ICSE 2025 EXAMINATION

Sample Question Paper - 2

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) The element with the highest ionisation potential in the periodic table is _____. **[1]**

a) He b) Xe

c) Ar d) Ne

(b) The electronegativity on moving from left to right in a period **[1]**

a) decreases b) depends on the number of valence electrons

c) increases d) remains the same

(c) The electronic configurations of four elements **[1]**

L : $1s^2 2s^2 2p^4$

Q : $1s^2 2s^2 2p^6 3s^2 3p^5$

P : $1s^2 2s^2 2p^6 3s^1$

R : $1s^2 2s^2 2p^6 3s^2$

The formulae of ionic compounds that can be formed between them are

a) LP, R_2L, P_2Q, RQ b) L_2P, RL, PQ, R_2Q

c) P_2L, RL, PO, RQ_2 d) LP, RL, PQ, RQ

(d) If few drops of a concentrated acid accidentally spills over the hand of a student, what should be done? **[1]**

a) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate b) After washing with plenty of water apply solution of sodium hydroxide on the hand

c) Wash the hand with saline solution
d) Neutralise the acid with a strong alkali

(e) Aqua regia is a mixture of: **[1]**

a) concentrated hydrochloric acid and dilute nitric acid
b) dilute hydrochloric acid and concentrated nitric acid
c) concentrated hydrochloric acid (3 parts) and concentrated nitric acid (1 part)
d) concentrated hydrochloric acid (1 part) and concentrated nitric acid (3 parts)

(f) Hydroxide of this metal is soluble in sodium hydroxide solution: **[1]**

a) Silver
b) Copper
c) Magnesium
d) Lead

(g) The element which has two atoms in its molecule is **[1]**

a) ozone
b) phosphorus
c) oxygen
d) helium

(h) What will be the empirical formula of CH_3COOH? **[1]**

a) CHO_2
b) $C_2H_2O_2$
c) CH_2O
d) C_2HO

(i) The particles present in strong electrolytes are: **[1]**

a) only molecules
b) only atoms
c) mainly ions
d) ions and molecules

(j) What does 22 carat gold means? **[1]**

a) 22 parts gold mixed with 2 parts of Cu or Ag
b) 22 parts gold mixed with 3 parts of Zn
c) 22 parts of gold only
d) 22 parts gold mixed with 2 parts of Al

(k) $NH_4Cl(s)$ is heated in a test tube. Vapours are brought in contact with red litmus paper, which changes to blue and then to red. It is because of **[1]**

a) greater diffusion of HCl than NH_3
b) formation of NH_4OH and HCl
c) greater diffusion of NH_3 than HCl
d) formation of NH_3 and HCl

(l) Select the pair of gases which turn lime water milky: **[1]**

a) CO_2 and NH_3
b) SO_2 and SO_3
c) CO_2 and SO_3
d) SO_2 and CO_2

(m) Which of the following reactions will not produce ethane? **[1]**

a) Reduction of CH_3COOH with HI/P_4
b) Reduction of CH_3COCH_3 with Hl/P_4
c) Sodalime decarboxylation of sodium propionate
d) Hydrogenation of ethane in the presence of Ni

(n) The functional group present in acetic acid is: **[1]**

a) Hydroxyl -OH

b) Carboxyl -COOH

c) Ketonic $>C=O$

d) Aldehydic -CHO

(o) What will be the final oxidation product of ethyl alcohol? **[1]**

a) Acetaldehyde

b) Acetone

c) Acetalhyde

d) Acetic acid

2. **Question 2** **[25]**

(a) Complete and balance the following equations. **[5]**

i. $KNO_3 + H_2SO_4$ (conc.) $\xrightarrow{200^\circ C}$ _____ + _____

ii. $2Cu(NO_3)_2 \xrightarrow{\Delta}$ _____ + _____ + _____

iii. $KOH + HNO_3 \longrightarrow$ _____ + _____

iv. $P + 5HNO_3 \longrightarrow$ _____ + _____ + _____

v. $C + 4HNO_3 \longrightarrow$ _____ + _____ + _____

(b) Match the gases given in column I to the identification of the gases mentioned in column II. **[5]**

