

Metals & Non Metals

ONE SHOT



GUN SHOT



100% Paper yahi se bnega

Ek bhi Q bahar se nahi hogा

Metals & Non Metals

100% NCERT

30+ PYQ

**Ab ek bhi Question Yaha se
Bahar se Nahi Hoga**

PHYSICAL PROPERTIES

Metals

1. Lustrous: have shining surface
(in pure state),
Metallic Lustre

1. Generally Hard

3. **Malleability:** property of substance that it can be beaten into thin sheets.



[Gold & Silver Most Malleable]

Non-metals

Non- Lustrous

Generally soft

Non-malleable

4. Ductility: Ability of metals to be drawn into thin wires. 1g of Gold metal → 2 km length of wire



Non-ductile

5. Good Conductor of electricity
Best are Silver , Copper , Gold

6. Good Conductor of Heat: Best are
Silver Copper .

Poor conductor of electricity

Poor Conductor of Heat

7. Have High Melting Point

8. Sonorous: Metals produce a sound on striking a hard surface.



9. Physical state: All metals except mercury exist as solids at room temperature.

Low Melting Point

Non-sonorous

Solid → Carbon , Sulphur

Liquid → Bromine

Gases → Nitrogen Cl₂ Oxygen F₂

Q. A metal and a non-metal that exists in liquid state at the room temperature are respectively

- (a) bromine and mercury
- (b) mercury and Iodine
- (c) mercury and bromine
- (d) iodine and mercury.

(CBSE 2024)

Q1

Exceptions

Metals

- 1) Alkali Metals – Li Na K are so soft that they can be cut with a Knife . (also Ga & Cs)

NaK Ce GaLi me Chaku chalaya

- 2) Gallium (Ga) & Cesium (Cs) very soft & have very low Melting point. They melt if you keep them on your palm.

Chess Khelti Gal ko hath me Rakha , pighal gayi

1. Mercury is Poor conductor of Heat (exist as liquid)

Mercury planet pe dhoop nahi aati

- 4) Lead (Pb) is a Poor Conductor of Electricity

Pub me light chali gayi

Non - Metals

- 1) Iodine & Graphite are Lustrous

Pencil me Iodex lagaya chamakne lagi

1. Diamond (form of Carbon) is Hardest Natural Substance. It has high Melting & Boiling Point.

Majboot Heere ko hathode se toda tave pe gara kiya , beasar rha

1. Graphite (form of Carbon) is Lustrous , Conducts Electricity



Q. Which one of the following metals is malleable and a poor conductor of electricity? (CBSE 2022)

(CBSE 2023)

Q2

~~(c) Lead~~

- (d) Silver

1. Copper & Aluminium are used for making cooking Vessels They are good conductor of heat and they do not melt (have high melting point).

2) Carbon is a non-metal that can exist in different forms. Each form is called an **allotrope. Eg : Graphite, Diamond, Coal.**

Q. (i) Write two properties of gold which make it the most suitable metal for ornaments.

→ Malleable & Ductile.

(i) Name two metals which are the best conductors of heat. → Cu Ag

(iii) Name two metals which melt when you keep them on your palm.

→
Gallium Cesium
(Ga) (Cs)

(CBSE 2020)

Q3

CHEMICAL PROPERTIES

1) Metal + Oxygen \rightarrow Metal Oxide

(Generally basic in nature)

→ Turns moist red litmus blue



↓
Catches fire

They are kept inside kerosene oil to

- i. Protect them from burning in air
- ii. Prevents accidental fires.

K and Na react so vigorously with oxygen that they catch fire
(Burns in air) even if kept in the open.

Q. Why is potassium kept immersed in kerosene ?

(CBSE 2021)
Q4

Metal + Oxygen □ Metal Oxide



Least reactive

Gold & Silver do not react with oxygen even at high temperatures.

• **Protein**: A polymer composed of **amino acids** linked by **peptide bonds**.

• **Peptide bond**: A covalent bond between the carbonyl carbon of one amino acid and the nitrogen atom of another.

• **Primary structure**: The linear sequence of amino acids in a protein.

• **Secondary structure**: A local folding of the primary structure, such as alpha-helices or beta-sheets.

• **Tertiary structure**: The overall three-dimensional conformation of the protein.

• **Quaternary structure**: The arrangement of multiple polypeptide chains in a protein complex.

• **Alpha-helix**: A common secondary structure where the backbone atoms form a right-handed helix.

• **Beta-sheets**: A common secondary structure where the backbone atoms form a zig-zag pattern.

• **Hydrophobic effect**: The tendency of non-polar molecules to cluster together in water, driven by the interaction of hydrophobic groups.

• **Hydrophilic effect**: The tendency of polar molecules to interact with water, driven by the interaction of hydrophilic groups.

• **Hydrogen bonding**: A weak intermolecular force between hydrogen atoms of one molecule and oxygen or nitrogen atoms of another molecule.

• **Van der Waals forces**: A weak intermolecular force resulting from the attraction of opposite charges between molecules.

• **Electrostatic interactions**: A weak intermolecular force resulting from the attraction of opposite charges between molecules.

• **Hydrophobic interactions**: A weak intermolecular force resulting from the attraction of non-polar molecules to each other.

• **Hydrophilic interactions**: A weak intermolecular force resulting from the attraction of polar molecules to each other.

• **Hydrogen bonding**: A weak intermolecular force between hydrogen atoms of one molecule and oxygen or nitrogen atoms of another molecule.

• **Van der Waals forces**: A weak intermolecular force resulting from the attraction of opposite charges between molecules.

• **Electrostatic interactions**: A weak intermolecular force resulting from the attraction of opposite charges between molecules.

• **Hydrophobic interactions**: A weak intermolecular force resulting from the attraction of non-polar molecules to each other.

• **Hydrophilic interactions**: A weak intermolecular force resulting from the attraction of polar molecules to each other.

• **Hydrogen bonding**: A weak intermolecular force between hydrogen atoms of one molecule and oxygen or nitrogen atoms of another molecule.

• **Van der Waals forces**: A weak intermolecular force resulting from the attraction of opposite charges between molecules.

• **Electrostatic interactions**: A weak intermolecular force resulting from the attraction of opposite charges between molecules.

Flame Test

Element	Ion	Flame test colour
Lithium	Li^+	Crimson
Sodium	Na^+	Yellow
Potassium	K^+	Lilac
Calcium	Ca^{2+}	Orange-red
Copper	Cu^{2+}	Green

YELLOW SUN → Yellow Sodium
GREEN COP → Copper
LIQOUR → Li Crimson
BLACK BIKE → Kali
CAR ORANGE → Ga



Amphoteric oxide.

Metal Oxides are generally basic in nature . Turns Moist red litmus blue
eg- MgO , CuO , Na_2O , K_2O , Fe_2O_3

But ,Some metal oxides show both acidic and basic nature, called
Amphoteric oxide.

E.g.: Oxides of Al & Zn \rightarrow Zonebey Ali in M phone
 \leftarrow Tariq



Q. Oxides of aluminium and zinc are (CBSE 2024)

- (a) acidic (b) basic
- (c) amphoteric (d) neutral.

Q8

Q. Which of the following statements is true for an amphoteric oxide?

- (a) It reacts only with acid and does not form water.
- (b) It reacts with acid as well as base to form salt and hydrogen gas.
- (c) It reacts with both acid as well as base to form salt and water.
- (d) It reacts only with base and does not form water.

