CHAPTER 8

CHEMICAL REACTIVITY

Q1. Differentiate between metals and nonmetals.

METALS	NON-METALS:
1. All metals except mercury are solids with high melting points and boiling points.	1. Non-metals have low melting and boiling points, about half of the non-metals are gases.
2. Metals have characteristic luster, known as metallic luster and can be polished.	2. Non-metals do not have luster like metals and cannot be polished.
3. They on hitting with hammer give off notes i.e they are Sonorous.	3. They are not sonorous and break on hitting.
4. Metals are malleable and ductile that is they can be converted into sheets and wires.	4. They are usually brittle and break easily when subjected to stress or strain.
5. Metals have great tensile strength and can withstand stress and strain.	5. They are neither malleable nor ductile.
6. They have relatively high densities.	6. They are generally bad conductors of heat and electricity.
7. They are good conductors of heat and electricity. Some common metals are Iron (Fe), Copper (Cu), Aluminum (Al) and Chromium (Cr).	7. They have relatively low densities. Some examples of non-metals are Sulphur (S), Carbon(C), Oxygen (O,), Nitrogen (N,) and Chlorine (Cl).

Q2. Describe metalloids in brief

METALLOIDS

Intermediate properties of metals and non-metals

Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te), Polonium (Po) and Astatine (At) are metalloids.

Q3. Compare the properties of Alkali and Alkaline Earth Metals

ALKALI METALS (IA)	ALKALINE EARTH METALS (IIA)
They are highly reactive than (IIA) group elements due to low ionization energy.	They are less reactive than (IA) group elements due to high ionization energy.

They form monovalent cation(M^+)	They form divalent cation(M^{2+})
They react violently with halogens $2Na + Cl_2 \rightarrow 2NaCl$	They react slowly with halogens $Ca + Cl_2 \rightarrow CaCl_2$
They react with oxygen on heating. $2Mg + O_2 \rightarrow 2MgO$	They immediately tarnish in air and form metal oxide. $K + O_2 \rightarrow KO_2$
They react with water vigorously at room temperature and form strong alkaline solution $2K + 2H_2O \rightarrow 2KOH + H_2$	They react with water less vigorously and form alkaline solution $Mg + H_2O \rightarrow MgO + H_2$ $MgO + H_2O \rightarrow Mg(OH)_2$
Their oxides and hydroxides are more basic than those of IIA group elements.	Their oxides and hydroxides are less basic than those of IA group elements.
They do not form metal carbides.	They form metal carbides on heating. $Ca + 2C \rightarrow CaC_2$

Q4. Give properties of sodium and give its uses

SODIUM (NA)

POSITION:

It is sixth most abundant element and constitutes 2.87% of earth's crust. It belongs to IA group, 3rd period of periodic table.

PHYSICAL PROPERTIES

1. Sodium is silvery white alkali metal.
2. It melts at 97.8°C and boils at 881.4°C.
3. It is soft and can be cut with Knife due to weak metallic bonding between their atoms.
4. Sodium metal has shining surface but its appearance becomes dull due to action of air.

CHEMICAL PROPERTIES

1. Reaction with oxygen

$$2Na + H_2SO_4 \rightarrow Na_2SO_4 + H_2$$

2. Sodium reacts with halogens to form sodium halide.

$$2Na + Br_2 \rightarrow 2NaBr$$

3. Sodium reacts with Sulphruic acid to form H_2 gas

$$2Na + O_2 \rightarrow Na_2O_2$$

4. It violently reacts with H_2O water and form Sodium Hydroxide and Hydrogen gas

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

USES:

1. It is an excellent heat transfer fluid so it is used as coolant in nuclear reactors.
2. It is used in Detergent preparation.
3. It is used as Street lights and gives yellow colour.
4. It is used as Reducing agent in the extraction of Calcium, Zirconium and Titanium

Q5. List common compounds of Sodium and their uses

Soda Ash	Na_2CO_3	Used as water softener	Soda Ash
Baking Soda	$NaHCO_3$	Used in Baking Powder, Health Salt, Beverages	Baking Soda
Table Salt	NaCl	Food Items	Table Salt
Sodium Nitrate	$NaNO_3$	Sodium Nitrate	Used as fertilizer and in Dynamite

Q6. Give properties of magnesium and give its uses

MAGNESIUM (MG)

POSITION:

It is 8th most abundant element found in earth's crust. Magnesium belongs to II-A group and 3rd period of periodic table.

