ICSE CLASS X BOARD EXAMINATION — YEAR 2027

SCIENCE PAPER 2: CHEMISTRY (52)

Chapter-Wise Question Bank (2023–2027 Board & Specimen Papers)

Papers Included

Board Papers (4): 2023 (T23 522), 2024 (T24 522), 2025 (T25 522), 2026 (T26 522). | Specimen Papers (5): 2023S (T23 522 – SPECIMEN), 2024S (T24 522 – SPECIMEN), 2025S (T25 522 – SPECIMEN), 2026S (T26 522 – SPECIMEN), 2027S (T27 522 – SPECIMEN).
Syllabus Scope: CISCE ICSE 2027 Chemistry (Science Paper 2) — Class X Syllabus Only.

Chapters Covered

1. Periodic Properties and variations of Properties – Physical and Chemical *[40 items: 16 MCQ, 6 Short, 18 Long]*
2. Chemical Bonding *[30 items: 11 MCQ, 9 Short, 10 Long]*
3. Study of Acids, Bases and Salts *[39 items: 16 MCQ, 7 Short, 16 Long]*
4. Analytical Chemistry *[25 items: 9 MCQ, 8 Short, 8 Long]*
5. Mole Concept and Stoichiometry *[39 items: 13 MCQ, 14 Short, 12 Long]*
6. Electrolysis *[24 items: 13 MCQ, 3 Short, 8 Long]*
7. Metallurgy *[26 items: 8 MCQ, 13 Short, 5 Long]*
8. Study of Compounds *[63 items: 19 MCQ, 20 Short, 24 Long]*
9. Organic Chemistry *[36 items: 15 MCQ, 6 Short, 15 Long]*
Picture-Based Questions (Diagram & Setup Section) *[44 items: 11 MCQ, 2 Short, 31 Long]*

How to Use This Bank

- **Source Tags:** After each question or option list, a bold blue tag gives the paper year: [2025] for a Board paper and [2025S] for a Specimen paper.
- **Merged Identical Questions:** Questions with identical wording across papers (ignoring capitals, punctuation, and 'the') are merged into one entry listing every year, e.g. [2024S] [2025S] [2026S].
- **Distinct Wording Variations:** If wording differs even slightly, separate entries are kept with their own tags and never merged.
- **Categories & Numbering:** Each chapter has three categories — A. Multiple Choice Questions (1 mark each), B. Short Questions (1 or 2 marks), and C. Long Questions (3+ marks) — restarting at 1 in each category.
- **Layout, Tables & Figures:** Questions use 'Number [Tab] Question [Tab] [Marks]', stripped of cognitive labels ([Recall], [Application], [Analysis]). Data tables use 8pt font with light grey header shading. Diagrams appear in Picture-Based Questions with red placeholders [FIGURE: description — paste from source paper, YEAR PAPER_CODE Q_NUMBER].

Chapter 1: Periodic Properties and variations of Properties – Physical and Chemical

A. Multiple Choice Questions (1 mark each)

1. Electron affinity is maximum in: **[1]**

(a) Alkaline earth metals

(b) Halogens

(c) Inert gases

(d) Alkali metals

[2023S]

2. An alkali metal found in period 3 and group 1 is: **[1]**

(a) Magnesium

(b) Lithium

(c) Sodium

(d) Potassium

[2023S]

3. An element in period 3, whose electron affinity is zero: **[1]**

(a) Neon

(b) Sulphur

(c) Sodium

(d) Argon

[2023]

4. An element with the largest atomic radius among the following is: **[1]**

(a) Carbon

(b) Nitrogen

(c) Lithium

(d) Beryllium

[2023]

5. An element with atomic no. _____ will form an acidic oxide. **[1]**

(a) 3

(b) 17

(c) 11

(d) 13

[2024S]

6. An element belongs to third period and sixteenth group. It will have _____ electrons in its valence shell. **[1]**

(a) 2

(b) 5

(c) 6

(d) 3

[2024S]

7. In the 2nd period Neon has maximum Ionization Potential because: **[1]**

(a) It has unstable electronic configuration.

(b) It easily accepts electrons.

(c) It easily loses electrons.

(d) The outer most shell is completely filled.

[2024]

8. Electron Affinity is maximum in: **[1]**

(a) Mg

(b) Ar

(c) Li

(d) Br

[2024]

9. 1H2 is an isotope of hydrogen. In the modern Periodic Table it will: **[1]**

(a) be placed before hydrogen

(b) be placed after hydrogen

(c) be placed at the same position as hydrogen

(d) not have any position in the Periodic Table

[2025S]

10. Which of the following electronic configuration represents the most electropositive element? **[1]**

(a) 2, 1

(b) 2, 8, 1

(c) 2, 2

(d) 2, 8, 2

[2025S]

11. Assertion (A): Alkali metals do not form dipositive ions. **[1]**

Reason (R): After loss of one electron alkali metals achieve stable electronic configuration of noble gases.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and 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

[2025S]

12. Assertion (A): The tendency of losing electrons increases down the Group. **[1]**

Reason (R): The most reactive metal is placed at the top of Group 1.

(a) Both (A) and (R) are true, and (R) is the correct explanation of (A).

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

(c) (A) is true but (R) is false.

(d) (A) is false but (R) is true.

[2025]

13. X, Y & Z are three metallic atoms in successive order belonging to the same group such that atomic radii of 'X' is the smallest. Which of the three atoms is the best reducing agent? **[1]**

(a) X

(b) Y

(c) Z

(d) All three have the same reducing power.

[2025]

14. Which element amongst the following has the largest atomic radius? **[1]**

(a) Al

(b) S

(c) Mg

(d) Na

[2026S]

15. X and Y are diatomic elements. X is less reactive than Y. What are elements X and Y? **[1]**

(a) X - chlorine, Y - iodine

(b) X - fluorine, Y - nitrogen

(c) X - iodine, Y - bromine

(d) X - oxygen, Y - nitrogen

[2027S]

16. Statement I: Halogens are very reactive. **[1]**

Statement II: Halogens have high electron affinity.

(a) Both the statements are true.

(b) Both the statements are false.

(c) Statement I is true, and statement II is false.

(d) Statement I is false, and statement II is true.

[2027S]

B. Short Questions (1 or 2 marks)

1. Define / State: **[2]**

(a) Electronegativity

(b) Gay-Lussac's Law of combining volumes

[2023]

2. Give reason for the following: **[2]**

(a) Ionisation potential decreases down a group.

(b) Ionic compounds do not conduct electricity in solid state.

[2023]

3. Element 'X' forms an oxide with the formula X_2O_3 which is a solid with high melting point. 'X' would most likely be placed in the group of the Periodic Table as: **[2]**

1. (a) Na (b) Mg (c) Al (d) Si

2. Justify your answer in the above question (1).

[2025S]

4. The atomic number of two atoms 'X' and 'Y' are 14 and 8 respectively. State: (Do not identify X and Y) **[2]**

(a) the period to which 'X' belongs.

(b) the formula of the compound formed between 'X' and 'Y'.

[2025]

5. Given below are two sets of elements from two different periods. Name the element with the highest ionisation potential in each of the following sets. **[2]**

(a) Al, Cl, Mg

(b) Ne, O, F

[2025]

6. Name the following: **[2]**

(a) The most electronegative element of Period 2.

(b) The largest atom of Period 3.

[2026]

C. Long Questions (3 marks)

1. Arrange the following as per the instruction given in the brackets: **[3]**

(a) Na, K, Cl, Si, S. (increasing order of electro negativity)

(b) Be, Li, F, C, B, N, O (increasing order of metallic character)

(c) Br, F, I, Cl (increasing order of atomic size)

[2023S]

2. An element X has atomic number 17. Answer the following questions. **[3]**

(a) State the period & group to which it belongs:

(b) Is it a Metal or Non Metal?

(c) Write the formula between X and Hydrogen.

[2023S]

3. State the terms / process for the following: **[5]**

(a) The energy released when an atom in the gaseous state accepts an electron to form an anion.

(b) Tendency of an element to form chains of identical atoms.

(c) The name of the process by which Ammonia is manufactured on a large scale.

(d) A type of salt formed by partial replacement of hydroxyl radicals with an acid radical.

(e) The ratio of the mass of a certain volume of gas to the same volume of hydrogen measured under the same conditions of temperature and pressure.

[2023]

4. Arrange the following as per the instruction given in the brackets: **[3]**

(a) Al, K, Mg, Ca (decreasing order of its reactivity)

(b) N, Be, O, C (increasing order of non-metallic character)

(c) P, Si, F, Be (decreasing order of valence electrons)

[2023]

5. Complete the following by choosing the correct answers from the bracket: **[5]**

(a) If an element has one electron in the outermost shell then it is likely to have the _____ [smallest/ largest] atomic size amongst all the elements in the same period.

(b) _____ [sulphuric acid/ hydrochloric acid] does not form an acid salt.

(c) A _____ [reddish brown/ dirty green] coloured precipitate is formed when ammonium hydroxide is added to a solution of ferric chloride.

(d) Alkanes undergo _____ [addition/ substitution] reactions.

(e) An _____ [alkaline/acidic] solution will turn methyl orange solution pink.

[2024S]

6. The electron affinity of an element X is greater than that of element Y. **[3]**

(a) How is the oxidising power of X likely to compare with that of Y?

(b) How is the electronegativity of X likely to compare with that of Y?

(c) State whether X is likely to be placed to the left or to the right of Y in the periodic table?

[2024S] [2025S] [2026S]

7. X [2, 8, 7] and Y [2, 8, 2] are two elements. Using this information complete the following: **[3]**

(a) _____ is the metallic element.

(b) Metal atoms tend to have a maximum of _____ electrons in the outermost shell.

(c) _____ is the reducing agent.

[2024S] [2025S]

8. Arrange the following as per the instructions given in the brackets: **[3]**

(a) Carbon, Fluorine, Beryllium (decreasing order of atomic size)

(b) Sulphuric acid, Phosphoric acid, Acetic acid (increasing order of number of replaceable H atoms per molecule)

(c) Potassium, Lithium, Sodium (increasing order of ionization potential)

[2024]

9. Identify the following: **[3]**

(a) An element in period 1 which can be placed in both group 1 and group 17 of the Periodic Table.

(b) The element having electronic configuration 2, 8, 6.

(c) The most electronegative element of period 3.

[2024]

10. Complete the following by choosing the correct answers from the bracket: **[5]**

(a) If an element has one electron in the outermost shell, then it is likely to have the _____ [smallest/ largest] atomic size amongst all the elements in the same period.

(b) _____ [sulphuric acid/ hydrochloric acid] does not form an acid salt.

(c) A _____ [reddish brown/ dirty green] coloured precipitate is formed when ammonium hydroxide is added to a solution of ferrous chloride.

(d) Alkynes undergo _____ [addition / substitution] reactions.

(e) An _____ [alkaline/acidic] solution will turn methyl orange solution pink or red.

[2025S]

11. Study the table given below. Use only the letters given in the table to answer the questions. Do not identify the elements. **[3]**

Table: Periodic table grid with elements E, J, Q, L, G, M, D, P, N (2025 Q4(iv))

IA	IIA	IIIA	IVA	VA	VIA	VIIA	0
–	–	–	E	–	J	–	Q
–	L	–	–	G	–	–	–
–	M	D	–	–	–	P	–
–	N	–	–	–	–	–	–

(a) State the valency of element 'G'.

(b) Which element can exhibit catenation?

(c) Write the formula of the compound formed between 'M' and 'P'.

[2025]

12. Complete the following by choosing the correct answers from the bracket: **[5]**

(a) When dilute sulphuric acid reacts with zinc granules, the gas evolved is _____ (hydrogen / carbon dioxide), which can be tested using a burning splint.

(b) A solution of copper(II) sulphate in sodium hydroxide solution forms a _____ (pale blue / green) precipitate.

(c) In methane, each hydrogen atom share(s) _____ (one / two) electron(s) with the central carbon atom to complete its valence shell.

(d) The electron affinity of element X is greater than that of element Y. The oxidising power of X is likely to be _____ (more / less) than that of element Y.

(e) The naturally occurring compound of a metal from which the metal can be extracted is called its _____ (ore / mineral).

[2026S]

13. L, M and N are three elements with atomic numbers 13, 7 and 10 respectively. Answer the following questions using only the alphabets given. Do not identify the elements. Which element: **[3]**

(a) can combine with hydrogen to form a gas which produces dense white fumes with concentrated HCl?

(b) has zero electron affinity?

(c) can form an ionic compound with oxygen?

[2026S]

14. Element A belongs to group 15 and period 2 of the Periodic Table. **[3]**

(a) Identify the element A.

(b) Write the formula of the compound formed when element A combines with hydrogen.

(c) Draw the dot (●) and cross (x) structure of the compound formed in (b) above.

[2026]

15. Elements P, Q, and R are in the same period of the modern periodic table. **[3]**

- P readily loses its one valence electron to form a stable ion.
- Q shares its electrons in bonding but does not form ions easily.
- R has high electronegativity.

Answer the following questions based on the above information:

(a) Which element would be most difficult to reduce among P, Q and R?

(b) Which element is expected to have the smallest atomic radius among P, Q and R?

(c) Arrange P, Q and R in order of decreasing ionization potential.

[2026]

16. Given below are a few elements: [Li, K, Ca, F]. Identify the element which: **[3]**

(a) has the least atomic radius.

(b) has two valence electrons.

(c) is the most electropositive.

[2026]

17. An element 'P' has 3 valence electrons in its L - shell and an element 'Q' has 7 valence electrons in its M - shell. Using this information, answer the following questions: **[3]**

(a) Identify the exact position of element 'Q' in terms of group and period in the Modern Periodic Table.

(b) The atomic radius of P is _____ (more/less) than that of Q.

[2027S]

18. In the reactivity series of metals, Z is a metal above hydrogen and its oxide has the formula ZO. It was found that ZO reacted with water and formed a hydroxide as the product. With reference to the above context, answer the following questions: **[3]**

(a) State the number of valence electrons present in element Z.

(b) Name the group which Z belongs to.

(c) What will be the formula of the hydroxide of Z?

[2027S]

Chapter 2: Chemical Bonding

A. Multiple Choice Questions (1 mark each)

1. A polar covalent compound is: **[1]**

(a) Methane

(b) Ammonia

(c) Nitrogen

(d) Chlorine

[2023S]

2. A → A+3; B → B-1. Number of electrons present in the outermost shell of atoms A and B respectively are: **[1]**

(a) 5, 1

(b) 3, 1

(c) 3, 7

(d) 5, 7

[2024S]

3. In the molecule of water, oxygen atom has: **[1]**

(a) One shared pair of electrons.

(b) Three shared pairs of electrons.