(CBSE 2023)

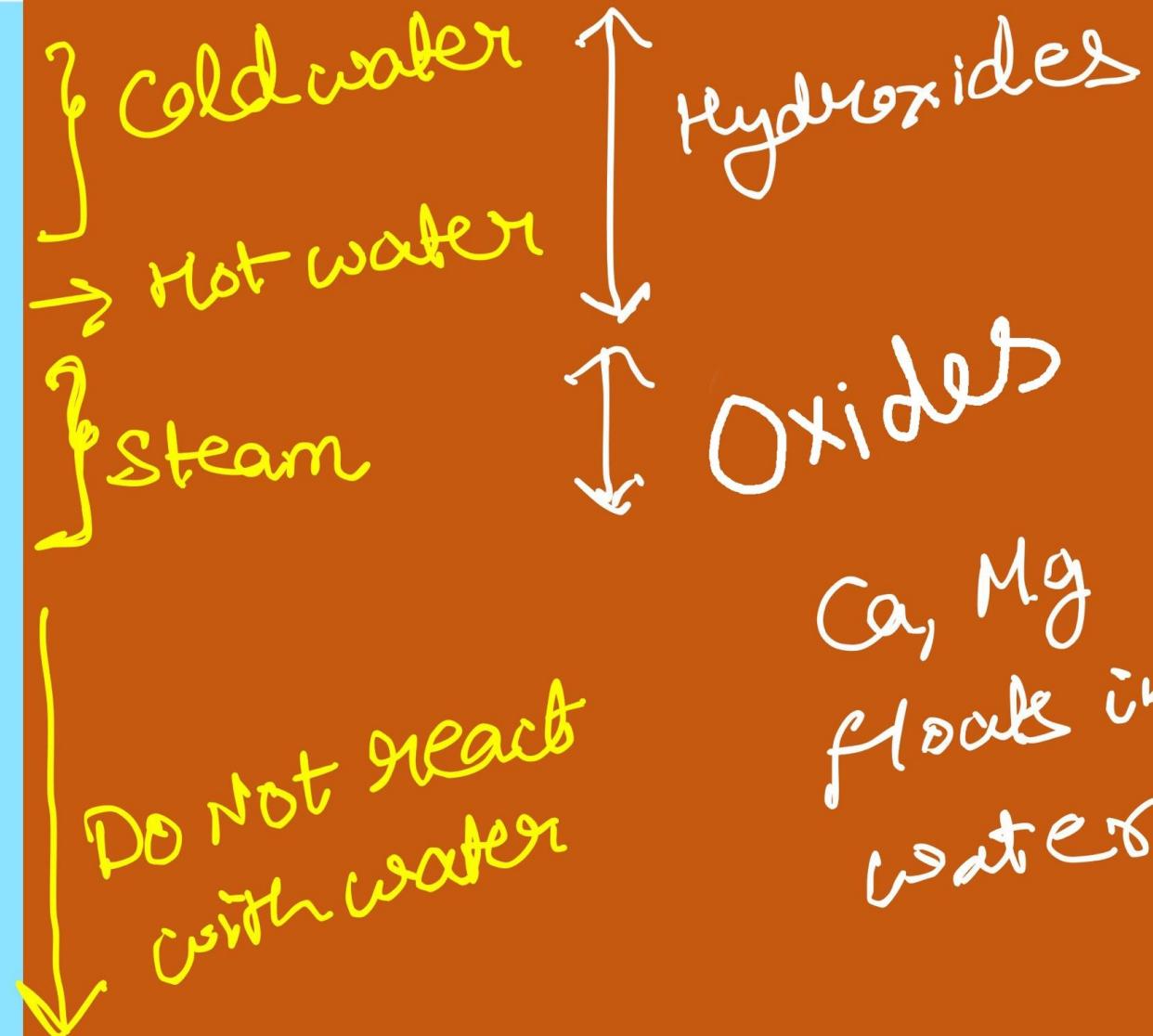
Q9

REACTION WITH WATER

Metal + Water \square Metal hydroxide / oxide + H₂

Potassium	kudi
Sodium	Naal
Calcium	Caai
Magnesium	Mango
Aluminium	Alto
Zinc	Zisko
Iron	Fir
Lead	Lekan
Hydrogen	Hum
Copper	Chale
Mercury	Mothura
Silver	Sath
Gold	Ghumre

K Na Ca Mg Al Zn Fe Pb H Cu Hg Ag Au



K
Na
Ca
Mg
Al
Zn
Fe
Pb
H
Cu
Hg
Ag
Au

Na reacts $\xrightarrow{\text{Violently}}$ with cold water. Reaction is highly exothermic. $\text{H}_2(\text{g})$ evolved catches fire



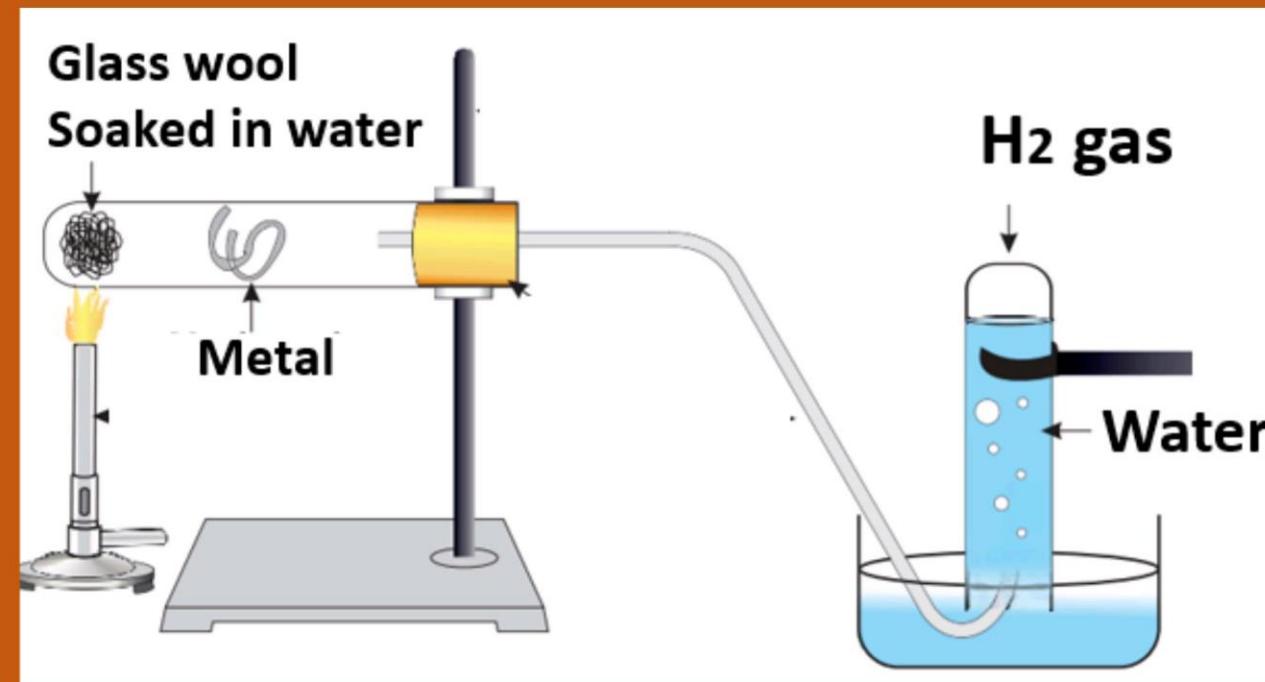
**Q1. Hold a piece of sodium metal with a pair of tongs.
Always handle sodium metal with care. Explain**

Ans. Because it can react with moisture (H_2O) from our hands (highly exothermic reaction) and can cause blisters.

