

ICSE 2025 EXAMINATION

Sample Question Paper - 1

Chemistry

Time Allowed: 2 hours

Maximum Marks: 80

General Instructions:

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes.
- This time is to be spent reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers.
- **Section A** is compulsory. Attempt any four questions from **Section B**.
- The intended marks for questions or parts of questions are given in brackets [].

Section A

1. **Question 1 Choose one correct answer to the questions from the given options:** [15]
- (a) Which of the following properties do not match with elements of the halogen family? [1]
- | | |
|--|---|
| a) They are highly chemically reactive | b) They are diatomic in their molecular form |
| c) They are metallic in nature | d) They have seven electrons in their valence shell |
- (b) Which law is like the seven notes of music; sa, re, ga, ma, pa, _____? [1]
- | | |
|-------------------|---|
| a) Law of triad | b) None of these |
| c) Law of octaves | d) Both Law of triad and Law of octaves |
- (c) When a metal atom becomes an ion: [1]
- | | |
|---------------------------------------|---------------------------------------|
| a) It loses electrons and is reduced | b) It loses electrons and is oxidised |
| c) It gains electrons and is oxidised | d) It gains electrons and is reduced |
- (d) A sample of soil is mixed with water and allowed to settle. The clean supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue? [1]
- | | |
|----------------|----------------|
| a) Vinegar | b) Antacid |
| c) Lemon juice | d) Common salt |
- (e) On diluting solution to pH of 4, its pH will [1]
- | | |
|----------------|--------------|
| a) remain same | b) decrease |
| c) increase | d) Can't say |
- (f) The salt solution which does not react with ammonium hydroxide is: [1]

- a) Calcium nitrate b) Copper nitrate
c) Lead nitrate d) Zinc nitrate

(g) A sample of Na_2CO_3 contains $6.02 \times 10^{23} \text{ Na}^+$ ion. The mass of the sample is [Na = 23, C = 12, O = 16] **[1]**

a) 53 g b) 106 gs
c) 212 g d) 165 g

(h) How many moles of oxygen are produced by the decomposition of six moles of potassium chlorate? **[1]**
 $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2 \uparrow$

a) 12 moles b) 9 moles
c) 3 moles d) 6 moles

(i) Which of the following does not differentiate between electrochemical cell and electrolytic cell? **[1]**

i. Spontaneous or non-spontaneous nature of chemical process
ii. Chemical reactions occurring at the electrodes
iii. Positive or negative nature of anode
iv. None of these

a) Option (iii) b) Option (i)
c) Option (ii) d) Option (iv)

(j) The two main metals in bronze are: **[1]**

a) Copper and tin b) Copper and zinc
c) Copper and lead d) Copper and nickel

(k) Dilute sulphuric acid acts as: **[1]**

a) Typical acid b) Least volatile acid
c) Drying agent d) Dehydrating agent

(l) The ratio of ammonia and air taken in Ostwald's process is **[1]**

a) 1 : 3 b) 1 : 10
c) 10 : 1 d) 3 : 1

(m) Absolute alcohol can be obtained from rectified spirit by **[1]**

a) azeotropic distillation b) vacuum distillation
c) fractional distillation d) steam distillation

(n) Select the acid which contains four hydrogen atoms in it: **[1]**

a) Acetic acid b) Sulphuric acid
c) Formic acid d) Nitric acid

(o) When ethyl alcohol and acetic acid are mixed, the resulting ester has a chemical formula: **[1]**

a) $\text{C}_2\text{H}_5\text{COOC}_2\text{H}_5$ b) $\text{C}_2\text{H}_5\text{COOCH}_3$
c) $\text{CH}_3\text{COOCH}_3$ d) $\text{CH}_3\text{COOC}_2\text{H}_5$

2. Question 2

[25]

- (a) i. Nitrogen can be obtained in pure state by heating a mixture of ammonium chloride and a substance A. Name the substance A. [5]
- ii. A gas X reacts with another gas Y in the presence of catalyst Z to give a colourless gas C. The gas C on reacting with air produces a brown gas A. The solution of X in water turns red litmus to blue. Explain the observation.
- iii. Why nitrogen dioxide is called mixed anhydride?