(c) Two lone pairs of electrons.

(d) One lone pair of electrons.

[2024]

4. Element 'P' has electronic configuration 2,8,8,1. The number of chlorine atoms present in the chloride of 'P' is: **[1]**

(a) 2

(b) 1

(c) 3

(d) 4

[2025S]

5. Given below are four ions: **[1]**

Cl–, Li+, Al3+, K+

Identify the pair of ions which have the same electronic configuration.

[Atomic number: Cl = 17, Li = 3, Al = 13, K = 19]

(a) Cl– & Li+

(b) Al3+ & K+

(c) Cl– & K+

(d) Li+ & K+

[2025]

6. Identify the ion that contain one lone pair of electrons. **[1]**

(a) OH-1

(b) H3O+

(c) NH4+

(d) H+

[2026S]

7. Which of the following element pairs will form an ionic bond? **[1]**

Table: Element pairs P, Q, R, and S (2026 Q1(ii))

Pair	Description
P	Elements of Group 1 & Group 2
Q	Elements of Group 14 & Group 16
R	Elements of Group 2 & Group 17
S	Elements of Group 15 & Group 18

(a) P

(b) Q

(c) R

(d) S

[2026]

8. An atom of X forms an ion according to the equation X → X+2. The atomic number of the atom X is: **[1]**

(a) 16

(b) 10

(c) 12

(d) 14

[2026]

9. The compound that has the highest melting point amongst the following is: **[1]**

(a) Methane

(b) Sodium chloride

(c) Ammonia

(d) Ethanol

[2026]

10. Assertion (A): Ionic compounds have high melting points. **[1]**

Reason (R): A strong electrostatic force of attraction exists between the oppositely charged ions.

(a) (A) is true but (R) is false.

(b) (A) is false but (R) is true.

(c) Both (A) and (R) are true, and (R) is the correct explanation of (A).

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

[2027S]

11. Identify the ion that contains one lone pair of electrons. **[1]**

(a) OH-1

(b) H3O+

(c) NH4+

(d) H+

[2027S]

B. Short Questions (1 or 2 marks)

1. Draw the electron dot structure for the following. **[2]**

(a) H3O+

(b) CH4

[2023S]

2. Draw the electron dot structure for the following: [At. No.: N = 7, H = 1] **[2]**

(a) Ammonium ion

(b) A molecule of nitrogen

[2023]

3. Draw the electron dot diagram of Hydronium ion. **[2]**

[2024S]

4. Draw the electron dot structure of: [Atomic number: N = 7, C = 6, H = 1] **[2]**

(a) Methane molecule

(b) Nitrogen molecule

[2024]

5. Give reasons for the following: **[2]**

(a) Inert gases do not form ions.

(b) Covalent compounds have a low melting and boiling point.

[2024]

6. Fill in the blanks by choosing the correct answer from the bracket: **[2]**

(a) Carbon tetrachloride is a _____ [polar / non-polar] covalent molecule.

(b) During electrolysis of acidulated water, the gas liberated at the anode is _____ [oxygen / hydrogen].

[2024]

7. Draw the electron dot diagram of ammonium ion. **[2]**

[2025S]

8. Draw the electron dot diagram of ammonium ion. [Atomic No.: N = 7, H = 1] **[2]**

[2026S]

9. A compound commonly used in the laboratory has formula H2P. H represents hydrogen, P represents a non-metal. Draw a dot and cross structure for the formation of the compound H2P. **[2]**

[2027S]

C. Long Questions (3 marks)

1. Identify the following: **[5]**

(a) The property by which carbon bonds with itself to form a long chain.

(b) A substance that conducts electricity in molten or aqueous state.

(c) The energy required to remove an electron from the valence shell of a neutral isolated gaseous atom.

(d) The name of the process by which the Bauxite ore is concentrated.

(e) The bond formed by a shared pair of electrons with both electrons coming from the same atom.

[2023S]

2. Fill in the blanks selecting the appropriate word from the given choice: **[3]**

(a) In a covalent compound the bond is formed due to _____ of electrons (sharing / transfer)

(b) A molecule which has a single lone pair of electrons _____. (NH3 / H2O)

(c) Electrovalent compounds do not conduct electricity in their _____ state. (molten / solid)

[2023S]

3. Match the Column A with Column B: **[5]**

Table: Matching Column A with Column B (2023 Q2(i))

	Column A		Column B
(a)	Sodium Chloride	1.	has two shared pair of electrons
(b)	Methane	2.	has high melting and boiling points
(c)	Hydrogen chloride gas	3.	a greenhouse gas
(d)	Oxidation reaction	4.	has low melting and boiling points
(e)	Water	5.	$Zn - 2e^- \rightarrow Zn^{2+}$
–	–	6.	$S + 2e^- \rightarrow S^{2-}$

[2023]

4. Identify the following: **[5]**

(a) A bond formed between two atoms by sharing of a pair of electrons, with both electrons being provided by the same atom.

(b) A salt formed by the complete neutralization of an acid by a base.

(c) A reaction in which the hydrogen of an alkane is replaced by a halogen.

(d) The energy required to remove an electron from a neutral gaseous atom.

(e) A homogenous mixture of two or more metals or a metal and a non-metal in a definite proportion in their molten state.

[2024S] [2025S]

5. Answer the following questions on chemical bonding and mole concept: **[3]**

(a) State wether the following statements are TRUE or FALSE. Justify your answer.

1. In an electrovalent compound, the cation attains the electronic configuration of the noble gas that comes after it in the periodic table.
2. In the formation of a compound PQ2, atom P gives one electron to each atom of Q. The compound PQ2 is a good conductor of electricity.

(b) Calculate the number of moles in 22 grams of carbon dioxide.

[2024S]

6. Match the Column A with Column B: **[5]**

Table: Matching Column A with Column B (2024 Q2(ii))

	Column A		Column B
(a)	Water	1.	Lithium
(b)	Alkali metal	2.	Iodine
(c)	Halogen	3.	Covalent compound
(d)	Calcium oxide	4.	Acetic acid
(e)	Weak acid	5.	Ionic compound
–	–	6.	Sulphuric acid

[2024]

7. The following table shows the electronic configuration of the atoms A, B, C and D. **[3]**

Table: Electronic configuration of atoms A, B, C and D (2024 Q7(iv))

Element	A	B	C	D
Electronic configuration	2, 8, 8, 2	2, 6	2, 8, 7	2, 4

(a) Write the formula of the compound formed between:

1. A and B
2. D and C

(b) Which of the above elements will exhibit catenation?

[2024]

8. Draw the dot and cross structure of the following: [Atomic number: Mg = 12, Cl = 17, H = 1, N = 7] **[3]**

(a) An ionic compound formed when Mg reacts with the dilute HCl.

(b) A covalent compound formed when H2 reacts with Cl2.

(c) The positive ion produced when ammonia gas is dissolved in water.

[2025]

9. Identify the following: **[5]**

(a) A bond formed between two atoms by sharing of a pair of electrons, with both electrons being provided by the same atom.

(b) A salt formed by the complete neutralisation of an acid by a base.

(c) A reaction in which the hydrogen of an alkane is replaced by a halogen.

(d) The energy required to remove an electron from a neutral gaseous atom.

(e) A homogenous mixture of two or more metals or a metal and a non-metal in a definite proportion in their molten state.

[2026S]

10. Draw the electron dot structure of: [Atomic No.: N = 7, H = 1] **[3]**

(a) ammonium ion (also label the co-ordinate bond)

(b) nitrogen molecule

[2027S]

Chapter 3: Study of Acids, Bases and Salts

A. Multiple Choice Questions (1 mark each)

1. An acid which has two replaceable hydrogen ions: **[1]**

(a) Acetic acid

(b) Hydrochloric acid

(c) Phosphoric acid

(d) Carbonic acid

[2023S]

2. An aqueous compound which turns colourless phenolphthalein to pink: **[1]**

(a) Ammonium hydroxide

(b) Nitric acid

(c) Anhydrous calcium chloride

(d) Sulphuric acid

[2023S]

3. The acid which does not form acid salt by a basic radical: **[1]**

(a) H_2CO_3

(b) H_3PO_4

(c) H_2SO_4

(d) CH_3COOH

[2023]

4. The indicator which changes to pink colour in an alkaline solution is: **[1]**

(a) Blue Litmus

(b) Methyl Orange

(c) Red Litmus

(d) Phenolphthalein

[2023]

5. The basicity of acetic acid is: **[1]**

(a) 1

(b) 2

(c) 3

(d) 4

[2024S]

6. Rotten egg smell is due to the liberation of: **[1]**

(a) HCl gas

(b) H_2S gas

(c) Cl_2 gas

(d) SO_2 gas

[2024]

7. Which of the following about oxides is correct? **[1]**

(a) A basic oxide is an oxide of a non-metal

(b) Acidic oxides contain ionic bonds

(c) Amphoteric oxides contain a metal

(d) Basic oxides are always gases

[2025S]

8. Which pair of reactants can be best used to produce lead (II) sulphate? **[1]**

(a) Sulphuric acid + Lead

(b) Sulphuric acid + Lead hydroxide

(c) Sodium sulphate + Lead nitrate

(d) Potassium sulphate + Lead oxide

[2025]

9. Which of the following will dissociate in aqueous solution, to give a positive ion other than hydronium ion, and a negative ion other than hydroxyl ion? **[1]**

(a) KOH

(b) dil. HCl

(c) NaCl

(d) CH_3COOH

[2026S]

10. When compound X reacts with dilute sulphuric acid, it releases a gas that turns acidified potassium dichromate solution from orange to green. Which of the following could be compound X? **[1]**

(a) Lead nitrate

(b) Copper carbonate

(c) Sodium chloride

(d) Potassium sulphite

[2026S]

11. For which pH change is there the maximum increase in acidity? **[1]**

Table: Initial and final pH values (2026S Q1(xi))

Option	Initial pH	Final pH
(a)	1	3
(b)	2	6
(c)	3	1
(d)	6	2

(a) Option (a)
(b) Option (b)
(c) Option (c)
(d) Option (d)

[2026S]

12. The electronic configuration of an element is 2,8,2. The hydroxide of this element can produce _____ hydroxyl ions per molecule. **[1]**

(a) 3
(b) 2
(c) 1
(d) 0

[2026]

13. Salts can be prepared by the action of dilute acid on: **[1]**

1. bases
2. carbonates
3. metals
4. sulphites

The method which cannot be used for the preparation of copper salts is:

(a) 1
(b) 2
(c) 3
(d) 4

[2026]

14. Non-metals like chlorine and iodine on reaction with hydrogen give: **[1]**

(a) acid
(b) base
(c) salt
(d) metal

[2027S]

15. A student tested the nature of four different solutions P, Q, R, and S using pH paper. He noted the following observations: Which of the above solutions is neutral in nature? **[1]**

Table: Colour of pH paper after testing solutions P, Q, R, and S (2027S Q1(ix))

	P	Q	R	S
Colour of the pH paper after testing	Blue	Green	Red	Violet

(a) P
(b) Q
(c) R
(d) S

[2027S]

16. When compound X reacts with dilute hydrochloric acid, it releases a gas that turns moist lead acetate paper black and decolourises acidified potassium permanganate solution. Which of the following is compound X? **[1]**

(a) Sodium nitrate
(b) Sodium sulphide
(c) Sodium carbonate
(d) Sodium sulphite

[2027S]

B. Short Questions (1 or 2 marks)

1. Identify the Anion present in each of the following compounds. **[2]**

(a) When Barium Chloride Solution is added to a solution of compound B, a white precipitate insoluble in dilute Hydrochloric acid is formed.
(b) When dilute Sulphuric acid is added to compound D, a gas is produced which turns lime water milky but has no effect on acidified potassium dichromate solution.

[2023S]

2. Distinguish between the following as directed: **[2]**

(a) Sodium Carbonate and Sodium Sulphate by using dilute HCl
(b) Ammonium Sulphate and Sodium Sulphate by using Calcium hydroxide.

[2023S]

3. State one observation in the following cases: **[2]**

(a) Sodium chloride solution is added to a solution of lead nitrate.
(b) Barium chloride solution is added to a solution of Zinc sulphate.

[2024S]

4. Identify only the anion present in the following compound: **[2]**

(a) The compound on heating produces a colourless, odourless gas which turns lime water milky and has no effect on acidified potassium dichromate solution.

(b) The solution of the compound which on treating with concentrated sulphuric acid and freshly prepared ferrous sulphate solution produces a brown ring.

[2024]

5. You are provided with the list of chemicals mentioned below in the box: [Sodium hydroxide solution, copper carbonate, zinc, hydrochloric acid, copper, dilute sulphuric acid]. Using suitable chemicals from the list given, write balanced chemical equation for the preparation of the salts mentioned below: **[2]**

(a) copper sulphate

(b) sodium zincate

[2026S]

6. Differentiate between the following pairs based on the criteria given in the bracket: **[2]**

(a) Acetic acid and Sulphuric acid (number of replaceable hydrogen ion per molecule)

(b) Electrolyte and Metallic conductor (the particles conducting electricity)

[2026]

7. Give reasons why: **[2]**

(a) Hydrochloric acid cannot form an acid salt.

(b) Electronegativity increases across a period.

[2026]

C. Long Questions (3 marks)

1. Match the following Column A with Column B. **[5]**

Table: Matching Column A with Column B (2023S Q2(ii))

	Column A		Column B
(a)	Acid Salt	1.	Black in colour
(b)	Copper Oxide	2.	Reddish brown
(c)	Zinc hydroxide	3.	Hydrogen chloride
(d)	Copper Metal	4.	Sodium Hydrogen Carbonate
(e)	Polar compound	5.	Soluble in excess sodium hydroxide

[2023S]

2. Choose the answer from the list which fits the description. [CaO, CO2, NaOH, Fe(OH)3, CO] **[3]**

(a) A basic oxide.

(b) An oxide which is acidic.

(c) An Alkali.

[2023S]

3. Fill in the blanks with the choices given in the brackets: **[5]**

(a) Metals are good _____. [oxidizing agents / reducing agents]

(b) Non-polar covalent compounds are _____ [good / bad] conductors of heat and electricity.

(c) Higher the pH value of a solution, the more _____ [acidic / alkaline] it is.

(d) _____, [Silver chloride / Lead chloride] is a white precipitate that is soluble in excess of Ammonium hydroxide solution.

(e) Conversion of ethene to ethane is an example of _____. [hydration / hydrogenation]

[2023]

4. Study the following observations and name the anions present in each of the reactions. **[3]**

(a) When a crystalline solid 'P' is warmed with concentrated H2SO4 and copper turnings a reddish brown gas is released.

