

Answers (1–25)

1. **B**
2. **C**
3. **B**
4. **C**
5. **B**
6. **B**
7. **C**
8. **C**
9. **C**
10. **C**
11. **B**
12. **C**
13. **A**
14. **A**
15. **A**
16. **A**
17. **B**
18. **C**
19. **B**
20. **C**
21. **B**
22. **B**
23. **A**
24. **B**
25. **D**
26. –B
27. –C,
28. –B,
29. –B,

30. –C

Answers (26–50)

26. B
27. C
28. B
29. B
30. C
31. C
32. A
33. C
34. A
35. B
36. B
37. B
38. B
39. B
40. C
41. B
42. C
43. A
44. A
45. A
46. A
47. B
48. A
49. C
50. C

COMPREHENSIVE MARKING SCHEME

SECTION A (Compulsory – Answer All)

[Total: 70 Marks]

1. Acid, Base, and Salt

(a)(i) Define a base according to the Bronsted-Lowry theory.

- **Answer:** A base is a proton (H^+ ion) acceptor.
- **Marking:**
 - Correct definition (**2 marks**).

(a)(ii) Give two examples of amphoteric substances.

- **Answer:**
 1. Water (H_2O)
 2. Aluminum hydroxide ($\text{Al}(\text{OH})_3$) / Amino acids / HCO_3^-
- **Marking:**
 - Each correct example (**1.5 marks \times 2 = 3 marks**).

(b)(i) Prepare dry NaCl crystals from NaCl + sand mixture.

- **Answer:**
 1. Dissolve mixture in water (sand is insoluble).
 2. Filter to remove sand.
 3. Evaporate filtrate to dryness.
- **Marking:**
 - Each correct step (**1 mark \times 3 = 3 marks**).

(b)(ii) Balanced equation for HCl + NaOH.

- **Answer:**



- **Marking:**

- Correct reactants/products (**1 mark**), balancing (**1 mark**).
-

2. Chemical Bonding

(a)(i) Define covalent bond.

- **Answer:** A bond formed by sharing electron pairs between atoms.

- **Marking:**

- Correct definition (**2 marks**).

(a)(ii) Diamond vs. Graphite hardness.

- **Answer:**

- Diamond: **Tetrahedral covalent network** (rigid 3D structure).
- Graphite: **Layered structure** with weak van der Waals forces between layers.

- **Marking:**

- Diamond explanation (**1.5 marks**), Graphite explanation (**1.5 marks**).

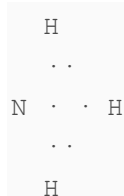
(b)(i) Electron dot structure for NH₃.

- **Answer:**

text

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(Lone pair on N, 3 single N-H bonds).

- **Marking:**

- Correct structure (**3 marks**).

(b)(ii) Two properties of ionic compounds.

- **Answer:**

1. High melting/boiling points.
2. Conduct electricity when molten/dissolved.

- **Marking:**

- Each property (**1 mark × 2 = 2 marks**).
-

3. States of Matter

(a)(i) Define sublimation with example.

- **Answer:**

- Direct solid → gas phase change.
- Example: Iodine / Dry ice (CO₂).

- **Marking:**

- Definition (**1 mark**), Example (**1 mark**).

(a)(ii) Gases vs. liquids compressibility.

- **Answer:**

- Gases have **large intermolecular spaces**; liquids have tightly packed particles.

- **Marking:**

- Correct explanation (**3 marks**).

(b)(i) Define Brownian motion.

- **Answer:** Random movement of particles in a fluid due to collisions.

- **Marking:**

- Correct definition (**2 marks**).

(b)(ii) Evaporation vs. boiling differences.

- **Answer:**

1. Evaporation: **Surface-only**, any temperature.
2. Boiling: **Throughout liquid**, fixed temperature.

- **Marking:**

- Each difference (**1.5 marks × 2 = 3 marks**).
-

4. Atomic Structure

(a)(i) Define isotopes.

- **Answer:** Atoms of the same element with **same protons but different neutrons**.

- **Marking:**

- Correct definition (**2 marks**).

(a)(ii) Uses of radioactive isotopes.

- **Answer:**

1. Carbon-14 dating.
2. Cancer treatment (e.g., Cobalt-60).

- **Marking:**

- Each use (**1.5 marks × 2 = 3 marks**).