- (b) Name the method used for preparation of the following salts from the list given below - [5]

Column I	Column II
(a) Sodium nitrate	(i) Simple displacement
(b) Iron (III) chloride	(ii) Neutralisation
(c) Lead chloride	(iii) Double decomposition
(d) Zinc sulphate	(iv) Direct synthesis

- (c) Complete the following by choosing the correct answers from the bracket:

- i. _____ are the longest periods, containing 32 elements each. [1]
- ii. Soluble salts are prepared by _____ whereas insoluble salts are generally prepared by _____. [1]
- iii. _____ is defined as the amount of substance which contains same number of units as the number of atoms in 12 g of carbon-12. [1]
- iv. Pure water consists almost entirely of _____ (ions/molecules). [1]
- v. Hydrogen chloride and water are examples of _____ (polar covalent compounds/non-polar covalent compounds) and a solution of hydrogen chloride in water _____ (contains/does not contain) free ions. [1]

- (d) Identify the following:

- i. The covalent compounds of carbon and hydrogen. [1]
- ii. A yellow non-metal formed when hydrogen sulphide gas is passed through concentrated nitric acid. [1]
- iii. The process of coating of iron with zinc. [1]
- iv. Ice like crystals formed on cooling an organic acid sufficiently. [1]
- v. Group 2 elements are called _____ metals. (alkali/alkaline) [1]

- (e) i. The volumes of gases A, B, C and D are in the ratio, 1 : 2 : 2 : 4 under the same conditions of temperature and pressure. [2]
- ii. i. Which sample of gas contains the maximum number of molecules?
- ii. If the temperature and the pressure of gas A are kept constant, then what will happen to the volume of A when the number of molecules is doubled?
- iii. If this ratio of gas volumes refers to the reactants and products of a reaction, which gas law is being observed?
- ii. An element A is placed on the left side of the periodic table with valency 2 and element B is placed on the right side of the periodic table with valency 3. [3]
- i. Write the equation to show how A and B form ions.

- ii. Which of the two elements will show reduction?
- iii. If B is a diatomic gas, write the equation for the direct combination of A and B to form a compound.

Section B

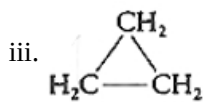
Attempt any 4 questions

3. **Question 3** [10]
- (a) Give the equations involved in brown ring test. [2]
 - (b) **Write the products and balance the equation.**
 - i. Zinc carbonate from Zinc sulphate. [1]
 - ii. Sodium sulphate using dilute sulphuric acid. [1]
 - (c) **Arrange the following as per the instruction given in the brackets:**
 - i. Na, K, Li (increasing chemical reactivity) [1]
 - ii. He, Ar, Ne (Increasing order of the number of shells) [1]
 - iii. Br, F, Cl [decreasing order of atomic radius] [1]
 - (d) **Fill in the blanks by selecting the appropriate word from the given choice:**
 - i. The carbon compounds containing _____ group are known as carbonylic acids. [1]
 - ii. A carbon atom linked with two carbon atoms is known as _____ carbon. [1]
 - iii. Complete the following, $n = \frac{\text{Molecular mass}}{\text{_____}}$ [1]
4. **Question 4** [10]
- (a) The non-polar and polar covalent compounds are generally formed between what kind of atoms? [2]
 - (b) Calculate the mass of calcium that will contain the same number of atoms as are present in 3.2 gm of sulphur. [2]
[Atomic masses: S = 32, Ca = 40]
 - (c) Answer the following questions with respect to the electrolytic process in the extraction of aluminium: [3]
 - i. Identify the components of the electrolyte other than pure alumina and the role played by each.
 - ii. Explain why powdered coke is sprinkled over the electrolytic mixture.
 - (d) **Explain the following:**
 - i. Zinc oxide can be reduced to zinc by using carbon monoxide, but aluminium oxide cannot be reduced by a reducing agent. [1]
 - ii. Anhydrous hydrogen chloride gas and anhydrous liquified hydrogen chloride are not acids. [1]
 - iii. Sodium chloride will conduct electricity only in fused or aqueous solution state. [1]
5. **Question 5** [10]
- (a) i. Write the IUPAC name of the given compounds: [1]

