Chemistry of Elements

Chemistry of Representative Elements:

- ❖ **Write two names with chemical formula of Al and Si**

Ans: Here are two compounds containing aluminum (Al) and silicon (Si) with their chemical formulas:

1. **Aluminum Oxide (Al_2O_3)**
2. **Silicon Dioxide (SiO_2)**

- ❖ **Write down the characteristics of group 1A elements**

Ans: Group 1A elements, also known as the **alkali metals**, include **Lithium (Li), Sodium (Na), Potassium (K), Rubidium (Rb), Cesium (Cs), and Francium (Fr)**. Here are their key characteristics:

1. **Valence Electrons:**
   - They have **1 valence electron** (ns^1 configuration), making them highly reactive.
2. **High Reactivity:**
   - **Very reactive**, especially with water, forming strong bases and releasing hydrogen gas.
3. **Soft Metals:**
   - They are **soft** and can be easily cut with a knife. Softness increases down the group.
4. **Low Melting and Boiling Points:**
   - They have **low melting and boiling points**, which decrease down the group.
5. **Low Density:**
   - Alkali metals are **low in density**; some (Li, Na, K) float on water.
6. **Flame Colors:**
   - Produce distinct **flame colors**:
     - **Li**: Red, **Na**: Yellow, **K**: Lilac, **Rb**: Red-violet, **Cs**: Blue.
7. **Good Conductors:**
   - They are excellent **conductors of electricity**.
8. **Strong Reducing Agents:**
   - Act as powerful **reducing agents**, easily losing one electron to form **+1 ions**.
9. **Solubility:**
   - Their compounds are highly **soluble in water**, forming strong alkaline solutions (e.g., NaOH, KOH).

- **Write down the name of group 3A elements. Why are they in the same group?**

Ans: **Group 3A Elements (Boron Group):**

1. **Boron (B)**
2. **Aluminum (Al)**
3. **Gallium (Ga)**
4. **Indium (In)**
5. **Thallium (Tl)**
6. **Nihonium (Nh)** (synthetic element)

Group 3A elements (B, Al, Ga, In, Tl, Nh) are in the same group because they share the following characteristics:

1. **Valence Electrons:**
   - All have **3 valence electrons** (ns^2np^1 configuration).
2. **Similar Chemical Properties:**
   - They tend to form **+3 oxidation states** in compounds.
3. **Metallic Character:**
   - Their **metallic nature increases** from boron (a metalloid) to thallium (a metal).
4. **Periodic Trends:**
   - They show similar trends in reactivity, atomic size, and other properties due to their position in the periodic table.

- **Explain why Li is a better reducing agent than Cs**

Ans: Lithium (Li) is a better reducing agent than **Cesium (Cs)** because of the following reasons:

1. **Smaller Atomic Size:**
   - Lithium has a **smaller atomic radius** compared to cesium, making its valence electron more tightly bound to the nucleus.
2. **Higher Ionization Energy:**
   - Lithium requires more energy to remove its valence electron, but once removed, it strongly attracts negative ions, enhancing its reducing ability.
3. **High Reduction Potential:**
   - Lithium has a **higher reduction potential**, meaning it more readily donates electrons in reactions compared to cesium.

❖ **Discuss the properties of Li with special reference to its position in the periodic table. Compare and contrast its properties with those of Na.**

Ans: **Properties of Lithium (Li):**

- **Group and Period:** Lithium is in **Group 1A** (alkali metals) and **Period 2**.
- **Atomic Size:** Lithium has a **small atomic radius** because it's in Period 2.
- **Ionization Energy:** It has **high ionization energy** compared to other alkali metals due to its smaller size.
- **Reactivity:** Less reactive than sodium, partly due to its smaller size and stronger hold on its valence electron.
- **Melting/Boiling Points: Higher melting** (180.5°C) and **boiling points** (1342°C) compared to sodium.
- **Density:** Lower density (0.534 g/cm^3) than sodium.

