why silver and gold are least reactive? *(U.B)*

Ans: **LEAST REACTIVITY OF SILVER AND GOLD**

Silver and gold are least reactive because these metals do not lose their electrons easily. They do not have the tendency to make cations.

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11. Can pure gold be used for making ornaments? If not why? ***(U.B+A.B)***

Ans: **PURE GOLD NOT USED FOR MAKING ORNAMENTS**

No, pure gold cannot be used for making ornaments because gold is too soft to be used as such. It is always alloyed with copper, silver or some other metal.

12. Why copper is used for making electrical wires? **(MTN 2017)*(U.B+A.B)***

Ans: **USE OF COPPER**

Copper is used for making of electrical wires because it is a good conductor of electricity and can easily be drawn into wires.

13. What is the trend of variation in densities of alkali metals? ***(U.B)***

Ans: **VARIATION IN DENSITIES**

Densities of alkali metals increase down the group in the periodic table due to increase in atomic mass.

14. Which metal is used for metal work? ***(K.B)***

Ans: **METAL USED FOR METAL WORK**

Metal work means objects that are made in an artistic and skilful way. Copper metal is used in metal work because it is easily workable. It is used in many ornaments, plumbing, roafing and other operations.

15. Why magnesium is harder than sodium? **(MTN 2017)*(U.B)***

Ans: **HARDNESS OF MAGNESIUM THAN SODIUM**

Magnesium is harder than sodium because in magnesium metallic bonding is stronger, than sodium. Magnesium involves 2 valence electrons in metallic bonding as compared to sodium which involves only one valence electron. Moreover magnesium has smaller atomic size and high ionization energy.

16. Why calcium is more electropositive than to magnesium? ***(U.B)***

Ans: **ELECTROPOSITIVITY OF CALCIUM AND MAGNESIUM**

Calcium is more electropositive than magnesium because calcium has larger size and greater nuclear charge than magnesium and in turn lower ionization energy than magnesium.

17. Why ionization energy of Na is less than Mg? ***(U.B)***

Ans: **LESS IONIZATION ENERGY OF NA THAN Mg**

Ionization energy of Na is less than Mg because Na has larger size and lower nuclear charge than Mg. It results in less nuclear attraction on valance electron in sodium.

18. Why the ionization energy of Na is more than K? ***(U.B)***

Ans: **IONIZATION ENERGY OF Na AND K**

The ionization energy of sodium is more than K because down the group electropositive character increases and ionization energy decreases. It becomes easier for potassium to lose electrons than sodium.

EXERCISE (LONG QUESTIONS)

1. Compare and contrast the properties of alkali and alkaline earth metals. ***(U.B+K.B)***

Ans: Answer given on pg # (Topic 3.1.2)

2. Discuss the inert character of silver and gold. ***(U.B)***

Ans: **INERT CHARACTER OF SILVER AND GOLD**

Silver and gold are inert metals because they both are **very less electropositive** and do not lose electrons easily.

Inert Character of Silver:

Silver is a white lustrous metal. 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.

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Inert Character of Gold:

Gold is a yellow soft metal. 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. It dissolves only in Aqua Regia. Because of its inertness in atmosphere it is an ornamental metal as well as used in making coins.

3. Why cations are smaller and anions are bigger in size than their respective neutral atoms? ***(U.B)***

Ans:

SMALL SIZE OF CATION

Cations are smaller than their corresponding neutral atoms because of two reasons: The removal of one or more electrons from a neutral atom usually, results in the loss of the outer most shell. The removal of electrons causes an imbalance in proton-electron ration thus a cation has smaller number of electrons than its parent atom. With the decrease in number of electrons the magnitude of effective nuclear charge increases, which pulls the electrons cloud of the cation near to the nucleus and thus makes the cation smaller in size than its parent neutral atom.

Examples:

The radius of Na is 186pm whereas ionic radius of cation (Na^+) is 102pm.

LARGE SIZE OF ANION

A negative ion is always bigger than its parent atom, the reason is that the addition of one or more electrons in the shell of a neutral atom enhances the repulsion between the electron causing the expansion of the shell. The added electrons reduce the attraction of nucleus to the electron that is why the size of anion increases as compared to the neutral atom.

Examples:

Atomic size of fluorine (F) is 71pm whereas anionic size of fluoride (F^-) is 136 pm.

4. Discuss why hardness and softness of a metal depends upon its metallic bonding? ***(U.B)***

Ans:

HARDNESS AND SOFTNESS

The softness and hardness of a metal depends upon the metallic bonding. The strength of the metallic bonds depends upon the number of valence electrons that each atom contributes for the metallic bonding.

Hardness of a Metal:

Some metals have **strong metallic bond due to the greater number of valence electrons** in the metal atoms. Such metals are **hard**.

Examples:

Magnesium metal has strong metallic bond as compared to sodium metal therefore magnesium is harder than sodium metal.

Softness of a Metal:

Some metals have weak metallic bond due to the less number of valance electrons in the metal atoms. Such metals are soft.

