Metals And Non-Metals

1) What are the physical properties of metals?

A) 1. Metals are strong, hard to cut.

2. Metals are solid in state.

3. Metals are lustrous i.e. shiny in nature.

Example: gold–shiny yellow; silver, zinc, aluminum -shiny grey; Copper- shiny reddish brown.

4. Metals are sonorous i.e. producing ringing sound. Examples: iron, silver, gold etc...

5. Metals are malleable i.e. can be drawn into thin sheets. Highly malleable metals are gold, silver, copper etc.…

6. Metals are ductile i.e. can be drawn into thin wires. Highly ductile metals are gold (can be drawn 1gm into wire of length 2kms), silver, copper etc.…

7. They are good conductors of heat. Examples: silver, copper (**note**: lead and mercury are comparatively poor conductors of heat)

8. They are good conductors of electricity. Examples: silver, copper, aluminum etc...

9. Metals have high melting point.

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2)What are the physical properties of Non-Metals?

A) 1. They are brittle.

2. They exist in three states of matter.

3. They are having dull surface.

4. They are not ductile and malleable.

5. They are not good conductors of heat and electricity.

6. They have low melting and boiling points.

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3)Write the exceptional cases of metals and non-metals.

A)

Sl.No	Metals	Non-Metals
1.	Mercury – A metal existed in liquid state.	Non-Metals like Iodine, Carbon in the form of Diamond is having lustrous surface.

2.	Gallium & Cesium - Metals have very low melting points. (these two metals melt even at our body temperature.)	Diamond and Graphite are allotropes of carbon having high melting points.
3.	Metals like Lithium, Sodium, Potassium, Magnesium are so soft even they cut with a knife.	Carbon a non-metal in the from of Diamond is very hard.
4.		Carbon a non-metal in the form of Graphite is a good conductor of electricity.

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4) Explain the reaction of following metals with Oxygen. (burning in air)

A) **Magnesium**:

i. Burning in air with white dazzle light.

ii. Chemical equation: $2Mg + O_2 \longrightarrow 2MgO$

iii. Magnesium Oxide dissolves in water.

Aluminium:

i. Aluminium doesn't burns in air but it burns in the presence of oxygen burn with a brilliant white flame.

ii. Chemical equation: $4Al + 3O_2 \longrightarrow 2Al_2O_3$

iii. Aluminium Oxide (Al_2O_3) is insoluble in water.

Copper:

i. Generally at ordinary conditions copper doesn't burns in air but it forms a black color layer on the surface of copper metal.

ii. Chemical equation: $2Cu+O_2 \longrightarrow 2CuO$.

iii. Copper Oxide (CuO) is insoluble in water.

Iron:

i. Iron can burn in the form of iron fillings with non-luminous color.

ii. Chemical equation: $3Fe+2O_2 \longrightarrow Fe_3O_4$.

iii. Iron Oxide (Fe_3O_4) is insoluble in water.

Lead:

i. Lead doesn't burn in air, but on heating it's surface changes into yellowish color.

ii. Chemical equation: $2Pb+O_2 \longrightarrow 2PbO$.

iii. Lead Oxide (PbO) is insoluble in water.

Zinc:

i. Zinc burns in air with a bright blueish green flame with fumes.

ii. Chemical equation: $2Zn + O_2 \longrightarrow 2ZnO$

iii. Zinc Oxide (ZnO) is insoluble in water.

Sodium:

i. Sodium react so vigorously with oxygen that it catches fire if kept in the open.

ii. Chemical equation: $4Na + O_2 \longrightarrow 2Na_2O$

iii. Sodium Oxide (Na_2O) is soluble in water.

Potassium:

i. Potassium react so vigorously with oxygen that it catches fire if kept in the open.

ii. Chemical equation: $4K + O_2 \longrightarrow 2K_2O$.

iii. Potassium Oxide (K_2O) is soluble in water.

Note: Reactivity order of given metals with oxygen is "K>Na > Mg > Al > Zn > Fe > Pb > Cu".

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5) What are amphoteric oxides? Give examples. Give reactions with acids and bases.

A) Metal oxides which are reacts with both acids and bases are called amphoteric oxides.

Example: Aluminium Oxide (Al_2O_3), Zinc Oxide (ZnO).

Chemical equations:

i. Reaction with acids:

$Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$.

$ZnO + H_2SO_4 \longrightarrow ZnSO_4 + H_2O$.

ii. Reaction with bases:

$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2$ (Sodium Aluminate) $+ H_2O$.

$ZnO + 2NaOH \longrightarrow Na_2ZnO_2$(Sodium Zincate) $+ H_2O$.

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6) Why sodium and potassium are stored in kerosene oil?

A) Potassium and sodium react so vigorously that they catch fire if kept in open. Hence to protect them and to prevent accidental fires. So, they are stored in kerosene.

7) What is "Anodizing"?

A) Formation of thick protective oxide layer on aluminium articles by electrolysis process is called Anodizing. The aluminium oxide layer prevents the metal from further oxidation and protect articles.

8) Why metals like Magnesium, Zinc, Aluminium, lead etc... are covered with a thin layer of oxide while kept in air?

A)1. Metals like magnesium, zinc, aluminum, and lead develop a thin layer of oxide on their surface when exposed to air due to a process called **oxidation**.

2. This thin oxide layer forms as a result of the metal reacting with oxygen in the air.

3. The protective oxide layer prevents the metal from further oxidation.

9) Explain the reaction of metals with water.

A) **Cold Water**:

i. Metals like Sodium and Potassium reacts violently with cold water.

ii. The reaction is so violent and exothermic that the evolved hydrogen immediately catches fire.

iii. $2K + 2H_2O \longrightarrow 2KOH\ (aq) + H_2 + \text{Heat energy.}$

$2Na + 2H_2O \longrightarrow 2NaOH\ (aq) + H_2 + \text{Heat energy.}$

iv. Calcium reacts with cool water is less violent.

$Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2.$

Hot Water: Magnesium a metal reacts with hot water.

$Mg + 2H_2O \longrightarrow Mg(OH)_2 + H_2.$

Steam: Aluminium, Iron and Zinc reacts with steam only and produce Hydrogen gas.

$2Al + 3H_2O(g) \longrightarrow Al_2O_3 + 3H_2.$

$3Fe + 4H_2O(g) \longrightarrow Fe_3O_4 + 4H_2.$

$Zn + H_2O(g) \longrightarrow ZnO + H_2.$

10)Why there will be an occurrence of fire when sodium and magnesium react with cold water whereas calcium do not produce fire?

A)1. The reaction between Sodium and Magnesium with cold water is exothermic process.

2. So, it releases a required amount of heat, which can burn the produced hydrogen gas.

3. Where as in case of Calcium there will be no required amount of heat produced to burn the liberated hydrogen gas.

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11) When calcium is placed in water, why it floats on water?

A) calcium floats on water primarily because of the hydrogen gas bubbles that form on its surface during the reaction.

Note: i. Metal Oxides like (CaO, MgO, Na_2O etc.) are basic in nature.

ii. If metal oxides are dissolved in water, produce Bases.

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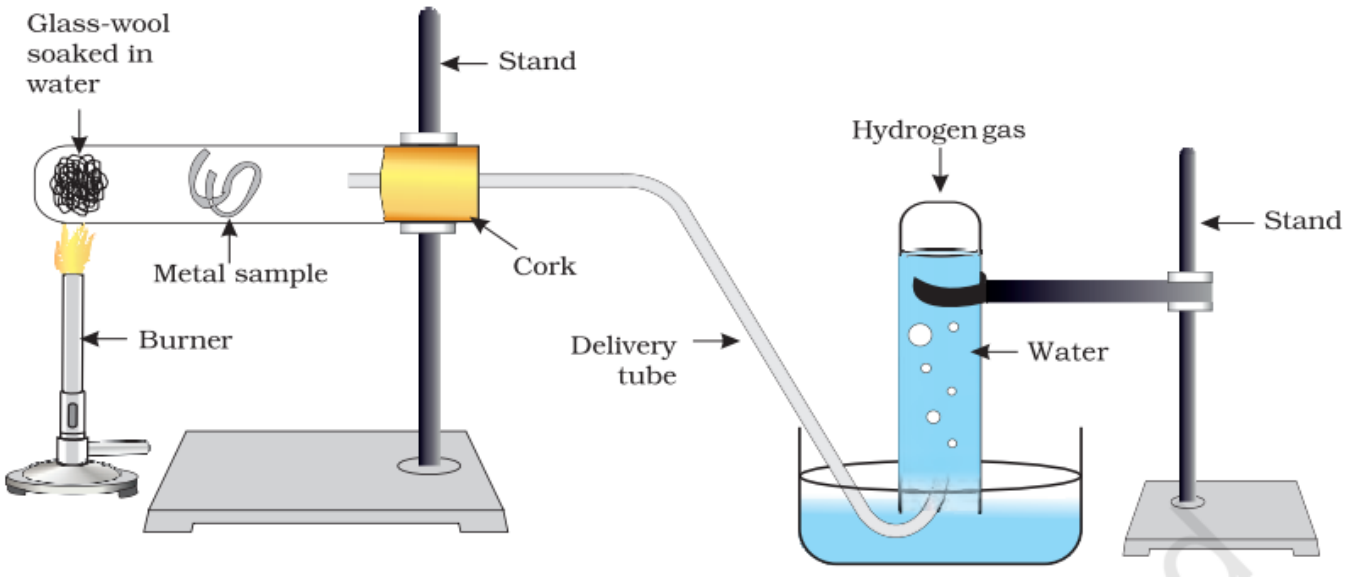
12)Draw a neat labeled diagram of action of steam on metals like Aluminium etc.

A)



Reaction of steam with metals like Aluminium, iron etc.

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13) What happens when metals react with acids?

A) Generally, when metals are reacting with acids, produce Hydrogen gas.

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14) Why Hydrogen gas is not evolved when a metal reacts with Nitric Acid (HNO_3)?

A)1. Because Nitric acid is a strong oxidizing agent.

2. It oxidizes the Hydrogen gas produced to water and itself gets reduced to any of the nitrogen oxides.

3. Example: $Fe + 6HNO_3 \longrightarrow Fe(NO_3)_3 + 3NO_2 + 3H_2O$.

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15) Name the metals reacts with Nitric Acid and produce Hydrogen gas. Give chemical equations.

A)1. Magnesium and Manganese react with very dilute Nitric acid to evolve H_2 gas.

2. $Mg + 2\,HNO_3 \longrightarrow Mg(NO_3)_2 + H_2\uparrow$

$Mn + 2\,HNO_3 \longrightarrow Mn(NO_3)_2 + H_2\uparrow$

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16) What is aqua regia? Explain.

A)1. It is also called Royal water.

2. Aqua regia is the freshly prepared mixture of 3:1 ratio of concentrated Hydrochloric Acid (conc. HCl) and concentrated Nitric Acid (conc. HNO_3).

3. It is highly corrosive, fuming liquid.

4. It can dissolve gold and platinum.

Note: Gold and silver are metals doesn't react with oxygen, any form of water and any acid.

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17) Name the metals used in the making of jewelry. Why?

A)1. Gold, Silver and platinum are the most commonly used metals in jewelry making.

2.Because,

i. Lustrous – appear to shiny.

ii. Malleable and ductile nature helps making jewelry in desired shape.

iii. Very low reactive.

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18) How do metals react with solutions of other metal salts?

A)1. When a metal is placed in a solution of another metal's salt, a **displacement reaction** can occur.