Al, Zn, Fe reacts with steam to form oxides

K
Na
Ca
Mg
Al
Zn
Fe
Pb
H
Cu
Hg
Ag
Au

Do not react with H_2O



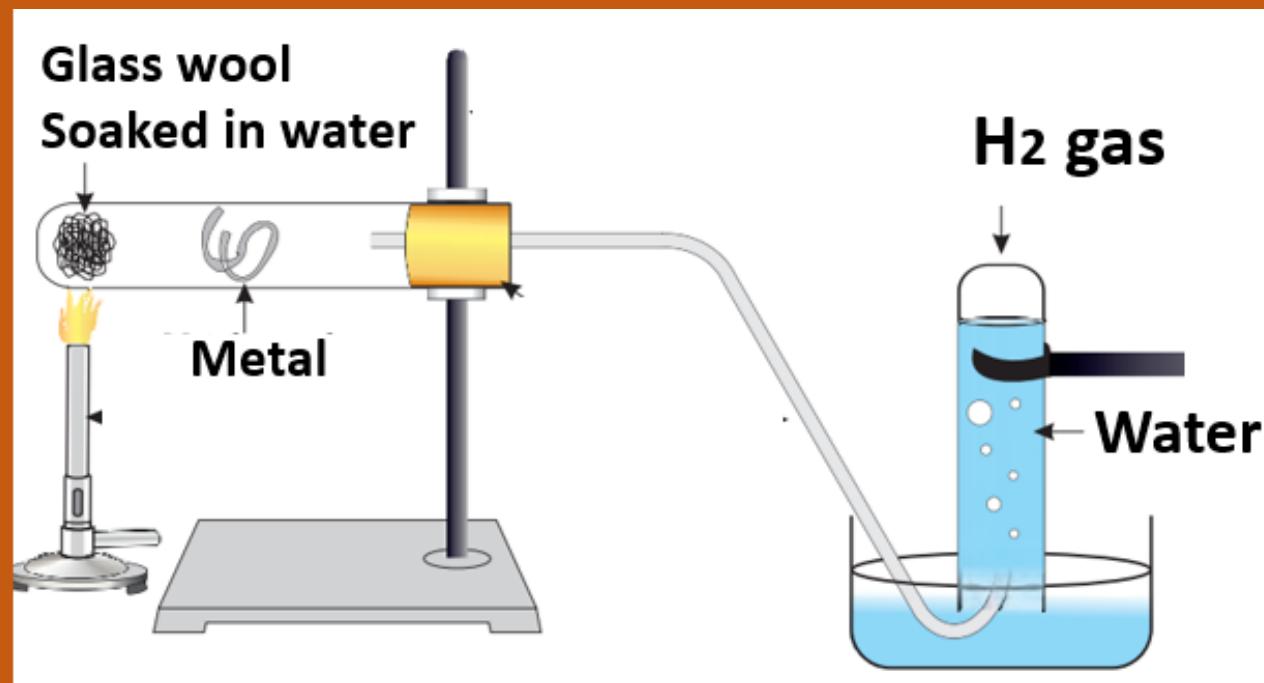
Al, Zn, Fe reacts with steam to form oxides



Al, Zn, Fe reacts with steam to form oxides

K
Na
Ca
Mg
Al
Zn
Fe
Pb
H
Cu
Hg
Ag
Au

Do not react with H_2O



Al, Zn, Fe reacts with steam to form oxides



Q. A metal 'A' reacts violently with cold water and the gas evolved catches fire. Another metal 'B' when dipped in water starts floating. The metal 'C' does not react either with cold or hot water, but reacts with steam. The metal 'D' does not react with water at all. Identify the metals 'A' 'B', 'C' and 'D'.

A → Na or K

B → Ca or Mg

C → Zn, Fe, Al

D → Cu, Pb, Ag

(CBSE 2023)

Q10

With the help of a labelled diagram show the experimental set up of action of steam on a metal.

(CBSE 2020)

Q11

REACTION WITH ACIDS

Metal + Dil Acid Salt + H₂



dil



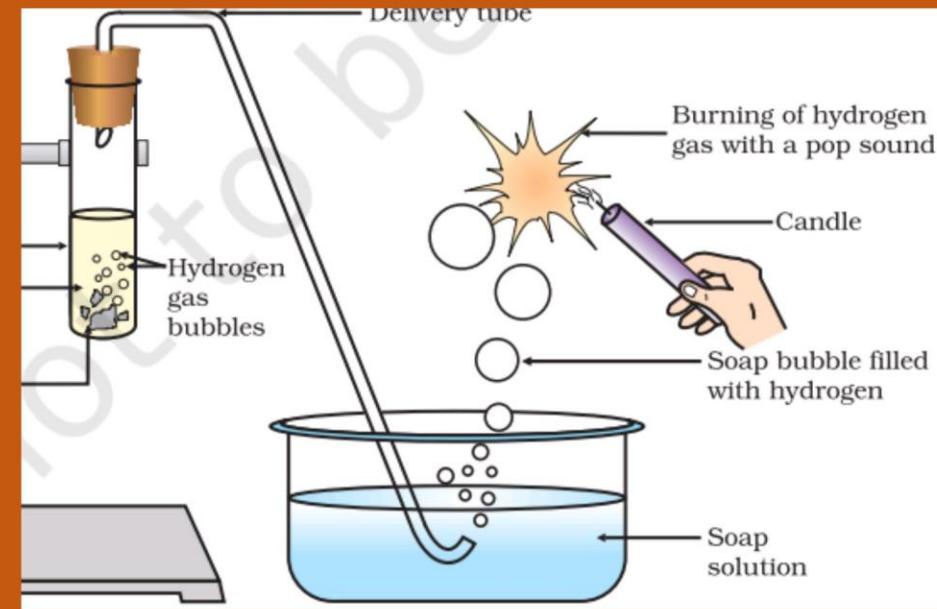
dil



dil



dil



- **Bubbles of H₂(g) are formed . H₂(g) Burns with a pop sound & extinguishes a burning candle.**
- **Rate of formation of bubble**
- **Mg > Al > Zn > Fe.**
- **Heat is evolved (Exothermic Reaction) order is same.**

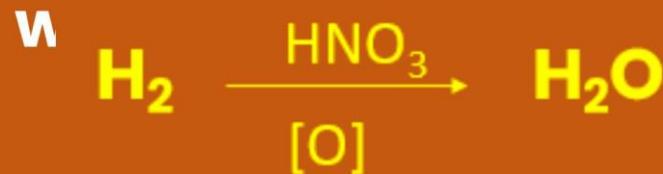
Special Case of Nitric Acid

Metal + Dil Acid Salt + H₂

→ oxidised to
water

H₂(g) not evolved when a metal reacts with dil HNO₃ (nitric acid).

HNO₃ is strong oxidising agent. It oxidises the H₂(g) produced to



& itself gets reduced to (NO, NO₂, N₂O)

Only Magnesium (Mg) & Manganese (Mn) reacts with very dil HNO₃ to give H₂(g).

Q. Assertion (A) : Hydrogen gas is not evolved when zinc reacts with nitric acid.

Reason (R) : Nitric acid oxidises the hydrogen gas produced to water and itself gets reduced.

- ~~(a)~~ Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.e

Q. Three metal samples of magnesium, aluminium and iron were taken and rubbed with sand paper. These samples were then put separately in test tube containing dilute hydrochloric acid.