Comparison with Sodium (Na):

- **Atomic Size:**
  - **Lithium:** Smaller radius (0.152 nm).
  - **Sodium:** Larger radius (0.186 nm).
- **Reactivity:**
  - **Lithium:** Less reactive.
  - **Sodium:** More reactive; loses its valence electron more easily.
- **Melting and Boiling Points:**
  - **Lithium:** Higher melting (180.5°C) and boiling points (1342°C).
  - **Sodium:** Lower melting (98°C) and boiling points (883°C).
- **Density:**
  - **Lithium:** Lower density (0.534 g/cm^3).
  - **Sodium:** Higher density (0.97 g/cm^3).
- **Flame Color:**
  - **Lithium:** Crimson red.
  - **Sodium:** Bright yellow.

❖ **Compare the chemistry of Boron and Aluminium**

Ans: Boron (B) and **Aluminum (Al)** are both elements in Group 3A (Boron group) but have distinct chemical properties due to their different positions in the periodic table. Here’s a comparison of their chemistry:

Atomic and Ionic Size:

- **Boron:** Smaller atomic and ionic radius.
- **Aluminum:** Larger atomic and ionic radius.

Oxidation States:

- **Boron:** Mainly +3, with some +1 in compounds.
- **Aluminum:** Consistently +3.

Reactivity:

- **Boron:** Less reactive; reacts with oxygen to form B_2O_3.
- **Aluminum:** More reactive; reacts easily with acids and bases, forming Al_2O_3.

Compounds:

- **Boron:** Forms amphoteric B_2O_3, boric acid (H_3BO_3), and complex hydrides.
- **Aluminum:** Forms amphoteric Al_2O_3, aluminum hydroxide ($Al(OH)_3$), and $AlCl_3$.

Physical Properties:

- **Boron:** Brittle metalloid.
- **Aluminum:** Malleable metal with good conductivity.

Applications:

- **Boron:** Used in glass, ceramics, and agriculture.
- **Aluminum:** Widely used in construction, packaging, and transportation.

❖ **Explain why alkali metals are highly reactive**

Ans: Alkali metals are highly reactive because they just have to give up a single electron to attain a noble gas configuration or stable electronic configuration. In other words, their ionization energy are very low and hence they can react with other compounds like water easily.

When **sodium** reacts with water, it forms **sodium hydroxide (NaOH)** and **hydrogen gas (H_2)**:

$2Na+2H2O \rightarrow 2NaOH+H2$

The reaction is vigorous and produces heat, showing sodium's high reactivity.

❖ **Write down the application of sulphur**

Ans: Sulfur has a wide range of applications across various industries. Here are some notable uses:

1. Sulfur is mainly used to produce sulfuric acid (H2SO4), which is bulk chemical , used in automobile`s battery (lead-acid batteries).
2. More than 30% of today's agro-chemicals contain at least one sulfur atom, mainly in fungicides, herbicides and insecticides.
3. It is used in gun powder and matches.
4. Calcium sulfate (gypsum) is used in cement and plaster.
5. Sulfur is also used in sulfate and phosphate fertilizer.
6. Sulfur is one of the core chemical elements needed for biochemical functioning and is an elemental macro-nutrient for all living organisms.
7. One of the uses of elemental sulfur is in vulcanization of rubber, where polysulfide chains crosslink organic polymers.

❖ **What is interhalogen compound? Give two example with their molecular shape.**

Ans: Interhalogen compounds are **molecules formed between two different halogens** from Group 17. They typically have the general formula **XY** (binary interhalogen), where X and Y are different halogens. These compounds are more reactive than individual halogens.

Examples and Molecular Shapes:

1. **Chlorine trifluoride (ClF_3):**
   - **Molecular Shape: T-shaped**.
   - **Description:** ClF_3 has three bonding pairs and two lone pairs on chlorine, resulting in a T-shaped molecular geometry.
2. **Iodine pentafluoride (IF_5):**
   - **Molecular Shape: Square pyramidal**.
   - **Description:** IF_5 has five bonding pairs and one lone pair on iodine, creating a square pyramidal shape.

