ICSE 2025 EXAMINATION

Sample Question Paper - 5

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) Ionisation potential increases over a period from left to right because the _____. **[1]**

a) Atomic radius increases and nuclear charge increases
b) Atomic radius decreases and nuclear charge decreases
c) Atomic radius increases and nuclear charge decreases
d) Atomic radius decreases and nuclear charge increases

(b) An element with the atomic number 19 will most likely combine chemically with the element whose atomic number is **[1]**

a) 17
b) 11
c) 18
d) 20

(c) The property which is characteristic of an electrovalent compound is that **[1]**

a) it has a high melting point
b) it is easily vaporised
c) it often exists as a liquid
d) it is a weak electrolyte

(d) Dilute sulphuric acid will produce a white precipitate when added to a solution of _____. **[1]**

a) Sodium nitrate
b) Copper nitrate
c) Zinc nitrate
d) Lead nitrate

(e) The reaction, which involves the formation of salts is **[1]**

a) neutralisation reaction
b) decomposition reaction
c) combination reaction
d) redox reaction

(f) A metal hydroxide which is unsoluble in caustic but soluble in excess of NH_4OH is **[1]**

a) $Zn(OH)_2$ b) $O(OH)_2$

c) $CO(OH)_2$ d) $Cu(OH)_2$

(g) The empirical formula of butane is **[1]**

a) C_2H_{15} b) C_4H_{12}

c) C_2H_5 d) C_3H_8

(h) The vapour density of a gas A is four times that of B. If molecular mass of B is M, then molecular mass of A is **[1]**

a) 4M b) 2M

c) M d) $\frac{M}{4}$

(i) A simple cell is set up with magnesium and copper as the electrodes and dilute sulphuric acid as the electrolyte. Which of the following will not occur? **[1]**

a) The electrons will flow from the magnesium electrode to the copper electrode

b) A gas will be given off at the magnesium electrode

c) The bulb will light up

d) A gas will be given off at the copper electrode

(j) An ore after levigation is found to have basic impurities. Which of the following can be used as flux during smelting? **[1]**

a) H_2SO_4 b) $CaCO_3$

c) SiO_2 d) Both CaO and SiO_2

(k) When dilute sulphuric acid reacts with iron, sulphide, the gas evolved is: **[1]**

a) Hydrogen sulphide b) Sulphur dioxide

c) Vapour of sulphuric acid d) Sulphur trioxide

(l) Which of the following is not used to detect hydrochloric acid? **[1]**

a) $AgNO_3$ b) NH_3

c) H_2SO_4 d) MnO_2

(m) Which of the following forms a homologous series? **[1]**

a) Butane, 2-methylbutane, 2, 3-dimethylbutane

b) Ethane, ethylene, acetylene

c) Methanol, ethanol, propanoic acid

d) Ethane, propane, butanone

(n) Urea was first obtained by heating ammonium cyanate by: **[1]**

a) Wohler b) Haber

c) Berzelius d) Lavoisier

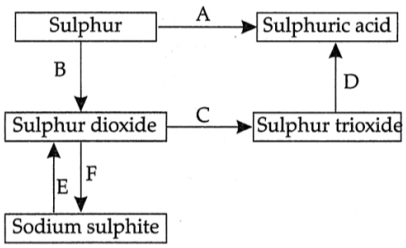
(o) The property of carbon to form chains and rings is called: **[1]**

a) Cracking b) Catenation

c) Hydrogenation d) Polymerization

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

(a) Reaction: **[5]**



a. Name the catalyst which helps in the conversion of sulphur dioxide to sulphur trioxide in step C.

b. In the contact process for manufacture of the sulphuric acid, sulphur trioxide is not converted to sulphuric by reacting it with water, instead two steps procedure is used. Write equation for the two steps involved.

c. What type of substance will liberate dioxide from sodium sulphite?

d. Write the equation for the reaction, where sulphur dioxide is converted sodium sulphite in step F.

e. Name the process used in A.

f. What is the reaction involved in B?