(CBSE 2024)

Q12



- (a) which one of the test tubes was the rate of formation of bubbles the fastest and the thermometer showed the highest temperature?
- (b) Why is hydrogen gas not evolved when a metal reacts with dilute nitric acid? Name the ultimate products formed in the reaction.



Displacement Reaction

K

Na

Ca

Mg

Al

Zn

Fe

Pb

H

Cu

Hg

Ag

Au



A is more reactive than B



Best way to check which metal is more reactive.

Q. Select the correct matching in the following table in connection with the given chemical reaction. $\text{CuSO}_4 + \text{Fe} \rightarrow \text{FeSO}_4 + \text{Cu}$

	Initial colour of solution	Final colour of solution	Final colour of iron nail	Type of reaction
(a)	Pale green	Blue	Grey	Displacement
(b)	Blue	Pale green	Brownish	Double displacement
(c)	Blue	Light blue	Grey	Double displacement
(d)	Blue	Pale green	Brownish	Displacement

**(CBSE 2021–2022 term 1)
Q13**

H.W.

Q. The pair(s) which will show displacement reaction is/are

- (i) NaCl solution and copper metal
- (ii) AgNO₃ solution and copper metal
- (iii) Al₂(SO₄)₃ solution and magnesium metal
- (iv) ZnSO₄ solution and iron metal.

(CBSE 2021-2022 term 1)

Q14

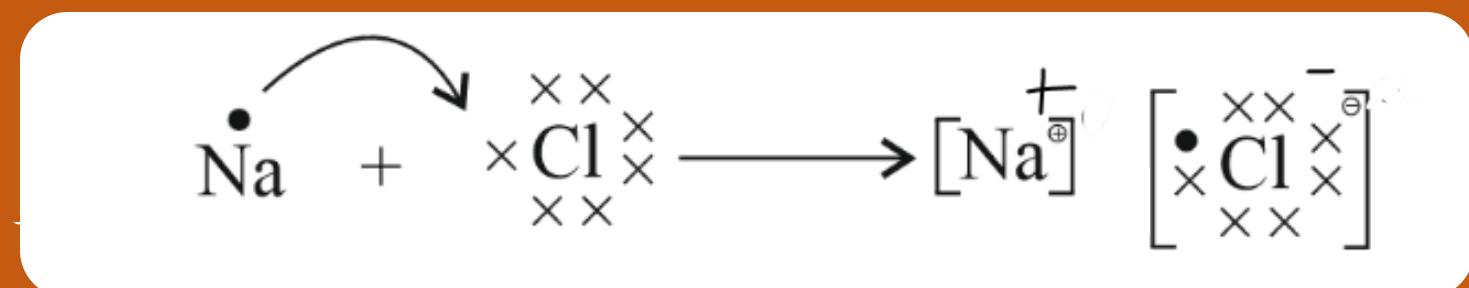
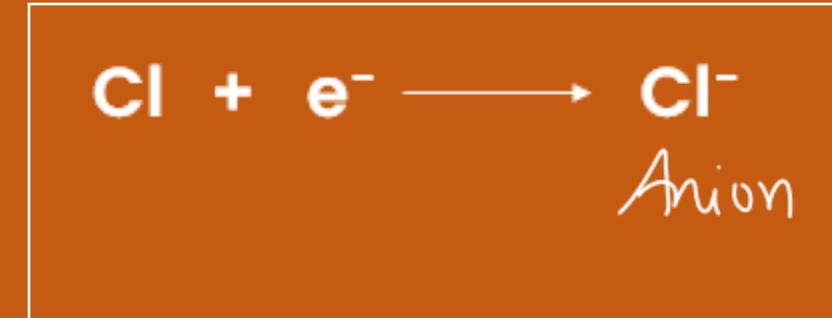
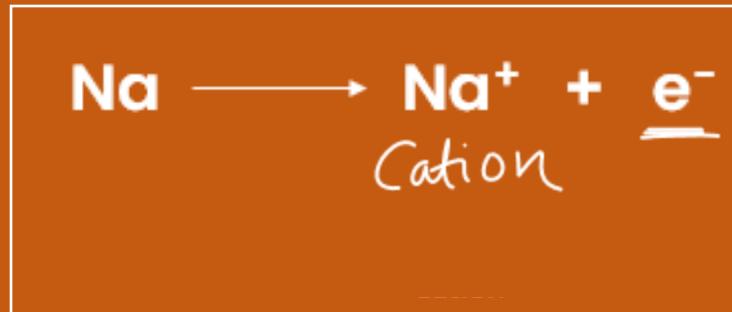
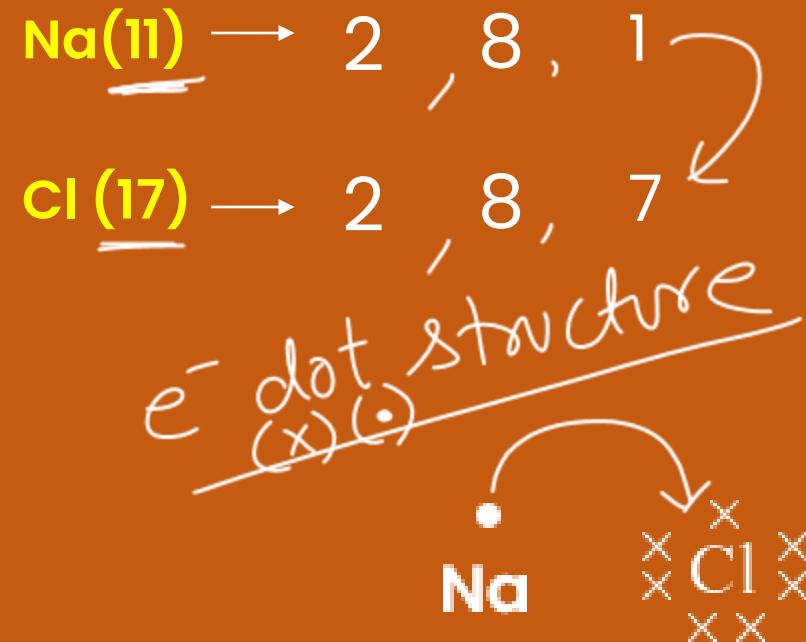
K
Na
Ca
Mg
Al
Zn
Fe
Pb
H
Cu
Hg
Ag
Au