(b) When few drops of dilute sulphuric acid is added to Salt 'R' and heated, a colourless gas is released which turns moist lead acetate paper silvery black.

(c) When few drops of barium nitrate solution is added to the salt solution 'Q', a white precipitate is formed which is insoluble in HCl.

[2023]

5. Choose the substances given in the box below to answer the following questions: **[3]**

Table: Substance list (2023 Q6(iii))

Iron	**Magnesium sulphite**	**Zinc**	**Sodium sulphide**
Lead	Ferric chloride	Copper	Ferrous sulphate

(a) The metal that will not produce hydrogen gas when reacted with dilute acids.

(b) The compound that will produce sulphur dioxide gas when reacted with dilute HCl.

(c) The solution of this compound produces dirty green precipitate with NaOH.

[2023]

6. Seema takes a blue crystalline salt P in a test tube. On heating it produces a white anhydrous powder. P is dissolved in water. Zinc is added to one part of the solution and to another part of the solution Barium chloride is added. **[3]**

(a) Name the compound P.

(b) Mention one observation when zinc is added to the solution of P.

(c) State the colour of the precipitate formed when barium chloride is added to the solution of P.

[2024S]

7. Answer the following questions on pH and periodic properties: **[3]**

(a) Mahesh prepared a basic solution X that has a pH 7. How will the pH of the solution X change on addition of the following:

1. Hydrochloric acid
2. a solution of a base

(b) The atomic number of an element is 15. To which group will this element belong to?

[2024S]

8. Mohan has three solutions P, Q and R having a pH of 13, 5 and 2 respectively. Which of the above solutions P, Q or R: **[3]**

(a) will react with Magnesium to liberate hydrogen gas?

(b) will liberate ammonia gas when it reacts with ammonium chloride?

(c) will contain molecules as well as ions?

[2024]

9. Match the salts underlined in Column A with the most suitable method of preparation given in Column B. **[3]**

Table: Matching salts in Column A with method of preparation in Column B (2024 Q8(iii))

	Column A		Column B
(a)	$ZnCl_2$ from Zn	1.	Precipitation
(b)	KNO_3 from KOH	2.	Direct combination
(c)	$CaCO_3$ from $CaCl_2$	3.	Displacement reaction
–	–	4.	Neutralization

[2024]

10. You are provided with the list of chemicals mentioned below in the box: [Sodium hydroxide solution, copper carbonate, zinc, hydrochloric acid, copper, dilute sulphuric acid, chlorine, iron].

Using suitable chemicals from the list given, write balanced chemical equation for the preparation of the salts mentioned below: **[3]**

(a) copper sulphate

(b) sodium zincate

(c) ferric chloride

[2025S]

11. Rohit has solution X, Y and Z that has pH 2, 7 and 13 respectively. Which solution. **[3]**

(a) will liberate sulphur dioxide gas when heated with sodium sulphite

(b) will liberate ammonia gas when reacted with ammonium chloride

(c) will not have any effect on litmus paper?

[2025S] [2026S]

12. P, Q, R and S are the different methods of preparation of salts. **[3]**

P – Simple displacement

Q – Neutralisation by titration

R – Precipitation

S – Direct combination

Choose the most appropriate method to prepare the following salts:

(a) $PbCl_2$

(b) $FeCl_3$

(c) Na_2SO_4

[2025]

13. Given below are some chemicals: [Lead nitrate, Copper, Hydrochloric acid, Lead oxide, Iron, Sodium carbonate, Copper carbonate, Chlorine]. Using suitable chemicals from the box given above, write balanced chemical equations for the preparation of the following salts. (Note: The chemicals may be used more than once, if needed.) **[3]**

(a) Lead (II) carbonate

(b) Copper (II) chloride

(c) Iron (II) chloride

[2026]

14. Complete the following sentences by choosing the correct option from the brackets: **[5]**

(a) The general formula of an alkyl group is _____ (C_nH_{2n+1}/C_nH_{2n-1}).

(b) The aqueous solution of _____ (zinc chloride/ sodium sulphate) gives white precipitate with barium nitrate.

(c) The gas liberated when alkalis are heated with ammonium salts is _____ (N_2/NH_3).

(d) The alloy that contains a non-metal as one of its constituents is _____ (bronze/steel).

(e) A salt prepared by neutralization in which titration is involved is _____ ($CaCl_2$/ NH_4Cl).

[2027S]

15. N is a metal which forms a basic oxide. N has atomic no. 11. **[3]**

(a) What is the molecular formula of the oxide of N?

(b) Write the balanced equation for the reaction that takes place when the oxide of N is treated with water.

(c) State the formula of the product obtained other than water when sulphuric acid is added to the product obtained in (b) above.

[2027S]

16. Rohit has three solutions X, Y and Z that have pH 2, 7 and 13 respectively. Which solution out of X, Y or Z will: **[3]**

(a) liberate sulphur dioxide gas when heated with sodium sulphite?

(b) liberate ammonia gas when reacted with ammonium chloride?

(c) not have any effect on litmus paper?

[2027S]

Chapter 4: Analytical Chemistry

A. Multiple Choice Questions (1 mark each)

1. The hydroxide which is soluble in excess of NaOH is: **[1]**

(a) Ferric hydroxide

(b) Lead hydroxide

(c) Copper hydroxide

(d) Calcium hydroxide

[2023S]

2. The metallic hydroxide which forms a deep inky blue solution with excess ammonium hydroxide solution is: **[1]**

(a) Fe(OH)2

(b) Cu(OH)2

(c) Ca(OH)2

(d) Fe(OH)3

[2023]

3. The nitrate which on thermal decomposition leaves behind a residue which is yellow when hot and white when cold: **[1]**

(a) Lead nitrate

(b) Ammonium nitrate

(c) Copper nitrate

(d) Zinc nitrate

[2023]

4. A compound P is heated in a test tube with sodium hydroxide solution. A red litmus paper held at the mouth of the test tube turns blue. Which of the following could compound P be? **[1]**

(a) zinc sulphate

(b) copper sulphate

(c) ferrous sulphate

(d) ammonium sulphate

[2024S] [2025S] [2026S]

5. The metal hydroxide which reacts with both acids and alkalis to form salt and water is: **[1]**

(a) Calcium hydroxide

(b) Magnesium hydroxide

(c) Aluminium hydroxide

(d) Ferric hydroxide

[2024]

6. A nitrate which forms a precipitate with ammonium hydroxide and is also soluble in excess of it: **[1]**

(a) ferrous nitrate
(b) ferric nitrate
(c) lead nitrate
(d) copper nitrate

[2025S]

7. Aqueous lead (II) nitrate can be distinguished from aqueous zinc nitrate by adding any of the following solution in excess, except: **[1]**

(a) aqueous potassium chloride
(b) aqueous sodium sulphate
(c) dilute sulphuric acid
(d) sodium hydroxide solution

[2025S]

8. Which gas decolourises potassium permanganate (KMnO4) solution? **[1]**

(a) Sulphur dioxide
(b) Ammonia
(c) Hydrogen chloride
(d) Carbon dioxide

[2025]

9. Identify from the following metal oxide which can react with an acid as well as an alkali. **[1]**

(a) Silver oxide
(b) Calcium oxide
(c) Copper(II) oxide
(d) Aluminium oxide

[2026S]

B. Short Questions (1 or 2 marks)

1. Name a probable Cation present based on the following Observations: **[2]**

(a) Reddish brown precipitate insoluble in Ammonium Hydroxide.
(b) Blue coloured sulphate solution.

[2023S]

2. Identify the cation in each of the following cases: **[2]**

(a) Ammonium hydroxide solution when added to Solution B gives a white precipitate which does not dissolve in excess of ammonium hydroxide solution.

(b) Sodium hydroxide solution when added to Solution C gives a white precipitate which is insoluble in excess of sodium hydroxide solution.

[2023]

3. State giving reasons if: **[2]**

(a) zinc and aluminium can be distinguished by heating the metal powder with concentrated sodium hydroxide solution.

(b) calcium nitrate and lead nitrate can be distinguished by adding ammonium hydroxide solution to the salt solution.

[2024S] [2025S]

4. Rita was given an unknown salt for identification. She prepared a solution of the salt and divided it into two parts. **[2]**

• To the first part of the salt solution, she added a few drops of ammonium hydroxide and obtained a reddish-brown precipitate.

• To the second part of the salt solution, she added a few drops of silver nitrate solution and obtained a white precipitate.

Name:

(a) the cation present and

(b) the anion present in the salt given for identification.

[2024]

5. Differentiate between the following pairs of compounds using the reagent given in the bracket: **[2]**

(a) Ammonium chloride and Sodium chloride (using an alkali)

(b) Zinc Nitrate solution and Calcium Nitrate solution (using excess sodium hydroxide solution)

[2025]

6. State giving reasons if: **[2]**

(a) zinc metal and aluminium metal can be distinguished by heating the metal powders separately in two different test tubes with concentrated sodium hydroxide solution.

(b) calcium nitrate and lead nitrate can be distinguished by adding ammonium hydroxide solution to the salt solution.

[2026S]

7. Alex was given a solution of an unknown salt Y for analysis. He performed the following tests and recorded his observations: **[2]**

• To a part of the solution Y, he added silver nitrate solution and obtained a white precipitate which was soluble in ammonium hydroxide solution.

• To the remaining solution he added a few drops of sodium hydroxide solution and obtained a pale blue precipitate.

Based on the observations made by Alex, identify:

(a) the anion and

(b) the cation present in salt Y.

[2026]

8. State giving reasons if: **[2]**

(a) Zinc metal and aluminium metal can be distinguished by heating the metal powders separately in two different test tubes with concentrated sodium hydroxide solution.

(b) Zinc nitrate and lead nitrate can be distinguished by adding ammonium hydroxide solution to the salt solution.

[2027S]

C. Long Questions (3 marks)

1. State one relevant observation for each of the following reactions: **[3]**

(a) When excess Ammonia is passed through an aqueous solution of Lead Nitrate.

(b) Copper Sulphate solution is electrolysed using Copper electrodes.

(c) Ammonium hydroxide is added to Ferrous Sulphate solution.

[2023S]

2. Abhishek was given a salt 'X' which was white in colour for analysis. On strong heating it produced a yellow residue, a colourless gas and also a reddish-brown gas. The solution of the salt 'X' when tested with excess of ammonium hydroxide produced a chalky white insoluble precipitate. **[3]**

(a) Name the coloured gas evolved when Abhishek heated the salt strongly.

(b) Which cation was present in the sample given to Abhishek?

(c) Identify the salt given to Abhishek for analysis.

[2025S]

3. Complete the following sentences by choosing the correct word(s) from the brackets: **[5]**

(a) _____ solution forms a coloured precipitate with ammonium hydroxide which is soluble in excess of ammonium hydroxide. [Ferrous chloride / Copper nitrate]

(b) Zinc blende is converted to zinc oxide by _____. [Calcination / Roasting]

(c) _____ conducts electricity by the movement of ions. [Molten iron / Molten sodium chloride]

(d) The reaction that takes place at the anode during the electrolysis of aqueous Sodium argentocyanide with silver electrodes is _____. [Ag → Ag+ + e– / Ag+ + e– → Ag]

(e) The salt formed when ZnO reacts with hot concentrated NaOH is _____. [sodium zincate / zinc hydroxide]

[2025]

4. Give one significant observation when: **[3]**

(a) a solution of barium chloride is added to zinc sulphate solution.

(b) lead nitrate is heated in a test tube.

(c) chlorine gas is passed over moist starch iodide paper.

[2025]

5. Abhishek was given a salt 'X' for analysis which was white in colour. On strong heating it produced a yellow residue, a colourless gas, and also a reddish-brown gas. The solution of the salt 'X' when tested with excess of ammonium hydroxide produced a chalky white insoluble precipitate. **[3]**

(a) Name the coloured gas evolved when Abhishek heated the salt strongly.

(b) Which cation was present in the sample given to Abhishek?

(c) Identify the salt given to Abhishek for analysis.

[2026S]

6. Complete the following sentences by choosing the correct option from the brackets: **[5]**

(a) The oxide that dissolves in caustic potash (KOH) is _____. [ZnO / CuO]

(b) The reaction that takes place at the anode during the electrolysis of molten lead bromide is _____. [2Br – 2e– → 2Br– / 2Br– – 2e– → Br2]

(c) The volume occupied by 8 grams of oxygen gas at STP is _____ litres. [5.6 / 8.96] [Atomic weight of O = 16]

(d) _____ does not give hydrogen gas when it reacts with cold and very dilute nitric acid. [Cu / Mn]

(e) _____ is a polar covalent compound. [HCl / CCl4]

[2026]

7. Give one relevant observation for the following: **[3]**

(a) Sodium hydroxide is added dropwise to Calcium nitrate solution.

(b) Dilute Hydrochloric acid is added to Iron (II) sulphide.

(c) An amphoteric metal is added to hot concentrated alkali.

[2026]

8. A chloride of iron 'R', when treated with sodium hydroxide gives P and Q as a product. Q is a reddish-brown precipitate. **[4]**

(a) Identify R.

(b) State the formula of the compounds P and Q formed after the reaction.

(c) What do you observe when excess NaOH is added to Q?

[2027S]

Chapter 5: Mole Concept and Stoichiometry

A. Multiple Choice Questions (1 mark each)

1. If the RMM of carbon dioxide is 44, then its vapour density is: **[1]**

(a) 22

(b) 32

(c) 44

(d) 88

[2023S]

2. The vapour density of CH3OH is _____. (At. Wt. C=12, H=1, O=16) **[1]**

(a) 32

(b) 18

(c) 16

(d) 34

[2023]

3. The atomic masses of sulphur (S), oxygen (O), and helium (He) are approximately 32, 16, and 4 respectively. Which of the following statements regarding the number of atoms in 32 g of sulphur, 16 g of oxygen, and 4 g of helium is correct? **[1]**

P. 16 g of oxygen contains four times the number of atoms as 4 g of helium.

Q. 16 g of oxygen contains half the number of atoms as 32 g of sulphur.

(a) only P

(b) only Q

(c) both P and Q

(d) neither P nor Q

[2024S]

4. Which of the following would occupy 22.4 litres at S.T.P.? **[1]**

1. 32g of oxygen gas

2. 2 moles of hydrogen gas

3. 6.022 x 10^23 molecules of ammonia

[Atomic weights: O = 16, H = 1, N = 14]

(a) 1 & 2

(b) 1 & 3

(c) 2 & 3

(d) 1, 2 & 3

[2024]

5. Which of the following would weigh the least? (Atomic masses C=12, O=16, Na=23) **[1]**

(a) 2 gram atoms of oxygen

(b) one mole of sodium

(c) 22.4 litres of carbon dioxide at STP

(d) 6.023 x 10^22 atoms of carbon

[2025S]

6. The ratio between the volumes occupied by 4.4 grams of carbon dioxide and 2 grams of hydrogen gas is: **[1]**

(a) 2.2 : 1

(b) 1 : 2.2

(c) 1 : 10

(d) 10 : 1

[2025S]

7. An organic compound has a vapour density of 22. The molecular formula of the organic compound is: **[1]**

[Atomic weight: C = 12, H = 1]

(a) CH4

(b) C2H4

(c) C2H6

(d) C3H8

[2025]

8. 40 cm3 of methane (CH4) is reacted with 60 cm3 of oxygen. The equation for the reaction is given below: **[1]**

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

All volumes are measured at room temperature. What is the total volume of the gases remaining at the end of the reaction?