Column I	Column II
(a) Hydrogen sulphide	(i) Turns acidified potassium dichromate solution green
(b) Nitric oxide	(ii) Turns lime water milky
(c) Carbon dioxide	(iii) Turns reddish brown when it reacts with oxygen
(d) Sulphur dioxide	(iv) Turns moist lead acetate paper silvery black

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

i. The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called _____. (electron affinity/ionisation potential/electronegativity) **[1]**

ii. Soluble salts are prepared by _____ whereas insoluble salts are generally prepared by _____. **[1]**

iii. The number of moles in 11 gm of nitrogen gas is _____. (0.39/0.49/0.29) [Atomic mass of N = 14] **[1]**

iv. _____ the concentration of an ion in a solution, the greater is the probability of its being discharged at its appropriate electrode. **[1]**

v. Quicklime is not used to dry HCl gas because _____ (CaO is alkaline/CaO is acidic/CaO is neutral). **[1]**

(d) **Identify the following:**

i. The property by which carbon compounds with itself to form a long chain. **[1]**

ii. The gas evolved when hydrochloric acid is added to manganese(IV) oxide. **[1]**

iii. The electrolytic deposition of a superior metal on a base plate. **[1]**

iv. The base which is soluble in water. **[1]**

v. The properties of the elements are a periodic function of their _____. (atomic number/mass number/relative atomic mass) **[1]**

(e) i. i. State the volume occupied by 40 gm of methane at STP, if its vapour density (V.D.) is 8. **[2]**

ii. Calculate the number of moles present in 160 gm of NaOH.
[Atomic mass: Na = 23, H = 1, O = 16].

ii. Elements X, Y and Z have atomic number 6, 9 and 12 respectively. Which: **[3]**

i. forms an anion?

ii. forms a cation?

iii. has four electrons in its valence shell?

Section B

Attempt any 4 questions

3. **Question 3** **[10]**

(a) State one chemical test to distinguish between each of the following pairs - **[2]**
Manganese dioxide and Copper (II) oxide.

(b) **Write the products and balance the equation.**

i. Sodium sulphate using dilute sulphuric acid. **[1]**

ii. Ammonium sulphate crystals. **[1]**

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

i. Cs, Na, Li, K, Rb (increasing order of metallic character) **[1]**

ii. F, B, N, O (In the increasing order of electron affinity) **[1]**

iii. K, Pb, Ca, Zn (In the increasing order of the reactivity) **[1]**

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

i. _____ is also known as wood spirit. (methanol/ethanol/propanol). **[1]**

ii. _____ was the first organic compound prepared in laboratory. **[1]**

iii. CH_2O is an _____ for the molecular formula, $C_6H_{12}O_6$. **[1]**

4. **Question 4** **[10]**

(a) Explain the bonding in methane molecule using electron dot structure. **[2]**

(b) Calculate the volume of 320 g of SO_2 at STP. **[2]**

[Atomic mass of S = 32 and O = 16]

(c) Bayer's process is used to concentrate bauxite to alumina. Give balanced chemical equations for the reaction taking place for its conversion from bauxite to alumina. **[3]**

(d) **Explain the following:**

i. Aluminium is more abundant than gold in the earth's crust, yet it is gold and not aluminium that has been known to man since ancient times. **[1]**

ii. Zinc chloride is stored in air-tight bottles. **[1]**

iii. An aqueous solution of sodium chloride conducts electricity. **[1]**

5. **Question 5** **[10]**

(a) i. What are the main types (groups) of aliphatic hydrocarbons? **[1]**

ii. Define Homologous series **[1]**

(b) Explain, polar covalent bond with the help of suitable example. **[2]**

(c) **Give balanced chemical equation for the following:**

i. Lead nitrate is heated in a dry test tube **[1]**

ii. Magnesium sulphate solution is mixed with barium chloride solution **[1]**

iii. Action of dilute sulphuric acid on sodium sulphite **[1]**

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

i. Barium chloride solution is slowly added to sodium sulphate solution. **[1]**

ii. Ammonium hydroxide solution is added to copper (II) nitrate solution in small quantities and then in excess. **[1]**

iii. In the electrolyte during the electrolysis of copper sulphate solutions with inert electrodes. **[1]**