❖ **Why SiO_2 is solid while CO_2 is gas at room temperature?**

Ans: SiO_2 (silicon dioxide) is a **solid** at room temperature because it has a **giant covalent network structure**, where strong covalent bonds connect silicon and oxygen atoms in a 3D lattice. These bonds require a lot of energy to break, resulting in a solid state.

CO_2 (carbon dioxide), on the other hand, is a **gas** because it consists of discrete molecules with weak **van der Waals forces** between them. These weak intermolecular forces are easily overcome, allowing CO_2 to exist as a gas at room temperature.

- ❖ **NCl_5 doesn't exist whereas PCl_5 does**

Ans: **NCl_5** doesn't exist, whereas **PCl_5** does, because of the difference in the ability of nitrogen and phosphorus to expand their valence shells:

- **Nitrogen (N):** Nitrogen is in Period 2, meaning it has only the **2s and 2p orbitals** available for bonding. It cannot expand its octet to accommodate more than 8 electrons due to the absence of available d-orbitals.
- **Phosphorus (P):** Phosphorus is in Period 3 and has access to **3d orbitals**. This allows it to expand its octet and form five bonds, accommodating 10 electrons in compounds like **PCl_5**.

Thus, phosphorus can form **PCl_5**, but nitrogen cannot form **NCl_5** because it cannot expand its valence shell beyond 8 electrons.

- ❖ **Write down the names with chemical formula of Al and Si containing minerals.**

Ans: Here are the names of minerals containing **Aluminum (Al)** and **Silicon (Si)** along with their chemical formulas:

Aluminum-containing Minerals:

1. **Bauxite** – **$Al_2O_3 \cdot xH_2O$** (main source of aluminum).
2. **Corundum** – **Al_2O_3** (a crystalline form of aluminum oxide).

Silicon-containing Minerals:

1. **Quartz** – **SiO_2** (a common form of silicon dioxide).
2. **Feldspar** – **$KAlSi_3O_8$** (common in rocks and soils, contains both aluminum and silicon).

- **Write down the names of group 3A elements**

Ans: The elements in **Group 3A** (Group 13) of the periodic table are:

1. Boron (B)
2. Aluminum (Al)
3. Gallium (Ga)
4. Indium (In)
5. Thallium (Tl)
6. Nihonium (Nh)

- **Write down the names, formulas, structure, and oxidation states of Nitrogen in a table**

Ans: Here's a table summarizing the **names**, **formulas**, **structures**, and **oxidation states** of various nitrogen compounds:

Name	Formula	Structure	Oxidation State of Nitrogen
Nitrogen gas	N_2	Linear ($N \equiv N$)	0
Ammonia	NH_3	Trigonal pyramidal	-3
Hydrazine	N_2H_4	H_2N-NH_2 (Bent structure)	-2
Nitrous oxide (Laughing gas)	N_2O	Linear (N=N=O)	+1
Nitric oxide	NO	Linear (N=O)	+2
Nitrogen dioxide	NO_2	Bent (O=N=O)	+4
Nitric acid	HNO_3	Planar (O=N(OH)=O)	+5
Dinitrogen tetroxide	N_2O_4	Planar (O_2N-NO_2)	+4
Nitrite ion	NO_2^-	Bent ($O=N-O^-$)	+3
Nitrate ion	NO_3^-	Trigonal planar ($O=N-O_2^-$)	+5

- **What do you mean by allotropic forms? What are the allotropic forms of oxygen and sulphur?**

Ans: Allotropic forms are different structural forms of the same element, each with distinct physical and chemical properties, due to variations in atomic arrangement.

Allotropic Forms of Oxygen:

1. **O_2 (Diatomic Oxygen):** Two oxygen atoms double-bonded (O=O).
2. **O_3 (Ozone):** Three oxygen atoms in a bent shape (O-O-O).

Allotropic Forms of Sulfur:

1. **Rhombic Sulfur:** S_8 rings in a rhombic crystal lattice.
2. **Monoclinic Sulfur:** S_8 rings in a monoclinic crystal lattice.