(a) 60 cm3

(b) 40 cm3

(c) 45 cm3

(d) 50 cm3

[2025]

9. The volume occupied by 2 moles of a gas at STP is: **[1]**

(a) 22.4L

(b) 2.24L

(c) 44.8L

(d) 4.48L

[2026S]

10. The ratio between the volumes occupied by 22 grams of carbon dioxide and 10 grams of hydrogen gas is: **[1]**

(a) 2.2 : 1

(b) 1 : 2.2

(c) 1 : 10

(d) 10 : 1

[2026S]

11. What volume of carbon dioxide is produced at STP when 5 litres of propane is burnt completely according to the equation given below? **[1]**

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

(a) 10 litres

(b) 15 litres

(c) 20 litres

(d) 25 litres

[2026]

12. An organic compound X containing carbon and hydrogen only has Vapour Density (V.D.) 14. The molecular formula of X is _____. (At. wt. of C=12, H=1) **[1]**

(a) CH

(b) C_2H_4

(c) C_2H_2

(d) CH_2

[2027S]

13. The volume occupied by 0.2 moles of a gas at S.T.P. is: **[1]**

(a) 22.4 litres

(b) 2.24 litres

(c) 44.8 litres

(d) 4.48 litres

[2027S]

B. Short Questions (1 or 2 marks)

1. Calculate: **[2]**

(a) A gas cylinder is filled with hydrogen and it holds 5 gms of gas. The same cylinder holds 85 gms of gas X under same temperature and pressure. Calculate the vapour density of gas X.

(b) Give the empirical formula of CH_3COOH.

[2023S]

2. Define: **[2]**

(a) Gay Lussac's law of combining volume.

(b) Vapour Density

[2023S]

3. Solve: 1250cc of oxygen was burnt with 300cc of ethane (C_2H_6). Calculate the volume of the unused oxygen and the volume of the carbon dioxide formed: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$ **[2]**

[2023S]

4. Find the empirical formula and molecular formula of an organic compound from the data given below: C = 75.92%, H = 6.32%, N = 17.76% its vapour density is 39.5 (At.wt: C=12, H=1, N=14) **[2]**

[2023S]

5. The Empirical formula of an organic compound is $CHCl_2$. If its relative molecular mass is 168, what is its molecular formula? [At. Wt. C = 12, H = 1, Cl = 35.5] **[2]**

[2023]

6. A gas cylinder of capacity 40 dm^3 is filled with gas X the mass of which is 20 g. When the same cylinder is filled with hydrogen gas at the same temperature and pressure the mass of hydrogen is 2 g. Find the relative molecular mass of the gas. **[2]**

[2024S]

7. Define the following terms: **[2]**

(a) Molar volume

(b) Normal salt

[2024]

8. Pratik heated 11.2 grams of element 'M' (atomic weight 56) with 4.8 grams of element 'N' (atomic weight 16) to form a compound. Find the empirical formula of the compound obtained by Pratik. **[2]**

[2025S]

9. A gas cylinder can hold 150 g of hydrogen under certain conditions of temperature and pressure. If an identical cylinder with the same capacity can hold 450 g of gas 'G' under the same conditions of temperature and pressure, find: **[2]**

(a) the vapour density of the gas 'G'.

(b) the molecular weight of gas 'G'.

[2025]

10. State / Define the following: **[2]**

(a) State Avogadro's Law.

(b) Define Co-ordinate bond.

[2025]

11. What will be the mass of carbon dioxide that will contain the same number of molecules as present in 3.2g of oxygen gas? [At. Wt: O=16, C=12] **[2]**

[2026S]

12. Equal volumes of ammonia gas and chlorine gas are kept in two different containers under the same conditions of temperature and pressure. Find the number of molecules contained in chlorine gas when the mass of ammonia is 34 g. **[2]**

[Atomic weight: Cl=35.5, H=1, N=14]

[2026]

13. 5.6 litres of gas Z weighs 32 g at STP. What is the molecular weight and vapour density of Z? **[2]**

[2026]

14. 20 grams of a gas M2P has lesser number of moles than 20 grams of the gas MP. Justify the above statement using mathematical calculations. [At.wt. M=14, P=16] **[2]**

[2027S]

C. Long Questions (3 marks)

1. Solve the following numerical problem. Ethane burns in oxygen according to the chemical equation: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$. If 80 ml of ethane is burnt in 300 ml of oxygen, find the composition of the resultant gaseous mixture when measured at room temperature. **[3]**

[2023]

2. Calculate: **[3]**

(a) The percentage of phosphorus in the fertilizer super phosphate $Ca(H_2PO_4)_2$ correct to 1 decimal point. [At. Wt. H=1, P=31, O=16, Ca=40]

(b) Write the empirical formula of C_8H_{18}.

[2023]

3. The empirical formula of an organic compound is C_3H_4N. Its molecular weight is 108. Find the amount of carbon in one mole of the compound. Show all the steps involved. (Atomic weights: C-12; H- 1; N- 14) **[3]**

[2024S]

4. 8.2 grams of calcium nitrate is decomposed by heating according to the equation: $2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$. Calculate the following: [Atomic weights: Ca – 40, N—14, O—16] **[4]**

(a) Volume of nitrogen dioxide obtained at STP

(b) Mass of CaO formed

[2024S] [2025S]

5. State the terms for the following: **[5]**

(a) The group obtained by removing one hydrogen atom from the parent alkane.

(b) Two metal plates or wires through which the current enters and leaves the electrolytic cell.

(c) The amount of substance which contains the same number of units as the number of atoms in carbon-12.

(d) The tendency of an atom to pull a shared pair of electrons towards itself in a compound.

(e) The formula which represents the simplest ratio between the atoms of elements present in a compound.

[2024]

6. Calcium carbonate reacts with dilute hydrochloric acid as given below: $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$ **[3]**

(a) What is the mass of 5 moles of calcium carbonate? (Relative molecular mass of calcium carbonate is 100)

(b) How many moles of HCl will react with 5 moles of calcium carbonate?

(c) What is the volume of carbon dioxide liberated at S.T.P. at the same time?

[2024]

7. Ammonia burns in oxygen as shown below: $4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$. If 240 cc of ammonia is burnt in 300 cc of oxygen, find out the composition of the resultant gaseous mixture at room temperature. **[3]**

[2024]

8. One variety of household fuel is a mixture of propane (60%) and butane (40%). If 20 litres of this mixture is burnt, find the total volume of carbon dioxide added to the atmosphere. The combination reactions can be represented as: **[3]**

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

[2025S]

9. The reaction between concentrated sulphuric acid and magnesium can be represented by the equation given below: $Mg + 2H_2SO_4 \rightarrow MgSO_4 + 2H_2O + SO_2$. If 60 g of magnesium is used in the reaction, calculate the following: [Atomic weight: Mg=24, H=1, S=32, O=16] **[3]**

(a) The mass of sulphuric acid needed for the reaction.

(b) The volume of sulphur dioxide gas liberated at S.T.P.

[2025]

10. An organic compound 'X' contains carbon, oxygen and hydrogen only. The percentage of carbon and hydrogen are 47.4% and 10.5% respectively. The relative molecular mass of 'X' is 76. Find the empirical formula and the molecular formula of 'X'. **[4]**

[Atomic weight: C = 12, O = 16, H = 1]

[2025]

11. Solid ammonium dichromate decomposes as under: $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$. If 126 g of ammonium dichromate decomposes, calculate: [At. Wt: N=14, Cr=52, O=16, H=1] **[3]**

(a) the number of moles of ammonium dichromate that undergoes decomposition.

(b) the mass of chromic oxide formed at the same time.

(c) the volume of nitrogen gas evolved at STP.

[2026S] [2027S]

12. $Zn + 4HNO_3 \rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2$ **[3]**

32.5 g of zinc reacts with concentrated nitric acid as given in the above equation.

[Atomic weight: H=1, N=14, O=16, Zn=65]

(a) How many moles of zinc was required in the reaction?

(b) Find the mass of nitric acid needed to react with 32.5 g of zinc.

(c) Find the volume of nitrogen dioxide liberated in (b).

[2026]

Chapter 6: Electrolysis

A. Multiple Choice Questions (1 mark each)

1. A weak electrolyte is: **[1]**

(a) Alcohol

(b) Potassium hydroxide

(c) Ammonium hydroxide

(d) Glucose

[2023S]

2. The product formed at the cathode in electroplating of an article with Nickel is: **[1]**

(a) Hydrogen gas

(b) Nickel ions

(c) Nickel atoms

(d) Oxygen gas

[2023S]

3. Which of the following reactions takes place at the anode during the electroplating of an article with silver? **[1]**

(a) Ag – 1e- → Ag1+

(b) Ag + 1e- → Ag1-

(c) Ag – 1e- → Ag

(d) None of the above

[2023]

4. An aqueous solution of copper sulphate turns colourless on electrolysis. Which of the following could be the electrodes? **[1]**

P. anode: copper; cathode: copper

Q. anode: platinum; cathode: copper

R. anode: copper; cathode: platinum

(a) only P

(b) only Q

(c) only R

(d) both Q and R

[2024S] [2025S]

5. A _____ solution is observed after placing Magnesium metal in a solution of Copper sulphate for half an hour. **[1]**

(a) Blue

(b) Colourless

(c) Reddish brown

(d) Dirty green

[2024S]

6. The process of electrolysis is an example of: **[1]**

(a) Oxidation reaction

(b) Reduction reaction

(c) Redox reaction

(d) Displacement reaction

[2024S]

7. The equation below shows the reaction between element 'X' and dilute sulphuric acid: X(s) + H2SO4 (aq.) → XSO4 (aq.) + H2 (g). Which particles are responsible for conducting electricity in dilute sulphuric acid and compound XSO4? **[1]**

(a) Electrons

(b) Only positive ions

(c) Only negative ions

(d) Both positive and negative ions

[2025S] [2026S]

8. Aqueous copper (II) sulphate is electrolysed using copper electrodes. Which statement about the electrolysis is not correct? **[1]**

(a) An oxidation reaction occurs at the positive electrode.

(b) The current is carried through the electrolyte by ions.

(c) The positive electrode loses mass.

(d) The number of copper (II) ions in the electrolyte decreases.

[2025]

9. Assertion (A): Aqueous solution of potassium chloride can conduct electricity. **[1]**

Reason (B): Conduction of electric current is due to the presence of free ions.

(a) (A) is true and (R) is false.

(b) (A) is false and (R) is true.

(c) Both (A) and (R) are true and (R) is the correct explanation of (A).

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

[2026S]

10. With respect to the electrolysis of copper (II) sulphate solution using copper electrodes, which statement is correct? **[1]**

(a) Copper metal is deposited at the negative electrode.

(b) Oxygen gas is produced at the positive electrode.

(c) The positive electrode increases in mass.

(d) The negative electrode decreases in mass.

[2026]

11. Assertion (A): Dilute Sulphuric acid is a stronger electrolyte than concentrated Sulphuric acid. **[1]**

Reason (R): Dilute Sulphuric acid has a higher concentration of mobile ions.

(a) (A) is true but (R) is false.

(b) (A) is false but (R) is true.

(c) Both (A) and (R) are true and (R) is the correct explanation of (A).

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

[2026]

12. Assertion (A): In the electrolysis of acidified water, the volume of hydrogen liberated is twice the volume of oxygen formed. **[1]**

Reason (R): Water has hydrogen and oxygen in the ratio of 1:2 by volume.

(a) (A) is true but (R) is false.

(b) (A) is false but (R) is true.

(c) Both (A) and (R) are true and (R) is the correct explanation of (A).

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

[2026]

13. Which statement given below is correct with reference to the flow of electric current? **[1]**

(a) In all aqueous solutions, current is carried by electrons.

(b) In all acidic solutions, current is carried by ions.

(c) In molten electrolytes, current is carried by electrons.

(d) In metal wires, current is carried by ions.

[2027S]

B. Short Questions (1 or 2 marks)

1. Fill in the blanks by choosing the correct answer from the brackets: **[2]**

(a) During electrolysis, the compound _____ in its molten state liberates reddish brown fumes at the anode. [NaCl / PbBr2]

(b) The ion which could be discharged most readily during electrolysis is _____. [Fe2+ / Cu2+]

[2023]

2. X - HCl ⇋ H1+ + Cl- (in solution state) **[2]**

Y - PbBr2 ⇋ Pb2+ + 2Br1- (in molten state)

From the above reactions X or Y, identify the reaction which exhibits:

(a) electrolytic dissociation

(b) ionization

[2024]

3. Justify the following statements: **[2]**

(a) Anode is known as the oxidizing electrode.

(b) Graphite electrodes are preferred in the electrolysis of molten lead bromide.

[2025]

C. Long Questions (3 marks)

1. During the Electrolysis of Copper II Sulphate solution using platinum as cathode and graphite as anode. **[3]**

(a) State what you observe at the cathode.

(b) State the change noticed in the electrolyte.

(c) Write the reaction at the cathode.

[2023S]

2. Name the particles present in: **[3]**

(a) Strong Electrolyte

(b) Weak Electrolyte

(c) Non Electrolyte

[2023S]

3. Answer the following questions with reference to electrorefining of copper: **[3]**

(a) What is the anode made of?

(b) What do you observe at the cathode?

(c) Write the reaction taking place at the cathode.

[2023]

4. Choose the answer from the list which fits in the description: [CCl4, PbO, NaCl, CuO, NH4Cl] **[3]**

(a) A compound which undergoes thermal dissociation.

(b) An amphoteric oxide.

(c) A compound which is a non-electrolyte.

[2023]

5. Copper sulphate solution is electrolysed using copper electrodes. **[3]**

(a) Which electrode [cathode or anode] is the oxidizing electrode? Why?

(b) Write the equation for the reaction occurring at the above electrode.

[2024S] [2025S]

6. Acidulated water is electrolysed using platinum electrodes. Answer the following questions: **[3]**

(a) Why is dilute sulphuric acid added to water?

(b) Write the reaction taking place at the cathode.