2. In this reaction, a more reactive metal displaces a less reactive metal from its salt solution.

3. More reactive metal+ Metal salt solution→ Less reactive metal +New salt solution.

4. Example: i. $Zn(s)+CuSO_4\,(aq)\rightarrow ZnSO_4\,(aq)+Cu(s)$

ii. $2Al(s)+3FeCl_3\,(aq)\rightarrow 2AlCl_3(aq)+3Fe(s)$

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19) What is reactivity series?

A) A list of metals arranged in the decreasing order of their chemical reactivity is called Reactivity series.

K > Na > Ca > Mg > Al	>	Zn > Fe > Pb	>	Cu > Hg > Ag > Au
Most reactive metals		Moderative reactive		Low reactive metals

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20) Define the following.

A)i. **Atomic Number(Z)**: Number of protons present in the nucleus of atom of an element is called atomic number.

ii. **Electronic Configuration**: The systematic arrangement of electrons in the orbits of atom of an element is called Electronic Configuration.

iii. **Valence Shell**: The outer most orbit of an atom is called valance shell.

iv. **Valence electrons**: The number of electrons present in the Valance shell/ outer most shell is called valance electrons.

v. **Octet Configuration**: There are 8 electrons present in the valance shell of atom of an element is called Octet Configuration.

vi. **Valency**: The maximum number of electrons either loss or gain by atom of an element to get octet configuration in its valence shell is called Valency.

Note: The maximum number of electrons either loss or gain by atom of an element is 4.

vii. **Electron Dot Structure**: Representation of valence electrons of atom of an element around the symbol of element with dots (**.**) or cross (**x**) is called electron dot structure.

viii. **Cation**: A cation is a positively charged ion. It forms when an atom or molecule loses one or more electrons.

ix. **Anion**: An anion is a negatively charged ion. It forms when an atom or molecule gains one or more electrons

x. **Chemical Bond**: The force of attraction existed between two or more atoms of same element or different elements is called chemical bond.

xi. **Ionic Bond**: a) A bond is existed between atoms of different elements by transfer of electron(s) is called Ionic bond.

b) A bond is existed between two oppositely charged ions is called Ionic bond.

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21) Note:

Sl. no	Name of element	Atomic Number (z)	Electronic Configuration K	L	M	N	Valence Electrons	Valency	Electron Dot Structure
1.	Helium (He)	2	2				2	0	
2.	Neon (Ne)	10	2	8			8	0	
3.	Argon (Ar)	18	2	8	8		8	0	
4.	Sodium (Na)	11	2	8	1		1	+1	
5.	Magnesium (Mg)	12	2	8	2		2	+2	
6.	Aluminium (Al)	13	2	8	3		3	+3	
7.	Potassium (K)	19	2	8	8	1	1	+1	
8.	Calcium (Ca)	20	2	8	8	2	2	+2	
9.	Nitrogen (N)	7	2	5			5	-3	
10.	Oxygen (O)	8	2	6			6	-2	
11.	Fluorine (F)	9	2	7			7	-1	
12.	Phosphorous (P)	15	2	8	5		5	-3	
13.	Sulphur (S)	16	2	8	6		6	-2	
14.	Chlorine (Cl)	17	2	8	7		7	-1	

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22) Write the properties of Ionic Compounds.

A)1. Ionic compounds are existed in solid state and these are brittle in nature.

Reason: Strong electrostatic forces of attraction existed between oppositely charged ions.

2. They are having high melting and boiling points.

Reason: Because of strong electrostatic force of attraction existed between opposite charged ions. Hence required more amount of energy to break the strong inter ionic attraction.

3. Ionic compounds are soluble in water but not solvents like kerosene and petrol.

Reason: Electrovalent compounds soluble in polar solvents but not in non-polar solvents.

4. Ionic compounds are bad conductors of electricity in solid state because having no free electrons as well as no ions.
5. But ionic compounds are good conductors of electricity in the form of molten state or in aqueous solution because of presence of ions.