$$\begin{array}{c} \text{H} \\ | \\ \text{H} - \text{C} - \text{C} \equiv \text{C} - \text{H} \\ | \\ \text{H} \end{array}$$
 - ii. Draw the relevant structural formula for vinegar. [1]
 - (b) Draw the appropriate structural formula of carbon tetrachloride and state the type of bond present in it. [2]
 - (c) **Give balanced chemical equation for the following:**

- i. The oxidising action of conc. sulphuric acid on carbon [1]
 - ii. Action of concentrated sulphuric acid on carbon [1]
 - iii. Dilute hydrochloric acid on sodium sulphite [1]
- (d) **State one relevant observation for each of the following reactions:**
- i. Dilute hydrochloric acid is added to sodium carbonate crystals. [1]
 - ii. A mixture of ammonium chloride and sodium hydroxide is heated. [1]
 - iii. In the electrolyte during the electrolysis of copper sulphate solutions with inert electrodes. [1]

6. **Question 6** [10]

- (a)
- i. Why do group 1 elements form unipositive ions? [2]
 - ii. Why do all elements in a group have similar properties?
- (b) Find the empirical formulae of the compounds with the following percentage compositions, [2]
- i. Zn = 47.8
 - ii. Cl = 52.2
- (c) Write the name and structure of at least one isomer in each of the following. [3]
- i. H_3COCH_3
 - ii. $\text{H}_3\text{C}-\text{CO}-\text{CH}_3$
 - iii. 
- (d) Write the product of the following reactions. [3]
- i. $\text{Ca}(\text{NO}_3)_2 + 2\text{NaOH} \rightarrow$
 - ii. $\text{FeSO}_4 + \text{NaOH} \rightarrow$
 - iii. $\text{FeCl}_3 + 3\text{NaOH} \rightarrow$
 - iv. $\text{CuSO}_4 + \text{NaOH} \rightarrow$
 - v. $\text{ZnSO}_4 + \text{NaOH} \rightarrow$
 - vi. $\text{Pb}(\text{NO}_3)_2 + 2\text{NaOH} \rightarrow$

7. **Question 7** [10]

- (a)
- i. What do you understand by a lone pair of electrons? [2]
 - ii. Draw the electron dot diagram of Hydronium ion. (H = 1, O = 8)
- (b) A gas cylinder contains 24×10^{24} molecules of nitrogen gas. If Avogadro's number is 6×10^{23} and the relative mass of nitrogen is 14, calculate: [2]
- i. mass of nitrogen as in the cylinder
 - ii. volume of nitrogen at STP in dm^3
- (c) Name the kind of particle present in [3]
- i. sodium hydroxide solution
 - ii. carbonic acid
 - iii. sugar solution
- (d) Give a laboratory preparation of [3]
- i. ethyl alcohol
 - ii. methyl alcohol

8. **Question 8** [10]
- (a) i. The metals of group 2 from top to bottom are: Be, Mg, Ca, Sr, Ba. Which of these metals will form ions most readily and why? [2]
ii. What property of an element is measured by electronegativity?
- (b) Calculate the mass of: [2]
i. 10^{22} atoms of sulphur
ii. 0.1 mole of carbon dioxide.
- (c) A is a soluble acidic oxide and B is a water soluble base. What should be the pH of [3]
i. aqueous solution of A?
ii. aqueous solution of B?
iii. distilled water?
- (d) i. How would you separate: Gold from a mixture of gold and copper filings? [3]
ii. Name a nitrate of a metal which on heating does not give nitrogen dioxide.
iii. Name all the products formed when: ammonium nitrate is heated.