(c) What is the observation at the anode?

[2025]

7. Match Column A with Column B: **[5]**

Table: Matching Column A with Column B (2026 Q2(iii))

	Column A		Column B
(a)	CuO + C → Cu + CO	1.	Oxidation
(b)	Al3+ + 3e– → Al	2.	Ionization
(c)	PbBr2 → Pb2+ + 2Br1–	3.	Reduction
(d)	2O2– – 2e– → O2	4.	Redox
(e)	HCl → H+ + Cl1–	5.	Electrolytic dissociation

[2026]

8. Match Column A with Column B: **[5]**

Table: Matching Column A with Column B (2027S Q2(iv))

	Column A		Column B
(a)	CuO + C → Cu + CO	1.	Oxidation
(b)	Al3+ + 3e– → Al	2.	Ionization
(c)	PbBr2 → Pb2+ + 2Br1–	3.	Reduction
(d)	2O2– – 4e– → O2	4.	Redox
(e)	HCl → H+ + Cl1–	5.	Electrolytic dissociation

[2027S]

Chapter 7: Metallurgy

A. Multiple Choice Questions (1 mark each)

1. The main components of bronze are: **[1]**

(a) Copper and tin

(b) Copper and iron

(c) Copper and lead

(d) Copper and zinc

[2023S]

2. The compound that is not an ore of aluminium: **[1]**

(a) Cryolite

(b) Corundum

(c) Fluorspar

(d) Bauxite

[2023]

3. Copper, Zinc and Tin are the metals alloyed to form: **[1]**

(a) Duralumin

(b) Brass

(c) Bronze

(d) Solder

[2024]

4. The compound that is not a constituent of the electrolytic mixture used in the Hall-Heroult's process is: **[1]**

(a) Al_2O_3

(b) $NaAlO_2$

(c) Na_3AlF_6

(d) CaF_2

[2024]

5. A mineral from which the metal can be extracted economically and conveniently is known as: **[1]**

(a) Matrix

(b) Ore

(c) Flux

(d) Alloy

[2024]

6. The metal whose oxide can be reduced by common reducing agents: **[1]**

(a) Copper

(b) Sodium

(c) Aluminium

(d) Potassium

[2025]

7. The ore that can be concentrated by using magnetic separation: **[1]**

(a) Corundum

(b) Haematite

(c) Calamine

(d) Bauxite

[2025]

8. In the electrolysis of molten aluminium oxide for extraction of aluminium, the following reactions take place: **[1]**

1. $Al^{3+} + 3e^- \rightarrow Al$

2. $2O^{2-} \rightarrow O_2 + 4e^-$

3. $C + O_2 \rightarrow CO_2$

4. $Al_2O_3 \rightleftharpoons 2Al^{3+} + 3O^{2-}$

The reaction that takes place at the negative electrode is:

(a) 1

(b) 2

(c) 3

(d) 4

[2026]

B. Short Questions (1 or 2 marks)

1. For each of the substances given below, what is the role played in the extraction of Aluminum. **[2]**

(a) Cryolite

(b) Graphite

[2023S]

2. Identify the alloy in each case from the given composition: **[2]**

(a) aluminium, magnesium, manganese, copper

(b) iron, nickel, chromium, carbon

[2023]

3. Write one use of the following alloys: **[2]**

(a) Bronze

(b) Fuse metal

[2023]

4. The following questions relate to the extraction of Aluminium by electrolysis. **[2]**

(a) Name the other aluminum containing compound added to alumina.

(b) Give a balanced equation for the reaction that takes place at the cathode.

[2024S]

5. Name the alloy which is made up of: **[2]**

(a) Copper, Zinc and Tin

(b) Lead and Tin

[2024S] [2025S]

6. Name the following: **[2]**

(a) The ore of Zinc containing its sulphide.

(b) The most commonly used oxide ore of Aluminium.

[2024S]

7. Name the main metal used in making of the alloys given below: **[2]**

(a) Duralumin

(b) Stainless steel

[2024]

8. Choose the correct answer from the list given below: [zinc blende, C_2H_2, calamine, CH, haematite] **[2]**

(a) The ore which can be concentrated by magnetic separation.

(b) Empirical formula of Ethyne.

[2024]

9. The following questions relate to the extraction of Aluminium by electrolysis. **[2]**

(a) Name the other aluminium containing compound added to alumina.

(b) Give a balanced equation for the reaction that takes place at the cathode.

[2025S]

10. Answer the following questions with reference to the concentration of bauxite ore. **[2]**

(a) Name the process used to concentrate the ore.

(b) Give a balanced chemical equation for the conversion of aluminium hydroxide to pure alumina.

[2025]

11. Name the main metal present in the following alloys: **[2]**

(a) Duralumin

(b) Brass

[2026S]

12. The following questions relate to the extraction of Aluminium by electrolysis. **[2]**

(a) Name the other compound which contains aluminium added to alumina.

(b) Give a balanced equation for the reaction that takes place at the cathode.

[2026S]

13. Bauxite is the principal ore used in the commercial extraction of aluminium. The Bayer's process is used to refine bauxite into pure alumina, with caustic soda playing a crucial role in the initial stage of the process. Based on this, answer the following questions: **[2]**

(a) Explain the reason behind the addition of caustic soda during the Bayer's process.

(b) Write a balanced chemical equation representing the reaction between bauxite and caustic soda during the Bayer's process.

[2026]

C. Long Questions (3 marks)

1. Match the following Column A with Column B. **[5]**

Table: Matching Column A with Column B (2024S Q2(ii))

	Column A		Column B
(a)	Aluminium	1.	Covalent compound
(b)	Sulphuric acid	2.	Carbonate ore
(c)	Calcination	3.	Hall Heroult's process
(d)	Calcium Chloride	4.	Contact Process
(e)	Carbon tetrachloride	5.	Electrovalent compound

[2024S] [2025S]

2. Complete the following sentences by choosing the correct answer from the brackets: **[5]**

(a) The salt that can be prepared by Direct Combination is _____. [FeCl3 / FeCl2]

(b) The metallic oxide which can be reduced by using common reducing agents is _____. [Fe2O3 / Al2O3]

(c) The metal nitrate which on thermal decomposition forms a black residue is _____. [zinc nitrate / copper nitrate]

(d) During the electrolysis of copper sulphate solution, if _____ is used as electrodes, the colour of the electrolyte does not fade. [copper / platinum]

(e) The process of heating the concentrated ore in a limited supply or absence of air is _____ [roasting / calcination]

[2024]

3. Match Column A with Column B. **[5]**

Table: Matching Column A with Column B (2026S Q2(iv))

	Column A		Column B
(a)	Aluminium	1.	Covalent compound
(b)	Sulphuric acid	2.	Carbonate ore
(c)	Calcination	3.	Hall Heroult's process
(d)	Calcium Chloride	4.	Contact Process
(e)	Carbon tetrachloride	5.	Electrovalent compound

[2026S]

4. Identify the reactants P, Q and R in the following reactions: **[3]**

(a) Copper oxide + P → Copper + water

(b) Iron pyrite + Q → Iron oxide + Sulphur dioxide

(c) Sodium chloride + R → Sodium nitrate + Silver chloride

[2026S]

5. Name the following: **[3]**

(a) The non-metallic element which is used as the anode during electrolytic reduction of fused alumina in Hall Heroult's process.

(b) An alloy which is made up of aluminium and magnesium only.

(c) The process of heating the concentrated ore in a limited supply of air or in the absence of air.

[2027S]

Chapter 8: Study of Compounds

A. Multiple Choice Questions (1 mark each)

1. Drying agent used to dry Hydrogen chloride gas: **[1]**

(a) Concentrated Sulphuric acid

(b) Calcium oxide

(c) Sulphurous acid

(d) Calcium hydroxide

[2023S]

2. The catalyst used in the Haber's Process is: **[1]**

(a) Molybdenum

(b) Platinum

(c) Nickel

(d) Finely divided Iron

[2023S]

3. The gas formed when carbon reacts with concentrated sulphuric acid: **[1]**

(a) Hydrogen

(b) Sulphur trioxide

(c) Sulphur dioxide

(d) Oxygen

[2023S]

4. In the laboratory preparation, HCl gas is dried by passing through: **[1]**

(a) dilute nitric acid

(b) concentrated sulphuric acid

(c) dilute sulphuric acid

(d) acidified water

[2023]

5. The salt formed when concentrated sulphuric acid reacts with KNO3 above 200°C: **[1]**

(a) K2SO4

(b) K2SO3

(c) KHSO4

(d) KHSO3

[2023]

6. The property exhibited by concentrated sulphuric acid when it is used to prepare hydrogen chloride gas from potassium chloride: **[1]**

(a) Dehydrating property

(b) Drying property

(c) Oxidizing property

(d) Non-volatile acid property

[2023]

7. Ammonia gas is passed through quicklime and then collected in a jar. Red and blue litmus papers are placed in the jar. W, X, Y and Z are the four observations. Which of the above observations correctly shows the reaction of the litmus papers to ammonia? **[1]**

Table: Litmus paper observations (2024S Q1(iv))

	Red litmus paper	Blue litmus paper
W	turns blue	remains blue
X	remains red	remains blue
Y	remains red	turns red
Z	turns blue	turns red

(a) W

(b) X

(c) Y

(d) Z

[2024S]

8. Glucose reacts with concentrated sulphuric acid to give a very pure form of carbon called sugar charcoal. The reaction taking place is: **[1]**

(a) oxidation

(b) combustion

(c) dehydration

(d) combination

[2024S]

9. Which of the following is NOT true with respect to nitric acid? **[1]**

(a) It is a strong reducing agent

(b) It is a strong oxidizing agent

(c) It is unstable to heat

(d) It liberates sulphur dioxide gas when treated with potassium sulphite

[2024S]

10. The catalyst used in Ostwald's process is _____. **[1]**

(a) Finely divided iron

(b) Graphite

(c) Vanadium pentoxide

(d) Platinum

[2024S]

11. The oxidizing agent in the equation $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$ is: **[1]**

(a) Sulphur

(b) Sulphuric acid

(c) Sulphur dioxide

(d) Water

[2024]

12. On passing ammonia gas over heated copper oxide for some time, a reddish-brown residue is left behind. What property of ammonia is demonstrated here? **[1]**

(a) Basic property

(b) Oxidising property

(c) Reducing property

(d) Acidic property

[2024]

13. Ammonia gas is collected by downward displacement of air since ammonia is: **[1]**

(a) very slightly soluble in water.

(b) heavier than air.

(c) lighter than air.

(d) insoluble in water.

[2024]

14. Assertion (A): Dry hydrogen chloride gas is collected by the upward displacement of air. **[1]**

Reason (R): Hydrogen chloride gas is lighter than air.

(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

[2025S]

15. In the reaction given below sulphuric acid acts as a/an: **[1]**

$S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$

(a) Non-volatile acid

(b) Dibasic acid

(c) Oxidising agent

(d) Reducing agent

[2025]

16. Assertion (A): In the Contact Process SO_3 gas is not directly dissolved in water to obtain sulphuric acid. **[1]**

Reason (R): Dense fog or misty droplets of sulphuric acid are formed which is difficult to condense.

(a) Both (A) and (R) are true, and (R) is the correct explanation of (A).

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

(c) (A) is true but (R) is false.

(d) (A) is false but (R) is true.

[2025]

17. A non-metal which reacts with concentrated sulphuric acid to form two gases which turn lime water milky is _____. **[1]**

(a) Sulphur

(b) Carbon

(c) Oxygen

(d) Nitrogen

[2026]

18. Rita added dilute hydrochloric acid to four metals. She recorded her observations in the table given below. While noting her observations she made some errors. Which observation(s) made by Rita is/are correct? **[1]**

Table: Observations of dilute hydrochloric acid added to metals (2026 Q1(vii))

Sr. No.	Metals	Observations
1	copper	a gas was given off
2	iron	a gas was given off
3	magnesium	no gas was given off
4	zinc	a gas was given off

(a) 1 only

(b) 3 only

(c) Both 1 and 4

(d) Both 2 and 4

[2026]

19. The following statements are related to the properties of sulphuric acid: **[1]**

1. Barium chloride reacts with sulphuric acid to give a white precipitate.
2. Sulphur dioxide gas is evolved when sulphuric acid reacts with carbon.
3. Sulphuric acid has a pH value of less than 7.0.
4. Copper (II) oxide reacts with sulphuric acid to form a blue solution.

Which two statements confirm the acidic nature of sulphuric acid?

(a) 1 and 2
(b) 1 and 3
(c) 3 and 4
(d) 2 and 4

[2027S]

B. Short Questions (1 or 2 marks)

1. Write the products and balance the equation. **[2]**

(a) S + Conc HNO_3 →
(b) ZnS + HCl →

[2023S]

2. Answer the following questions on ammonia and ammonium hydroxide: **[2]**

(a) State one property of Ammonia demonstrated in the Fountain Experiment.
(b) Give the ionic equation when Ammonium Hydroxide is dissolved in water.

[2023S]

3. State a relevant reason for the following: **[2]**

(a) Hydrogen chloride gas cannot be dried over quick lime.
(b) Ammonia gas is not collected over water.

[2023]

4. Differentiate between the following pairs based on the criteria given in the brackets: **[2]**

(a) Cane sugar and hydrated copper sulphate [using concentrated H_2SO_4]
(b) Sulphuric acid and hydrochloric acid [type of salts formed]

[2023]

5. Identify the reactant and write the balanced equation for the following: Nitric acid reacts with compound Q to give a salt $Ca(NO_3)_2$, water and carbon dioxide. **[2]**

[2024S] [2025S]

6. What property of Sulphuric acid is exhibited in each of the following cases: **[2]**

(a) In the preparation of HCl gas when it reacts with Sodium chloride.
(b) When conc. Sulphuric acid reacts with Copper to produce Sulphur dioxide gas.

[2024S]

7. Answer the following questions on the reducing action of ammonia: **[2]**

(a) Ranjana wants to prove that ammonia is a reducing agent. To demonstrate this, she passes ammonia gas over heated copper oxide. What will she observe?

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

[2024S] [2025S]

8. Rewrite the following statements by adding the correct word as shown in the example: **[2]**

Example:

Given Statement: Ammonia changes moist red litmus to blue.

Correct Statement: Aqueous ammonia changes moist red litmus to blue.

(a) Sulphuric acid acts as a dehydrating agent.

(b) Ammonia reacts with chlorine to give ammonium chloride and nitrogen.

[2024]

9. Differentiate between the following pairs based on the criteria given: **[2]**

(a) Sulphuric acid and Nitric acid (using barium chloride solution)

(b) Unsaturated and Saturated hydrocarbons (type of bond present)

[2024]

10. Give balanced equation for the following reactions: **[2]**

(a) Copper reacts with concentrated Nitric acid.