- ❖ **PF_5 is possible but NF_5 is not possible why?**

Ans: **PF_5** is possible, but **NF_5** is not, primarily due to differences in the ability of phosphorus and nitrogen to expand their valence shells:

1. **Phosphorus (P):**
    - **Expansion of Octet:** Phosphorus, being in Period 3, has access to **d-orbitals** in addition to its s and p orbitals. This allows phosphorus to accommodate more than 8 electrons, making it possible to form **PF_5**, where phosphorus forms five bonds with fluorine atoms.
2. **Nitrogen (N):**
    - **Lack of d-Orbitals:** Nitrogen is in Period 2 and does not have available d-orbitals. As a result, it cannot expand its valence shell beyond 8 electrons. This limitation makes it impossible for nitrogen to form **NF_5**. Nitrogen can form a maximum of four bonds (as seen in compounds like **NH_4^+** or **NCl_3**).

Chemistry of the Elements

Metallurgy of some selected elements:

1.What is metallurgy?

Metallurgy is the branch of science and engineering concerned with the study of metals, their properties, production, and processing. It involves the extraction of metals from ores, refining them, and developing ways to create useful products through various processes like casting, forging, and alloying.

2.Discribe briefly the metallurgy of (Fe)

The metallurgy of **iron (Fe)** involves several key processes to extract and refine it from its ores, mainly in the form of iron oxides such as hematite (Fe_2O_3) and magnetite (Fe_3O_4). The most common method used for iron extraction is through the **blast furnace process**, followed by refining processes to produce different grades of iron and steel.

3. Occurrence and extraction of (Fe)

Occurrence of Iron (Fe)

Iron is the second most abundant metal in the Earth's crust, making up about 5% of its composition. It is primarily found in the form of **iron ores** as oxides, carbonates, and sulfides. The most common iron ores include:

1. **Hematite (Fe_2O_3)**: The most important iron ore, containing about 70% iron by weight.
2. **Magnetite (Fe_3O_4)**: Another major iron ore, with high iron content (72%).
3. **Limonite ($FeO(OH)\cdot nH_2O$)**: A hydrated iron oxide, containing 40-60% iron.
4. **Siderite ($FeCO_3$)**: Iron carbonate ore, containing about 48% iron.
5. **Pyrite (FeS_2)**: Also known as fool's gold, but not typically used for iron extraction because of its sulfur content.

Extraction of Iron

The extraction of iron is primarily done through the **blast furnace process**, where iron is extracted from its ore, typically hematite or magnetite. The major steps involved in the extraction of iron are:

1. Mining: Iron ores, mainly hematite (Fe_2O_3) and magnetite (Fe_3O_4), are extracted through open-pit or underground mining.

2. Concentration: The ore is crushed and sometimes concentrated using **magnetic separation**.

3. Reduction in Blast Furnace: The iron ore is mixed with coke (carbon) and limestone ($CaCO_3$) and heated in a blast furnace.

- **Combustion of Coke**:

$$C + O_2 \rightarrow CO_2$$

This generates heat and produces carbon dioxide (CO_2).

- **Formation of Carbon Monoxide**:

$$CO_2 + C \rightarrow 2CO$$

Carbon monoxide (CO) acts as the main reducing agent in the furnace.

- **Reduction of Iron Ore**: The carbon monoxide reduces the iron ore to molten iron:

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

This produces **molten iron** (also called **pig iron**) which collects at the bottom of the furnace.

4. Purification: The molten iron, called **pig iron**, can be further refined in a **basic oxygen furnace** to produce steel.

This process yields iron for various industrial applications.

4.Occurrence and extraction of (Mg)

Occurrence of Magnesium (Mg)

Magnesium is the eighth most abundant element in the Earth's crust and is found primarily in the following forms:

1. **Minerals**:
    - **Magnesite ($MgCO_3$)**: A major source of magnesium.
    - **Dolomite ($CaMg(CO_3)_2$)**: A common mineral containing both calcium and magnesium.
2. **Seawater**:
    - Seawater contains dissolved magnesium salts, primarily in the form of **magnesium chloride ($MgCl_2$)**. About 0.13% of seawater is magnesium.