6. **Question 6** **[10]**

(a) An element Z has atomic number 16. Answer the following questions. **[2]**

i. State the period and group to which Z belongs.

ii. Is Z a metal or a non-metal?

(b) Find the number of moles and molecules present in 7.1 g of Cl_2. (At. Wt. Cl = 35.5) **[2]**

(c) Give the common name of **[3]**

i. ethanol

ii. ethoxyethane

iii. ethanoic acid

(d) Distinguish between the following pairs of compounds using the test given within the brackets. **[3]**

i. Calcium sulphite and calcium carbonate (using dil. HCl).

ii. Calcium nitrate and potassium nitrate (using a flame test).

iii. Lead nitrate solution and Zinc nitrate solution (using an alkali).

7. **Question 7** **[10]**

(a) What is the essential difference in the nature of compounds when two combining atoms? **[2]**

i. differ much in their electronegativities?

ii. don't differ much in their electronegativities?

(b) If the empirical formula of a compound is CH and it has a vapour density of 13, find the molecular formula of the compound. **[2]**

(c) Identify the following reactions as either oxidation or reduction. **[3]**

i. $\mathrm{O} + 2e^- \longrightarrow \mathrm{O}^{2-}$

ii. $\mathrm{K} \longrightarrow \mathrm{K}^+ + e^-$

iii. $\mathrm{Fe}^{3+} + e^- \longrightarrow \mathrm{Fe}^{2+}$

(d) Write the IUPAC name of the following compounds: **[3]**

i. Ethyl alcohol

ii. Formaldehyde

iii. Acetaldehyde

iv. Acetic acid

8. **Question 8** **[10]**

(a) Show the formation of covalent bonds in **[2]**

i. oxygen

ii. nitrogen molecule by dot diagram.

(b) If 6 litres of hydrogen and 4 litres of chlorine are mixed and exploded and if water is added to the **[2]**

gases formed, find the volume of the residual gas.

(c) A metal carbonate X on reacting with an acid gives a gas which when passed through a solution Y gives the carbonate back. On the other hand, a gas G that is obtained at anode during the electrolysis of brine and when passed on dry Y, it gives a compound Z, used for disinfecting drinking water. Identify X, Y, G and Z. **[3]**

(d) List the properties of ammonia that make it: **[3]**

i. A good refrigerant

ii. A cleaning agent

iii. As a source of hydrogen

Solution

Section A

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

(i) **(a)** He
Explanation: {
He

(ii) **(c)** increases
Explanation: {
increases

(iii) **(c)** P_2L, RL, PO, RQ_2

Explanation: {
Given, L has $\rightarrow$ 6 valence electrons
Q has $\rightarrow$ 7 valence electrons
P has $\rightarrow$ 1 valence electron
R has $\rightarrow$ 2 valence electrons
Thus, the ionic compounds formed between them are P_2L, RL, PQ and RQ_2.

(iv) **(a)** Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate
Explanation: {
Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate

(v) **(c)** concentrated hydrochloric acid (3 parts) and concentrated nitric acid (1 part)
Explanation: {
concentrated hydrochloric acid (3 parts) and concentrated nitric acid (1 part).

(vi) **(d)** Lead
Explanation: {
Lead hydroxide $Pb(OH)_2$ is soluble in excess of sodium hydroxide solution.

