

PART - I

1. (c)
2. (a)
3. (a)
4. (d)
5. (c)
6. (c)
7. (d)
8. (a)
9. (d)
10. (a)
11. (c)
12. (c)
13. (c)
14. (a)
15. (c)

PART - II

16. Minerals: -

Naturally occurring compounds of metals found in the earth's crust; may or may not be useful for metal extraction.

Ores: -

Those minerals from which a metal can be extracted economically and conveniently.

17. Fe^{3+} is more stable than Fe^{2+} .

Reason: -

Fe^{3+} has the electronic configuration [AR] $3d^5$, which is a half-filled d-subshell and hence more stable due to extra exchange energy.

Fe^{2+} has configuration [AR] $3d^6$, which is less stable.

Therefore, Fe^{3+} is more stable than Fe^{2+} .

18. Coordination number is defined as the number of ligand donor atoms directly bonded to the central metal ion or atom in a coordination complex.

19. Covalent solids are solids in which the constituent atoms are held together throughout the crystal lattice by strong covalent bonds, forming a giant network structure (e.g., diamond, SiO_2).

20. Examples of first-order reactions:

- Radioactive decay of nuclei
- Decomposition of hydrogen peroxide
 $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$
- Hydrolysis of ethyl acetate in acidic medium
- Decomposition of nitrogen pentoxide
 $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$

21. Limitations of Arrhenius concept (short):

- Applicable only to aqueous solutions.
- Cannot explain acid-base reactions in non-aqueous or gaseous phase.
- Fails to explain the basic nature of substances without OH^- (e.g., NH_3).
- Cannot explain acid-base reactions without H^+ or OH^- ions (e.g., $\text{HCl} + \text{NH}_3 \rightarrow \text{NH}_4\text{Cl}$).

22. Electrophoresis is the phenomenon in which colloidal particles move towards the oppositely charged electrode when an electric field is applied.

- Positively charged particles move towards the cathode.
- Negatively charged particles move towards the anode.

It is used to determine the charge on colloidal particles and in the purification of colloids.

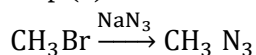
23. (a) The structure shows a central carbon attached to three methyl groups and one $-\text{OH}$ group (tert-butyl alcohol).

IUPAC name: 2-Methylpropan-2-ol

(b) The structure shows a benzene ring attached to $-\text{CH}_2-\text{CH}_2-\text{OH}$.

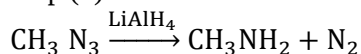
IUPAC name: 2-Phenylethan-1-ol

24. Step (1):



So, A = methyl azide (CH_3N_3).

Step (2):



So, B = methylamine (CH_3NH_2).

Answer:

A - Methyl azide

B - Methylamine

PART - III

25. Interhalogen compounds are compounds formed between two different halogen elements.

Examples:

- ClF , BrF_3 , IF_5 , ICl_3

These compounds are generally more reactive than halogens (except fluorine).

26. Properties of interstitial compounds (short):

- They are hard and rigid.
- Have high melting points.
- Retain metallic conductivity.
- Show non-stoichiometric composition.
- Chemically inert compared to pure metals.

27. Arrhenius equation:

$$k = Ae^{-E_a/RT}$$

Where: -

- k = rate constant of the reaction
- A = frequency (pre-exponential) factor
- E_a = activation energy
- R = gas constant
- T = absolute temperature (in kelvin)

28. Factors affecting electrolytic conductance:

- Nature of electrolyte (strong or weak)
- Concentration of electrolyte
- Temperature
- Nature of solvent (viscosity and dielectric constant)

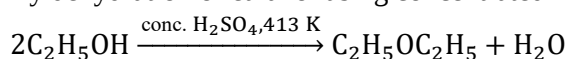
29. Homogeneous catalysis is a type of catalysis in which the catalyst and reactants are in the same physical state (phase).

Example:

Hydrolysis of sucrose in the presence of dilute HCl , where all are in the aqueous phase.

30. Preparation of diethyl ether (short):

By dehydration of ethanol using concentrated H_2SO_4 at 413 K :



31. Haloform reaction (short):

Methyl ketones ($\text{R}-\text{CO}-\text{CH}_3$) on heating with halogen ($\text{Cl}_2/\text{Br}_2/\text{I}_2$) and alkali give haloform (CHX).

Example (iodoform reaction):



32. Epimers are diastereomers that differ in configuration at only one chiral (asymmetric) carbon atom.

Example: -

D-Glucose and D-Mannose are epimers as they differ in configuration at the C-2 carbon atom.

33. For the complex $[\text{Ag}(\text{NH}_3)_2]^+$:

(a) Ligand:

Ammonia (NH_3 , ammine ligand)

(b) Central metal ion:

Silver (Ag^+)

(c) IUPAC name:
Diamminesilver(I) ion

PART – IV

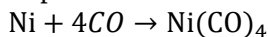
34. (a) (i) Gravity separation method (Hydraulic washing):

It is a method used to concentrate ores based on the difference in densities of the ore and gangue.

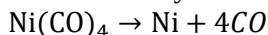
The powdered ore is washed with a stream of water; lighter gangue particles are washed away, while heavier ore particles settle down.