Metals & Non-Metals React
Ionic Compound Electrovalent Compounds

2, 8, 8 — Complete Octet
 Last shell
 $8 e^-$

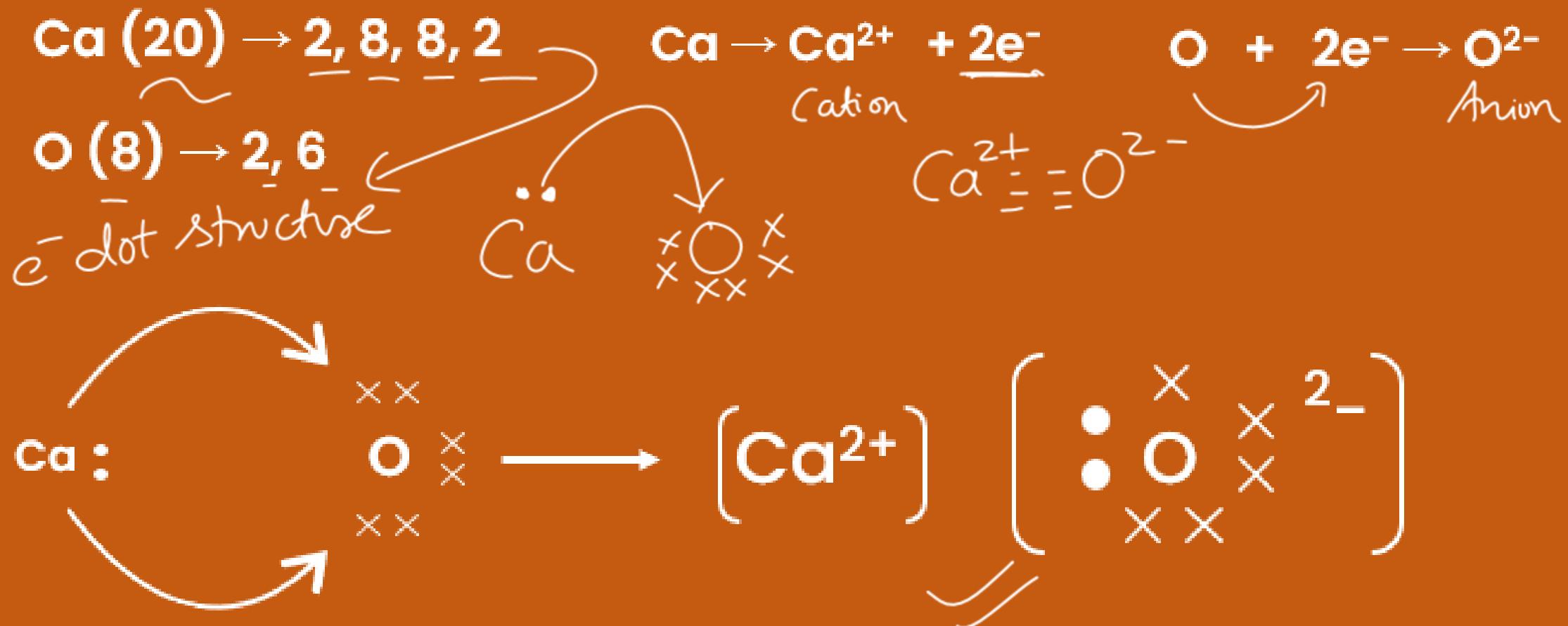
Element	Atomic No.	Electronic Configuration
Sodium (Na)	11	$2, 8, 1$
Magnesium (Mg)	12	$2, 8, 2$
Calcium (Ca)	20	$2, 8, 8, 2$
Chlorine (Cl)	17	$2, 8, 7$
Oxygen (O)	8	$2, 6$

Formation of Sodium Chloride (Na^+Cl^-)

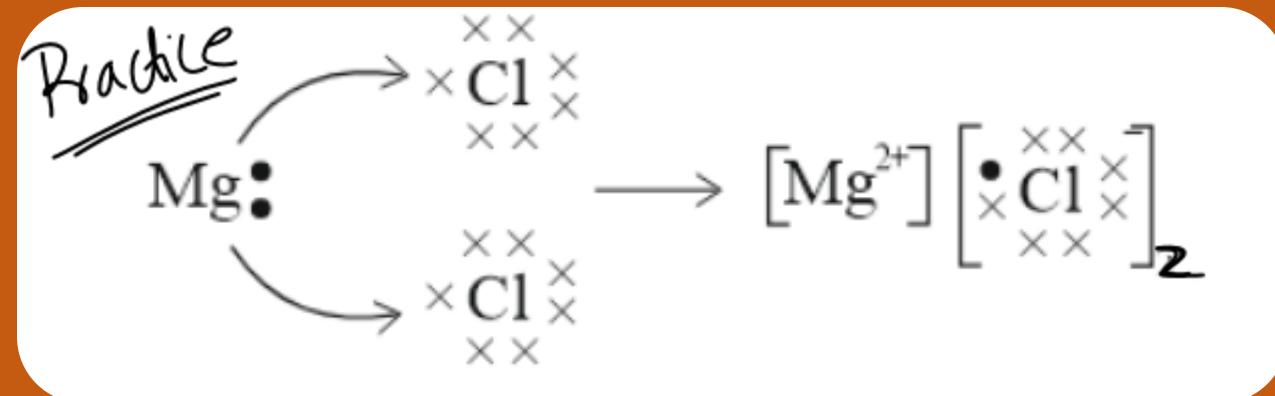
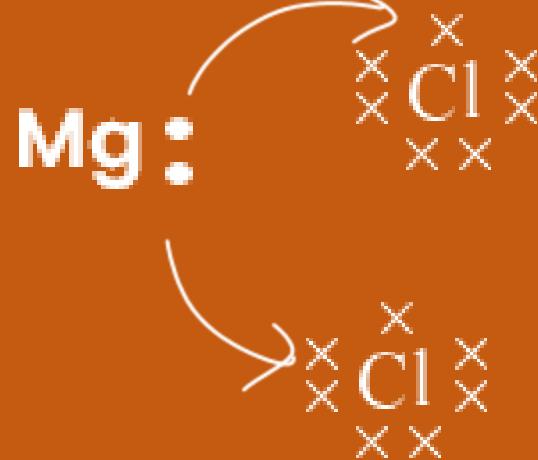
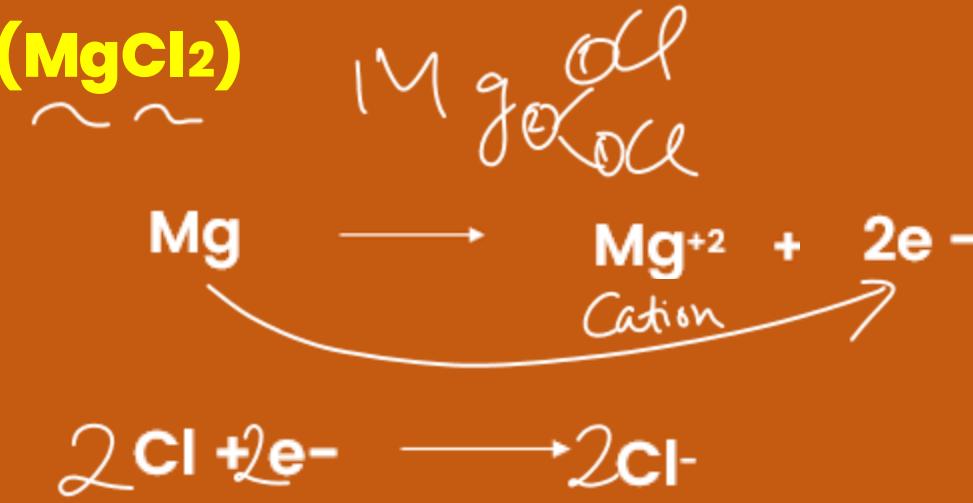
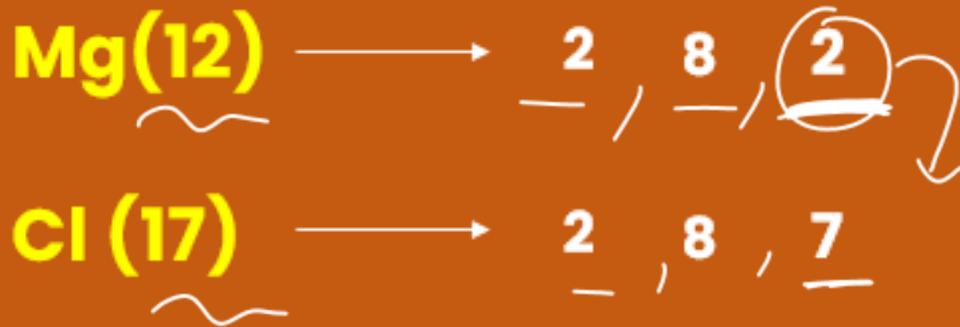