Solution

Section A

1. Question 1 Choose one correct answer to the questions from the given options:

- (i) (c) They are metallic in nature

Explanation: {

They are metallic in nature

- (ii) (c) Law of octaves

Explanation: {

Law of octaves

- (iii) (b) It loses electrons and is oxidised

Explanation: {

It loses electrons and is oxidised

- (iv) (b) Antacid

Explanation: {

Antacid

- (v) (c) increase

Explanation: {

Given, pH = 4

On dilution, the concentration of H^+ ions decreases, that results in increase in the pH value, as $pH = -\log[H^+]$

- (vi) (a) Calcium nitrate

Explanation: {

Calcium nitrate

- (vii) (a) 53 g

Explanation: {

Each Na_2CO_3 contain $2 \times N_A$ Na^+ ion ($N_A = 6.02 \times 10^{23}$)

$\therefore$ When we have $2 \times N_A$ of Na^+ ions,

we have 1 mole of Na_2CO_3 i.e., 106 g of Na_2CO_3

(Molar mass (M) = 106)

Hence, when we have N_A ions of Na^+ , the mass of

$$Na_2CO_3 = \frac{M}{2} = \frac{106}{2} = 53 \text{ g}$$

- (viii) (b) 9 moles

Explanation: {

9 moles

- (ix) (c) Option (ii)

Explanation: {

Oxidation always occurs at anode and reduction always occurs at cathode.

Thus, we can not differentiate an electrochemical cell and an electrolytes cell by chemical reactions occurring at electrodes.

- (x) (a) Copper and tin

Explanation: {

Copper and tin

- (xi) (a) Typical acid

Explanation: {

Typical acid

(xii) (b) 1 : 10

Explanation: {

1 : 10

(xiii) (a) azeotropic distillation

Explanation: {

Absolute alcohol is named to 100% concentrated ethanol with chemical formula C_2H_5OH . To obtain absolute alcohol from rectified spirit (95% ethanol + 5% water) azeotropic distillation is used.

(xiv) (a) Acetic acid

Explanation: {

Acetic acid

(xv) (d) $CH_3COOC_2H_5$

Explanation: {

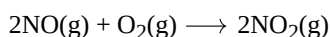
$CH_3COOC_2H_5$

2. Question 2

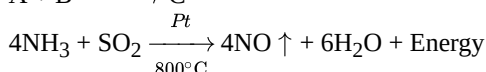
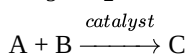
(i) i. The substance A = Sodium nitrate

ii. $A + B \xrightarrow{\text{catalyst}} C$

The gas C when comes in contact with air (O_2) a brown gas D is produced which is due to nitrogen dioxide (NO_2), hence, C is NO.



The solution of A in water turns red litmus blue, hence it is a base i.e., NH_4OH .



iii. Nitrogen dioxide called mixed anhydrous because it dissolves in water forming two acids i.e., nitrous acid (HNO_2) and nitric acid (HNO_3).

(ii) (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)

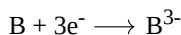
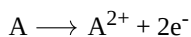
(iii) Complete the following by choosing the correct answers from the bracket:

- i. 1. Sixth and seventh
2. 6 and 7
3. 6, 7
4. 7, 6
- ii. 1. neutralisation, precipitation reactions
- iii. 1. Mole
- iv. 1. molecules
- v. 1. Polar covalent compounds, contains

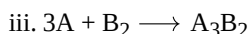
(iv) Identify the following:

- i. 1. Hydrocarbons
- ii. 1. Sulphur
- iii. 1. Galvanization
- iv. 1. Glacial acetic acid
- v. 1. alkaline

- (v) i. i. Sample of gas D contains the maximum number of molecules.
ii. When the number of molecules is doubled then the volume of the gas A will get doubled.
iii. Gay Lussac's law of combining volumes.
- ii. i. Elements placed on the left side of the periodic table are electropositive (metals) and hence, will lose electrons for stability. Elements present on the right side are electronegative and will gain an electron for stability.