(ii) Mond's process (Refining of nickel - short):

Impure nickel is heated with carbon monoxide at 50 – 60°C to form volatile nickel carbonyl:



Nickel carbonyl is then heated at 180 – 200°C, where it decomposes to give pure nickel:



OR

(b)(i) Inert pair effect is the tendency of the outermost s-electrons (ns^2) of heavy p-block elements to remain unshared or inert during bond formation.

(ii) Uses of boric acid (short):

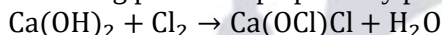
- Used as a mild antiseptic (eye wash).
- Used in the manufacture of glass and ceramics.
- Used as an insecticide.
- Used as a buffer solution.

35. (a) (i) Uses of oxygen (short):

- Used for respiration and in medical oxygen therapy.
- Used in welding and cutting of metals (oxy-acetylene flame).
- Used in steel manufacture.
- Used as an oxidizer in rocket fuels.

(ii) Preparation of bleaching powder (short):

Bleaching powder is prepared by passing dry chlorine gas over dry slaked lime $\text{Ca}(\text{OH})_2$.



OR

(b) Postulates of Werner's Coordination Theory (short):

- A metal shows two types of valencies: primary and secondary.
- Primary valency corresponds to oxidation state and is ionisable.
- Secondary valency corresponds to coordination number and is non-ionisable.
- Secondary valencies are fixed in number and have definite spatial arrangement.
- Ions satisfying secondary valency are directly attached to the metal ion.

36. (a) Crystalline solids:

- Have long-range ordered arrangement of particles
- Possess definite shape and sharp melting point
- Are anisotropic
- Example: NaCl, diamond

Amorphous solids:

- Have random arrangement of particles
- Do not have a sharp melting point
- Are isotropic
- Example: glass, rubber

OR

(b) (i) pH is defined as the negative logarithm (base 10) of the hydrogen ion concentration in a solution.

$$\text{pH} = -\log[H^+]$$

(ii) Example:



- If we add sodium acetate (CH_3COONa), which contains the common ion CH_3COO^- , the dissociation of acetic acid decreases.

Reason: -

- According to Le Chatelier's principle, adding a common ion shifts the equilibrium to the left, reducing the concentration of H^+ ions.

Effect: -

- pH increases slightly for weak acids.
- Solubility of salts decreases in the presence of a common ion.

37. (a) Nernst Equation Derivation (Short Version)

(i) Start with Gibbs free energy change:

$$\Delta G = \Delta G^\circ + RT \ln Q$$

Where: -

- ΔG = Gibbs free energy
- ΔG° = Standard Gibbs free energy
- R = Gas constant, T = Temperature (K)
- Q = Reaction quotient

(ii) Relate Gibbs free energy to cell potential:

$$\Delta G = -nFE \text{ and } \Delta G^\circ = -nFE^\circ$$

Where: -

- n = number of electrons
- F = Faraday constant
- E = Cell potential

(iii) Substitute into ΔG equation:

$$-nFE = -nFE^\circ + RT \ln Q$$

(iv) Solve for E :

$$E = E^\circ - \frac{RT}{nF} \ln Q$$

(v) Convert into log (common log):

$$E = E^\circ - \frac{0.0591}{n} \log_{10} Q \text{ at } 298K$$

Nernst Equation:

$$E = E^\circ - \frac{0.0591}{n} \log Q$$

OR

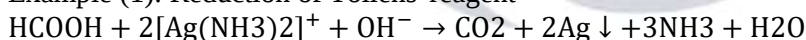
(b) Characteristics of a Catalyst:

- Increases reaction rate without being consumed.
- Does not change the equilibrium position of the reaction.
- Lowers the activation energy of the reaction.
- Regenerated at the end of the reaction, so it can be reused.
- Specific in action – usually works for a particular reaction.

38. (a) Reducing Action of Formic Acid (HCOOH)

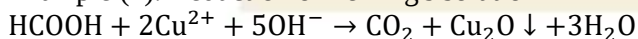
Reason: -Formic acid can donate electrons and is easily oxidized to CO_2 , so it acts as a reducing agent.

Example (1): Reduction of Tollens' reagent



Observation: -Silver mirror is formed.

Example (2): Reduction of Fehling's solution

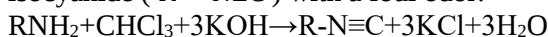


Observation: Red precipitate of Cu_2O is formed.

OR

(b) (i) Carbylamine Reaction

Definition: When a primary amine (RNH_2) is heated with chloroform (CHCl_3) and alkali (KOH), it forms an isocyanide ($\text{R}-\text{N}=\text{C}$) with a foul odor.



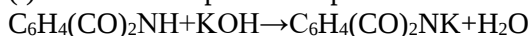
Use: Test for primary amines (positive test: foul-smelling isocyanide).

(ii) Gabriel Phthalimide Synthesis

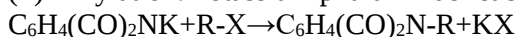
Purpose: Preparation of primary amines (RNH_2) from alkyl halides.

Steps: -

(i) Formation of potassium phthalimide:



(ii) Alkylation: Potassium phthalimide reacts with alkyl halide ($\text{R}-\text{X}$) $\rightarrow$ N-alkyl phthalimide



(iii) Hydrolysis: N-alkyl phthalimide hydrolyzed $\rightarrow$ primary amine



Key Point: Produces only primary amines, avoiding secondary/tertiary amines.