(b) Aluminium nitride is treated with warm water.

[2024]

11. What property of Sulphuric acid is exhibited in each of the following cases: **[2]**

(a) In the preparation of HCl gas when it reacts with Sodium chloride.

(b) When concentrated Sulphuric acid reacts with Copper to produce Sulphur dioxide gas.

[2025S]

12. Ammonia gas is passed over heated copper (II) oxide in a combustion tube: **[2]**

(a) Name the gas evolved.

(b) What will be the colour of the residue that is left in the combustion tube at the end of the reaction?

[2025]

13. Seema added a few pieces of copper turnings to a test tube containing concentrated acid P and she noticed that a reddish-brown gas evolved. **[2]**

(a) Name the acid P used by Seema.

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

[2025]

14. Give one significant observation when: **[2]**

(a) Excess of chlorine gas reacts with ammonia.

(b) Zinc nitrate is strongly heated in a test tube.

[2026S] [2027S]

15. Give reasons: **[2]**

(a) When ammonia gas is passed over black copper oxide in a combustion tube a reddish-brown substance is left behind.

(b) Quick lime is not used to dry hydrogen chloride gas.

[2026S]

16. Write balanced chemical equations for the following: **[2]**

(a) Laboratory preparation of hydrochloric acid from a less volatile acid.

(b) Bromine gas is passed over ethene in the presence of carbon tetrachloride.

[2026S]

17. Identify the reactant and write the balanced equation for the following: Nitric acid reacts with compound Q to give a salt Calcium nitrate, water and carbon dioxide. **[2]**

[2026S]

18. Give reasons for the following: **[2]**

(a) Nitric acid does not normally liberate hydrogen gas when it reacts with active metals.

(b) Silver-plated cutlery is not considered as pure silver.

[2026S]

19. Study the reaction given below and answer the questions that follow: **[2]**

$NaNO_3 + H_2SO_4$ (Conc., < 200°C) → $NaHSO_4 + HNO_3$

(a) Give one reason for maintaining the temperature below 200°C.

(b) Why is concentrated Sulphuric acid used in the above reaction?

[2026]

20. Carbon reacts with an acid to form carbon dioxide, water and nitrogen dioxide. **[2]**

(a) Name the acid used in the reaction.

(b) Write a balanced chemical equation for the reaction that occurs.

[2026]

C. Long Questions (3 marks)

1. Complete the following by choosing the correct answers from the bracket: **[5]**

(a) Ammonia in the liquefied form is _____. [neutral / basic]

(b) Organic compounds are generally insoluble in _____. [Water / Organic solvents]

(c) An inert electrode used in electrolysis of acidified water is _____. [iron / platinum]

(d) Hydrocarbons having double bond is _____. [alkenes / alkynes]

(e) An alkaline gas gives dense white fumes of _____ [NH4OH / NH4Cl] with hydrogen chloride gas.

[2023S]

2. The following questions are pertaining to the laboratory preparation of Hydrogen chloride gas. **[3]**

(a) Write a balanced chemical equation for its preparation mentioning the condition required.

(b) Why is concentrated Nitric Acid not used in the preparation of Hydrogen Chloride gas?

(c) How is Hydrogen Chloride gas collected?

[2023S]

3. Explain the following: **[3]**

(a) Concentrated Nitric acid appears yellow when it is left standing in a glass bottle.

(b) An inverted Funnel is used to dissolve Hydrogen Chloride gas in water.

(c) All apparatus made of glass is used in the laboratory preparation of Nitric acid.

[2023S]

4. State the conditions required for the following reactions: **[3]**

(a) Conversion of Sulphur dioxide to Sulphur trioxide.

(b) Conversion of Ammonia to Nitric acid

(c) Conversion of Nitrogen to Ammonia

[2023S]

5. Choose the role played by concentrated Sulphuric acid as A, B, C which is responsible for the reactions 1 to 3. **[3]**

A. Oxidizing agent

B. Non Volatile Acid

C. Dehydrating agent

1. $NaNO_3 + H_2SO_4 (<200°C) \rightarrow NaHSO_4 + HNO_3$
2. $CuSO_4.5H_2O (H_2SO_4) \rightarrow CuSO_4 + 5H_2O$
3. $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$.

[2023S]

6. Complete and balance the following equations: **[3]**

(a) $NH_4Cl + Ca(OH)_2 \rightarrow$

(b) $CuSO_4 + NH_4OH \rightarrow$

(c) $Cu + Conc.\ HNO_3 \rightarrow$

[2023]

7. The following questions are pertaining to the laboratory preparation of Ammonia gas from Magnesium nitride: **[3]**

(a) Write a balanced chemical equation for its preparation.

(b) Why is this method seldom used?

(c) How do you identify the gas formed?

[2023]

8. State one relevant observation for each of the following: **[3]**

(a) To the copper nitrate solution, initially few drops of sodium hydroxide solution is added and then added in excess.

(b) Burning of ammonia in excess of oxygen.

(c) Dry ammonia gas is passed over heated PbO.

[2023]

9. Convert the following reactions into a balanced chemical equation: **[3]**

(a) Ammonia to nitric oxide using oxygen and platinum catalyst.

(b) Sodium hydroxide to sodium sulphate using sulphuric acid.

(c) Ferrous sulphide to hydrogen sulphide using hydrochloric acid.

[2023]

10. Give balanced equations for each of the following: **[3]**

(a) Action of warm water on Aluminium nitride.

(b) Oxidation of carbon with conc. Nitric acid.

(c) Dehydration of ethanol by conc. Sulphuric acid at a temperature of 170°C.

[2024S]

11. With respect to Haber's process answer the following: **[3]**

(a) Temperature of the reaction

(b) Catalyst used

(c) Balanced equation for the reaction occurring

[2024S]

12. Identify the following substances: **[3]**

(a) An alkaline gas which produces dense white fumes when reacted with HCl gas.

(b) The anion present in the salt, which produces a gas with the smell of rotten eggs when reacted with dil. HCl.

(c) The particles present in strong electrolytes.

[2024S]

13. The following table is related to an Industrial process of an acid. Identify (a), (b) and (c). **[3]**

Table: Industrial process of an acid (2024 Q3(iv))

Name of the process	Reactant	Catalyst	Final product
(a)	$SO_2 + O_2$	(b)	(c)

[2024]

14. Hydrogen chloride gas is prepared in the laboratory by the action of concentrated sulphuric acid on sodium chloride. **[3]**

(a) Give balanced chemical equation for the above reaction.

(b) State the method of collection of the gas formed above.

(c) What is the property of sulphuric acid that makes it a suitable reagent for the reaction?

[2024]

15. Match the Column A with Column B: **[5]**

Table: Matching Column A with Column B (2025 Q2(iv))

	Column A		Column B
(a)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	1.	Vanadium Pentoxide
(b)	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	2.	Nickel
(c)	$2SO_2 + O_2 \rightleftharpoons 2SO_3$	3.	Iron
(d)	$C_2H_4 + H_2 \rightarrow C_2H_6$	4.	Concentrated Sulphuric acid
(e)	$CuSO_4.5H_2O \rightarrow CuSO_4 + 5H_2O$	5.	Platinum

[2025]

16. Name the gas produced during each of the following reactions: **[3]**

(a) When copper is treated with hot, concentrated nitric acid.

(b) When ammonia is burnt in an atmosphere of oxygen.

(c) When ferrous sulphide reacts with dilute hydrochloric acid.

[2025]

17. Give balanced equations for the following: **[3]**

(a) Action of dilute hydrochloric acid on ammonium carbonate.

(b) Oxidation of sulphur with hot concentrated nitric acid.

(c) Reaction of concentrated sulphuric acid with carbon.

[2025]

18. You are provided with some compounds in the box. [PbO, CH_4, PbO_2, CO_2, HCl, NCl_3, SO_2]. Choose the most appropriate compound which fits the descriptions (a) to (c) given below: **[3]**

(a) A colourless gas which turns acidified $K_2Cr_2O_7$ from orange to green.

(b) A yellow explosive oily liquid formed when excess chlorine gas reacts with ammonia gas.

(c) A yellow metallic oxide formed on thermal decomposition of $PbCO_3$.

[2025]

19. Write balanced chemical equations for the following reactions: **[3]**

(a) Ammonium chloride reacts with calcium hydroxide.

(b) Nitric acid reacts with zinc carbonate.

(c) Concentrated sulphuric acid is added to hydrated copper sulphate.

[2026S]

20. State the property exhibited by sulphuric acid in each of the following reactions: **[3]**

(a) Sulphur with concentrated sulphuric acid.

(b) Conversion of ferrous sulphide to hydrogen sulphide gas using sulphuric acid.

(c) Ethanol with concentrated sulphuric acid.

[2026S]

21. During the manufacture of sulphuric acid, a chemist collected the gas formed after catalytic oxidation of sulphur dioxide. **[3]**

(a) Name the gas collected.

(b) Which acid is formed when the gas collected by the chemist is dissolved directly in water?

(c) Why should we not dissolve this gas directly in water?

[2026]

22. Anil is a laboratory assistant in a college. He prepared nitric acid but stored it in a transparent container exposed to sunlight. After a few days, brown fumes were observed in the container and the acid turned slightly yellowish in colour. **[3]**

(a) What was the error made by Anil while storing the acid?

(b) Why were brown fumes observed in the container?

(c) How can the yellowish tinge in the acid be removed?

[2026]

23. Write balanced chemical equations for the following: **[5]**

(a) Chlorination of chloroform in the presence of diffused sunlight.

(b) Hydrated aluminium oxide is treated with caustic soda.

(c) Zinc oxide is treated with caustic alkali.

(d) Copper reacts with cold dilute nitric acid.

(e) Laboratory preparation of nitric acid using sodium nitrate.

[2027S]

24. Identify the reactants P, Q and R in the following reactions: **[3]**

(a) Copper (II) oxide + P → Copper + Water + Nitrogen

(b) Iron pyrite + Q → Iron oxide + Sulphur dioxide

(c) Ammonia + R → Nitrogen + Water

[2027S]

Chapter 9: Organic Chemistry

A. Multiple Choice Questions (1 mark each)

1. The organic compound prepared when Ethanol undergoes dehydration: **[1]**

(a) Methane

(b) Ethane

(c) Acetylene

(d) Ethene

[2023S]

2. The IUPAC name of methyl acetylene is: **[1]**

(a) Propyne

(b) Ethene

(c) Propane

(d) Ethyne

[2023S]

3. An example of a cyclic organic compound is: **[1]**

(a) Propene

(b) Pentene

(c) Butene

(d) Benzene

[2023]

4. The hydrocarbon formed when sodium propanoate and soda lime are heated together: **[1]**

(a) Methane

(b) Ethane

(c) Ethene

(d) Propane

[2023]

5. The general formula of hydrocarbons with single covalent bonds is: **[1]**

(a) C_nH_{2n+2}

(b) C_nH_{2n}

(c) C_nH_{2n-2}

(d) C_nH_{2n-6}

[2023]

6. _____ is the functional group in methanol. **[1]**

(a) >C=O

(b) –OH

(c) –CHO

(d) –COOH

[2024S]

7. Unsaturated hydrocarbons undergo: **[1]**

(a) Addition reaction

(b) Substitution reaction

(c) Oxidation reaction

(d) Redox reaction

[2024]

8. Reaction of an alcohol with a carboxylic acid in the presence of concentrated H_2SO_4 is termed as: **[1]**

(a) Halogenation

(b) Esterification

(c) Hydrogenation

(d) Dehydrohalogenation

[2024]

9. Conversion of Ethanol to Ethene by the action of concentrated sulphuric acid involves: **[1]**

(a) Dehydration

(b) Dehydrogenation

(c) Dehydrohalogenation

(d) Hydrolysis

[2024]

10. Which formula represents a saturated hydrocarbon? **[1]**

(a) C_4H_8

(b) C_5H_{12}

(c) C_4H_6

(d) C_5H_{10}

[2025]

11. Which of the following options has all the compounds which are members of the same homologous series? **[1]**

(a) CH4, C2H6, C3H8

(b) CH4, C2H6, C3H6

(c) C3H4, C3H6, C3H8

(d) C2H4, C3H6, C4H10

[2025]

12. Methanol and ethanol belong to the same homologous series. What does this statement mean? **[1]**

(a) Their molecules contain atoms only of carbon and hydrogen.

(b) Their molecules have the same number of carbon atoms.

(c) They have the same functional group.

(d) They have the same relative molecular mass.

[2026S]

13. Identify the equation that shows the reaction of ethane with chlorine in the presence of ultraviolet light. **[1]**

(a) $C_2H_6 + Cl_2 \rightarrow C_2H_6Cl_2$

(b) $C_2H_6 + Cl_2 \rightarrow C_2H_4Cl_2 + H_2$

(c) $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$

(d) $C_2H_6 + Cl_2 \rightarrow 2CH_3Cl$

[2026]

14. An unsaturated hydrocarbon with three atoms of carbon and six atoms of hydrogen is: **[1]**

(a) propyne

(b) propane

(c) propene

(d) propanol

[2026]

15. Identify the organic compound(s) with the molecular formula C_3H_8O. **[1]**

1. propanol
2. propanal
3. propanoic acid

(a) Only 1

(b) Only 2

(c) Both 2 and 3

(d) Both 1 and 2

[2027S]

B. Short Questions (1 or 2 marks)

1. Identify the functional group in the following organic compounds: **[2]**

(a) HCHO

(b) C2H5COOH

[2023S]

2. Name the following: **[2]**

(a) Organic compounds with same molecular formula but different structural formula.

(b) Group of organic compounds where the successive members follow a regular structural pattern, successive compounds differ by a 'CH2' group.

[2023]

3. Arrange the following according to the instructions given in brackets: **[2]**

(a) C2H2, C3H6, CH4, C2H4 (In the increasing order of the molecular weight)

(b) Cu2+, Na+, Zn2+, Ag+ (The order of Preferential discharge at the cathode)

[2023]

4. Complete and balance the following equations: **[2]**

(a) CH3COONa + NaOH (CaO, Δ) →

(b) CH3COOH + Mg →

[2025]

5. State whether the following statements are True or False: **[2]**

(a) Organic compounds having different molecular formula, but same structural formula are called isomers.

(b) A salt is a compound formed by partial or complete replacement of the hydrogen ion of an acid by a metal or electro positive ion.

[2026]

6. What is the ratio of methane to the acidic gaseous product obtained when methane undergoes complete combustion? Give a balanced equation for the above reaction. **[2]**

[2027S]

C. Long Questions (3 marks)

1. Give balanced chemical equation for the following: **[3]**

(a) Laboratory Preparation of Methane from Sodium Acetate.