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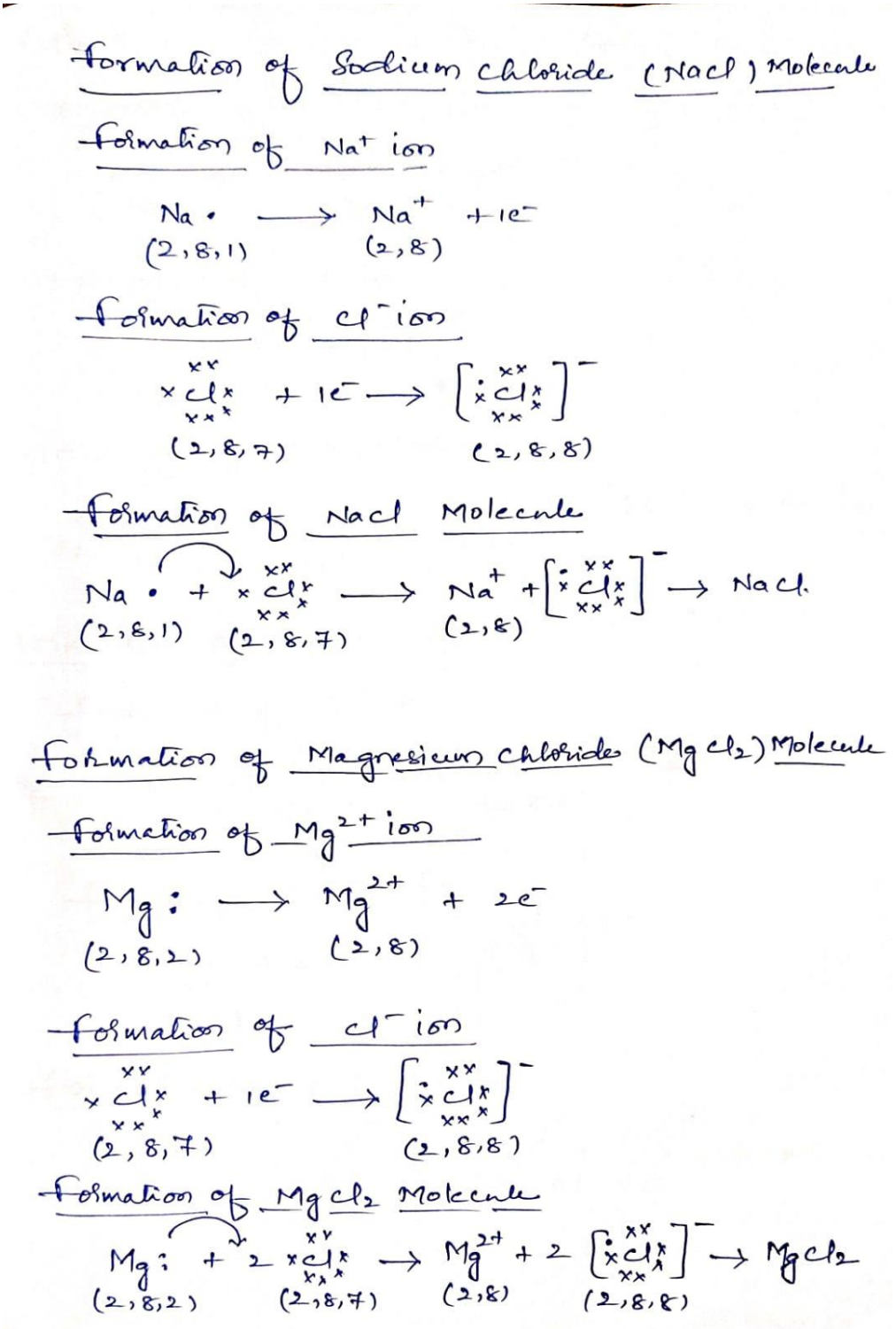
23) Show the formation of following molecules.

A)



Formation of Aluminium chloride ($AlCl_3$) Molecule

Formation of Al^{3+} ion

$$\underset{(2,8,3)}{\dot{A}l:} \longrightarrow \underset{(2,8)}{Al^{3+}} + 3e^-$$

Formation of Cl^- ion

$$\underset{(2,8,7)}{:\ddot{Cl}:} + 1e^- \longrightarrow \underset{(2,8,8)}{\left[:\ddot{Cl}:\right]^-}$$

Formation of $AlCl_3$ Molecule

$$\underset{(2,8,3)}{\dot{A}l:} + 3\ \underset{(2,8,7)}{:\ddot{Cl}:} \longrightarrow \underset{(2,8)}{Al^{3+}} + 3\left[:\ddot{Cl}:\right]^- \rightarrow AlCl_3.$$

Formation of Calcium Oxide (CaO) molecule

Formation of Ca^{2+} ion

$$\underset{(2,8,8,2)}{Ca:} \longrightarrow \underset{(2,8,8)}{Ca^{2+}} + 2e^-$$

Formation of O^{2-} ion

$$\underset{(2,6)}{:\ddot{O}:} + 2e^- \longrightarrow \underset{(2,8)}{\left[:\ddot{O}:\right]^{2-}}$$

Formation of CaO molecule

$$\underset{(2,8,8,2)}{Ca:} + \underset{(2,6)}{:\ddot{O}:} \longrightarrow \underset{(2,8,8)}{Ca^{2+}} + \underset{(2,8)}{\left[:\ddot{O}:\right]^{2-}} \longrightarrow CaO$$

Formation of Aluminium Oxide (Al_2O_3) molecule

Formation of Al^{3+} ion

$$\dot{Al}: \longrightarrow Al^{3+} + 3e^-$$
(2,8,3) (2,8)

Formation of O^{2-} ion

$$\overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}} + 2e^- \longrightarrow \left[:\overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}}\right]^{2-}$$
(2,6) (2,8)

Formation of Al_2O_3 Molecule

$$2\,\dot{Al}: + 3\,\overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}} \longrightarrow 2\,Al^{3+} + 3\left[:\overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}}\right]^{2-} \rightarrow Al_2O_3.$$
(2,8,3) (2,6) (2,8)

Formation of Sodium Oxide (Na_2O) Molecule

Formation of Na^+ ion

$$Na\cdot \longrightarrow Na^+ + 1e^-$$
(2,8,1) (2,8)

Formation of O^{2-} ion

$$\overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}} + 2e^- \longrightarrow \left[:\overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}}\right]^{2-}$$
(2,6)

Formation of Na_2O molecule

$$2\,Na\cdot + \overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}} \longrightarrow 2\,Na^+ + \left[:\overset{\times\times}{\underset{\times\times}{O}}\overset{\times}{\underset{\times}{}}\right]^{2-} \rightarrow Na_2O$$
(2,8,1) (2,6) (2,8) (2,8)

24) Explain the electrical conductivity of ionic compounds in the form of aqueous solution.

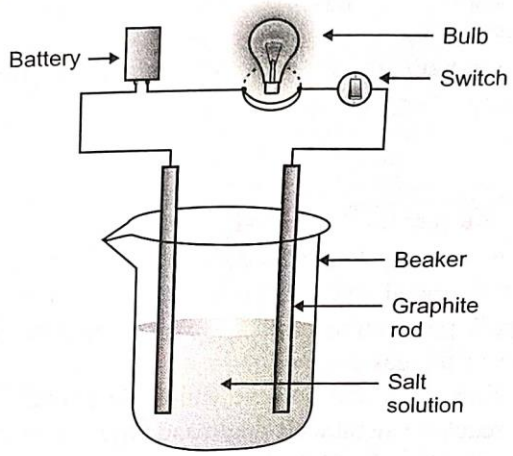
A)

Aim : **To show that ionic compounds conduct electricity in an aqueous solution.**

Materials Required : Connecting wires, battery, ammeter, beaker, distilled water, sodium chloride.