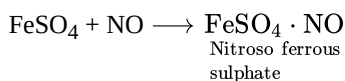
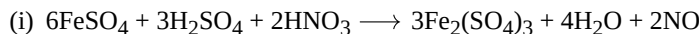


ii. Element B will show reduction.

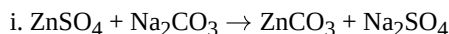


Section B

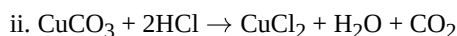
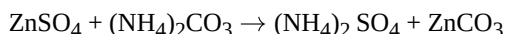
3. Question 3



(ii) Write the products and balance the equation.



or



(iii) Arrange the following as per the instruction given in the brackets:

i. $Li < Na < K$

ii. $He < Ne < Ar$

iii. Decreasing order of atomic radius $Br > Cl > F$

(iv) Fill in the blanks by selecting the appropriate word from the given choice:

i. 1. carbonyl ($-COOH$)

ii. 1. Catenation

iii. 1. Empirical formula mass

4. Question 4

(i) **Non-polar covalent bonds** These type of bonds are generally formed between

i. similar atoms such as in H_2 , O_2 , N_2 , F_2 , etc.

ii. atoms having negligible or zero electronegativity difference e.g., CH_4 .

Polar covalent bonds These type of bonds are generally formed between

i. dissimilar atoms such H_2O , NH_3 .

ii. atoms having different electronegativities and atomic radii, such as in HCl , HF , etc.

(ii) 32 gm of sulphur contains 6.023×10^{23} atoms

$$3.2 \text{ gm of sulphur contains} = \frac{6.023 \cdot 10^{23} \cdot 3.2}{32 \cdot 10}$$

$$= 6.023 \times 10^{23} \text{ atoms}$$

6.023×10^{23} atoms are present in 40 gm of calcium

$$6.023 \times 10^{23} \text{ atoms are present in} = \frac{6.023 \times 10^{22} \times 40}{6.023 \times 10^{23} \times 10}$$

$$= 4 \text{ gm.}$$

(iii) i. **Cryolite** - lowers the fusion temperature of the electrolyte.

Fluorspar - increases the conductivity of the electrolyte or acts as a solvent.

ii. to prevent the heat loss from the electrolyte.

(iv) Explain the following:

i. This is because of the fact that aluminium has great affinity towards oxygen and so, it cannot be reduced by reducing agents such as carbon monoxide, carbon or hydrogen.

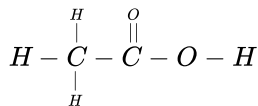
ii. This is because neither of them forms hydrogen ions or hydronium ions (H_3O^+) due to the absence of water molecules.

iii. Na^+ and Cl^- ions become mobile only on melting or dissolving it in water and only then can $NaCl$ conduct electricity.

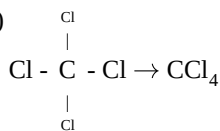
5. Question 5

(i) i. Propyne

ii. Vinegar (CH_3COOH acetic acid)

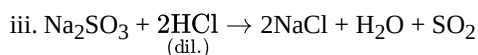
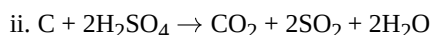


(ii)



4 - single covalent bonds

(iii) Give balanced chemical equation for the following:



(iv) State one relevant observation for each of the following reactions:

- Brisk effervescence with the evolution of a colourless, odourless gas which when passed through lime water, it turns milky.
- Ammonia gas, sodium chloride and water is formed/Ammoniacal smell.
- The colour of the electrolyte fades i.e., from blue it changes to colourless.

6. Question 6

- Group 1 elements contain one electron in their outermost shell. These elements lose this electron easily to attain the octet (8 electrons) in their outermost shell. Hence, they form unipositive ion.
- All the elements in a group have similar properties because they have identical valence shell electronic configuration.

(ii)	Element	Percentage Composition	Atomic Weight	Atomic Ratio	Simplest Ratio
	Zn	47.8	65	$\frac{47.8}{65} = 0.73$	$\frac{0.73}{0.73} = 1$
	Cl	52.2	35.5	$\frac{52.2}{35.5} = 1.46$	$\frac{1.46}{0.73} = 2$

Thus, the ratio of Zn : Cl atoms = 1 : 2. The empirical formula of the compound is ZnCl_2 .