(b)(i) Electronic configuration & group (Z=12, A=24).

- **Answer:**

- Configuration: **2,8,2**.
- Group: **2 (alkaline earth metals)**.

- **Marking:**

- Configuration (**2 marks**), Group (**1 mark**).

(b)(ii) Charge of ion.

- **Answer:** **2+** (loses 2 electrons).

- **Marking:**

- Correct charge (**2 marks**).
-

5. Practical Applications

(a)(i) Why conc. H_2SO_4 is not used to dry NH_3 .

- **Answer:** NH_3 (base) reacts with H_2SO_4 (acid):



- **Marking:**

- Correct explanation (**3 marks**).

(a)(ii) Gas dried by conc. H_2SO_4 .

- **Answer: Hydrogen (H₂) / Chlorine (Cl₂).**

- **Marking:**

- Correct example (**2 marks**).

(b)(i) Observations when Mg burns in air.

- **Answer:**

1. Bright white flame.
2. White ash (MgO) forms.

- **Marking:**

- Each observation (**1.5 marks × 2 = 3 marks**).

(b)(ii) Balanced equation for Mg + O₂.

- **Answer:**



- **Marking:**

- Correct equation (**2 marks**).
-

6. Acid-Base Titration Calculations

(a) Balanced equation for HCl + NaOH.

- **Answer:**



- **Marking:**

- Correct equation (**2 marks**).

(b)(i) Moles of HCl (0.5 mol/dm³, 25 cm³).

- **Answer:**

$$\text{Moles} = 0.5 \times 0.025 = 0.0125 \text{ mol} \quad \text{Moles} = 0.5 \times 0.025 = 0.0125 \text{ mol}$$

- **Marking:**

- Correct calculation (**2 marks**).

(b)(ii) Concentration of NaOH (20 cm³ used).

- **Answer:**

$$\text{Concentration} = \frac{0.0125}{0.02} = 0.625 \text{ mol/dm}^3 \quad \text{Concentration} = \frac{0.020}{0.0125} = 1.6 \text{ mol/dm}^3$$

- **Marking:**

- Correct steps (**4 marks**).

(b)(iii) Concentration of NaCl solution.

- **Answer:**

$$\text{Total volume} = 45 \text{ cm}^3 \quad \text{Total volume} = 45 \text{ cm}^3 \quad \text{Concentration} = \frac{0.0125}{0.045} \approx 0.278 \text{ mol/dm}^3$$

- **Marking:**

- Correct calculation (**2 marks**).

(b)(iv) pH of resulting solution.

- **Answer: 7** (neutral salt solution).

- **Marking:**

- Correct pH (**2 marks**).

(c) Suitable indicator.

- **Answer:** Phenolphthalein / Methyl orange.
 - **Marking:**
 - Correct indicator (**2 marks**).
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SECTION B (Optional – Answer Any 3)

[Total: 40 Marks]

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[Total: 40 Marks]

7. Acid, Base, and Salt

(a)(i) Why ethanoic acid is a weak acid.

- **Answer:**
Ethanoic acid (CH_3COOH) **partially dissociates** in water, releasing few H^+ ions.



- **Marking:**
 - Partial dissociation (**2 marks**).
 - Equilibrium sign (\rightleftharpoons) (**1 mark**).
 - Example equation (**1 mark**).

(a)(ii) Two differences: Strong vs. Weak acids.

- **Answer:**
 1. **Strong acids** fully dissociate (e.g., HCl), while **weak acids** partially dissociate (e.g., CH_3COOH).
 2. **Strong acids** have higher electrical conductivity than weak acids at same concentration.

- **Marking:**

- Each correct difference (**1.5 marks × 2 = 3 marks**).

(b)(i) Test for carbonate ion (CO_3^{2-}).

- **Answer:**

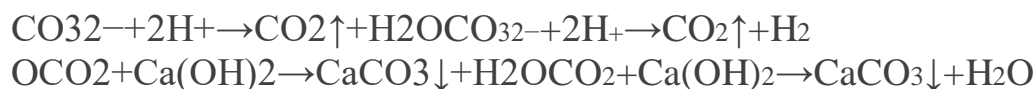
1. Add dilute acid (e.g., HCl) to the sample.
2. Observe **effervescence** (bubbles of CO_2 gas).
3. Pass gas through limewater → turns **milky** (confirms CO_2).