Examples:

Sodium has weak metallic bond as compared to magnesium metal that's why it is soft as compared to magnesium. It has low melting point and can easily be cut with knife.

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5. Give the reaction of sodium with; H_2O, O_2, Cl_2 and H_2. ***(U.B+K.B)***

Ans:

REACTIONS OF SODIUM

Reaction with H_2O:

Sodium reacts with water vigorously at room temperature to give strong alkaline solution and hydrogen gas.

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

Reaction with O_2:

Sodium immediately tarnishes in air giving sodium oxide which forms strong alkali in water.

$$4Na + O_2 \longrightarrow 2Na_2O$$

$$Na_2O + H_2O \longrightarrow 2NaOH$$

Reaction with Cl_2:

Sodium reacts violently with chlorine at room temperature to give sodium chloride.

$$2Na + Cl_2 \longrightarrow 2NaCl$$

Reaction with H_2:

Sodium reacts with hydrogen, at high temperature to form sodium hydride.

$$2Na + H_2 \longrightarrow 2NaH$$

6. What are physical properties of calcium metal? Give its uses. ***(K.B)***

Ans:

PHYSICAL PROPERTIES AND USES OF CALCIUM

Physical Properties:

The physical properties of calcium are as follows:

(i) Calcium is silvery grey and fairly harder.

(ii) Its density is 1.55g cm^{-3}

(iii) It is malleable and ductile.

(iv) It is good conductor of heat and electricity.

(v) Its melting point is 851°C and boiling point is 1484°C.

(vi) Its flame colour is brick red.

(vii) Its first ionization energy is 590kJmol^{-1} and second ionization energy is 1145kJmol^{-1}.

Uses of Calcium:

- It is used to remove sulphur from petroleum products.
- It is used as reducing agent to produce Cr, U and Zr.

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7. Write down the chemical properties of the non-metals?

(DGK 2016, BWP 2017, SGD 2016, 2017, BWP 2017, LHR 2017 G-I) ***(U.B+K.B)***

8. Compare the physical properties of metals and non-metals. **(DGK 2016)** ***(U.B+K.B)***

Ans: **COMPARISON OF PHYSICAL PROPERTIES**

The comparison of physical properties of metals and non-metals are as follows:

Metals	Non-metals
• All metals are solids except mercury.	• Non-metals are solid, liquid and gases.
• They have high melting and boiling points.	• They have low melting and boiling points.
• They have metallic luster and can be polished.	• They do not have metallic luster and cannot be polished. They have dull surface.
• They are malleable and ductile.	• They are not malleable and ductile.
• They are good conductors of heat and electricity.	• They are poor conductors of heat and electricity.
• They have high densities.	• They have low densities.
• They are usually hard.	• They are usually soft.

9. How you can compare the softness and hardness of metals? ***(U.B)***

Ans: **SOFTNESS AND HARDNESS OF METALS**

Softness and hardness of metals **depends upon** the **strength of metallic bond** present in them.

Dependency of Metallic Bond:

The strength of a metallic bond depends upon the following factors:

- **Charge** present on positive metallic ion.
- **Number of mobile electrons** set free by each atom.

Softness of Metals:

Metals having weak metallic bond are soft metals. Such metals have low melting points, boiling points, densities etc.

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Example:

Sodium is a soft metal due to weak metallic bond. It can be cut with a knife. Its melting point is very low as compared to other metals.

Harness of Metals:

Metals having strong metallic bond are hard metals. Such metals have high melting points, boiling points, densities etc.

Example:

Magnesium is a hard metal due to strong metallic bond. Its melting point is 650°C which is very nigh as compared to sodium.

10. Give the chemical properties of magnesium and its uses. ***(U.B+K.B)***

Ans: **CHEMICAL PROPERTIES AND USES OF MAGNESIUM**

Chemical properties:

(i) Reaction with water:

Magnesium reacts with water less vigorously and on heating produces weak base.

$$Mg + H_2O \longrightarrow MgO + H_2$$

$$MgO + H_2O \longrightarrow Mg(OH)_2$$

(ii) Reaction with oxygen:

Magnesium reacts with oxygen on heating and magnesium oxide is formed.

$$2Mg + O_2 \xrightarrow{Heat} 2MgO$$

(iii)Reaction with Nitrogen:

Magnesium forms stable nitride when heated with nitrogen.

$$3Mg + N_2 \xrightarrow{Heat} Mg_3N_2$$

Uses of Magnesium:

- Magnesium is used in flash light bulbs and in fireworks.
- It is used in the manufacture of light alloys.
- Magnesium ribbon is used in thermite process to ignite aluminium powder.
- Magnesium is used as anode for prevention of corrosion. .

