# ICSE 2025 EXAMINATION

# Sample Question Paper - 3

# Chemistry

**Time: 2 Hours.** **Total Marks: 80**

*Maximum Marks: 80*
*Time allowed: Two hours*
*Answers to this paper must be written on the paper provided separately.*
*You will not be allowed to write during first 15 minutes.*
*This time is to be spent in 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

(*Attempt **all** questions from this Section*)



**Question 1**

Choose one correct answer to the questions from the given options: [15]

(i) $NH_4OH + FeCl_3 \rightarrow NH_4Cl + Fe(OH)_3$

To balance the above equation, the coefficient for ammonium hydroxide and ammonium chloride will be:

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

(ii) In a given reaction, barium hydroxide reacts with ammonium chloride to form products X and Y. Identify X and Y.

$Ba(OH)_2 + NH_4Cl \rightarrow X + Y$

(a) $BaCl_2$ and $NH_3$
(b) $BaCl_2$ and $NH_4OH$
(c) $BaCl_2$ and $H_2O$
(d) $NH_4$ and $H_2O$

(iii) Which one of the following metals does not react with water at any conditions?

(a) Gold
(b) Iron
(c) Lead
(d) Potassium

(iv) Valency of magnesium atom is:
   (a) 3
   (b) 4
   (c) 2
   (d) 5

(v) **Assertion (A)**: Calcium and magnesium have similar chemical properties.
   **Reason (R):** Elements appearing in the same vertical column have similar properties.
   (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.

(vi) The reaction which involves a chemical change:
   (a) Freezing of water
   (b) Weathering of rocks
   (c) Ripening of fruits
   (d) Copper metal drawn into wires

(vii) Which of the following acids is NOT used in the preparation of hydrogen from metals?
   (a) Nitric acid
   (b) Hydrochloric acid
   (c) Sulphuric acid
   (d) None of the above



(viii) The pressure-volume relationship is given by:
   (a) Boyle's
   (b) Charles'
   (c) Daltons'
   (d) Gay Lussacs

(ix) The proportion of carbon dioxide in the atmosphere is about:
   (a) 0.10%
   (b) 78.09%
   (c) 0.03%
   (d) 0.93%

(x) The boiling point of alcohol on the Kelvin scale is 351 K. What will be its boiling point on the Celsius scale?
   (a) 151°C
   (b) 78°C
   (c) 251°C
   (d) 178°C

(xi) **Assertion (A)**: Sulphuric acid is the cause of acid rain.
**Reason (R):** Sulphur dioxide combines with water to form sulphuric acid.
(a) Ozone
(b) Lead
(c) Chlorofluorocarbon
(d) Suspended particulate matter

(xii) Dry hydrogen when passed over a heated metal like Na, K, and Ca reacts to give their corresponding:
(a) Alloy
(b) Hydrides
(c) Ore
(d) Both alloy and ore

(xiii) Which of the following is NOT the characteristic of inner transition elements?
(a) Actinides are radioactive in nature
(b) They show variable valencies
(c) They form coloured ions
(d) They have low melting and boiling points

(xiv) What will be the valency of an element having atomic number Z = 7?
(a) 1
(b) 2
(c) 3
(d) 4

(xv) Which of the following is NOT a physical property of water?
(a) It is a colourless liquid
(b) On increasing pressure the freezing point of water increases
(c) Water contracts when cooled up to 4°C
(d) The specific heat capacity of water is 1 calorie/(gram°C)

**Question 2**

(i) [5]

(a) Complete the table:

| Element | Mass No. | Atomic No. | p | N | e |
|---|---|---|---|---|---|
| A | 1 | 1 | 1 | __ | __ |
| B | 14 | __ | 7 | __ | 7 |
| C | __ | 12 | 12 | 12 | __ |
| D | 35 | __ | 17 | __ | 17 |

(b) Give the electronic configuration of A, B, C and D.
(c) Identify A, B, C and D.
(d) How many valence electrons are present in A, B, C and D?

(e) What is the valency of A, B, C and D?

(ii) Match the following: [5]

| Column I | Column II |
|---|---|
| **1.** Torr | (a) $V_1/T_1 = V_2/T_2$ |
| **2.** Kelvin | (b) $P_1V_1 = P_2V_2$ |
| **3.** $cm^3$ | (c) Pressure |
| **4.** Boyle's law | (d) Temperature |
| **5.** Charle's law | (e) Volume |

(iii) Fill in the blanks: [5]

(a) Dalton used symbol _____ for oxygen and symbol _____ for hydrogen.