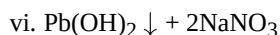
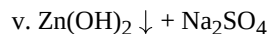
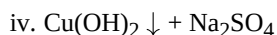
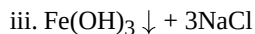
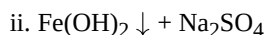
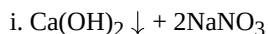
(iii) The name and structure of at least one isomer in each of the following:

i. $\text{C}_2\text{H}_5\text{OH}$: Ethyl alcohol

ii. $\text{C}_2\text{H}_5\text{CHO}$: Propanal

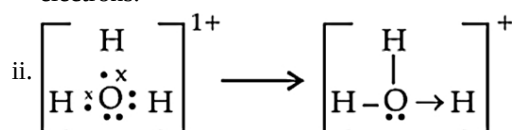
iii. $\text{H}_3\text{C}-\text{CH}=\text{CH}_2$: Propene

(iv) The products of given reactions are follows:



7. Question 7

- The pair of electrons which is not yet shared with other atoms in a covalent molecule is known as lone pair of electrons.



- i. 6×10^{23} molecules of nitrogen weights = $2 \times 14 = 28$ g

$\therefore 24 \times 10^{24}$ molecules of nitrogen weights = $\frac{28 \times 24 \times 10^{24}}{6 \times 10^{23}}$

= 1120 g

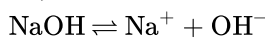
ii. Volume of nitrogen gas at STP

6×10^{23} molecules of N_2 occupy 22.4 L at STP

$$24 \times 10^{24} \text{ molecules of } N_2 \text{ occupy} = \frac{22.4 \times 24 \times 10^{24}}{6 \times 10^{23}} \\ = 896 \text{ L}$$

(iii) i. Sodium hydroxide solution is a strong electrolyte. So the kind of particle present in sodium hydroxide solution are ions only.

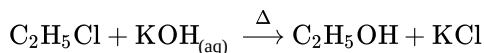
i.e., Na^+ and OH^- ion.



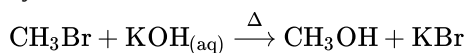
ii. Carbonic acid is weak electrolyte, so the kind of particles present in weak electrolyte are ions and unionised molecules.

iii. Sugar particles present in sugar solution are molecules only.

(iv) i. **Laboratory preparation of ethyl alcohol:** By hydrolysis of C_2H_5Cl (ethyl chloride) with hot aqueous potassium hydroxide solution.



ii. **Laboratory preparation of methyl alcohol:** By hydrolysis of methyl bromide with hot aqueous potassium hydroxide solution.



8. Question 8

(i) i. Ba will form ions most readily. Because it's ionisation potential is lowest in the group.

ii. Ability of the element to attract the shared pair of electron in a covalent bond towards itself.

(ii) i. 6×10^{23} atoms of sulphur = 32 g

$$10^{22} \text{ atoms of sulphur} = \frac{32}{6 \times 10^{23}} \times 10^{22} = 0.533 \text{ g}$$

ii. Molar mass of $CO_2 = 12 + 2 \times 16 = 44\text{g}$

1 mole of CO_2 weights = 44 g

0.1 mole of CO_2 weights = $44 \times 0.1 = 4.4 \text{ g}$

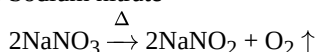
(iii) i. $A + \text{Water} \longrightarrow \text{Acid}$, hence, pH of A < 7.

ii. B is a water-soluble base, hence, pH of B > 7.

iii. Distilled water is neutral (pH = 7).

(iv) i. A mixture of gold and copper filings is treated with concentrated nitric acid. Copper reacts with cone. HNO_3 to form blue solution of copper nitrate while gold does not react. Now, it is separated by filtration.

ii. Sodium nitrate



iii. The products formed when ammonium nitrate is heated are nitrous oxide and water (steam).