- Na^+ & Cl^- ions (oppositely charged) attract each other.
- Na^+ & Cl^- are held together by strong **Electrostatic Forces of attraction**.
- Sodium chloride (NaCl) do not exist as molecule but as combination of oppositely charged ions \Rightarrow **Ionic Compound Electrolyte Compound**

Formation of Calcium Oxide (CaO)



Formation of Magnesium chloride ($MgCl_2$)



Ionic / Electrovalent Compounds Properties

1. Hard, solid compounds because of strong force of attraction between +ve and -ve ions.
Brittle in nature, Breaks into pieces if pressure is applied
 2. Have High Melting & Boiling points because large amount of energy is required to break strong inter-ionic attraction.
 3. Generally soluble in water but insoluble in solvents like kerosene, petrol, alcohol etc.
 4. In Solid State do not conduct electricity as ions cannot move because of strong electrostatic forces of attraction.

In Molten State, Heat Energy weakens the strong electrostatic forces of attraction and ions can move freely, hence in molten state, conducts electricity.
- In aqueous solution, conducts electricity as solution of ionic compound in water contains ions. Ions move to opposite electrodes. (Water weakens the strong electrostatic forces of attraction between ions).

Q. Why do ionic compounds in the solid state not conduct electricity?

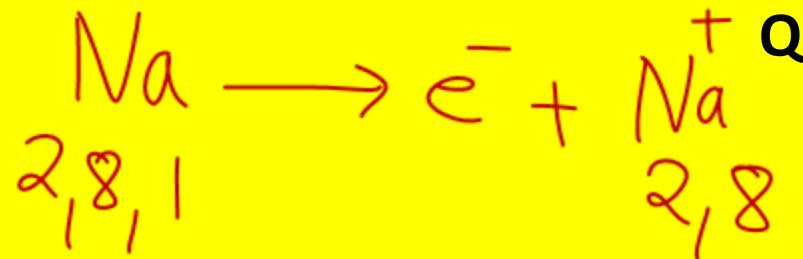


H. W. (CBSE 2023)
Q15

Q. (i) Show the electron transfer in the formation of magnesium chloride.

(ii) List two properties of ionic compounds other than their high melting and boiling points.

(iii) (A) While forming an ionic compound say sodium chloride how does sodium atom attain its stable configuration?



(CBSE 2023)

Q16

Q. Assertion (A) : The solution of ionic compounds are good conductors of electricity.

Reason (R) : Movement of ~~atoms~~ of elements take place in solution.

ions

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
- (c) ~~(A)~~ is true, but (R) is false.
- (d) (A) is false, but (R) is true.

Q. (i) By the transfer of electrons, illustrate the formation of bond in magnesium chloride and identify the ions present in this compound.



(ii) Ionic compounds are solids. Give reason.

(CBSE 2020)



Q18

Q. (a) Write electron dot structure of Ca (At. No. 20) and O (At. No. 8).

(b) Show the formation of calcium oxide by transfer of electrons.

(c) Name the ions present in this compound.

(d) List four important characteristics of this compound.

(CBSE 2020)



Q19

Q. When two compounds namely sodium chloride and calcium chloride are heated directly, one by one on the flame of a burner, they impart different colours to the flame.

Flame Test

- (i) Name the colour imparted by (1) sodium chloride and (2) calcium chloride.
- (ii) Are these compounds soluble in organic solvents such as kerosene or petrol? Justify your answer.



Car-Orange
≈ (Red)

Na + Cl →
Metal Non-metal

Ionic Compounds

(CBSE 2023)

Q20

Extraction of Metals

1. **Minerals** → elements or compounds which occur naturally in earth's crust
2. **Ores** → Those minerals which contain a very high % of a particular metal & metal can be profitably extracted from it, are called ores.

Q. What is **Gangue**?

Ans. Impurities like soil, sand, etc present in metal Ore

Top in Activity Series

K
Na
Ca
Mg
Al

very reactive, so never found
in free state as free metal

5

3

moderately reactive. Found in
Earth's crust in form of Oxides,
sulphides & Carbonates

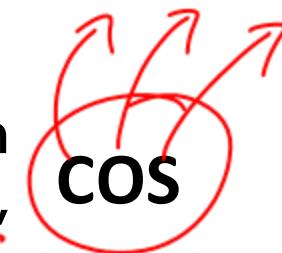
5

Cu
Hg
Ag
Au
Pt

Least reactive, hence found in
free state as free metals

Low in Activity Series

Note: Copper ,Silver, Mercury are found in
free state as well as in combined state as
oxides & sulphides



Metallurgy



Free Comb ko Silver Cup
me Mercury Liquid me
dubaya

Q. Where is iron placed in the reactivity series of metals? Write the form/forms in which its ores are found in nature.

COS

(CBSE 2023)

Q21

Q. The metals which are found in both free state as well as combined state are

- (a) gold and platinum**
- (b) platinum and silver**
- (c) ~~copper and silver~~**
- (d) gold and silver.**

(CBSE 2024)

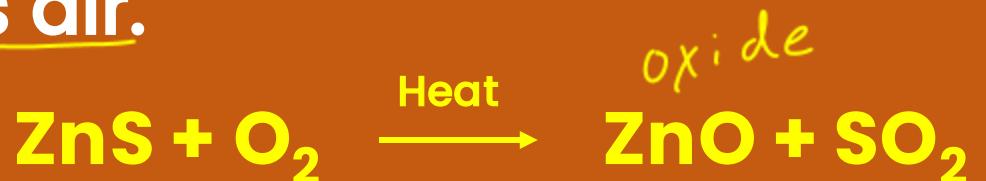
Q22

Extracting Metal → Middle of Activity Series

- K
Na
Ca
Mg
Al } ① 1. Present as oxides, sulphides or carbonates in nature.
- Zn
Fe
Pb } ② 2. Sulphides/Carbonates converted to oxide, as it's easy to extract metal from oxide.



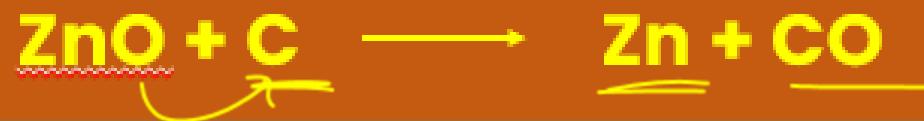
- H
Cu
Hg
Ag
Au
Pt } ③ • Roasting: Heating sulphide ores strongly in presence of excess air.



- H
Cu
Hg
Ag
Au
Pt } ④ • Calcination: Heating carbonate ores strongly in limited air.



- Now, metal oxide is reduced (removal of oxygen) with help of Reducing Agent Carbon. (Coke)



Q. Assertion (A) : The extraction of metals from their sulphide ores cannot take place without roasting of the ore. ✓ *R S*

Reason (R) : Roasting converts sulphide ores directly into metals.

(CBSE 2024)

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). Q23

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Q. Differentiate between roasting and calcination giving chemical equation for each.

H.W.