- **Marking:**

- Procedure steps (**3 marks**).
- Limewater test (**1 mark**).

(b)(ii) Equation for carbonate test.

- **Answer:**



- **Marking:**

- First equation (**1 mark**).
 - Limewater equation (**1 mark**).
-

8. Chemical Bonding

(a)(i) Metallic bonding definition.

- **Answer:**

A lattice of **positive metal ions** surrounded by a "sea" of **delocalized electrons**.

- **Marking:**

- Positive ions + delocalized electrons (**3 marks**).

(a)(ii) Why metals conduct electricity.

- **Answer:**

Delocalized electrons are **mobile** and carry charge when a voltage is applied.

- **Marking:**

- Electron mobility (**2 marks**).
- Applied voltage context (**2 marks**).

(b)(i) Bonding in NaCl vs. HCl.

- **Answer:**

- **NaCl:** Ionic bond (Na^+ and Cl^- ions).
- **HCl:** Polar covalent bond (shared electrons closer to Cl).

- **Marking:**

- NaCl description (**2 marks**).
- HCl description (**2 marks**).

(b)(ii) Which conducts electricity in solution?

- **Answer:**

NaCl conducts because it **ionizes fully** into Na^+ and Cl^- ions in water. HCl (gaseous) forms ions only when dissolved.

- **Marking:**

- NaCl explanation (**1 mark**).
- HCl clarification (**1 mark**).

9. States of Matter

(a)(i) Diffusion & Graham's law.

- **Answer:**

- **Diffusion:** Movement of particles from high → low concentration.
- **Graham's Law:** Rate of diffusion $\propto \frac{1}{\sqrt{\text{Molar Mass}}}$.

- **Marking:**

- Diffusion definition (**2 marks**).
- Graham's law formula (**2 marks**).

(a)(ii) Order of diffusion rates (slowest → fastest).

- **Answer:**



(Molar masses: $\text{CO}_2=44$, $\text{O}_2=32$, $\text{N}_2=28$, $\text{H}_2=2$).

- **Marking:**

- Correct order (**3 marks**).

(b)(i) Critical temperature definition.

- **Answer:**

The highest temperature at which a gas can be liquefied by pressure alone.

- **Marking:**

- Correct definition (**3 marks**).

(b)(ii) Real gases deviate at high pressure.

- **Answer:**

1. Intermolecular forces become significant.
2. Gas particles occupy volume (non-negligible).

- **Marking:**

- Forces explanation (**1.5 marks**).
 - Volume explanation (**1.5 marks**).
-

10. Atomic Structure

(a)(i) Three principles of hybridization.

- **Answer:**

1. Mixing of atomic orbitals.
2. Hybrid orbitals have **equal energy**.
3. Number of hybrid orbitals = number of mixed orbitals.

- **Marking:**

- Each principle (**1.33 marks × 3 ≈ 4 marks**).

(a)(ii) Maximum electrons in 3rd energy level.

- **Answer:**

$$2n^2 = 2(3)^2 = 18 \text{ electrons}$$

- **Marking:**

- Correct calculation (**3 marks**).

(b)(i) Orbit vs. Orbital.

- **Answer:**

- **Orbit:** Fixed circular path (Bohr model).
- **Orbital:** Probability region for electrons (quantum model).

- **Marking:**

- Orbit definition (**1.5 marks**).
- Orbital definition (**1.5 marks**).

(b)(ii) Electron configuration of iron (Fe, Z=26).

- **Answer:**

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

or $[Ar] 4s^2 3d^6$

- **Marking:**

- Correct configuration (**3 marks**).
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Key Notes for Marking Section B:

1. **Partial credit** is awarded for:

- Correct concepts with minor errors (e.g., incomplete equations).
- Logical steps in calculations.

2. **Deduct 0.5–1 mark** for:

- Missing units (e.g., mol/dm³).
 - Incorrect subscripts/superscripts (e.g., writing CO₃ instead of CO₃²⁻).
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SUMMARY

- **Section A:** 70 marks allocated across **definitions, explanations, equations, and calculations**.
- **Partial credit** awarded for logical steps (e.g., in calculations).
- **Section B:** Focus on **conceptual depth** and **application**.