11. Write a comprehensive note on the electropositive character of metals? ***(U.B)***

Ans: *Answer given on pg #* (Topic 8.1.1)

12. Compare the ionization energies of alkali and alkaline earth metals. ***(U.B)***

Ans: *00* (Topic 8.1.2)

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ADDITIONAL CONCEPTUAL QUESTIONS

Q.1 Write any two differences between alkali metals and alkaline earth metals. **(GRW 2016 G-II)*(U.S)***

Ans:

DIFFERENTIATION

The difference between alkali metals and alkaline metals are as follows:

Alkali metals	Alkaline metals
• Alkali metals are extremely reactive elements because of their ns¹ valence shell electronic configuration.	• The alkaline earth metal atoms are smaller and have more nuclear charge.
• There is only one electron in their valence shell, it can be easily given out.	• They have two electrons in their valence shells.

Q.2 Write two uses of gold. **(LHR 2017 G-I)*(K.B)***

Ans:

USES OF GOLD

Because of its inertness in atmosphere, it is an ornamental metal as well as used in making coins.

Q.3 Write at least two physical properties of magnesium. **(LHR 2016 G-I)*(K.B)***

Ans:

PHYSICAL PROPERTIES OF MAGNESIUM

(i) It is Malleable and ductile.

(ii) It is Good conductor of heat and electricity.

Q.4 How purity of gold is shown? **(Do you know Pg. # 145)*(K.B)***

Ans:

PURITY OF GOLD

Purity of gold is shown by **carats**.

Carats:

*"The **number of parts by weight** of gold that is present **in 24 parts of alloy** is called carats".*

24 Carats Gold:

Twenty four carat gold is pure.

22 Carats Gold:

22 carats gold means that **22 parts pure gold is alloyed with 2 parts** of either **silver** or **copper** for making ornaments and jewelry.

Q.5 What is white gold? **(Do you know Pg. # 145)*(K.B)***

Ans:

WHITE GOLD

White gold is an alloy with **palladium, nickel** or **zinc**.

Q.6 Why alkali metals are more reactive than alkaline earth metals? **(GRW 2017 G-I)*(U.B)***

Ans:

REACTIVITY OF ALKALI METALS

The alkali metals are more reactive than alkaline earth metals because they have **low ionization energy values**.

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TERMS TO KNOW

Terms	Definitions
Metals	Metals are the elements (except hydrogen) which are **electropositive** and form cations by losing electrons.
Electropositive Character	Metals have the **tendency to lose** their valance electrons. This property of a metal is termed as electro-positivity or metallic character.
Malleability	Malleability is the property of metals due to which they can be **beaten/hammered into sheets**.
Ductility	Ductility is the property of the metals due to which they can be **drawn into wires.**
Transition Metals	The elements in which **d-orbital** are in the **process of filling**, constitute a group of metals called transition metals.
Alkali Metals.	The elements in **Group 1 (Li, Na, K, Rb, Cs, Fr)** of the periodic table are called alkali metals.
Non-metals	The elements which form **negative ions** (anions) by gaining electrons are called non-metals.
Electronegative Character	The tendency of an element to gain electrons and from negative ions is called **non-metallic character** or electronegative character or electronegativity.
Halogens	Elements of **Group-17** of the periodic table consist of fluorine, chlorine, bromine, iodine and astatine. They are collectively called halogens.
Oxidizing Agent	A substance that oxidizes another substance by taking its electrons is called an oxidizing agent.
Alkaline Earth Metals	Elements in **Group-2 (Be, Mg, Ca, Sr, Ba, Ra)** of the periodic table are called alkaline earth metals because they form alkaline solution with water and are found in Earth's crust.
Noble Metals	The metals in the periodic table which are **relatively inactive** because they do not lose electrons easily are called noble metals.
Carats	The **number of parts by weight of gold** that is present in 24 parts of alloy is called carats.

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SELF TEST

Time: 35 Minutes **Marks: 25**

Q.1 Four possible answers (A), (B), (C) and (D) to each question are given, mark the correct answer. (6×1=6)

1. Which one of the following is less malleable?

(A) Silver **(B)** Gold

(C) Iron **(D)** Sodium

2. Human body is composed of nearly how many elements?

(A) 25 **(B)** 27

(C) 26 **(D)** 28

3. Which one of the following halogens has lowest electronegativity?

(A) Calcium **(B)** Magnesium

(C) Iodine **(D)** Chlorine

4. The melting point of sodium metal is:

(A) 200°C **(B)** 110°C

(C) 100°C **(D)** 97°C

5. Colour of calcium flame in air is:

(A) Brick red **(B)** Golden

(C) White **(D)** Green

6. Which one of the following elements is the lightest and floats on water?

(A) Sodium **(B)** Lithium

(C) Magnesium **(D)** Calcium

Q.2 Give short answers to following questions. (5×2=10)

(i) Write any two uses of magnesium.

(ii) Write down physical properties of metals.

(iii) Why platinum is used for making jewellery?

(iv) Write down the names of four least reactive metals.

(v) Give chemical reactions of halogens with hydrogen.

Q.3 Answer the following questions in detail. (5+4=9)

(i) Write a note on electropositive character. **(5)**

(ii) Write any four comparisons of chemical properties and reactivities of alkali metals and alkaline earth metals. **(4)**

Note:

Parents or guardians can conduct this test in their supervision in order to check the skill of students.

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