(b) Match the salts given in Column I with their method of preparation given in Column II: **[5]**

Column I	**Column II**
(a) $Pb(NO_3)_2$ from PbO	(i) Simple displacement
(b) $MgCl_2$ from Mg	(ii) Titration
(c) $FeCl_3$ from Fe	(iii) Neutralisation
(d) $NaNO_3$ from NaOH	(iv) Combination

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

i. Metals are good _____ (oxidizing agents/reducing agents) because they are electron _____ (acceptors/donors). **[1]**

ii. The basicity of acetic acid is _____. (3, 1, 4) **[1]**

iii. A formula which shows the simplest whole number ratio is _____. **[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. Nitric acid is a strong _____ agent therefore it does not liberate hydrogen on reaction with metals. **[1]**

(d) **Identify the following:**

i. Compound containing $-\overset{\overset{O}{\|}}{C}-H$ functional group. **[1]**

ii. A colourless gas that becomes reddish brown when it comes in contact with atmosphere. **[1]**

iii. The process of extraction of metals from its ores by electrolysis. **[1]**

iv. A compound which is soluble in water and the only negative ions in the solution are hydroxide ions. **[1]**

v. Metals form _____ chlorides. (Covalent/ionic) **[1]**

(e) i. A compound made up of two elements X and Y has an empirical formula X_2Y. If the atomic weight of X is 10 and that of Y is 5 and the compound has a vapour density 25, find the molecular formula. **[2]**

ii. Draw the electron dot diagram for the compounds given below. Represent the electron by (·) and (×) in the diagram. [Atomic No.: Ca = 20, O = 8, Cl = 17, H = 1] **[3]**

i. Calcium oxide

ii. Chlorine molecule

iii. Water molecule

Section B

Attempt any 4 questions

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

(a) Why phosphorous pentaoxide and quick lime cannot be used for drying hydrochloric acid gas? **[2]**

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

i. Magnesium metal is treated with dilute hydrochloric acid **[1]**

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

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

i. Mg^{2+}, Cu^{2+}, Na^{+}, H^{+} (In the order of preferential discharge at the cathode) **[1]**

ii. He, Ar, Ne (Increasing order of the number of shells) **[1]**

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

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

i. Ethanoic acid reacts with ethanol in presence of concentrated H_2SO_4, so as to form a compound and water. The chemical reaction which takes place is called _____ (dehydration/esterification/hydrogenation). **[1]**

ii. _____ is a cyclic hydrocarbon. **[1]**

iii. Calculate the _____ of the compound from its empirical formula. **[1]**

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

(a) What is the difference between the fluoride ion and neon atom even when the electronic configuration of both are same? **[2]**

(b) Calculate the mass of lime stone required to produce 112 kg of quicklime by burning it. **[2]**

(c) Give the chemical formula of: **[3]**

i. Bauxite

ii. Cryolite

iii. Sodium aluminate

(d) **Explain the following:**

i. Copper is used to make hot water tanks and not steel. **[1]**

ii. People suffering from acidity are advised to drink cold milk. **[1]**

iii. Sea water is a strong electrolyte. **[1]**

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

(a) i. Solid which can be used instead of conc. sulphuric acid to prepare ethylene by the dehydration of ethanol. Identify the substance. **[1]**

ii. Gas used for ripening of fruits. Identify the gas. **[1]**

(b) Compare the properties of covalent and electrovalent compounds on the following points: **[2]**

i. Solubility

ii. Structure

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

i. Reaction of Ammonia with heated copper oxide **[1]**

ii. Concentrated hydrochloric acid and potassium permanganate solution **[1]**

iii. Action of dilute sulphuric acid on zinc sulphide **[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 in excess to copper sulphate solution. **[1]**

iii. At the anode when aqueous copper sulphate solution is electrolysed using copper electrodes. **[1]**

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

(a) Observe the table and fill the blanks. **[2]**

Li(7)	Cl	Ca(40)
-	Br	-
K(39)	I	Ba(137)

(b) Calculate the volume of oxygen required for the complete combustion of 8.8 g of propane (C_3H_8). **[2]**

(Atomic mass of C = 12, O = 16, H = 1, Molar volume = 22.4 dm^3 at STP)

(c) i. Name the main constituent of acetic acid. **[3]**

ii. What is the effect of acetic acid on litmus paper?

iii. Write the name of the compound present in litmus which is responsible for its colour changes.