(b) Symbol represents _____ atom(s) of an element.

(c) Symbolic expression for a molecule is called _____.

(d) Sodium chloride has two radicals. Sodium is a _____ radical, while chloride is _____ radical.

(e) Valency of carbon in $CH_4$ is _____ , in $C_2H_6$ is _____, in $C_2H_4$ is ___ and in $C_2H_2$ is ____.

(iv) Write the formulae and balance the following chemical equations: [5]

(a) Magnesium + Nitrogen → Magnesium nitride

(b) Magnesium nitride + Water → Magnesium hydroxide + Ammonia

(c) $\text{Copper hydroxide} \xrightarrow{\Delta} \text{Copper oxide} + \text{Water}$

(d) $\text{Potassium chlorate} \xrightarrow{\Delta} \text{Potassium chloride} + \text{Oxygen}$

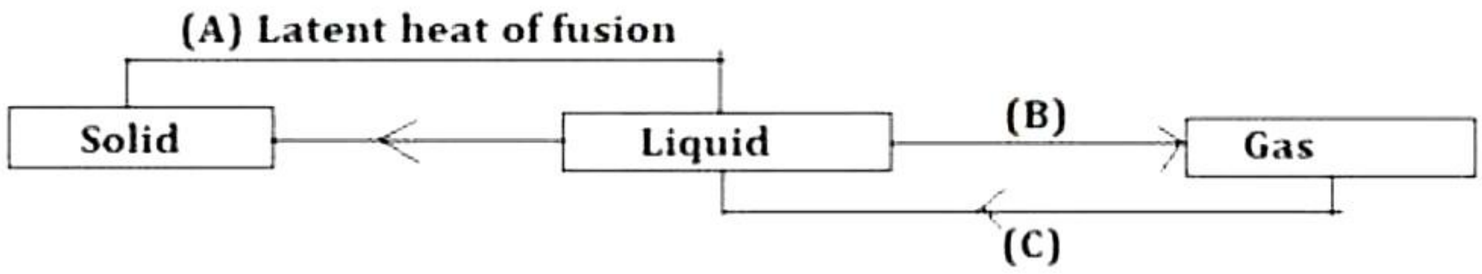
(e) Zinc sulphide + Oxygen → Zinc oxide + Sulphur dioxide

(v) [5]

(a) Identify the element present in the following groups and periods:

1. Group 1, Period 5
2. Group 11, Period 2
3. Group 16, Period 2

(b) Identify B and C in the below illustration:



## SECTION-B

*(Attempt any four questions)*

**Question 3**

(i) State the type of reaction. [2]

(a) $NaOH + HCl \rightarrow NaCl + H_2O$

(b) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

(c) $2Fe + 3Cl_2 \rightarrow 2FeCl_3$

(d) $2PbO_2 \xrightarrow{\Delta} 2PbO + O_2$

(ii) What happens when sodium is dropped in cold water? [2]

(iii) Define the following: [3]

(a) Pollutants

(b) Air pollution

(c) Photochemical smog

(iv) Give the names of the following compounds. [3]

(a) $CaSO_4$

(b) $Zn(OH)_2$

(c) $AgNO_3$



**Question 4**

(i) What is the difference between precipitation and neutralisation reactions? What types of salts are prepared by neutralisation and precipitation? [2]

(ii) Give reasons: [2]

(a) Electrovalent compounds conduct electricity in a molten or aqueous state.

(b) Electrovalent compounds have high melting and boiling points, while covalent compounds have low melting and boiling points.

(iii) What happens when electric current is passed through acidified water? Give reactions.[3]

(iv) 870 cc of moist hydrogen is measured at 9°C and 659 mm of Hg pressure. Find the volume of dry hydrogen at NTP. The vapour pressure of water at 9°C is 9 mm of Hg. [3]

**Question 5**

(i) Draw an atomic orbital diagram of bonding between two oxygen atoms. [2]

(ii) How can we make equations more informative? [2]

(iii) What will be the reaction between metals like magnesium and aluminium with hot water and steam? [3]

(iv) Hydrogen gas occupies a volume of 400 $cm^3$ at a temperature of 27°C and normal atmospheric pressure. Find the volume of the gas at 10°C at constant pressure. [3]