Extraction of Magnesium

There are two main methods for extracting magnesium: **electrolytic process** and **thermal reduction**.

1. Electrolytic Process (from seawater or brine):

This is the most common method for extracting magnesium from **seawater** or **brines**.

Key Steps:

- **Precipitation**: Seawater or brine is treated with **calcium hydroxide ($Ca(OH)_2$)**, which reacts with dissolved magnesium to form **magnesium hydroxide ($Mg(OH)_2$)**:

$$Mg^{2+} + 2OH \rightarrow Mg(OH)_2$$

- **Conversion to Magnesium Chloride**: Magnesium hydroxide is then treated with **hydrochloric acid (HCl)** to form **magnesium chloride ($MgCl_2$)**:

$$\mathrm{Mg}(OH)_2 + 2HCl \rightarrow \mathrm{Mg}Cl_2 + 2H_2O$$

- **Electrolysis**: The magnesium chloride is melted and subjected to **electrolysis**. An electric current is passed through molten $MgCl_2$, separating magnesium metal from chlorine gas:

$$\mathbf{Mg}\boldsymbol{Cl_2} \rightarrow \mathbf{Mg} + \boldsymbol{Cl_2}$$

Magnesium metal is collected at the cathode, and chlorine gas is released at the anode.

<u>2. Thermal Reduction Process (Pidgeon Process):</u>

This method is commonly used when extracting magnesium from **magnesite** or **dolomite**.

Key Steps:

- **Calcination**: The ore (magnesite or dolomite) is heated to high temperatures (~1200°C) in a furnace to form magnesium oxide (MgO):

$$\boldsymbol{MgCO_3 \rightarrow MgO + CO_2}$$

- **Reduction**: The magnesium oxide is mixed with a reducing agent, typically **ferrosilicon (FeSi)**, and heated in a vacuum or a sealed furnace. The magnesium oxide is reduced to magnesium metal vapor, which is then condensed into solid magnesium:

$$\boldsymbol{2MgO + Si \rightarrow 2mg + SiO_2}$$

5.Occurrence and extraction of (Al)

<u>Occurrence of Aluminum (Al)</u>

Aluminum is the most abundant metal in the Earth's crust, making up about 8%. However, it is rarely found in its pure form due to its high reactivity. It commonly occurs in compounds, primarily in **bauxite**, the main ore of aluminum. **Bauxite** contains aluminum minerals like:

- **Gibbsite ($Al(OH)_3$)**
- **Boehmite ($AlO(OH)$)**
- **Diaspore ($AlO(OH)$)**

Aluminum is also found in other minerals, such as **cryolite (Na_3AlF_6)**, but bauxite is the primary source for commercial aluminum extraction.

Extraction of Aluminum

The extraction of aluminum is mainly done using the **Bayer process** and the **Hall-Héroult process**.

1. Bayer Process (Refining Bauxite to Alumina):

- **Crushing and Grinding**: Bauxite is crushed and ground.
- **Digestion**: Bauxite is treated with **sodium hydroxide (NaOH)** at high temperature, dissolving aluminum compounds into **sodium aluminate**, leaving impurities as red mud.

$$Al(OH)_3 + NaOH \rightarrow NaAlO_2 + 2H_2O$$

- **Precipitation**: Aluminum hydroxide precipitates out of the solution.

$$NaAlO_2 + 2H_2O \rightarrow Al(OH)_3 + NaOH$$

- **Calcination**: Aluminum hydroxide is heated to produce **alumina (Al_2O_3)**.

$$2Al(OH)_3 \rightarrow Al_2O_3 + 3H_2O$$

2. Hall-Héroult Process (Electrolytic Reduction of Alumina to Aluminum):

- **Electrolysis Setup**: Alumina is dissolved in molten **cryolite (Na_3AlF_6)** and placed in an electrolytic cell.
- **Electrolysis**: Electric current reduces alumina to **molten aluminum** at the cathode, and oxygen is released at the anode, which reacts with carbon to form CO_2.

$$Al_2O_3 \rightarrow 4Al_3 + 3O_2$$

At the Cathode: $4Al^{3+} + 12e$- $\rightarrow 4Al$ (molten aluminum collects at the bottom)

At the Anode: $6O^{2-} \rightarrow 3O_2 + 12e^{-}$ (oxygen reacts with carbon to form CO_2)

6.Occurrence and extraction of (Cu)

Copper (Cu) is a versatile metal that has been used by humans for thousands of years due to its excellent electrical conductivity, thermal conductivity, malleability, and resistance to corrosion. Its occurrence and extraction involve several key processes.