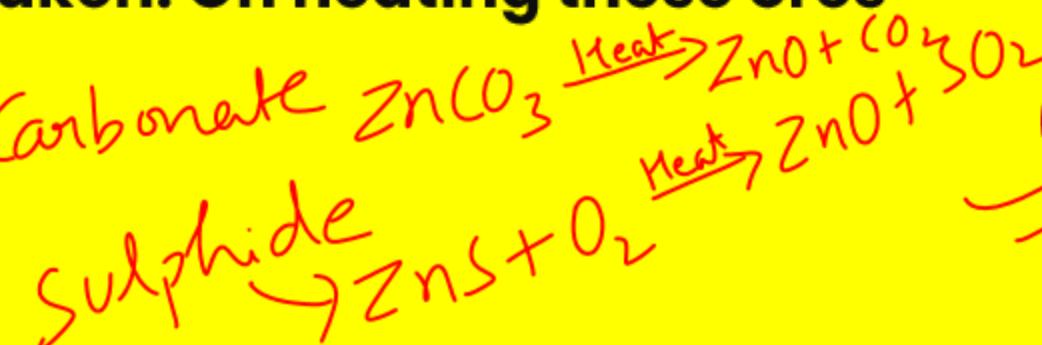
(CBSE 2023)
Q24

Q. Two ores X and Y were taken. On heating these ores it was observed that

- (a) ore X gives CO_2 gas, and
- (b) ore Y gives SO_2 gas.

Write steps to convert these ores into metals, giving chemical equations of the reactions that take place.

H.W.



(CBSE 2020)
Q25



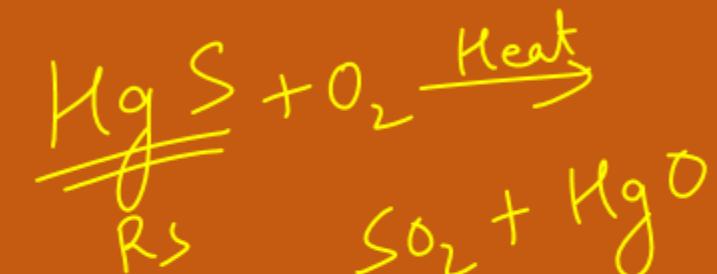
Extracting Metals Low in Activity Series

- Their sulphides ore converted to oxides.
- The oxides on heating converts to metal, no reducing agent used

K
Na
Ca
Mg
Al
Zn
Fe
Pb
H
Cu
Hg
Ag
Au
Pt



Balanc'd



Cinnabar

Q. Name the ore of mercury and state the form in which it is found in nature. Write the chemical equations along with the condition required for the reactions involved in the extraction of mercury from its ore.



(CBSE 2024)
Q26

Q. Write balanced chemical equations to explain what happens, when

(i) Mercuric oxide is heated.



(CBSE 2020)

(ii) Mixture of cuprous oxide and cuprous sulphide is heated.

Q27

Extracting Metals → Top of Activity Series

- Carbon cannot reduce their oxides, these metals are very reactive & have More affinity (likeness) for oxygen than carbon.

- Such Metals are obtained by **Electrolytic Reduction** (Reduction with help of electric current)

- Na, Ca, Mg → electrolysis of molten chlorides ; Al from Oxide



At Cathode:



At Anode:



K	{	Na
Ca		
Mg	{	Al
Zn		
Fe	{	Pb
H		
Cu	{	Hg
Ag		
Au	{	Pt
Pt		

Q. Name the process of reduction used for a metal that gives vigorous reaction with air and water both.

electrolytic reduction

Carbon cannot be used as a reducing agent to obtain aluminium from its oxide? Why?

K
Na
Ca
Mg
Al

Reactive

(S)

(CBSE 2023)

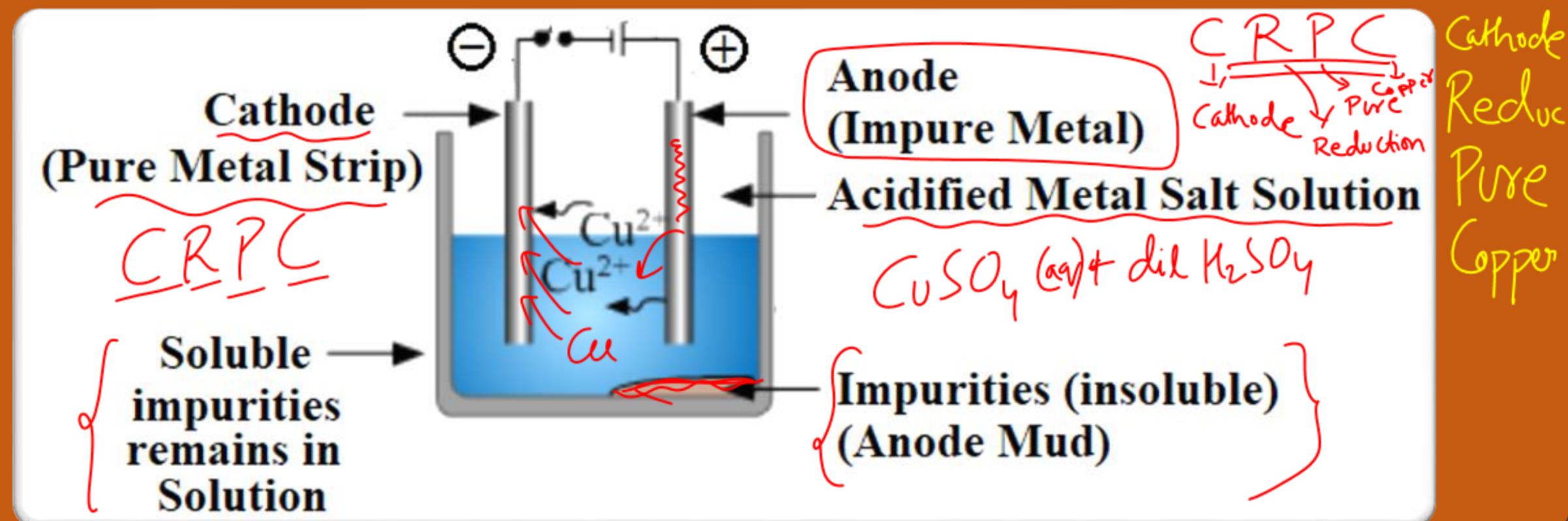
Q28

Refining of Metals

→ 99% pure

- Metal obtained after carbon reduction or electrolytic reduction is not very pure.
- The most common method for refining metal is Electrolytic Refining.

Ex: *electrolytic refining of Copper using CuSO₄ Solution*



At Anode: Pure copper enters solution

At Cathode: equivalent amount of pure copper from solution deposits at cathode.



Q. The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining. ~~✓~~

(CBSE 2024)

Q29

(i) What is the cathode and anode made of in the refining of copper by this process?

C R P C

A I C

(ii) Name the solution used in the above process and write its formula.