(vii) **(c)** oxygen
Explanation: {
O_2 (oxygen)

(viii) **(c)** CH_2O

Explanation: {
CH_2O

(ix) **(c)** mainly ions
Explanation: {
mainly ions

(x) **(a)** 22 parts gold mixed with 2 parts of Cu or Ag
Explanation: {
22 parts gold mixed with 2 parts of Cu or Ag

(xi) **(c)** greater diffusion of NH_3 than HCl

Explanation: {
Ammonium chloride decomposes to form ammonia and hydrogen chloride gas. Ammonia diffuses faster than hydrogen chloride because its light. Ammonia is basic and thus red litmus paper turns blue, while hydrogen chloride is acid, thus blue litmus turns red.

(xii) **(d)** SO_2 and CO_2

Explanation: {

SO_2 and CO_2

(xiii) **(b)** Reduction of CH_3COCH_3 with Hl/P_4

Explanation: {

Reduction of CH_3COCH_3 with Hl/P_4 does not product ethane. It produce propane with HI/P4.

$$CH_3COCH_3 \xrightarrow[2H]{HI/P_4} \underset{\text{Pr opane}}{CH_3CH_2CH_3}$$

(xiv) **(b)** Carboxyl -COOH

Explanation: {

Carboxyl -COOH

(xv) **(d)** Acetic acid

Explanation: {

Acetic acid

2. Question 2

(i) Complete reaction are as follows:

i. $KHSO_4 + HNO_3$

ii. $2CuO + 4NO_2 \uparrow + O_2 \uparrow$

iii. $KNO_3 + H_2O$

iv. $H_3PO_4 + 5NO_2 + H_2O$

v. $CO_2 + 4NO_2 + 2H_2O$

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

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

i. 1. ionisation potential

ii. 1. neutralisation, precipitation reactions

iii. 1. 0.39

iv. 1. higher

v. 1. CaO is alkaline

(iv) Identify the following:

i. 1. Catenation

ii. 1. Chlorine

iii. 1. Electroplating

iv. 1. Alkali

v. 1. atomic number

(v) i. i. Molecular mass of methane (CH_4)

$= 12 + 1 \times 4$

$= 16$ gm

Mass of methane = 40

$M = V.D. \times 2$

$= 8 \times 2$

$= 16$ gm

Volume of 16 gm of CH_4 at STP

$= 22.41$

Volume of 40 gm of CH_4 at STP

$= \frac{22.4 \times 10}{16}$

$= 56$ l

ii. Mass of the NaOH = 160 gm

Molecular mass of NaOH = 23 + 16 + 1

= 40

Number of moles = $\frac{\text{Mass of the substance}}{\text{Molecular mass}}$

$= \frac{160}{40}$ = 4 moles

ii. i. Y forms an anion.

ii. Z forms a cation.

iii. X has four electrons in its valence shell.

Section B

3. Question 3

(i) To both the compounds add. conc. HCl and heat, the following observations help:

$$MnO_2 + \underset{(conc.)}{4HCl} \xrightarrow{\Delta} \underset{\text{(greenish yellow gas is liberated)}}{MnCl_2} + 2H_2O + Cl_2 \uparrow$$

$$CuO + \underset{(conc.)}{HCl} \xrightarrow{\Delta} \underset{\text{(no gas is liberated but the solution turns bluish)}}{CuCl_2} + H_2O$$

(ii) Write the products and balance the equation.

i. $CuCO_3 + 2HCl \rightarrow CuCl_2 + H_2O + CO_2$

ii. $2NH_4OH + H_2SO_4 \longrightarrow (NH_4)_2SO_4 + 2H_2O$

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

i. Li < Na < K < Rb < Cs (increasing order)

ii. B, N, O, F

iii. Pb, Zn, Ca, K

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

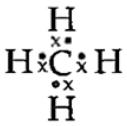
i. 1. methanol

ii. 1. Urea

iii. 1. empirical formula

4. Question 4

(i) To attain the stable electronic configuration of the nearest noble gas, carbon needs four electrons and hydrogen needs one electron. Therefore, in the methane molecule formation of one atom of carbon shares four electron pairs, one with each of the four atoms of hydrogen. It results in the formation of four single covalent bond between them. The electron sharing can be illustrated using electron dot structure which is as follows:



