ICSE 2025 EXAMINATION

Sample Question Paper - 1

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) The breakdown of CFCs in the presence of UV rays produce
- (a) Oxygen
- (b) Hydrogen
- (c) Chlorine
- (d) Carbon

(ii) The negatively charged monoatomic, monovalent ion/radical is
- (a) Hydrogen
- (b) Oxide
- (c) Sulphate
- (d) Iodide

(iii) Select a hygroscopic substance.
- (a) Stone
- (b) Copper
- (c) Paper
- (d) Glass

(iv) Which of the following formulae of elements were used by Mendeleev for giving the classification?

(a) Sulphides
(b) Nitrides
(c) Carbonates
(d) Oxides

(v) **Assertion (A)**: Potassium nitrate decomposes to give potassium nitrite along with evolution of nitrogen gas which is represented by the equation:

$KNO_3 \longrightarrow KNO_2 + O_2$

Reason (R): An equation must be balanced in order to comply with "Law of Conservation of Matter".

(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) Which of the following is a use of an electrolytic decomposition reaction?

(a) To obtain metals from their ores
(b) They are used in photography
(c) To produce salts
(d) Photosynthesis in plants

(vii) The crystals of sodium chloride produces cracking sound on heating, called:

(a) Crystallisation
(b) Deliquescence
(c) Hydration
(d) Decrepitation

(viii) Which one of the following isotopes is used as a fuel in nuclear reactors?

(a) An isotope of Uranium
(b) An isotope of Iodine
(c) An isotope of Cobalt
(d) An isotope of Thorium

(ix) Rasika added a solution of silver nitrate to a solution of sodium chloride. The product would be:

(a) Black solid mass silver chlorite
(b) White precipitate of silver chloride
(c) Dirty green precipitate of sodium chloronitrate
(d) Blue colour solution of sodium nitrite

(x) The metal oxide which is reduced by hydrogen is:

(a) Al_2O_3

(b) CuO

(c) CaO

(d) Na_2O

(xi) **Assertion (A)**: Solubility of Glauber's salt first increases and then decreases with temperature.

Reason (R): Glauber's salt is anhydrous above 32.8°C.

(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.

(xii) Newlands classification of elements did not include:

(a) Metals

(b) Noble gases

(c) Non-metals

(d) Metalloids

(xiii) Which one of the following is the main reason for using helium instead of hydrogen for filling balloons?

(a) Lighter than air.

(b) Almost as light as hydrogen.

(c) Non-combustible

(d) Inflammable

(xiv) Hydrogen is NOT used as a fuel in the form of:

(a) Coal gas

(b) Water gas

(c) Liquid hydrogen

(d) Ammonia gas

(xv) General gas constant is represented by:

(a) B

(b) K

(c) R

(d) S

Question 2

(i) Complete the table given below by identifying V, W, X, Y and Z. [5]

Element	Symbol	No. of Protons	No. of Neutrons	No. of Electrons
Strontium	$^{88}_{38}V$	38	50	38
Chlorine	$^{35}_{17}Cl$	17	*W*	17
Uranium	*X*	92	146	92
Boron	$^{11}_{5}B$	5	6	*Y*
Copper	$^{63}_{29}Cu$	*Z*	34	29

(ii) Match the following: [5]

Column A	Column B
(a) Element short by 1 electron in octet	(i) Transition elements
(b) Highly reactive metals	(ii) Noble gases
(c) Non-reactive elements	(iii) Alkali metals
(d) Elements of groups 3 to 12	(iv) Alkaline earth metals
(e) Radioactive elements	(v) Halogens
(f) Elements with 2 electrons in the outermost orbit	(vi)Actinides

(iii) Fill in the blanks: [5]

(a) Nitric oxide is _____ toxic.

(b) The gaseous material which envelopes the Earth is called _____.

(c) The lowest region of the atmosphere is called _____.

(d) The stratosphere mainly contains _____, _____ and ozone.

(e) Rain water containing H_2SO_4 and HNO_3 is called _____.

(iv) Complete the following statements: [5]

(a) The chemical change involving iron and hydrochloric acid illustrates a _____ reaction.

(b) In the type of reaction called _____, two compounds exchange their positive and negative radicals.

(c) A catalyst either _____ or _____ the rate of a chemical reaction but itself remains _____ at the end of the reaction.

(d) On heating, hydrated copper sulphate changes its colour from _____ to _____.

(e) Calcium carbonate decomposes into carbon dioxide and calcium oxide by _____ of heat.