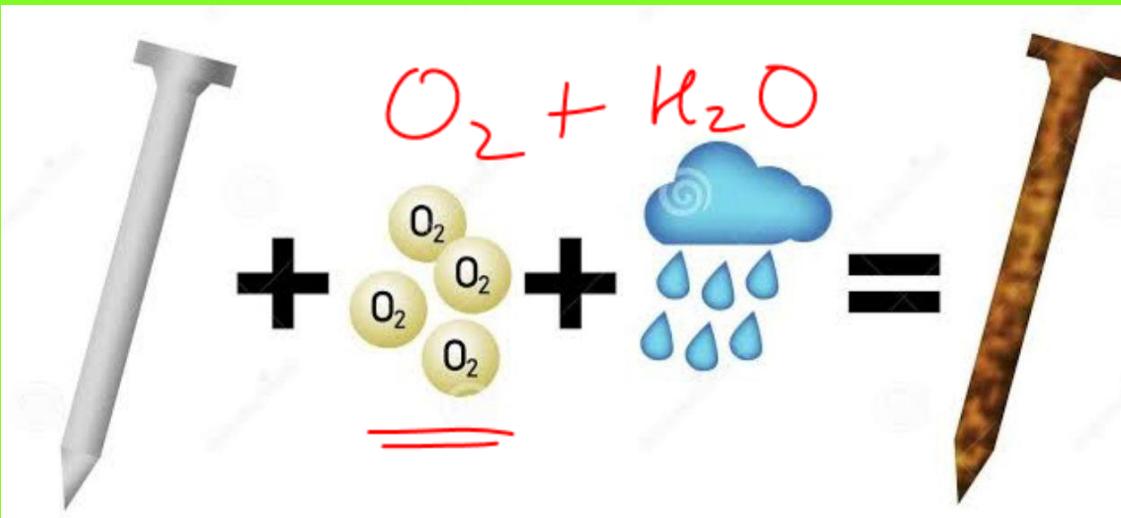
(iii) How copper gets refined when electric current is passed in the electrolytic cell?

Corrosion :

When a **metal** is **attacked** by substances around it such as moisture (water vapour + oxygen), acid etc., it is said to **corrode** and this process is called **corrosion**.

Examples –

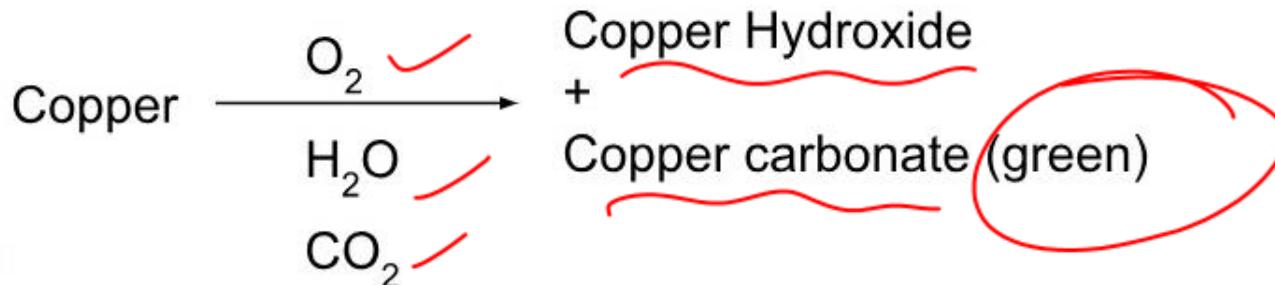
1) Rusting of Iron



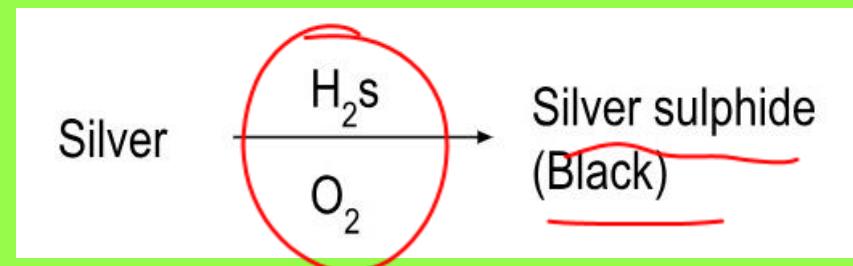
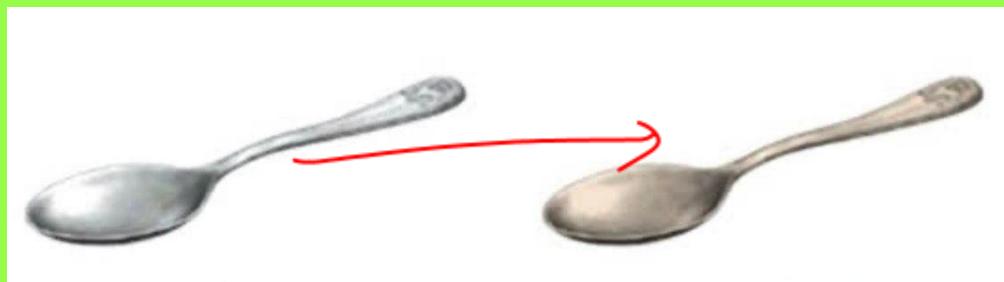
Iron

Hydrated (Reddish Brown)
Iron oxide (Rust)

2) Tarnishing of copper



3) Tarnishing of silver



NOTE : CORROSION is an example of Oxidation

Prevention of Corrosion



Painting



Oiling



Greasing



Galvanising
Zn layer



Anodising
Al layer Oxide

Galvanisation:

Zn

- Steel & Iron are coated with thin layer of Zinc.
- It is done through electrolysis.
- It does not change property of metal.

Surface Pe Deposit

Anodising: Process of forming a thick oxide layer of Al.

Al₂O₃

This layer prevents corrosion of metal.

The oxide layer also give articles attractive finish.

Q. (c) Explain any two methods that are employed to prevent rusting/corrosion of metals.

CBSE 2023
Q30

Alloy: A homogeneous mixture of two or more metals, or a metal & non metal.

Step 1: Melting primary metal.

Step 2: Dissolving other elements in fixed proportions.

Step 3: Cooling to room temperature.

The properties of An Alloy is different from the metals from which it is obtained.

1 Pure Iron is very soft & stretches easily when hot

Pure Iron + Carbon (0.05%) → Hard & Strong Iron Carbon Alloy

2. **Stainless steel** → Iron + Nickel + Chromium

Hard & do not rust

3. **Amalgam** → Alloy in which one metal is mercury

4. **Brass (BCoZ)** → Alloy of Zn + Cu

5. **Bronze (Coat)** → Alloy of Copper & Tin (Cu + Sn)

6. **Solder (SoTeLa)** → Alloy of Lead & Tin (Pb + Sn)



Stainless steel

Brass (BCOZ) → Alloy of Zn + Cu

Bronze (CoaT) → Alloy of Copper & Tin (Cu + Sn)

Alloy of Au

Solder (SoTeLa) → Alloy of Lead & Tin (Pb + Sn)

Alloy

Poor conductor
of Electricity

} has low M.P.
Melt w/ corrosion



Stainless steel

Q. Assertion (A) : The metals and alloys are good conductors of electricity. ✗

Reason (R) : Bronze is an alloy of copper and tin and it is not a good conductor of electricity.

(CBSE 2020)

- (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion (A).
- (b) Both (A) and (R) are true, but (R) is not the correct explanation of the assertion (A).
- (c) (A) is true but (R) is false.
- (d) (A) is false but (R) is true.

Q31
H.W.

Thermit Reaction/Welding:



Molten Learn



- The above reaction is so highly exothermic, that heat given out produces metal in molten state. This molten metal is used to join railway tracks or cracked machine parts. This reaction is known as thermit reaction..

Q. A metal 'X' is used in thermit process. When 'X' is heated with oxygen, it gives an oxide 'Y, which is amphoteric in nature. X' and 'Y' respectively are

- (a) Mn, MnO₂ (b) Al, Al₂O₃
(c) Fe, Fe₂O₃ (d) Mg, MgO

(CBSE 2023/2024)
H.W.

Q32