Procedure :

1. Take 100 mL of distilled water in a beaker.
2. Complete the circuit as shown in diagram.
3. Add little amount of sodium chloride into this beaker and stir the solution.
4. Switch ON the circuit and observe the reading of an ammeter.



Aqueous solution of ionic compounds conducts electricity

Observation : There is a deflection in the ammeter reading.

Conclusion : It shows that ionic compounds conduct electricity in an aqueous solution.

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25) Define the following.

A) a. **Metallurgy**: The process of extraction of metals from their ores and their maintenance is called Metallurgy.

b. **Minerals**: The elements are compounds which are occur naturally in the Earth's crust are called as Minerals.

c. **Ore**: Minerals contain a very high percentage of particular metal and the metal can be extracted profitably from it. Such minerals are called ores.

d. **Gangue**: The impurities such as clay, sand, pebbles etc.… are present in an ore is called gangue.

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26) What are the sources of minerals?

A) 1. Earth's crust and sea water are sources of minerals.

2. But Earth's crust is the major source of minerals than sea water.

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27) List the metals existed in the Earth's crust in the free state (native state).

A)1. The metals at the bottom of the activity series are the least reactive. So, they are often found in a free state.

2. For example, Gold, Silver, Platinum and copper.

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28) What are the stages of Metallurgy? Explain.

A) 1. There are three stages of Metallurgy. They are

a. **Concentration of Ore**: This stage involves removing impurities or gangue from the ore, thereby increasing the concentration of the desired meta

b. **Extraction of Metal from the Concentrated Ore**: This involves the reduction of the concentrated ore to obtain the metal.

c. **Refining of the Metal**: This final stage is about purifying the extracted metal to remove any remaining impurities and achieve the desired level of purity

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29) Define the following.

A) 1. **Calcination**: The process of heating of ores strongly in the limited air is called calcination.

2. **Roasting**: The process of heating of ores are strongly in the presence of excess of air is called Roasting.

Note: In both the process, Ore of a metal convert into oxide ore.

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30) Why ores of some metals are converting into oxide ores?

A) To extract a metal easily from its oxide ore by reducing process.

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31) Write the differences between Calcination and Roasting.

A)

Roasting	Calcination
1. Roasting is a pyrochemical process in which the ore is heated in the presence of air below its melting point.	1. Calcination is a pyrochemical process in which the ore is heated in the absence of air.
2. It is an oxidation reaction.	2. It is a decomposition reaction.
3. It requires oxygen	3. It doesn't require oxygen.
4. It is suitable to sulphide ores.	4. It is suitable to carbonate ores.
5. Ex: $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$	5. Ex: $CaCO_3 \rightarrow CaO + CO_2$

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32) What is thermite process? Write its uses.

A)1. The highly reactive metal Aluminium used as reducing agent to displace a metal of low reactivity from its ore is called thermite process.

2.In this process extracted metal is existed in liquid state

3.Examples: i. $Fe_2O_3 + 2Al \xrightarrow{Heat} 2Fe + Al_2O_3 + Heat$

ii. $3MnO_2 + 4Al \xrightarrow{Heat} 3Mn + 2\ Al_2O_3 + Heat.$

4.**Uses**: i. The thermite process is commonly used for welding, especially in joining railway tracks.

ii. Repairing Heavy Machinery

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33)How can you extract metals low in the active series?

A)1. Metals low in the activity series are very unreactive.

2. The oxides of these metals can be reduced to metals by heating alone.

3. Examples

a. **Extraction of mercury from its ore Cinnabar (HgS):**

i. Roasting of Cinnabar: Conversion of Cinnabar (HgS) into mercuric oxide by heating.

$2HgS + 3O_2 \xrightarrow{Heat} 2HgO + 2SO_2(g).$

ii. Reduction of Mercuric Oxide (HgO) into Mercury on Further heating.

$2HgO \xrightarrow{Heat} 2Hg(l) + O_2\,(g).$

b. **Extraction of copper from its Sulphide ore (Cu_2S):**

i. The ore is subjected partially roasting in air to give its oxide.

$2Cu_2S + 3O_2 \xrightarrow{Heat} 2Cu_2O + 2SO_2.$

ii. When the supply of air is stopped and the temperature is raised the rest of Sulphide ore reacts with oxide.

$2Cu_2O + Cu_2S \xrightarrow{Heat} 6Cu + SO_2.$

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34)Explain the extraction of zinc from its Sulphide ore zinc blend (ZnS) and its carbonate ore calamine ($ZnCO_3$).

A)1. To extract the zinc from both the ores, the ores are initially converted into oxide ores.

2. Sulphide ore is changing into oxide ore by roasting.

$2ZnS + 3O_2 \xrightarrow{Heat} 2ZnO + 2SO_2$

3. Carbonate ore is changing to oxide ore by calcination.

$ZnCO_3 \xrightarrow{Heat} ZnO + CO_2.$

4. Reduce Zinc Oxide into Zinc metal by heating with coke.

$ZnO + C \xrightarrow{Heat} Zn + CO.$

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35)Name the process using to extract metals in the top of the activity series. Why?

A)1. The process used to extract metals at the top of the reactivity series is electrolysis.

2. Metals at the top of the activity series, such as sodium, potassium, calcium, magnesium, and aluminum, are highly reactive.

3.Due to their strong affinity for oxygen and other non-metals, these metals form very stable compounds, making it difficult to extract them using conventional chemical reduction methods like smelting or reduction with carbon.

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36) Explain extraction of metals in the top of the activity series like sodium, magnesium etc… from their Chloride ores.

A)1. These metals are obtained by electrolytic reduction process (Electrolysis).

2.Initially allow the current into chloride ores of sodium, magnesium etc… Then ore is turned into molten state and splits into corresponding positive and negative ions.