(d) There are three test tubes A, B and C containing copper sulphate solution, calcium nitrate solution and zinc nitrate solution, respectively. Half of each solutions is treated with excess of sodium hydroxide and rest half of each solution is treated with excess of ammonium hydroxide. Note down the observation, precipitate formed initially and their solubility in excess. **[3]**

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

(a) Element X is a metal with a valency 2, Y is a non-metal with a valency 3. **[2]**

i. Write an equation to show how Y forms on ion.

ii. If Y is a diatomic gas write an equation for the direct combination of X and Y to form a compound.

(b) Oxygen oxidises ethyne to carbon dioxide and water as shown by the equation: **[2]**

$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

What volume of ethyne gas at STP is required to produce 8.4 dm^3 of carbon dioxide at STP? (H = 1, C = 12, O = 16)

(c) Name the particles present in: **[3]**

i. Strong electrolyte

ii. Non-electrolyte

iii. Weak electrolyte.

(d) Give the molecular formula of one homologous of each of the following: **[3]**

i. C_6H_{14}

ii. C_3H_6

iii. C_4H_8

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

(a) Two non-metals combine with each other by the sharing of electrons to form a compound X. **[2]**

i. What type of chemical bond is present in X?

ii. State whether X will have a high melting point or low melting point.

iii. Will it be a good conductor of electricity or not?

iv. Will it dissolve in organic solvents or not?

(b) 560 ml of carbon monoxide is mixed with 500 ml of oxygen and ignited. The chemical equation for the reaction is as follows: **[2]**

$2CO + O_2 \rightarrow 2CO_2$

Calculate the volume of oxygen used and carbon dioxide formed in the above reaction.

(c) Solution A is a sodium hydroxide solution. Solution B is a weak acid. Solution C is dilute sulphuric acid. Which solution will: **[3]**

i. liberate sulphur dioxide from sodium sulphite?

ii. give a white precipitate with zinc sulphate solution?

iii. contain solute molecules and ions?

(d) Why SO_3 is not directly dissolved in water to form sulphuric acid? **[3]**

Solution

Section A

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

(i) **(d)** Atomic radius decreases and nuclear charge increases

Explanation: {

Atomic radius decreases and nuclear charge increases

(ii) **(a)** 17

Explanation: {

17

(iii) **(a)** it has a high melting point

Explanation: {

it has a high melting point

(iv) **(d)** Lead nitrate

Explanation: {

Lead nitrate

(v) **(a)** neutralisation reaction

Explanation: {

neutralisation reaction

(vi) **(d)** $Cu(OH)_2$

Explanation: {

$Cu(OH)_2$ is insoluble in excess of NaOH but soluble in excess of ammonium hydroxide and gives deep blue or prussian blue solution. The reaction is as follow

$Cu(OH)_2 + (NH_4)_2SO_4 + \underset{Excess}{2NH_4OH} \rightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$

(vii) **(c)** C_2H_5

Explanation: {

C_2H_5

(viii) **(a)** 4M

Explanation: {

Given A = 4 times V.D of B

$\because$ Molar mass (M) = $2 \times$ V.D = $2 \times (4V \cdot D)$

Thus, molar mass of A = 2B

If M be the molar mass of B then,

Molar mass of A = $2 \times 2B = 2 \times 2M = 4M$

(ix) **(d)** A gas will be given off at the copper electrode

Explanation: {

On using H_2SO_4 (dil.) as electrolytes and Mg and Cu as electrodes.

Mg being more reactive and Cu is less reactive than hydrogen. Thus, it will not give any gas at copper electrode.

(x) **(c)** SiO_2

Explanation: {

For removing basic impurities present in the ore acidic flux like SiO_2 is used during smelting.

(xi) **(a)** Hydrogen sulphide

Explanation: {

Hydrogen sulphide

(xii) **(c)** H_2SO_4

Explanation: {

H_2SO_4

(xiii) **(a)** Butane, 2-methylbutane, 2, 3-dimethylbutane

Explanation: {

A Homologous series is a group of organic compounds (compounds that contain C atoms) that differ from each other by one methylene (CH_2) group. For e.g. butane, 2-methylbutane, 2, 3-dimethyl butane.