**Question 6**

(i) List out the postulates of Thomson's model of the atom. [2]

(ii) What is meant by scavenging? [2]

(iii) Give three uses of hydrogen. [3]

(iv) Moist nitrogen at a pressure of 700 mmHg and a temperature of 27°C is found to occupy a volume of 100 $cm^3$. Find the volume of dry nitrogen gas at STP (Aqueous tension at 27°C is 15 mmHg). [3]



**Question 7**

(i) Write the formulae and balance the following equations. [3]

(a) $\text{Copper hydroxide} \xrightarrow{\Delta} \text{Copper oxide} + \text{Water}$

(b) $\text{Potassium Chlorate} \xrightarrow{\Delta} \text{Potassium chloride} + \text{Oxygen}$

(c) Sodium reacts with water to produce sodium hydroxide and hydrogen

(ii) State usefulness of noble gases. [3]

(iii) A given amount of gas A is confined in a chamber of constant volume. When the chamber is immersed in a bath of melting ice, the pressure of the gas is 100 cmHg. [4]

(a) What is the temperature when the pressure is 10 cm Hg?

(b) What will be the pressure when the chamber is brought to 100°C

**Question 8**

(i) Why does metallic character increase down a group? [2]

(ii) 6 $dm^3$ of dry gas is collected at a temperature of 27°C and pressure of 700 mmHg. Find the volume of the gas at STP. [2]

(iii) Metals other than zinc are not used in the laboratory preparation of hydrogen gas. Give reason. [3]

(iv) Give reason. [3]

(a) An atom is electrically neutral.

(b) The mass of an atom is concentrated in the nucleus of an atom.

(c) The Rutherford model of an atom could not provide stability to the nucleus.

# Solution

## SECTION A

**Solution 1**

(i) (d)
(ii) (b)
(iii) (a)
(iv) (c)
(v) (a)
(vi) (c)
(vii) (a)
(viii) (a)
(ix) (c)
(x) (b)
(xi) (c)
(xii) (b)
(xiii) (d)
(xiv) (c)
(xv) (b)



**Solution 2**

(i)

(a)

| Element | Mass No. | Atomic No. | p | n | e |
|---|---|---|---|---|---|
| A | 1 | 1 | 1 | **0** | **1** |
| B | 14 | **7** | 7 | **7** | 7 |
| C | **24** | 12 | 12 | 12 | **12** |
| D | 35 | **17** | 17 | **18** | 17 |

(b) Electronic configuration of A = 1
Electronic configuration of B = 2, 5
Electronic configuration of C = 2, 8, 2
Electronic configuration of D = 2, 8, 7

(c) A = Hydrogen, B = Nitrogen, C = Magnesium, D = Chlorine

(d) A = 1, B = 5, C = 2, D = 7

(e) A = 1, B = 3, C =2, D = 1

(ii)

| Column I | Column II |
|---|---|
| **1.** Torr | (c) Pressure |
| **2.** Kelvin | (d) Temperature |
| **3.** $cm^3$ | (e) Volume |
| **4.** Boyle's law | (b) $P_1V_1 = P_2V_2$ |
| **5.** Charle's law | (a) $V_1/T_1 = V_2/T_2$ |

(iii)

(a) Dalton used the symbol [○] for oxygen and the symbol [⊙] for hydrogen.

(b) Symbol represents gram atom(s) of an element.

(c) Symbolic expression for a molecule is called molecular formula.

(d) Sodium chloride has two radicals. Sodium is a basic radical, while chloride is an acid radical.

(e) Valency of carbon in $CH_4$ is 4, in $C_2H_6$ is 4, in $C_2H_4$ is 4 and in $C_2H_2$ is 4.