(ii) Molecular mass of SO_2 = 32 + 2 × 16

= 64 amu

Since 64 g of SO_2 occupies at 22.4 litres at STP

320 g of SO_2 occupies at 22.4 litres at STP = $\frac{320 \times 22.4}{64}$

= 112 litres

(iii) Bayer's method for extraction of alumina from bauxite ore.

$$\underset{Bauxite}{Al_2O_3 \cdot 2H_2O} \xrightarrow{NaOH} \underset{Sodium\ aluminate}{2NaAlO_2} + 3H_2O$$

$$NaAlO_2 + 2H_2O \xrightarrow{NaOH} 2NaOH + \underset{\substack{Aluminium \\ hydroxide}}{Al(OH)_3}$$

$$2Al(OH)_3 \xrightarrow{1473\ K} \underset{\substack{\text{Alumina} \\ \text{(pure)}}}{Al_2O_3} + 3H_2O$$

(iv) Explain the following:

i. This is due to the fact that aluminium never occurs in the free state in nature. It is always chemically combined with other elements. This is because of its high reactivity. The ores of aluminium are also very stable and cannot be reduced by coke. On the other hand, gold is a noble metal. It is available in the free state or native form because of its unreactive nature.

ii. Zinc chloride is a deliquescent substance. It absorbs moisture from the atmosphere and turns into solution. In order to prevent this, it is stored in air tight bottles.

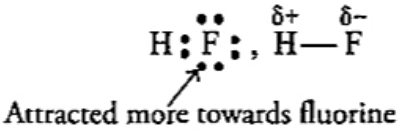
iii. Aqueous solution of sodium contains mobile ions like Na^+, Cl^-, H^+, OH^-, H_3O^+ ions which are responsible for conduction of electricity.

5. Question 5

(i) i. i. Saturated aliphatic hydrocarbons e.g., Methane and ethane.
ii. Unsaturated aliphatic hydrocarbons e.g., Ethene and ethyne.

ii. A homologous series is a group of organic compounds having similar structure and similar chemical properties in which the successive compounds differ by CH_2 groups.

(ii) When covalent bond is formed between two dissimilar atoms e.g., HF (heteronuclear molecule), the shared pair of electrons between the two atoms get displaced towards more electronegative atom, fluorine. As a result, hydrogen atom becomes slightly positively charged and fluorine becomes slightly negatively charged. This type of bond is called polar covalent bond.



(iii) Give balanced chemical equation for the following:

i. $2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 \uparrow + O_2 \uparrow$

ii. $MgSO_4 + BaCl_2 \rightarrow BaSO_4 \downarrow + MgCl_2$

iii. $Na_2SO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + SO_2 \uparrow$

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

i. When barium chloride solution white precipitate of is slowly added to sodium sulphate solution, then white precipitate of barium sulphate is formed.
$BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

ii. Initially a Bluish white ppt. is formed which on addition of excess of ammonium hydroxide dissolves and a deep inky blue solution is formed.

iii. The colour of the electrolyte fades i.e., from blue it changes to colourless.

6. Question 6

(i) i. Atomic number of element, Z = 16
Electronic configuration $\begin{matrix} K & L & M \\ 2 & 8 & 6 \end{matrix}$
Number of shells is 3, (i.e., K, L, M). So, period is 3.
Group number VIA

ii. Z is non-metal. Since, non-metals usually have 5, 6 or 7 electrons in their outermost orbits.

(ii) Molecular mass of $Cl_2 = 2 \times 35.5 = 71$

No. of moles = $\frac{\text{Mass of substance}}{\text{Mass of one mole}}$

$= \frac{7.1}{71} = 0.1$ moles of Cl_2

71 g of chlorine has 6.023×10^{23} molecules

7.1 g of chlorine will have = $\frac{6.023 \cdot 10^{23}}{71} \times 7.1$

$= 6.023 \times 10^{22}$ molecules

(iii) i. The common name of ethnol - ethyl alcohol

ii. The common name of ethoxyethane - diethyl ether

iii. The common name of ethanoic acid - acetic acid

(iv) i.