(xiv) **(a)** Wohler

Explanation: {

Wohler

(xv) **(b)** Catenation

Explanation: {

Catenation

2. Question 2

(i) a. Platinum or vanadium pentoxide

b. $SO_3 + \underset{\text{conc.}}{H_2SO_4} \rightarrow \underset{\text{Oleum}}{H_2S_2O_7}$

$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

c. Dil. acid e.g., dil. H_2SO_4 or dil. HCl

d. $2NaOH + SO_2 \rightarrow \underset{\text{Sodium sulphite}}{Na_2SO_3} + H_2O$

e. Contact process

f. $S + O_2 \xrightarrow{\text{Burn}} SO_2$

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

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

i. 1. reducing agents, donors

ii. 1. 1

2. one

iii. 1. Empirical formula

iv. 1. higher

v. 1. oxidising

(iv) Identify the following:

i. 1. Aldehyde

ii. 1. Nitric oxide

iii. 1. Electrometallurgy

iv. 1. Alkali

v. 1. ionic

(v) i. Empirical formula = X_2Y

Atomic weight of X = 10

Atomic weight of Y = 5

Empirical formula weight = $2 \times 10 + 5 = 25$

Vapour density = 25

Molecular weight = $2 \times$ VD = $2 \times 25 = 50u$

$n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{50}{25} = 2$

Molecular formula = Empirical formula $\times$ 2

$= 2 \times X_2Y = X_4Y_2$

ii. Electronic configuration of elements:

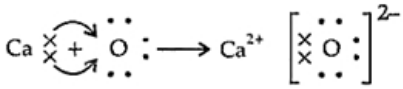
$_{20}Ca$ = 2, 8, 8, 2

$_{8}O$ = 2, 6

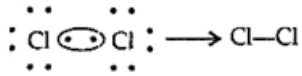
$_{17}Cl = 2, 8, 7$

$_{1}H = 1$

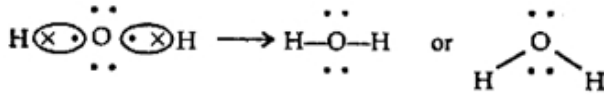
i. Calcium oxide (CaO)



ii. Chlorine molecule (Cl_2)



iii. Water molecule (H_2O)



Section B

3. Question 3

(i) We cannot use phosphorous pentaoxide and quick lime because they both react with hydrochloric acid.

$2P_2O_5 + 3HCl \longrightarrow 3HPO_3 + POCl_3$

$CaO + 2HCl \longrightarrow CaCl_2 + H_2O$

(ii) Write the products and balance the equation.

i. $\underset{\text{Magnesium}}{Mg} + \underset{\text{Hydrochloric acid}}{2HCl} \rightarrow \underset{\text{Magnesium chloride}}{MgCl_2} + \underset{\text{Hydrogen}}{H_2\uparrow}$

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

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

i. Cu^{2+}, H^+, Mg^{2+}, Na^+

ii. He < Ne < Ar

iii. B, N, O, F

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

i. 1. esterification

ii. 1. Cyclobutane

iii. 1. empirical weight

4. Question 4

(i) Electronic configuration

For fluoride ion (F^-), K - 2, M - 8

For neon (Ne) atom, K - 2, M - 8

Neon atom is a neutral atom but fluoride ion is negatively charged.

(ii) $CaCO_3 \overset{\triangle}{\rightarrow} CaO + CO_2$

1 mole of $CaCO_3$ = 40 + 12 + 48 = 100 kg

1 mole of CaO = 40 + 16 = 56 kg

$\therefore$ 56 kg of CaO is obtained from limestone = 100 kg

112 kg of CaO is obtained from limestone

$= \frac{100 \times 112}{56} = 200$ kg.

(iii) i. $Al_2O_3 \cdot 2H_2O$

ii. Na_3AlF_6

iii. $NaAlO_2$

(iv) Explain the following:

i. This is because copper is a good conductor of heat, whereas steel, an alloy of iron, is not a good conductor of heat.

ii. This is because the gastric juice in the stomach contains hydrochloric acid (HCl) while cold milk is alkaline in nature. Hence, cold milk neutralises excess of hydrochloric acid in the stomach.

iii. Sea water is not a pure water, it contains NaCl which dissociates completely into free mobile ions and behave as strong electrolyte.