(b) Preparation of Ethyne from 1, 2 dibromoethane.

(c) Ethene reacting with Chlorine.

[2023S]

2. Give a balanced chemical equation for the following conversions with conditions: **[3]**

(a) Ethene from ethanol

(b) Ethyne from calcium carbide

(c) Monochloromethane from methane

[2023]

3. Give reasons: **[3]**

(a) Ethene undergoes addition reaction.

(b) Hydrocarbons can be used as fuels.

(c) Hydrogen chloride gas cannot be collected over water.

[2024S]

4. Give balanced equations for the following: **[3]**

(a) Laboratory preparation of ethyne from calcium carbide.

(b) Conversion of acetic acid to ethyl acetate.

(c) Laboratory preparation of nitric acid.

[2024S] [2025S] [2026S]

5. Complete and balance the following equations: **[3]**

(a) $Al_2O_3 + NaOH \rightarrow$

(b) $C_2H_5COONa + NaOH (\Delta, CaO) \rightarrow$

(c) $C_2H_4Br_2 +$ alcoholic $KOH (\Delta) \rightarrow$

[2024]

6. Choose the organic compound from the list given below to answer the following questions:
[Ethene, Ethanoic acid, Ethanol, Methanal] **[3]**

(a) The compound which does not have a double bond in its structure.

(b) The compound which in its pure form turns into an ice like solid on cooling.

(c) The compound which is used for artificial ripening of fruits.

[2024]

7. Identify the gas evolved in each of the following reactions: **[3]**

(a) Methane undergoes complete combustion.

(b) Copper carbonate is heated.

(c) MnO_2 reacts with concentrated HCl.

[2024]

8. Give balanced equations for each of the following: **[3]**

(a) Action of warm water on Aluminium nitride.

(b) Oxidation of carbon with conc. Nitric acid.

(c) Laboratory preparation of ethanol by using chloroethane and aqueous sodium hydroxide.

[2025S] [2026S]

9. State the terms for the following: **[5]**

(a) Undistilled alcohol containing a large amount of methanol.

(b) A salt formed by the partial replacement of the hydroxyl group of a di-acidic or a tri-acidic base by an acid radical.

(c) Organic compounds having the same molecular formula but different structural formula.

(d) The tendency of an atom to attract the shared pair of electrons towards itself when combined in a compound.

(e) The type of covalent bond in which electrons are shared unequally between the combining atoms.

[2025]

10. In a round bottom flask, a mixture of ethanol, acetic acid and concentrated sulphuric acid was heated: **[3]**

(a) Name the type of reaction occurring in the above set up.

(b) What is the role of sulphuric acid in this reaction?

(c) State one observation that takes place during the reaction.

[2026S]

11. Identify the following terms / compounds: **[5]**

(a) A compound which reacts with water to give acetylene gas.

(b) The gas evolved when sodium propanoate is heated with soda lime.

(c) A reddish-brown precipitate formed when ferric chloride solution reacts with an alkali.

(d) A pair of electrons present in an atom which is not shared with any other atom during bond formation.

(e) The relative molecular mass of a substance expressed in grams.

[2026]

12. Complete and balance the following equations: **[3]**

(a) $C_2H_4Br_2 + KOH$ (alcoholic) →

(b) NH_3(excess) + Cl_2 →

(c) $C_{12}H_{22}O_{11}$ ((conc.) H_2SO_4) →

[2026]

13. An unsaturated hydrocarbon having two carbon atoms was made to react with two moles of hydrogen gas in the presence of a catalyst to give a saturated hydrocarbon. Using the above information, answer the following questions: **[3]**

(a) The type of reaction that occurred is _____. (addition / substitution)

(b) Name a suitable catalyst which is used in the reaction.

(c) Write a balanced chemical equation for the above reaction.

[2026]

14. Give balanced equations for each of the following: **[3]**

(a) Action of warm water on calcium carbide.

(b) Oxidation of sulphur with conc. nitric acid.

(c) Laboratory preparation of ethane by using sodium propionate and soda lime.

[2027S]

15. In a round bottom flask, a mixture of ethanol, acetic acid and concentrated sulphuric acid was heated. Answer the following questions: **[3]**

(a) Name the type of reaction occurring in the above set up.

(b) What is the role of sulphuric acid in this reaction?

(c) State one observation that takes place during the reaction.

[2027S]

Picture-Based Questions

Note: This section compiles all diagram-, apparatus-, and structure-based questions across the 2023–2027 papers. Each figure is represented by a red placeholder specifying the source paper, paper code, and question number.

A. Multiple Choice Questions (1 mark each)

1. In which of the following electrolytic cells [P, Q, R or S] will silver plating be done on the spoon? **[1]**

[FIGURE: Four electrolytic cell setups P, Q, R, and S showing battery polarity, silver plate, silver plated spoon, and distilled water vs silver nitrate solution — paste from source paper, 2024S T24 522 – SPECIMEN Q1(vi)]

(a) P

(b) Q

(c) R

(d) S

[2024S]

2. The structures of four hydrocarbons are shown below: How many isomers of butene are there? **[1]**

[FIGURE: Four branched/linear hydrocarbon structures (isobutane, 2-methylpropene, but-1-ene, propene) — paste from source paper, 2025S T25 522 – SPECIMEN Q1(vi)]

(a) 1

(b) 2

(c) 3

(d) 4

[2025S]

3. A student takes Cu, Al, Fe and Zn strips, separately in four test tubes labeled as I, II, III and IV respectively. He adds 10 ml of freshly prepared ferrous sulphate solution to each test tube and observes the colour of the metal residue in each case. He would observe a black residue in the test tubes: **[1]**

[FIGURE: Four test tubes (I) Cu, (II) Al, (III) Fe, and (IV) Zn containing ferrous sulphate solution and metal strips — paste from source paper, 2025S T25 522 – SPECIMEN Q1(xv)]

(a) (I) and (II)

(b) (I) and (III)

(c) (II) and (III)

(d) (II) and (IV)

[2025S]

4. The diagram given below shows the bonding in the covalent molecule AB2. Which option represents the correct electronic configuration of atoms A and B before combining together to form the above molecule? **[1]**

[FIGURE: Orbit structure diagram showing covalent bonding in molecule AB2 where central atom A shares two pairs of electrons with two B atoms — paste from source paper, 2025 T25 522 Q1(viii)]

Table: Electronic configuration options for atoms A and B (2025 Q1(viii))

Option	A	B
(a)	2, 4	2, 8, 6
(b)	2, 4	2, 8, 7
(c)	2, 8	2, 8, 8
(d)	2, 6	2, 8, 7

(a) Option (a)
(b) Option (b)
(c) Option (c)
(d) Option (d)

[2025]

5. Four reactions are shown below in the diagram: Which reactions produce water? **[1]**

[FIGURE: Four reaction setups: 1. heating calcium carbonate, 2. dilute hydrochloric acid + zinc, 3. burning ethanol in spirit lamp, 4. dilute sulphuric acid + magnesium carbonate — paste from source paper, 2026S T26 522 – SPECIMEN Q1(v)]

(a) 1 and 2
(b) 1 and 3
(c) 3 and 4
(d) 2 and 3

[2026S]

6. The structures of four hydrocarbons are shown below: How many isomers of butene are shown in the above structures? **[1]**

[FIGURE: Four hydrocarbon structures (isobutane, 2-methylpropene, but-1-ene, propene) — paste from source paper, 2026S T26 522 – SPECIMEN Q1(ix)]

(a) 1
(b) 2
(c) 3
(d) 4

[2026S]

7. In the process of Electrorefining of Copper shown in the diagram below, which of the following statements is correct? **[1]**

[FIGURE: Electrorefining of Copper cell showing Anode, Cathode, CuSO4 solution, and Anode mud — paste from source paper, 2026S T26 522 – SPECIMEN Q1(xv)]

(a) The anode is made of pure Copper.

(b) The cathode is made of impure Copper.

(c) Copper is deposited at the anode.

(d) Copper ions from the anode move to the cathode and get deposited as pure Copper.

[2026S]

8. A hydrocarbon X undergoes the reaction under suitable conditions as shown below: Which compound(s) is/are unsaturated? **[1]**

[FIGURE: Structural equation showing n-butane (X) cracking into propene (Y) + methane (Z) — paste from source paper, 2026 T26 522 Q1(vi)]

(a) X only

(b) Y only

(c) X and Z

(d) Y and Z

[2026]

9. The diagram given below represents the industrial process for the manufacture of concentrated sulphuric acid by the Contact process. What is used in step R to obtain sulphuric acid from sulphur trioxide? **[1]**

[FIGURE: Contact process block diagram: sulphur → sulphur dioxide → sulphur trioxide →(R) sulphuric acid — paste from source paper, 2027S T27 522 – SPECIMEN Q1(ii)]

(a) vanadium pentoxide

(b) water only

(c) water followed by concentrated sulphuric acid

(d) concentrated sulphuric acid followed by water

[2027S]

10. The diagram given below shows that P reacts with dilute hydrochloric acid to produce a gas which when passed through substance Q, reduces it. What are substances P and Q? **[1]**

[FIGURE: Conical flask with dilute hydrochloric acid + solid P generating gas passed through heated combustion tube containing substance Q — paste from source paper, 2027S T27 522 – SPECIMEN Q1(v)]

(a) P - copper, Q - lead (II) oxide

(b) P - lead, Q - magnesium oxide

(c) P - magnesium, Q - calcium oxide

(d) P - zinc, Q - copper (II) oxide

[2027S]

11. A teacher demonstrated four different reactions as shown in the diagram below: Which reactions will produce water? **[1]**

[FIGURE: Four reaction setups: 1. dilute hydrochloric acid + zinc, 2. heating calcium carbonate, 3. burning ethanol in spirit lamp, 4. dilute sulphuric acid + magnesium carbonate — paste from source paper, 2027S T27 522 – SPECIMEN Q1(xiv)]

(a) 1 and 2

(b) 1 and 3

(c) 3 and 4

(d) 2 and 3

[2027S]

B. Short Questions (1 or 2 marks)

1. A student was asked to perform two experiments in the laboratory based on the instructions given: Observe the picture given below and state one observation for each of the Experiments 1 and 2 that you would notice on mixing the given solutions. **[2]**

[FIGURE: (a) Experiment 1: pouring solution of zinc sulphate into test tube containing solution of barium chloride; (b) Experiment 2: pouring ammonium hydroxide solution into test tube containing precipitate of copper hydroxide — paste from source paper, 2025S T25 522 – SPECIMEN Q6(ii)]

[FIGURE: (a) Experiment 1: pouring solution of zinc sulphate into test tube containing solution of barium chloride; (b) Experiment 2: pouring ammonium hydroxide solution into test tube containing precipitate of copper hydroxide — paste from source paper, 2026S T26 522 – SPECIMEN Q6(i)]

(a) Experiment 1

(b) Experiment 2

[2025S] [2026S]

2. The diagram below illustrates the structures of two atoms P and Q. What is the formula and mass of one mole of the compound formed when P and Q react together? [At. wt of P is 23 and Q is 16] **[2]**

[FIGURE: Atomic orbit diagrams for atom P (11p, 12n; 2,8,1) and atom Q (8p, 8n; 2,6) — paste from source paper, 2027S T27 522 – SPECIMEN Q7(ii)]

[2027S]

C. Long Questions (3 marks)

1. The diagram shows an experiment set up for the laboratory preparation of a pungent smelling gas. The gas is alkaline in nature. **[5]**

[FIGURE: Laboratory preparation setup showing heated round-bottom flask with Mixture X, drying tower with substance Y, and downward displacement collection of Gas — paste from source paper, 2023S T23 522 – SPECIMEN Q2(i)]

(a) Name the gas collected in the gas jar.

(b) Write a balanced chemical equation for the above preparation.

(c) How is the gas being collected?

(d) What is the purpose of using Y?

(e) How will you find that the jar is full of gas?

[2023S]

2. Draw the structural formula and give IUPAC names for the following organic compounds: **[5]**

[FIGURE: Structural formulae for (b) 1. H3C–CH2–CH2–CH2–O–H and 2. H–C≡C–CH3 — paste from source paper, 2023S T23 522 – SPECIMEN Q2(v)]

(a) Draw the structural formula for the following:

1. 2-pentanol
2. Ethanal
3. 1-butene

(b) Name the following organic compounds in IUPAC system:

1. [Structure 1 shown in figure]
2. [Structure 2 shown in figure]

[2023S]

3. The following sketch illustrates the process of conversion of Alumina to Aluminium: Study the diagram and answer the following: **[5]**

[FIGURE: Electrolytic cell for conversion of Alumina to Aluminium showing electrodes Y (anode), Z (cathode), powdered substance X on surface, and electrolyte mixture — paste from source paper, 2023 T23 522 Q2(ii)]

(a) Name the constituent of the electrolyte mixture which has a divalent metal in it.

(b) Name the powdered substance 'X' sprinkled on the surface of the electrolyte mixture.

(c) What is the name of the process?

(d) Write the reactions taking place at the electrodes 'Y' (anode) and 'Z' (cathode) respectively.

[2023]

4. Give the structural formula and IUPAC name of the following organic compounds: **[5]**

[FIGURE: Structural formulae for (b) 1. CH3–C(=O)–O–H (ethanoic acid) and 2. CH3–CH2–CH(OH)–CH3 (butan-2-ol) — paste from source paper, 2023 T23 522 Q2(v)]

(a) Give the structural formula of the following organic compounds:

1. 2-chlorobutane
2. Methanal
3. But-2-yne

(b) Give the IUPAC name of the following organic compounds:

1. [Structure 1 shown in figure]
2. [Structure 2 shown in figure]

[2023]

5. The setup shown below is that of the fountain experiment with hydrogen chloride gas in the flask. The fountain starts when a few drops of water from the dropper are introduced into the flask. Instead of the drops of water, Pooja started the fountain by introducing a few drops of Sodium hydroxide into the flask. **[5]**

[FIGURE: Fountain experiment setup showing inverted flask with HCl gas, jet tube, dropper, and beaker of litmus solution — paste from source paper, 2024S T24 522 – SPECIMEN Q2(i)]

(a) Explain why the litmus solution gets sucked up when Sodium hydroxide is used.

(b) What will be the colour of the fountain when Sodium hydroxide is used? Justify your answer.

(c) If instead of HCl gas, ammonia gas is filled in the flask and water is introduced from the dropper, will there be a different observation? Justify your answer.