Substance	Test	Gas evolved	Odour
Calcium carbonate	Using dil. HCl	CO_2	Odourless
Calcium sulphite		SO_2	Pungent

ii.

Substance	Test	Flame Colour
Calcium nitrate	Using Flame Test	Deep orange
Potassium nitrate		Pink/Purple

iii.

Substance	NH_4OH in excess
Lead nitrate solution	Precipitate formed is insoluble.
Zinc nitrate solution	Precipitate formed is soluble.

7. Question 7

(i) i. Form either ionic bond or polar covalent bond.

ii. Form non-polar covalent bond.

(ii) Empirical formula of a compound = CH

Empirical formula mass = 12 + 1 = 13 g

Molecular formula mass = 2 $\times$ Vapour density

= 2 $\times$ 13 = 26 g

n = $\frac{26}{13}$ = 2

Molecular formula = $(\text{Empirical formula})_n$

$\therefore$ Molecular formula = $(CH)_2 = C_2H_2$

(iii) i. $O + 2e^- \longrightarrow O^{2-}$ - Reduction

ii. $K \longrightarrow K^+ + e^-$ - Oxidation

iii. $Fe^{3+} + e^- \longrightarrow Fe^{2+}$ - Reduction

(iv) i. Ethanol

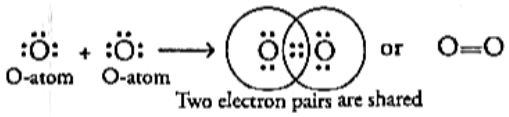
ii. Methanal

iii. Ethanal

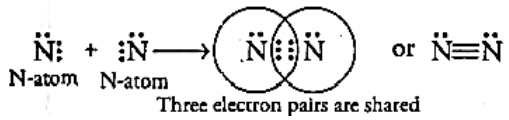
iv. Ethanoic acid

8. Question 8

(i) i. Oxygen



ii. Nitrogen



(ii) $\underset{1\text{ vol.}}{H_2} + \underset{1\text{ vol.}}{Cl_2} \rightarrow \underset{2\text{ vols.}}{2HCl}$

Since, 1 volume of chlorine reacts with 1 litres of hydrogen.

$\therefore$ 4 litres of chlorine will react with only 4 volumes of hydrogen. 6 litres of H_2 provided, out of which 4 litres of H_2 used. HCl gas is highly soluble in water. Unused H_2 will be 6 - 4 = 2 litres. Therefore, residual gas will be unreacted chlorine = (6 - 4) = 2 litres.

(iii) X is calcium carbonate ($CaCO_3$) and the gas evolved is carbon dioxide (CO_2), when calcium carbonate reacts with acid, calcium chloride($CaCl_2$) is formed.

$\underset{X}{CaCO_3}$ + 2HCl (dil.) $\longrightarrow CaCl_2 + H_2O + CO_2 \uparrow$

Solution Y is lime water $Ca(OH)_2$ because, when CO_2 is passed through it, it gives the carbonate back as shown by the given equation.

$\underset{Y}{Ca(OH)_2}$ + $CO_2 \longrightarrow CaCO_3 \downarrow + H_2O$

The gas evolved at anode during the electrolysis of brine is chlorine (Cl).

$Ca(OH)_2 + Cl_2 \longrightarrow \underset{Bleaching\ powder\ (Z)}{CaOCl_2} + H_2O$

(iv) i. Ammonia can be liquefied easily and has a high latent heat of vaporisation.

ii. This is because ammonia solution emulsifies fats and grease.
iii. Ammonia can be liquefied and transported easily and on decomposition it gives hydrogen whereas liquid hydrogen is dangerous to transport in cylinders.