Occurrence of Copper

Copper is found in various forms in nature, mainly in the form of ores. The most common copper ores are:

1. **Chalcopyrite ($CuFeS_2$):** The most abundant copper ore, making up around 70% of all copper reserves.
2. **Chalcocite (Cu_2S):** A significant copper ore with a higher concentration of copper.
3. **Bornite (Cu_5FeS_4):** Contains both copper and iron, also a commercially viable source of copper.
4. **Malachite ($Cu_2CO_3(OH)_2$):** A green mineral and one of the oldest copper ores used by humans.
5. **Azurite ($Cu_3(CO_3)_2(OH)_2$):** A blue copper carbonate mineral.
6. **Cuprite (Cu_2O):** A relatively rare ore, it is an important secondary source of copper.
7. **Native Copper (Cu):** Metallic copper found in nature, though relatively rare.

Extraction of Copper

The extraction of copper (Cu) involves the following steps:

1. **Mining:** Copper ores, mainly chalcopyrite ($CuFeS_2$), are mined through open-pit or underground methods.
2. **Concentration:** The ore is crushed and concentrated using **froth flotation**.
3. **Roasting (Smelting):** The concentrated ore is heated in the presence of oxygen to produce copper matte (Cu_2S) and sulfur dioxide (SO_2).
4. **Conversion:** The matte is further heated to remove impurities, producing **blister copper** (98% pure).

5. **Refining:** Blister copper is refined by **electrolysis**, producing **99.99% pure copper**.

7.Occurrence and extraction of (Zn)

Occurrence of Zinc (Zn)

Zinc is primarily found in the Earth's crust in the form of various ores. The most common zinc ores include:

1. **Sphalerite (ZnS):** The most important and widely mined zinc ore, accounting for the majority of zinc production.
2. **Smithsonite ($ZnCO_3$):** A carbonate ore of zinc.
3. **Zincite (ZnO):** A zinc oxide ore, though less common.
4. **Hemimorphite ($Zn_4Si_2O_7(OH)_2 \cdot H_2O$):** A silicate ore of zinc.

Zinc is also found in small amounts as a trace element in other ores and minerals.

Extraction of Zinc

The extraction of zinc (Zn) involves the following steps:

1. **Mining:** Zinc ores, mainly sphalerite (ZnS), are mined through open-pit or underground methods.
2. **Concentration:** The ore is crushed and concentrated using **froth flotation**.
3. **Roasting:** The concentrated zinc sulfide (ZnS) is heated with oxygen to produce zinc oxide (ZnO) and sulfur dioxide (SO_2).

$$\boldsymbol{2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2}$$

4. **Reduction:** Zinc oxide is reduced to metallic zinc by:
   - **Smelting (pyrometallurgy):** ZnO is heated with carbon (coke) to produce zinc metal.

$$\boldsymbol{ZnO + C \rightarrow Zn + CO}$$

- **Electrolysis (hydrometallurgy):** ZnO is leached with sulfuric acid, and pure zinc is recovered via electrolysis.

5. **Purification:** The zinc is purified to **99.99%** purity through refining processes.