3.In this process metals are deposited at cathode and chloride gas is liberated at anode.

4. Extraction of Sodium:

$NaCl \xrightarrow{\text{electrolysis}} Na^+ + Cl^-$

At cathode: $Na^+ + e^- \longrightarrow Na(metal)$

At anode: $2Cl^- \longrightarrow Cl_2 + 2e^-$

5. Extraction of Magnesium:

$MgCl_2 \xrightarrow{\text{Electrolysis}} Mg^{2+} + 2Cl^-$

At cathode: $Mg^{2+} + 2e^- \longrightarrow Mg(metal)$

At anode: $2Cl^- \longrightarrow Cl_2 + 2e^-$

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37) What is refining of metals?

A) The process of removing impurities present in extracted crude metal is called refining of metals.

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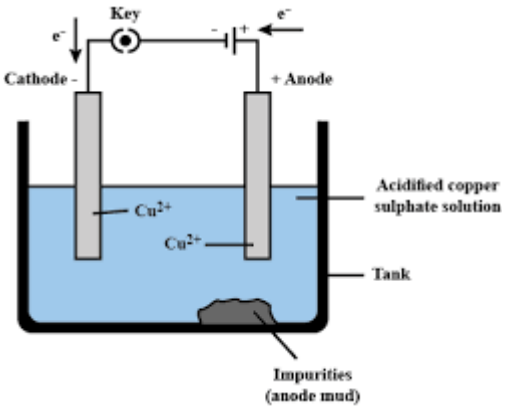
38) What is electrolytic refining? Explain it.

A)1. Electrolytic refining is a process used to purify metals by using electrolysis. This method involves placing an impure metal (called the anode) into an electrolyte solution and using an electrical current to deposit the pure metal onto a cathode.



- **Anode (Impure Metal):** The impure metal that needs to be purified is used as the anode. For example, in the case of copper refining, the anode is made of impure copper.
- **Cathode (Pure Metal):** A thin sheet of the pure metal is used as the cathode, where the purified metal will be deposited.
- **Electrolyte:** The electrolyte is a solution that contains metal ions of the metal to be refined. For copper refining, the electrolyte is usually a solution of copper sulfate ($CuSO_4$) and sulfuric acid (H_2SO_4).

2. **Electrolysis Process:**
   - When an electric current is passed through the electrolyte, the metal ions from the anode dissolve into the solution.
   - These ions then migrate toward the cathode, where they gain electrons (are reduced) and are deposited as pure metal.
   - Meanwhile, impurities that are less reactive than the metal remain in solution or form a sludge at the bottom of the cell (called anode mud).

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39) What is anode mud?

A) the residue that forms at the bottom of an electrolytic cell during the electrorefining of metals, such as copper or lead is called “anode mud”.

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40) What is corrosion? Give examples.

A) Corrosion is the gradual destruction or deterioration of a material, usually a metal, due to a chemical reaction with oxygen and acidified gases in the presence of moisture in air. For example:

i. Silver articles become black because reacts with Sulphur in air to form a coating of silver Sulphide.

ii. Surface of copper articles loses shiny brown surface and gains a green coat due to reaction of copper with moist Carbon dioxide, then form basic copper carbonate which is in green color.

iii. Rusting of iron.

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41) What is rusting of iron?

A) Iron in the presence of moisture combines with oxygen from the air to form a brown color substance called rust.

$$4Fe+3O_2+2n\ H_2O \rightarrow 2\ Fe_2O_3{\cdot}n\ H_2O$$

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42) What are essential conditions of rusting?

A) **Presence of Water**: Moisture is necessary for rusting to occur. Humid conditions accelerate the process.

Presence of Oxygen: Atmospheric oxygen is needed for rust to form.

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43) How can you prevent corrosion of iron?

A) i. Painting, Oiling and greasing.

ii. Galvanization: Coating iron with a layer of zinc, which acts as a sacrificial metal.

iii. Chrome plating: a process in which a thin layer of chromium is electroplated onto the surface of a metal

iv. Alloying: Mixing iron with other metals, like chromium which is resistant to rust.

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44) What is an Alloy?

A) A mixture of two or more metals or a metal and non-metal is called an Alloy. This process improving the desired properties of metals.

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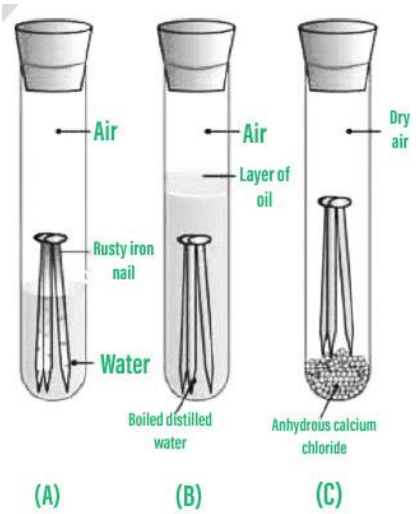
45) Suggest an experiment to prove that the presence of water and air is essential for corrosion.

A) **Aim:**

To prove that the presence of air and water is essential for corrosion or for rusting of iron articles.

Apparatus:

3 boiled test tubes, 3 corks, boiled distilled water, anhydrous calcium chloride, clean iron nails.



Procedure:

- Take three test tubes and place clean iron nails in each of them.
- Label these test tubes A, B and C. Pour some water in test tube A and cork it.
- Pour boiled distilled water in test tube B, add about 1 ml of oil and cork it. The oil will float on water and prevent the air from dissolving in the water.
- Put some anhydrous calcium chloride in test tube C and cork it. Anhydrous calcium chloride will absorb the moisture.
- Leave these test tubes for a few days and then observe.

- We will observe that iron nails rust in test tube A, but they do not rust in test tubes B and C.