(iv)

(a) $3Mg + N_2 \rightarrow Mg_3N_2$

(b) $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$

(c) $Cu(OH)_2 \xrightarrow{\Delta} CuO + H_2O$

(d) $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

(e) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

(v)

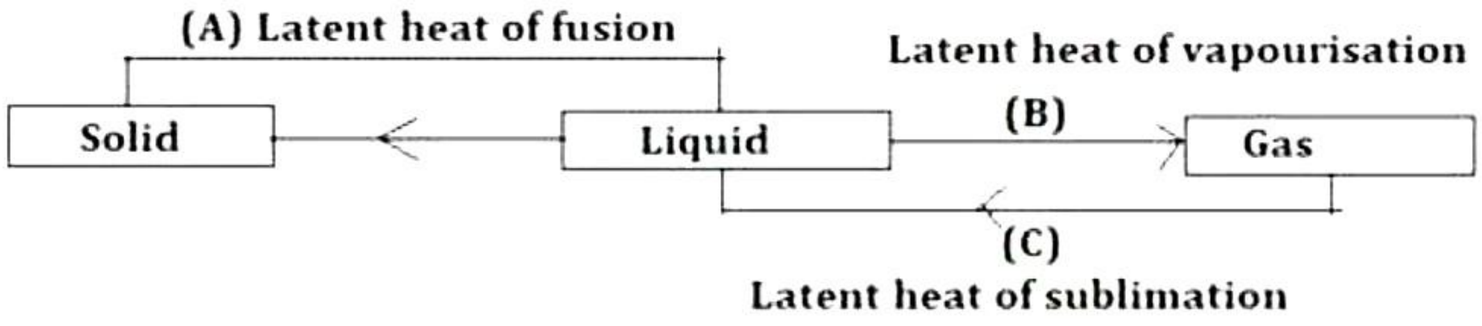
(a)

1. Rubidium
2. Copper
3. Oxygen

(b)

B = Latent heat of vapourisation

C = Latent heat of sublimation



## SECTION-B

*(Attempt any four questions)*

**Solution 3**

(i)

(a) Double decomposition - neutralisation

(b) Double decomposition – precipitation

(c) Synthesis

(d) Thermal decomposition

(ii) When sodium is dropped in cold water, it reacts explosively and burns with golden yellow flame. The reaction is exothermic and vigorous. It forms sodium hydroxide with the liberation of hydrogen gas.

$2Na + 2H_2O \rightarrow 2NaOH + H_2\uparrow$

(iii)

(a) Pollutants: A pollutant is defined as an undesirable matter present in excess in the environment.

(b) Air Pollution: It is defined as the presence of a contaminant in the atmosphere in a concentration large enough to injure human, plant and animal life.

(c) Photochemical smog: Smog which is formed by photochemical reaction in the atmosphere is known as photochemical smog.

(iv)

(a) $CaSO_4$: Calcium sulphate

(b) $Zn(OH)_2$: Zinc hydroxide.

(c) $AgNO_3$: Silver nitrate

**Solution 4**

(i) Neutralisation reaction is a double decomposition reaction in which $H^+$ ions of an acid reacts with $OH^-$ ions of a base to form salt and water. In this reaction, the products formed are soluble. Whereas during precipitation, solid particles i.e. (precipitate) is formed. This precipitate is insoluble in water. Soluble salts are prepared by neutralization. Insoluble salts are prepared by precipitation.

(ii)

(a) They are good conductors of electricity in the fused or aqueous state because electrostatic forces of attraction between ions in the solid state are very strong, and these forces weaken in the fused state or in the solution state. Hence, ions become mobile.

(b) In electrovalent compounds, there exists a strong force of attraction between the oppositely charged ions, and a large amount of energy is required to break the strong bonding force between ions. So, they have high boiling and melting points. In covalent compounds, weak forces of attraction exist between the binding molecules, thus less energy is required to break the force of binding. So, they have low boiling and melting points.

(iii) When electric current is passed through acidified water, it decomposes to give hydrogen at cathode and oxygen at anode.

At Cathode:

$H^+ + e^- \rightarrow [H]$

$2[H] \rightarrow H_2$

At Anode:

$OH^- - e^- \rightarrow OH$

$4[OH] \rightarrow 2H_2O + O_2$

(iv)

$$P_{total} = P_{Dry\,H_2} + P_{Water}$$

$$659 = P_{Dry\,H_2} + 9$$

$$P_{Dry\,H_2} = 659 - 9$$

$$= 650\,mm$$

Let,

$P_1$ and $V_1$ be the pressure and volume of dry hydrogen gas at temperatute $T_1$

$P_2$ and $V_2$ be the pressure and volume of dry hydrogen gas at temperatute $T_2$

