CHEMISTRY IMPORTANTS

The 2-mark answers Unit-One questions:

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1) What is an ionic bond? Give example.

An **ionic bond** is a chemical bond formed by the **transfer of electrons** from a metal to a non-metal.
Example: NaCl (Sodium Chloride) – Na^+ and Cl^- ions.

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2) Define covalent bond. Give example H_2, O_2.

A **covalent bond** is formed when **two atoms share one or more pairs of electrons**.
Examples:

- H_2: H–H (single bond)
- O_2: O=O (double bond)

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3) Define hybridization. Give example.

Hybridization is the process of **mixing atomic orbitals** to form new hybrid orbitals of equal energy for bonding.
Example: In CH_4 (methane), carbon undergoes **sp^3 hybridization**.

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4) Define lattice energy.

Lattice energy is the energy **released** when one mole of an **ionic compound** is formed from its **gaseous ions**.
It is a measure of the strength of the ionic bond.

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5) Write Fajans' rules.

Fajans' rules predict **covalent character in ionic compounds**:

- Smaller cation size
- Larger anion size
- Higher cation charge
  These increase covalent character.

6) Write the resonance structures of CO_2, SO_2, SO_3, NO, NO_2.

CO_2:
O=C=O (linear)
↔ O^-–C≡O^+ and O^+≡C–O^-

SO_2:
O=S–O ↔ O–S=O (with lone pairs and formal charges)

SO_3:
O=S(=O)–O ↔ resonance among all 3 oxygen atoms

NO:
N=O ↔ N^+≡O^-

NO_2:
O=N–O ↔ O–N=O (bent structure with resonance)

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7) Write the isomers of butane, hexane, heptane.

- **Butane (C_4H_{10}):**
    1. *n-Butane*
    2. *iso-Butane (2-methylpropane)*
- **Hexane (C_6H_{14}):** 5 isomers
    1. *n-Hexane*
    2. *2-Methylpentane*
    3. *3-Methylpentane*
    4. *2,3-Dimethylbutane*
    5. *2,2-Dimethylbutane*
- **Heptane (C_7H_{16}):** 9 isomers (names not required for 2 marks; just mention the count)

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8) Write the oxidation of alkenes with $KMnO_4$.

Cold, dilute $KMnO_4$: Alkenes form **glycols** (diols).
Example: CH_2=CH_2 + [O] → HO–CH_2–CH_2–OH

Hot, concentrated $KMnO_4$: Cleaves double bond into **carboxylic acids or ketones**.

2-mark answers for Unit 2 questions:

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1) What are dienes? Give classification.

Dienes are hydrocarbons containing **two double bonds**.
Classification:

- **Conjugated dienes**: Double bonds separated by one single bond (e.g., 1,3-butadiene)
- **Cumulated dienes**: Double bonds are adjacent (e.g., allene)
- **Isolated dienes**: Double bonds separated by two or more single bonds

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2) Write the hybridization of alkane.

In **alkanes**, all carbon atoms are **sp^3 hybridized**.
Each carbon forms four **sigma bonds** with bond angle of **109.5°**.

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3) Write the hybridization of alkene.

In **alkenes**, the double bonded carbon atoms are **sp^2 hybridized**.
They form **one sigma and one pi bond** with bond angle of **120°**.

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4) Write the hybridization of alkynes.

In **alkynes**, the triple bonded carbon atoms are **sp hybridized**.
They form **one sigma and two pi bonds**, with bond angle **180°**.

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5) Write a note on acidity of alkynes.

Terminal alkynes are acidic due to the **sp-hybridized carbon** having high **s-character** (50%) which attracts electrons more.
Example: HC≡CH can release H^+ to form acetylide ion (strong base).

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6) Define activating and deactivating substances. Give example.

- **Activating groups** increase the reactivity of benzene towards electrophiles.
  Example: –OH, $–NH_2$

- **Deactivating groups** decrease the reactivity.
  Example: $-NO_2$, –COOH

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7) Write the resonance structure of Naphthalene and Anthracene.

Naphthalene: Two fused benzene rings with alternating double bonds (5 resonance structures)
Anthracene: Three linearly fused benzene rings showing resonance over the entire system.

(You can draw the structures if needed for exams.)

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8) Write Huckel's rule of aromaticity.