$NaCl \rightleftharpoons Na^+ + Cl^-$

5. Question 5

(i) i. Aluminium oxide

ii. Ethylene

(ii)

	Electrovalent Compounds	Covalent Compounds
(i) Solubility	These are solvent in polar solvents like water but insoluble in organic solvents.	These are insoluble in water but dissolve in organic solvents.
(ii) Structure	It is formed by the number of electrons lost or gained by an atom to form electrovalent bond	It is formed by sharing of electrons to form covalent bond.

(iii) Give balanced chemical equation for the following:

i. $3CuO + 2NH_3 \rightarrow 3Cu + 3H_2O + N_2$

ii. $2KMnO_4 + 16\underset{\text{conc.}}{HCl} \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2 \uparrow$

iii. $ZnS + H_2SO_4 \rightarrow ZnSO_4 + H_2S \uparrow$

(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. Deep blue solution is formed.

iii. The copper of the anode dissolves and therefore it becomes thin or consumed gradually.

6. Question 6

(i) According to Dobereiners triads, when elements are arranged in the increasing order of atomic masses, the atomic mass of middle element was roughly the average of atomic masses of other two elements.

So, atomic mass of middle element

$= \frac{7+39}{2} = 23$

23 is the atomic mass of sodium (Na).

Similarly, atomic mass of other element

$= \frac{40+137}{2} = 88.5 \approx 88$

88 is the atomic mass of strontium (Sr).

(ii) Balanced chemical equation

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

Mass of Propane = C_3H_8

$(12 \times 3) + (1 \times 8) = 36 + 8 = 44$ g

44 g of propane require 5×22.4 L of oxygen at STP

8.8 g of propane requires = $\frac{5 \times 22.4 \times 8.8}{44}$

= 22.4 litres.

(iii) i. Vinegar is the main constituent of acetic acid.

ii. Being acidic in nature, it turns blue litmus to red.

iii. 7-hydroxyphenoxazone is present in litmus which is responsible for its colour changes.

(iv) i. Reaction with sodium hydroxide (NaOH)

	Salts	Small amount	In excess
Test tube A	Copper sulphate	Pale blue ppt.	Insoluble
Test tube B	Calcium nitrate	White ppt.	Sparingly soluble
Test tube C	Zinc nitrate	White ppt.	Soluble

ii. Reaction with ammonium hydroxide (NH_4OH)

	Salts	Small amount	In excess

Test tube A	Copper sulphate	Pale blue	Soluble
Test tube B	Calcium nitrate	No ppt.	No ppt.
Test tube C	Zinc sulphate	White gelatinous	Soluble

7. Question 7

(i) i. $Y + 3e^- \rightarrow Y^{3-}$

ii. $3X + Y_2 \rightarrow X_3Y_2$

(ii) $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

$4 \times 22.4\ dm^3$ of CO_2 is formed from $2 \times 22.4\ dm^3$ of ethyne. So, $8.4\ dm^3$ of CO_2 is formed from $(2 \times 22.4 \times 8.4)/(4 \times 22.4)$.

volume of ethyne = $4.2\ dm^3$

(iii) i. Only ions

ii. Only molecules

iii. Both molecules and ions

(iv) i. C_5H_{12} - It is of alkane group.

ii. C_2H_4 - It is of alkene group.

iii. C_3H_6 - It is of alkene group

8. Question 8

(i) i. Covalent bond

ii. Low melting point

iii. No, it will not be a good conductor of electricity.

iv. Yes, because it is a non-polar compound so it will dissolve in non-polar solvents.

(ii) $\underset{2\text{ vol.}}{2CO} + \underset{1\text{ vol.}}{O_2} \rightarrow \underset{2\text{ vol .}}{2CO_2}$

2 volumes of CO consume 1 volume of O_2

560 ml volumes of CO consume = $\frac{1 \times 560}{2}$ = 280 ml of O_2.

2 volumes of CO gives 2 volumes of CO_2

560 ml volumes of CO give = $\frac{2 \times 560}{2}$

= 560 ml of CO_2.

(iii) i. C - Dilute sulphuric acid

ii. A - Sodium hydroxide

iii. B - Weak acid contains molecules and ions.

(iv)SO_3 is not directly absorbed in water as:

i. Reaction is highly exothermic.

ii. SO_3 does not form a homogeneous mixture with water.

iii. A dense fog of sulphuric acid particles is formed and it may cause disease, "phossy jaw".