By using gas equation,

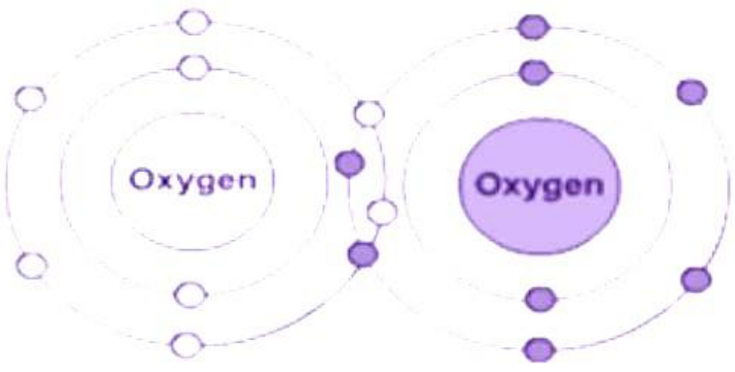
$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{650 \times 870}{287} = \frac{760 \times V_2}{273}$$

$$V_2 = 720.33\,cc$$

**Solution 5**

(i) Bonding between two oxygen atoms: A double covalent bond is formed by sharing two pairs of electrons between the oxygen atoms, each contributing two electrons.




(ii) The equations can be made more informative in three ways:

1. By indicating the physical states of the reactants and products.
2. By indicating the heat changes taking place in the reaction.
3. By indicating the conditions under which the reaction takes place like temperature, pressure, presence of catalyst, etc.

(iii) Metals like magnesium and aluminium react with hot water or steam to form hydrogen gas.

Magnesium: Magnesium reacts with hot water or steam to produce magnesium oxide and liberates hydrogen gas.

$Mg + H_2O \rightarrow MgO + H_2\uparrow$

Aluminium: Aluminium is difficult to get in its pure form. This is because, aluminium has a great affinity towards oxygen. Thus, it is coated with aluminium oxide ($Al_2O_3$). This oxide layer on the surface of aluminium can be removed by rubbing it with sand paper. Thus, aluminium obtained in its pure form reacts with hot water or steam to produce hydrogen gas.

$2Al + 3H_2O \rightarrow Al_2O_3 + 3H_2\uparrow$

(iv) Initial volume ($V_1$) = 400 $cm^3$

Initial temperature ($T_1$) = 27 + 273 K = 300 K

Final volume ($V_2$) = ?

Final temperature ($T_2$) = 10 + 273 = 283 K

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\Rightarrow \frac{400}{300} = \frac{V_2}{283}$$

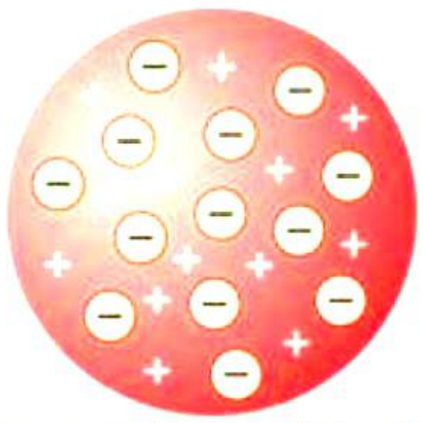
$$V_2 = \frac{400 \times 283}{300} = 377.33 \text{ cm}$$

**Solution 6**

(i) According to Thomson's model of atom:

(a) An atom consists of a positively charged sphere and the negatively charged electrons are embedded in it.

(b) The negative and positive charges are equal in magnitude. Hence, the atom has no overall positive and negative charge.



**Thomson's model of an Atom**

(ii) In the stratosphere, the reactive species of chlorine gets locked up and are unable to stop depletion of ozone layer. Locking of chlorine monoxide and chlorine free radicals is called scavenging. In the atmosphere, nitrogen dioxide scavenges chlorine monoxide and methane scavenges chlorine atoms. These scavengers react with chlorine monoxide and chlorine free radicals.

$ClO(g) + NO_2(g) \rightarrow ClONO_2(g)$

$[Cl] + CH_4(g) \rightarrow CH_3(g) + HCl(g)$

(iii) Uses of hydrogen:

(a) As a fuel: As hydrogen gas has got high heat of combustion, so it is used as fuel in the form of:

(A) Coal gas

(B) Water gas

(C) Liquid hydrogen

(b) Oxy-hydrogen torch: A mixture of hydrogen and oxygen is burnt in a specially designed apparatus called an oxy-hydrogen torch. The flame is used for cutting and welding of metals.

(c) Atomic hydrogen torch: creates a high temperature which is used for welding alloys containing metals like manganese, chromium etc.