Inert Gas:

1.Use or Application of inert gases

Inert gases, also known as noble gases, are a group of elements in Group 18 of the periodic table. They include helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), and radon (Rn). Their inertness, due to their full valence electron shells, makes them useful in various applications:

1. **Helium (He)**: Helium is lighter than air and used to fill balloons and airships. Helium is used as a coolant in superconducting magnets and other low-temperature applications due to its very low boiling point.
2. **Neon (Ne)**: Neon lamps are used in high-voltage indicators and as indicators in electrical circuits.
3. **Argon (Ar)**: Argon is used as an inert gas shield in arc welding to prevent oxidation and contamination of the weld.
4. **Krypton (Kr)**: Krypton is used in certain types of high-efficiency lighting, including some types of fluorescent lamps.
5. **Xenon (Xe)**: Xenon is used in some medical anesthetics due to its anesthetic properties.
6. **Radon (Rn)**: Historically, radon was used in cancer treatment, though its use has declined due to its radioactivity and health risks.

2.Write the name of the inert gases with electronic configuration

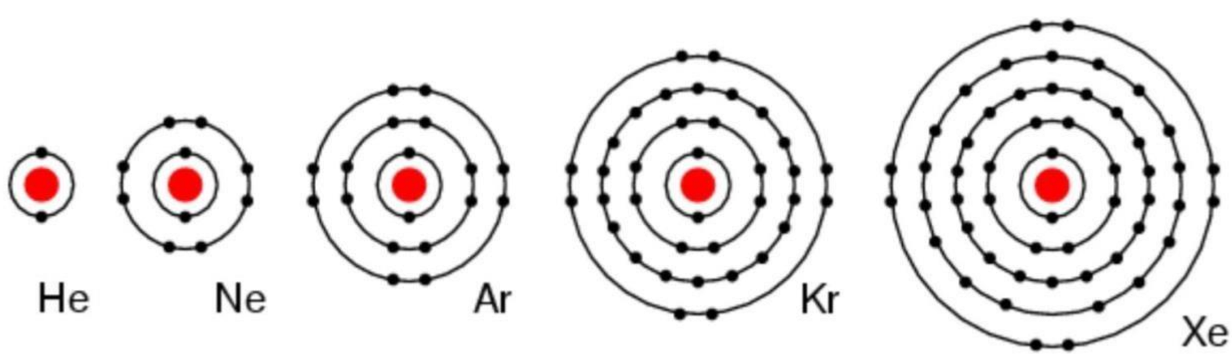
Here are the inert gases with their respective electron configurations:

1. **Helium (He)**:
   - **Electron Configuration**: $1s^2$

2. **Neon (Ne)**:
   - **Electron Configuration**: $1s^2\ 2s^2\ 2p^6$
3. **Argon (Ar)**:
   - **Electron Configuration**: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
4. **Krypton (Kr)**:
   - **Electron Configuration**: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6$
5. **Xenon (Xe)**:
   - **Electron Configuration**: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6$
6. **Radon (Rn)**:
   - **Electron Configuration**: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6$

3.Explain why inert gases are chemically inactive

Inert gases, also known as noble gases, are chemically inactive due to their electronic configuration. These gases- helium, neon, argon, krypton, xenon, and radon—have full valence electron shells, which makes them highly stable. Atoms of these gases have eight electrons in their outer shell (except for helium, which has two), following the octet rule. This complete electron configuration means they do not need to gain, lose, or share electrons to achieve stability, which is why they do not readily react with other elements. Their lack of reactivity is a key characteristic that distinguishes them from other elements.



4.Why their inert and discuss their position in the periodic table of elements?

Position of nobel gas in periodic table of elements The term "inert" typically refers to the lack of reactivity or interaction with other substances. The term can also apply to substances that do not react under normal conditions, like certain metals or materials. In chemistry, "inert" is often used to describe noble gases like helium, neon, and argon, which are characterized by their very low reactivity due to having full electron shells. This full valence shell makes them chemically stable and unlikely to form compounds with other elements. So noble gases are known as inert gases because of their reluctance to combine with other elements to form compounds.

Nobel gases are also known as inert gases and do not take part in chemical reactions. They have their outermost shell complete and thus remain stable. They do not combine with other substances, nor they affected by oxidising agents or by reducing agents. So they are placed in the 18 or VIIIA group. Since, the outermost shell is complete, the valency is zero, hence VIIIA group is also referred to as zero group.