A compound is **aromatic** if it is:

- **Cyclic**, **planar**, **conjugated**, and
- Has **(4n + 2) π electrons**, where n = 0, 1, 2, ...

Example: Benzene (6 π electrons, n=1) is aromatic.

2-mark answers for Unit 3 questions:

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1) What is rate of a reaction? Mention its unit.

The **rate of a reaction** is the change in concentration of a reactant or product per unit time.
Unit: $mol \cdot L^{-1} \cdot s^{-1}$

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2) Write the relationship between half-life period and order of reaction.

- For **first-order reactions**:
  t1/2=0.693kt_{1/2} = {0.693}{k} (independent of concentration)
- For **zero or second order**, t1/2t_{1/2} depends on initial concentration.

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3) What are surface reactions? Give its characteristics.

Surface reactions occur on the surface of solids, especially catalysts.
Characteristics:

- Occur at solid-gas or solid-liquid interfaces
- Highly influenced by surface area and nature of the surface

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4) What are different types of liquid mixtures?

1. **Ideal mixtures** – follow Raoult's law (no heat change)
2. **Non-ideal mixtures** – show deviation (positive or negative) from Raoult's law
3. **Azeotropic mixtures** – constant boiling mixtures that can't be separated by distillation

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5) Define positive and negative adsorption.

- **Positive adsorption:** Solute accumulates on the surface (e.g., gas on charcoal)
- **Negative adsorption:** Solute concentration decreases on the surface (surface repels solute)

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6) Write Gibbs adsorption equation. Mention the terms.

Gibbs adsorption equation: Γ=−1/RT (d γ\/d ln c)

Where:

- Γ\Gamma = surface excess
- γ\gamma = surface tension
- CC = concentration
- RR = gas constantD
- TT = temperature

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7) What is the effect of dissolved substance on surface tension of solvent?

- If solute **increases surface tension**, it is **non-surface active**.

- If solute **decreases surface tension**, it is **surface-active** (like soaps, detergents).

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8) What are adsorption indicators?

Adsorption indicators are dyes used in **precipitation titrations** which get adsorbed on the precipitate and change color at the equivalence point.
Example: Fluorescein in silver nitrate titration.

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9) Define physisorption and chemisorption.

- **Physisorption:** Weak van der Waals forces, low heat of adsorption, reversible.
- **Chemisorption:** Strong chemical bond, high heat of adsorption, often irreversible.

2-mark answers for Unit 4 questions:

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1) Define Normality and Molarity

- **Normality (N):** Number of gram-equivalents of solute per litre of solution.
  N=gram equivalents volume in litres N
- **Molarity (M):** Number of moles of solute per litre of solution.
  M=moles of solute volume in litres M

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2) Give the classification of titrimetric analysis. Give example for each.

1. **Acid-base titration** (e.g., HCl vs NaOH)
2. **Redox titration** (e.g., $KMnO_4$ vs $FeSO_4$)
3. **Complexometric titration** (e.g., EDTA vs Ca^{2+})
4. **Precipitation titration** (e.g., $AgNO_3$ vs NaCl)

3) Indicator used for EDTA titration

The most common indicator is **Eriochrome Black T (EBT)**.
It forms a colored complex with metal ions and changes color at the end point.

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4) Write a note on metal ion indicators

Metal ion indicators are organic dyes that form colored complexes with metal ions.
At endpoint, metal ions form a complex with EDTA, releasing the indicator and causing a **color change**.

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5) Write the mechanism of precipitation

Precipitation occurs when the product of ion concentrations exceeds the **solubility product (Ksp)**, forming an insoluble solid.
Steps:

1. **Supersaturation**
2. **Nucleation**
3. **Crystal growth**

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6) Define co-precipitation and post-precipitation

- **Co-precipitation:** Unwanted substances get precipitated along with desired precipitate.
- **Post-precipitation:** Impurities form after the main precipitate is formed and settle on it.

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7) Write the factors influencing precipitation

1. **Concentration of ions**
2. **Temperature**
3. **pH of solution**
4. **Rate of mixing**
5. **Presence of common ions or impurities**

8) Write the structure of Oxine and DMG

- **Oxine (8-hydroxyquinoline):**
  A quinoline ring with –OH at position 8

- **DMG (Dimethylglyoxime):**
  A dioxime compound with two $–CH_3$ groups