[2024S]

6. Draw the structural diagram and give the IUPAC name of the following organic compounds: **[5]**

[FIGURE: Structural formulae for (b) 1. propan-1-ol (CH3–CH2–CH2OH) and 2. pent-1-ene (H2C=CH–CH2–CH2–CH3) — paste from source paper, 2024S T24 522 – SPECIMEN Q2(v)]

(a) Draw the structural diagram for the following compounds:

1. 1-propanal
2. 1, 2 dichloro ethane
3. But-2-ene

(b) Give the IUPAC name of the following organic compounds:

1. [Structure 1 shown in figure]
2. [Structure 2 shown in figure]

[2024S]

7. The following sketch represents the electroplating of an Iron cup with Nickel metal. Study the diagram and answer the following questions: **[5]**

[FIGURE: Electroplating setup showing ammeter A, battery, Anode, Cathode (Iron cup), and Electrolyte — paste from source paper, 2024 T24 522 Q2(i)]

(a) During electroplating the iron cup is placed at the cathode. Why?

(b) Name the ion that must be present in the electrolyte.

(c) State one condition that is necessary to ensure that the deposit is smooth, firm and even.

(d) Write the reaction taking place at the cathode.

(e) What change would you observe at the anode?

[2024]

8. Give the IUPAC names and draw the structural diagram for the following organic compounds: **[5]**

[FIGURE: Structural formulae for (a) 1. 2,3-dichloropentane and 2. propanoic acid — paste from source paper, 2024 T24 522 Q2(v)]

(a) Give the IUPAC names of the organic compounds represented by the structural formulae given below:

1. [Structure 1 shown in figure]
2. [Structure 2 shown in figure]

(b) Draw the structural diagram for the following organic compounds:

1. 3-methyl pentane
2. propyne
3. methanal

[2024]

9. Electroplating steel objects with silver involves a three-step process. **[5]**

step 1 A coating of copper is applied to the object.

step 2 A coating of nickel is applied to the object.

step 3 The coating of silver is applied to the object.

[FIGURE: Electrolytic cell for step 1 showing copper (anode), steel object (cathode), and aqueous copper(II) sulphate electrolyte — paste from source paper, 2025S T25 522 – SPECIMEN Q2(i)]

[FIGURE: Electrolytic cell for step 1 showing copper (anode), steel object (cathode), and aqueous copper(II) sulphate electrolyte — paste from source paper, 2026S T26 522 – SPECIMEN Q2(i)]

(a) A diagram of the apparatus used for step 1 is shown.

1. The chemical process taking place on the surface of the object is $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$. What is the observation seen on the surface of the object?
2. Explain why the concentration of copper ions in the electrolyte remains constant throughout step1.

(b) Give two changes which would be needed in order to coat nickel onto the object in step 2.

(c) Write down the reaction taking place at the positive electrode during step 3.

[2025S] [2026S]

10. Draw the structural diagram and give the IUPAC name of the following organic compounds: **[5]**

[FIGURE: Structural formulae for (b) 1. propan-1-ol (CH3–CH2–CH2OH) and 2. pent-1-ene (H2C=CH–CH2–CH2–CH3) — paste from source paper, 2025S T25 522 – SPECIMEN Q2(v)]

(a) Draw the structural diagram for the following compounds:

1. propanoic acid
2. pentan-2-ol
3. 2, 2 dibromo butane

(b) Give the IUPAC name of the following organic compounds:

1. [Structure 1 shown in figure]
2. [Structure 2 shown in figure]

[2025S]

11. The diagram given below is a representation of the Industrial preparation of Nitric acid by Ostwald's process. With respect to the process answer the following questions: **[3]**

[FIGURE: Block diagram of Ostwald's process showing Ammonia Oxidation Converter, Heat Exchanger, Oxidation Chamber, and Absorption Towers yielding HNO3 — paste from source paper, 2025S T25 522 – SPECIMEN Q4(iv)]

(a) Write the temperature and the catalyst required during the catalytic oxidation of ammonia.

(b) Give balanced chemical equation for the reaction occurring during the conversion of nitrogen dioxide to nitric acid.

[2025S]

12. Given below in column A is a schematic diagram of the electrolytic reduction of alumina. Identify the parts labelled as A, B and C with the correct options from the Column B. **[3]**

[FIGURE: Schematic diagram of Hall-Heroult electrolytic cell in Column A with labels A (cathode lining), B (anode rods), and C (electrolyte mixture) matched against Column B options 1–5 — paste from source paper, 2025S T25 522 – SPECIMEN Q5(iv)]

Table: Options in Column B for electrolytic reduction of alumina (2025S Q5(iv))

Option No.	Column B
1.	Platinum
2.	Anode
3.	Cathode
4.	Electrolyte mixture
5.	Bauxite

[2025S]

13. The structures of six organic compounds are shown: **[3]**

[FIGURE: Six organic structures labelled A (but-2-ene), B (ethanoic acid), C (n-butane), D (ethanol), E (2-methylpropane), and F (ethene) — paste from source paper, 2025S T25 522 – SPECIMEN Q8(iv)]

(a) Identify two of the compounds that are members of the same homologous series but are not isomers.

(b) Which two compounds are isomers of each other?

(c) F can be prepared from D. Give a chemical equation for the reaction.

[2025S]

14. A student was instructed by the teacher to prepare and collect ammonia gas in the laboratory by using aluminium nitride. The student had set up the apparatus as shown in the diagram below. Study the given diagram and answer the following questions: **[5]**

[FIGURE: Laboratory preparation of ammonia from Aluminium nitride with thistle funnel adding X, drying tower with Y, and collection over Water — paste from source paper, 2025 T25 522 Q2(i)]

(a) Name the substance X added through the thistle funnel by the student.

(b) Write a balanced equation for the reaction occurring between Aluminium nitride and substance X.

(c) Identify the substance Y.

(d) State the function of Y.

(e) Why could the student not collect ammonia gas at the end of the experiment?

[2025]

15. Draw the structural diagram and give IUPAC name for the following organic compounds: **[5]**

[FIGURE: Structural formulae for (b) 1. 1,1,2,2-tetrachloroethane, 2. butanoic acid, and 3. 2-methylbut-1-ene (or 2-methylbut-2-ene as printed) — paste from source paper, 2025 T25 522 Q2(v)]

(a) Draw the structural diagram for the following organic compounds:

1. 2-methyl propene
2. butanal

(b) Give IUPAC name for the following organic compounds:

1. [Structure 1 shown in figure]
2. [Structure 2 shown in figure]
3. [Structure 3 shown in figure]

[2025]

16. Rohit took two different salt solutions in test tubes C and D as shown in the figure below. He added dilute HCl to each of the two test tubes. The products formed in the test tubes C and D are silver chloride and lead chloride respectively. State: **[3]**

[FIGURE: Two test tubes C (AgNO3 solution + dilute HCl) and D (Pb(NO3)2 solution + dilute HCl) — paste from source paper, 2025 T25 522 Q5(iv)]

(a) one common observation made by Rohit in both the reactions.

(b) the observations made by him on addition of excess of ammonium hydroxide to the products formed in:

1. test tube C
2. test tube D

[2025]

17. Given below is a diagram showing the placement of five different oxides. With respect to the given diagram answer the following questions: **[3]**

[FIGURE: Venn diagram of Basic oxides (Na2O, Fe2O3), Acidic oxides (CuO, SO2), and intersection Region X (ZnO) — paste from source paper, 2025 T25 522 Q6(i)]

(a) Name the type of oxide represented in region X in the diagram.

(b) Identify the oxide which has been incorrectly placed in the above diagram.

(c) Name the oxide from the above diagram which will form an alkali when dissolved in water.

[2025]

18. Given below are organic compounds labelled A to F. Answer the questions that follow: **[3]**

[FIGURE: Six organic structures A (ethanoic acid), B (ethanol), C (ethene), D (n-butane), E (ethane), and F (2-methylpropane) — paste from source paper, 2025 T25 522 Q6(ii)]

(a) Which compound forms a single product with bromine?

(b) Which two compounds have the same molecular formula?

(c) Which two compounds will react together in the presence of concentrated H2SO4 to form a product with a fruity smell?

[2025]

19. Give the IUPAC name and draw the structural diagram for the following organic compounds: **[5]**

[FIGURE: Structural formulae for (a) 1. propan-1-ol (CH3–CH2–CH2OH) and 2. pent-1-ene (H2C=CH–CH2–CH2–CH3) — paste from source paper, 2026S T26 522 – SPECIMEN Q2(v)]

(a) Give the IUPAC name of the following organic compounds:

1. [Structure 1 shown in figure]
2. [Structure 2 shown in figure]

(b) Draw the structural diagram for the following compounds:

1. but-2-yne
2. 1, 1, 1, trichloro methane
3. pentan-2-ol

[2026S]

20. Write balanced chemical equation for the following conversions (A to C): **[3]**

[FIGURE: Conversion scheme showing Zn →(A) ZnSO4 →(C) Zn(OH)2 and Zn →(B) ZnS — paste from source paper, 2026S T26 522 – SPECIMEN Q8(iii)]

[2026S]

21. Given below is the industrial process for the manufacture of ammonia gas. Study the schematic diagram to answer the following questions. **[5]**

[FIGURE: Schematic diagram of Haber's process showing H2 and N2 entering Compresser C, Catalytic chamber, Recycler R for unreacted gases, and Liquid ammonia outlet — paste from source paper, 2026 T26 522 Q2(i)]

(a) Name the process.

(b) Which catalyst is used in the above process?

(c) In the above diagrammatic setup, how is ammonia gas separated from the unreacted gases to obtain liquid ammonia?

(d) Which two properties of ammonia gas can be demonstrated by the Fountain Experiment?

[2026]

22. Give the IUPAC name and draw the structural diagram for the following organic compounds: **[5]**

[FIGURE: Condensed structural formulae for (a) 1. HO–CH(CH3)–CH2–CH3 (butan-2-ol) and 2. H3C–CH2–CH(CH3)–CH2–CH3 (3-methylpentane) — paste from source paper, 2026 T26 522 Q2(v)]

(a) Give the IUPAC name for the following organic compounds:

1. HO – CH(CH3) – CH2 – CH3
2. H3C – CH2 – CH(CH3) – CH2 – CH3

(b) Draw the structural diagram for each of the following organic compounds:

1. butanal
2. pent-2-yne
3. The isomer of n-butane

[2026]

23. The diagram given below shows the electroplating of a spoon with silver. With reference to the diagram, answer the following questions: **[4]**

[FIGURE: Electroplating cell showing Spoon (Cathode), Silver (Anode), and Sodium argento cyanide solution (Electrolyte) — paste from source paper, 2026 T26 522 Q5(iii)]

(a) Write an equation for the reaction that occurs at the cathode.

(b) Silver nitrate solution is not preferred as an electrolyte in the above process. Give a reason.

(c) Why is alternating current not used in the process?

(d) What is the observation at the anode?

[2026]

24. Study the reaction scheme shown below and identify the reactants A, B and C. **[3]**

[FIGURE: Reaction scheme showing Ethanol →(A) Ethene, Ethanol →(B) Ethyl acetate, and Ethanol →(C) Carbon dioxide + water — paste from source paper, 2026 T26 522 Q7(iv)]

[2026]

25. K, L and M are beakers containing three different solutions as shown below. Name the beaker which: **[3]**

[FIGURE: Three beakers K (Aqueous acetic acid), L (Sodium chloride solution), and M (Distilled water) — paste from source paper, 2026 T26 522 Q8(iv)]

(a) contains only ions.

(b) contains only molecules.

(c) has pH less than 7.

[2026]

26. The diagram given below shows the electrolysis of acidulated water. With reference to the diagram, answer the following questions: **[5]**

[FIGURE: Electrolysis of acidified water cell with electrodes A (+) and B (–), inverted test tubes collecting GAS, and battery — paste from source paper, 2027S T27 522 – SPECIMEN Q2(i)]

(a) Write an equation for the reaction that takes place at A.

(b) Give a test to confirm the product formed at A.

(c) Which gas is liberated at B?

(d) Why is water acidified for electrolysis?

(e) What is the ratio by volume of the gases liberated at A and B?

[2027S]

27. Give the IUPAC name and draw the structural diagram for the following organic compounds: **[5]**

[FIGURE: Structural formulae for (a) 1. HO–C(=O)–CH2–CH2–CH3 (butanoic acid) and 2. 2,4-dimethylpentane (or 2-methylpentane as printed with two CH3 branches on C2 and C4) — paste from source paper, 2027S T27 522 – SPECIMEN Q2(v)]

(a) Give the IUPAC name of the following organic compounds:

1. HO – C(=O) – CH2 – CH2 – CH3
2. [Structure 2 shown in figure]

(b) Draw the structural diagram for the following compounds:

1. diethyl ether
2. isopentane
3. propanone

[2027S]

28. A student was given a crystalline salt 'B' for analysis which was blue in colour. He added a few drops of dense oily hygroscopic liquid to it and observed a colourless neutral gas/vapour being released and the salt turning white. **[3]**

[FIGURE: Pouring hygroscopic liquid from test tube into a test tube containing blue crystalline salt B — paste from source paper, 2027S T27 522 – SPECIMEN Q3(iii)]

(a) Identify the blue crystalline salt B.

(b) Which property of the hygroscopic liquid is demonstrated in this reaction?

(c) Write a balanced chemical equation for the above reaction.

[2027S]

29. Write balanced chemical equations for the following conversions (A to C): **[3]**

[FIGURE: Conversion scheme showing Zn →(A) ZnSO4 →(C) Zn(OH)2 and Zn →(B) ZnS — paste from source paper, 2027S T27 522 – SPECIMEN Q5(iii)]

[2027S]

30. Rohan has two test tubes, A containing sodium chloride and B containing ammonium chloride as shown in the diagram below. He adds sodium hydroxide solution to both the test tubes and warms them gently. Answer the following questions: **[4]**

[FIGURE: Two test tubes: Test tube A (NaCl + NaOH) and Test tube B (NH4Cl + NaOH) — paste from source paper, 2027S T27 522 – SPECIMEN Q6(iii)]

(a) In which test tube (A or B) will Rohan observe the evolution of a gas?

(b) Name the gas that is evolved.

(c) What will be the colour of the flame when this gas burns in oxygen?

(d) Write an equation for the reaction that occurs in the test tube in which the gas has evolved.

[2027S]

31. The structures of five organic compounds, C, D, E, F and G are shown. Answer the following questions about these compounds. (Each compound may be used once, more than once or not at all.) State which compound, C, D, E, F or G: **[4]**

[FIGURE: Five organic structures C (propene), D (propan-1-ol), E (n-butane), F (1,2-dibromoethane), and G (ethene) — paste from source paper, 2027S T27 522 – SPECIMEN Q8(iii)]

(a) on halogenation will form F.

(b) is an alcohol.

(c) is an isomer of 2-methyl propane.

(d) is in the same homologous series as ethene.

[2027S]