PROPERTIES:

1. It is a grey-white metal.
2. It melts at 650°C and boils at 1090°C.
3. Magnesium fire cannot be extinguished with water because H_2 gas is highly flammable and intensifies the fire.
4. Magnesium fire can be extinguished by using dry sand.
5. Magnesium reacts violently with water and releases Hydrogen gas

$$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$$

USES:

1. It is used in flares and photographic flash bulbs because it burns to produce brilliant white light.
2. Magnesium hydroxide are used as an Antacid.
3. It is used for manufacturing of Mobile Phones, Laptop and Tablet Computers because of light weight and electrical properties.
4. The use of Magnesium reduces the weight of vehicle by replacing steel components of a vehicle.
5. Magnesium alloys are used in aviation industry, space crafts and missile because they are light weight and remain stable at high temperature.

6. Magnesium can be changed into intricate (twisters, knotty) shapes, so it is used in tennis rackets and handles of archery bows.

Q7. Give properties of calcium and give its uses

CALCIUM (CA)

POSITION:

It is 5th abundant metal in earth's crust. It belongs to IIA group and 4th period.

PROPERTIES:

It is silvery white soft metal. It melts at 851oC and boils at 1484oC.

USES:

Calcium is essential for healthy teeth and bones

List common compounds of calcium and their uses.

Slaked lime	$Ca(OH)_2$	As soil conditioner, used in water treatment to reduce acidity. Used in steel industry to remove impurities from Iron ore
Gypsum	$2CaSO_4.H_2O$	It is used as component in construction of buildings. It is used medically in plaster for setting broken bones.
Calcium hypochlorite	$CaOCl_2$	It is used for sterilization of water in swimming pool.
Calcium tungstate	$CaWO_4$	It is used in Luminous paints.
Limestone	$CaCO_3$	As source of CO_2, In Cement industry

Q8. What are soft and hard metals. Also give their examples

SOFT METALS

The metals which are scratched easily are called soft metals.

EXAMPLE

Alkali metals like; Sodium(Na), Potassium (K) and Rubidium (Rb) are soft metals.

HARD METALS

Metals which show strong resistance towards scratching are called hard metals.

EXAMPLE

Nickle (Ni), Iron (Fe), Tungsten(W) are hard metals.

Q9. Differentiate between sodium and iron

Sodium	**Iron**
It is a soft metal of group IA	It is a hard metal VIIIB
It has large atomic size	It has smaller ionic radii
It has low value (0.5) on moh scale	It has high value (4.5) on moh scale
It has weak metallic bonding so it is a soft metal	It has strong metallic bonding so it is hard metal.
It can be cut easily with knife.	It is hammered to form sheets and wires.
It is light due to its low density (0.971 g/cm^3).	It is heavier metal due to its high density (7.87 g/cm^3).
It has low melting and boiling point values (melting point = 98°C, boiling point = 890°C)	It has high melting and boiling point values (melting point = 1535°C, boiling point = 2450°C)

Q10. What is Noble Metal

NOBEL METALS

Nobel metals are less electro positive so they are difficult to oxidize. Therefore, they show no reaction with atmospheric gases and resist corrosion.

EXAMPLES

Gold (Au), Silver (Ag), Platinum (Pt), Iridium (Ir), Osmium (Os), Rhodium (Rh), Ruthenium (Ru), Palladium (Pd).