Observation:

- In test tube A, the nails are exposed to air and water. Hence, the nails rusted.
- In test tube B, the nails are exposed only to water, but not to air, because the oil float on water and prevent the air from dissolving in the water. Hence, the nails are not rusted.
- In test tube C, the nails are exposed to dry air, because anhydrous calcium chloride will absorb the moisture, if any, from the air. Hence, the nails are not rusted.

Conclusion:

From the above experiment we can prove that air and water are essential for corrosion.

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46) Write the differences between Metals and Non-Metals based on their chemical properties.

A)

Metals	Non-metals
(*i*) Metals can lose electrons easily to form positive ions.	(*i*) Non-metals can gain electrons easily to form negative ions.
(*ii*) Metals form basic oxides.	(*ii*) Non-metals form acidic oxides.
(*iii*) Metals can displace hydrogen from dilute acids.	(*iii*) Non-metals cannot displace hydrogen from dilute acids.
(*iv*) Reactive metals can displace hydrogen from water or steam.	(*iv*) Non-metals cannot displace hydrogen from water.

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47) Write some alloys with constituent metals.

A)

Sl. No	Alloy Name	Constituent Metals
1.	Hard Iron	Iron, Carbon about 0.05%
2.	Stainless Steel	Iron (Fe), Chromium (Cr), Nickel (Ni), Carbon (C)
3.	Brass	Copper (Cu), Zinc (Zn)

4.	Bronze	Copper (Cu), Tin (Sn)
5.	Solder	Tin (Sn), Lead (Pb)

Note:

i. An amalgam is an alloy that contains mercury as one of its primary components.

ii. Purity of gold is measured in carat. 24-carat gold is pure gold. It is soft.

iii. Ornament gold is 22-carat gold. It means that 22 parts of pure gold alloyed with 2 parts of either silver or copper.

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48) List ores of some metals.

A)

Sl. No	Metal	Ore
1.	Aluminium	Bauxite
2.	Iron	Hematite, Magnetite
3.	Copper	Chalcopyrite, Bornite, Malachite
4.	Zinc	Sphalerite
5.	Lead	Galena
6.	Mercury	Cinnabar
7.	Manganese	Pyrolusite

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49)Name two metals which will displace hydrogen from dilute acids and two metals which will not.

A) i. Metals which displaces Hydrogen from dilute acids: Calcium, Magnesium, Aluminium, Zinc, Iron, Lead etc..

ii. Metals which do not displace Hydrogen from dilute acids: Silver, Copper, Gold, Mercury.

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50) You are given a hammer, a battery, a bulb, wires and a switch.
(a) How could you use them to distinguish between samples of metals and non-metals?
(b) Assess the usefulness of metals based on properties shown by these tests.

A) (a) i. We take the given samples of metal and non-metal, place them on a block of iron and beat them with a hammer four or five times, turn by turn. The sample which changes into a thin sheet on hammering will be a metal. On the other hand, the sample which breaks into pieces on hammering (and does not form a thin sheet) will be a non-metal. We say that metals are malleable whereas non-metals are brittle.

ii. Take a battery, a torch bulb fitted in a holder, some wires with crocodile clips and a switch and connect them to make an electric circuit. Insert the given samples of the metal and non-

metal between the free ends of the crocodile clips in the circuit, one by one. The sample which allows the current to pass through it making the bulb to light up, will be a metal

(b) Since metals are malleable, they can be turned into sheets and these metal sheets can then be used for various purposes. For example, iron sheets are used for making boxes (trunks), buckets and roofing material. And because metals are good conductors of electricity, therefore, metal wires are used as electric wires for various purposes. For example, copper wires are used in domestic electric wiring for carrying electricity.

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51) In the electrolytic refining of a metal M, what would you take as the anode, the cathode, and the electrolyte?

A) In the electrolytic refining of metal M:

(a) a thick block of the impure metal M is made anode. It is connected to the positive terminal of the battery.

(b) a thin strip of pure metal M is made cathode. It is connected to the negative terminal of the battery.

(c) a water-soluble salt of metal M is taken as electrolyte.

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52) Pratyush took Sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test-tube over the burning Sulphur.

(a) What will be the action of this gas on: (i) dry litmus paper? (ii) moist litmus paper?

(b) Write a balanced chemical equation for the reaction taking place.

A) (a) When Sulphur is burnt in air then Sulphur dioxide gas is formed.

(i) Sulphur dioxide gas has no action on dry litmus paper.

(ii) Sulphur dioxide gas turns moist blue litmus paper to red.

(b) $S\ (s) + O_2\ (g) \longrightarrow SO_2\ (g)$

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53) What type of oxides are formed when non-metals combine with oxygen?

A) Non-metals combine with oxygen to form acidic oxides or neutral oxides.

Examples of acidic oxides: CO_2, SO_2, SO_3, NO_2 etc…

Examples of neutral oxides: H_2O, P_2O_5

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54) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking.

A) i. the oxygen of air reacts with aluminium to form a thin protective layer of aluminium oxide on its surface.

ii. The presence of aluminium oxide layer makes the aluminium metal resistant to the action of air and water.

iii. Due to its high resistance to corrosion and high heat conductivity, aluminium metal is used for making cooking utensils.

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55) You must have seen tarnished copper vessels being cleaned with lemon (or tamarind juice). Explain why, these sour substances are effective in cleaning these vessels.

A) The sour substances such as lemon (or tamarind juice) contain acids. These acids dissolve the coating of copper oxide or basic copper carbonate present on the surface of tarnished copper vessels and makes them shining red-brown again.

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56) Give reasons why copper is used to make hot water tanks and not steel (an alloy of iron).

A) i. Copper is fairly resistant to corrosion but steel rusts quite easily.

ii. Copper is a very good conductor of heat but steel is not such a good conductor of heat.