(d) Haber's process: It is used for the manufacture of ammonia.

$N_2 + 3H_2 \rightarrow 2NH_3$

(iv) $P_1 = 700 - 15 = 685$ mmHg $P_2 = 760$ mmHg

$V_1 = 100\ cm^3$ $V_2 =$

$T_1 = 27 + 273 = 300$ K $T_2 = 273$ K

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{685 \times 100}{300} = \frac{760 \times V_2}{273}$$

$$V_2 = \frac{685 \times 100 \times 273}{300 \times 760} = \frac{187005}{2280}$$

$$V_2 = 82.01 \text{ cm}^3$$

**Solution 7**

(i)

$$(a)\ Cu(OH)_2(s) \xrightarrow{\Delta} CuO(s) + H_2O(l)$$

$$(b)\ 2KClO_3(s) \xrightarrow{MnO_2, \Delta} 2KCl(s) + 3O_2(g)$$

$$(c)\ 2Na(s) + 2H_2O(l) \longrightarrow 2NaOH(aq) + 2H_2(g)$$

(ii) Usefulness of noble gases:

- Helium is a light gas so it is used in fitting balloons for meteorological observations.
- It is also used in gas cooled nuclear reactors.
- Neon is used in discharged tubes and fluorescent bulbs for advertisement display purposes. Neon bulbs are used in botanical gardens and in green houses.
- Argon is used mainly to provide an inert atmosphere in high temperature metallurgical processes (arc welding of metals and alloys) and for filling electric bulbs. It is also used in laboratory for handling substances that are air-sensitive.
- Xenon and Krypton are also used in light bulbs designed for special purposes.



(iii)

(a) $V_1 = V_2 = V$

$P_1 = 100$ cmHg

$T_1 = 273$ K

$P_2 = 10$ cmHg

$T_2 = ?$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{100 \times V}{273} = \frac{10 \times V}{T_2}$$

$$T_2 = 27.3\text{K}$$

(b) $V_1 = V_2 = V$

$P_1 = 100$ cmHg

$P_2 = ?$

$T_1 = 273$ K

$T_2 = 373\ K$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{100 \times V}{273} = \frac{P_2 \times V}{373}$$

$$P_2 = 136.63\,\text{cm of Hg}$$

**Solution 8**

(i) As we move down the group, the number of shells increases. The effective nuclear charge experienced by valence electrons decreases because the outermost electrons move farther away from the nucleus. Therefore, these valence electrons can be lost easily. By losing the electrons, element gains positive charge. Hence, metallic character increases down the group.

(ii) $V_1 = 6\ dm^3$ $V_2 = ?$

$P_1 = 700$ mm Hg $P_2 = 760$ mm Hg

$T_1 = 27 + 273K = 300\ K$ $T_2 = 273\ K$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{700 \times 6}{300} = \frac{760 \times V_2}{273}$$

$$V_2 = \frac{700 \times 6 \times 273}{300 \times 760} = \frac{1146600}{228000}$$

$= 5.02\ dm^3$

(iii) Metals other than zinc cannot be used in laboratory preparation due to following reasons:

(a) Sodium and potassium react with acid violently.

(b) Calcium and magnesium are cost effective.

(c) Aluminium forms protective coating of its oxide because of its high affinity for oxygen.

(d) Iron has to be heated. Due to this, impurities like hydrogen sulphide and sulphur dioxide gas are produced.

(e) Lead cannot be used because it reacts with dilute sulphuric acid or hydrochloric acid to form salts.

(f) Metals like copper, mercury, etc., cannot be used as they come below the Hydrogen in the activity series. As, only the metals which are more reactive than the hydrogen itself can displace hydrogen from acids.

For example, Cu + dil. HCl → No reaction

(iv)

(a) An atom is electrically neutral because the number of positively charged particles, i.e. protons, is equal to the number of negatively charged particles, i.e. electrons.

(b) The mass of an atom is contributed by the mass of the protons and neutrons present in the nucleus of an atom. The electrons present outside the nucleus are of negligible mass; therefore, the mass of atom is concentrated in the nucleus of an atom.

(c) According to Rutherford, the protons are present in the nucleus and the electrons revolve around the nucleus. Electrons continuously lose energy and ultimately fall into the nucleus following a spiral path. Thus, the nucleus of an atom gets destroyed.