Q11. Write short note in silver, gold and platinum

SILVER (AG): -

1. It is widely used in society.
2. It is used in Jewelry, decorative items and silver tableware because it does not tarnish and maintain its silvery shiny appearance.
3. It is used to make mirror because it is best reflector of visible light.
4. Silver forms compounds of significant importance.
   Silver Nitrate ($AgNO_3$) or Lunar caustic is used in detection of Halogen.
5. Light sensitive material AgBr and AgI are used in Photographic films.

GOLD (AU): -

1. Gold has importance in our society.
2. It is used in jewelry because it has very high luster, yellow colour and tarnish resistance.
3. Gold is used in electronic components because it is highly efficient conductor of current and cannot corrode.
4. Gold is used in connecting wires, connection strips, switches and relay contacts to make electronic devices highly reliable.
5. Gold is used in cellphones, global positioning systems, Calculators etc.
6. Gold is used in Laptop Computers for rapid and accurate transmission of digital information.
7. It is used in dentistry because it is chemically inert, non-allergic and easy for dentist to work.
8. Gold coated polyester films are used in space vehicles to reflect infrared radiation and stabilize the temperature of space vehicle.
9. The helmet of Astronaut is coated with thin film of gold which reflect intense Solar radiation and protect eyes, skin of astronaut.
10. Glass surface coated with gold will reflect solar radiations outward and keep the buildings cool in summer.
11. It also reflects internal heat inward and keeps the Building warm in winter.
12. Gold symbolizes purity, beauty and stability so it is used in making medals, trophies awards etc.

PLATINUM (PT): -

1. It is a silvery white corrosion resistance metal. It is paramagnetic transition metal.
2. It is used in chemical reactions as catalyst.
3. It is used as catalytic converter in vehicles.
4. It helps the complete combustion of Hydrocarbons and reduces the emission of air pollutants.

Q12. Define Electronegative Characteristics.

ELECTRONEGATIVE CHARACTERISTICS:

A Non-metal has property to accept electron easily and form Anion. It is called electronegative character.

Q13. What are halogens? Give their chemical reaction

HALOGENS

Halogen belongs to VII-A group and consists of Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I) and Astatine (At). Halogens exist in Molecular form. The reactivity of halogens decreases down the group because atomic size increases and electro negativity decreases down the group

1. Halogens act as oxidizing agent, because they easily accept electron.

$$2Na + Cl_2 \rightarrow 2NaCl$$

2. More reactive Halogen can displace less reactive Halogen form a solution of its salt.$2KCl + F_2 \rightarrow 2KF + Cl_2$

3.Reaction of Hydrogen with Halogen form Halogen acid.

$$H_2 + X_2 \rightarrow 2HX \ (X = F_2, Cl_2, r_2, I_2)$$

The Acidic strength of Halogen Acid decreases in the following order

HI > HBr > HCl > HF

EXERCISE/NUMERICAL

Q1. Identify the elements as Metals, Non-metals and Metalloids from the following elements :-

C, Ca, Sb, S, Sr, Si, K, P, Ba, Ge

Q2. Arrange the following Halogen Acids in increasing order of their Acidic strength: HBr, HCl, HI, HF

Q3. Identify the VIIIA group elements from the following

N, Na, Ni, Ne, Ar, At, He.

Q4. Write names and symbols of Nonmetals of VA group elements.

Q5. Which group contain nonmetals in gaseous state only?

Q6. Write names and symbols of few noble metals?

Q7. Why helmets of astronauts are coated with thin film of gold?

Q8. Why glass surface is coated with gold?

Q9. Why gold is used in jewelry?

Q10. Why platinum is used as catalytic converter in vehicles?

Q11. Write melting point, boiling point, density and moh values of sodium and iron.

Q12. Which metal is found in liquid state?

Q13. Identify the alkaline earth metals from the following elements.

Bi, Br, Ba, B, Se, Si, Sb, Sr