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57) Zinc oxide, magnesium oxide and copper oxide were heated, turn by turn, with zinc, magnesium and copper metals as shown in the following table:

Metal oxide	Zinc	Magnesium	Copper
1. Zinc oxide 2. Magnesium oxide 3. Copper oxide			

In which cases will you find displacement reactions taking place?

A) We know that a more reactive metal can displace a less reactive metal from its oxide. Keeping in mind that out of zinc, magnesium and copper metals, magnesium is the most reactive, zinc is less reactive whereas copper is the least reactive metal, we will find that the displacement reactions will take place in the following cases:

Metal oxide	Zinc	Magnesium	Copper
1. Zinc oxide	—	Displacement	—
2. Magnesium oxide	—	—	—
3. Copper oxide	Displacement	Displacement	—

---

58) Which metals do not corrode easily?

A) Those metals which are at the bottom of the 'reactivity series' are highly unreactive and do not corrode easily

Examples: Gold, Platinum.

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59) Samples of four metals A, B, C and D were taken and added to the solutions given in the following table, one by one. The results obtained are as follows:

Metal	Iron (II) sulphate	Copper (II) sulphate	Zinc sulphate	Silver nitrate
A	No reaction	*Displacement*		
B	*Displacement*		No reaction	
C	No reaction	No reaction	No reaction	*Displacement*
D	No reaction	No reaction	No reaction	No reaction

(i) Which is the most reactive metal?

A) B - because it gives displacement reaction with iron (II) sulphate

(ii) What would you observe when metal B is added to a solution of copper (II) sulphate?

A) A displacement reaction will take place.

(iii) Arrange the metals A, B, C and D in the order of decreasing reactivity.

A) B > A > C > D.

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60) Write the uses of non-metals.

A) i. Coal, Petrol, diesel etc.. are the compounds of Carbon a non-metal used as fuel.

ii. Oxygen a non-metal helpful for respiration and combustion.

iii. Non-metals like Nitrogen and Sulphur are used in fertilizers.

iv. Chlorine a non-metal used to disinfect water, in making PVC plastic.

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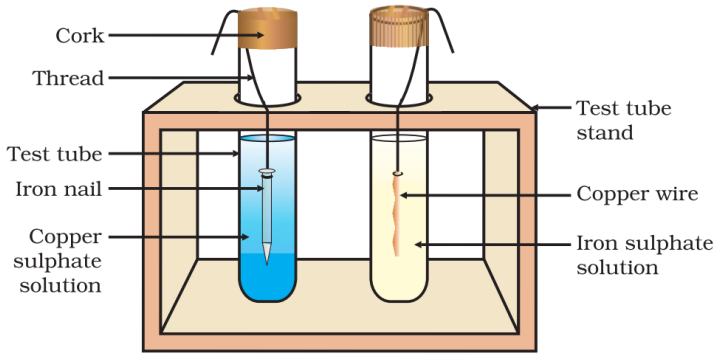
61) How do metals react with solutions of other metal salts? Describe with an activity. **(OR)** Explain the extraction of low reactive metals from their metal salt solution by using highly reactive metals. **(OR)** Explain the displacement of low reactive metals from their metal salts by using highly reactive metals.

A) **Aim:** To study about displacement of low reactive metals from their metal salts by using highly reactive metals

Apparatus: Copper wire, Iron nail, Iron Sulphate solution, Copper Sulphate solution and two test tubes.

Diagram:



Procedure:

i. Take a clean wire of copper and an iron nail.

ii. Put the copper wire in a solution of iron sulphate and the iron nail in a solution of copper sulphate

Observation:

i. After 20 mins the intensity of blue colour of copper sulphate solution gradually decreases and turn into pale green colour.

ii. So, a shiny reddish brown colour layer formed over iron nail.

iii. There is no change in the colour of iron sulphate solution.

Reason:

i. So, iron is highly reactive metal. That's why iron displaces copper from copper sulphate solution.

$$Fe + CuSO_4 \text{ (Blue solution)} \longrightarrow FeSO_4 \text{ (Pale green sol)} + Cu$$

ii. Copper is low reactive than iron. That's why it doesn't displaces iron from iron sulphate. Hence, No reaction takes place.

Conclusion:

Highly reactive metals can displace low reactive metals from their salt solutions.

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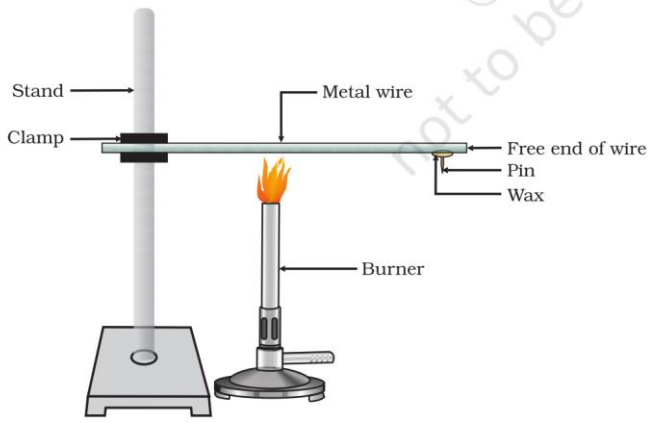
62) How to show that metals are good conductors of heat with the help of a activity ?

A) **Aim:** Study about heat conductivity of metals.

Required Materials: Copper / Aluminium rod, wax, stand, clamp, burner, pin / small iron nail.

Diagram:



Procedure:

i. Take an Aluminium/ copper rod.

ii. Clamp this rod on a stand as shown in the fig.

iii. Fix a pin to the free end of the rod using wax.

iv. Heat the wire with a burner near the place where the rod is clamped to the stand.

Observation:

After few minutes we are observed that, the pin at free end is detached.

Reason:

When aluminium/ copper rod is heated at one end, heat reaches the other end, melting the wax, and the pin gets detached.

Conclusion:

Metals are good conductors of heat.

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