(f) Nitrogen and hydrogen when subjected to _____ pressure produce ammonia in the presence of _____ iron.

(v) [5]

(a) Deduce the molecular formula of the following:

1. Magnesium sulphate
2. Ammonium bicarbonate
3. Aluminium oxide

(b) What is the valency of the underlined element in the following compounds?

1. $\underline{Ca}Cl_2$
2. $\underline{C}Cl_4$

SECTION-B

(Attempt any four questions)

Question 3

(i) Explain:

(a) Photochemical reaction

(b) Electrochemical reaction

(ii) 100 gm of sugar is dissolved in 3 kg of water. Calculate the concentration of the solution. [5]

(iii) How are chlorofluorocarbons decomposed? [3]

(iv) Balance the following chemical equations: [3]

(a) $AgNO_3 \xrightarrow{\Delta} Ag + NO_2 + O_2$

(b) $Cu + H_2SO_4 \rightarrow CuSO_4 + H_2O + SO_2$

(c) $NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

Question 4

(i) Why respiration is considered an exothermic reaction? [2]

(ii) Electrovalent compounds dissolve in water, whereas covalent compounds do not. Explain. [2]

(iii) Explain why the hardness of water makes it unfit for washing purposes. [3]

(iv) When 8.4 g of potassium bicarbonate is added to a dilute solution of hydrochloric acid weighed as 20 g, it is observed that 4.4 g of CO_2 is released into the atmosphere. The residue left behind is 24 g. Show that these observations are in accordance with law of conservation of mass. [3]

Question 5

(i) In the formation of compound XY_2, an atom X gives one electron to each Y atom. What is the nature of the bond in XY_2? Draw the electron–dot structure of this compound.[2]

(ii) Identify the acidic and basic radical in the following: [2]

(a) Ferrous sulphate

(b) Sodium nitrite

(iii) Divide the following redox reactions into oxidation and reduction half-reactions. [3]

(a) $Zn + Pb^{2+} \rightarrow Zn^{2+} + Pb$

(b) $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$

(c) $Cl_2 + 2Br^- \rightarrow Br^2 + 2Cl^-$

(iv) The volume of certain gas was found 400 cm3, when pressure was 520 mm of Hg. If the pressure is increased by 30 %, find the new volume of the gas. [3]

Question 6

(i) Explain: Electrovalent compounds have high meltin and boiling points, while covalent compounds have low melting and boiling points. [2]

(ii) Write the impact of acid rain on soil. [2]

(iii) A given mass of a gas occupies 960 ml at 27°C. What volume will it occupy if the temperature is raised to 177°C, pressure remaining constant? [3]

(iv) A small piece of calcium metal is put into a small trough containing water. There is effervescence and white turbidity is formed. [3]

(a) Name the gas formed in the reaction. How would you test the gas?

(b) Write an equation for the reaction.

(c) What do you observe when a few drops of red litmus solution are added to the turbid

Question 7

(i) The metals of Group 2 from top to bottom are Be, Mg, Ca, Sr and Ba. [3]

(a) Which of these elements will form ions most readily and why?
State the common feature in the electronic configuration of all these elements.

(b) Explain periodicity of these elements in terms of metallic character and electro positivity.

(ii) Name the following: [3]

(a) The non-metals present in period 2 and metals in period 3.

(b) The element of period 3 with valency 4.

(c) The element in period 3 which does not form an oxide.

(iii) At what temperature will 500 cm^3 of a gas measured at 20 °C occupy half and double its volume if the pressure is kept constant? [4]

Question 8

(i) Give reasons for the following: [2]

(a) The size of a Cl−ion is greater than the size of a Cl atom.

(b) Ionisation potential of the element increases across a period.

(ii) A gas occupies the initial volume of 400 cm3 at a pressure 'Z'. If the pressure is changed to 5 atmosphere, the volume of the gas was found to be 200 cm^3. Calculate the value of 'Z'. [2]

(iii) [3]

(a) Name the process in which water gas is used for the manufacture of hydrogen.

(b) Give balanced chemical equation for the large scale preparation of hydrogen from water gas.

(c) How are carbon dioxide and carbon monoxide removed from hydrogen produced?

(iv) Which of the following changes are endothermic or exothermic in nature? [3]

(a) Decomposition of ferrous sulphate

(b) Digestion of food

(c) Decomposition of calcium carbonate

Solution

SECTION A

Solution 1

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

Solution 2

(i)

Element	Symbol	No. of Protons	No. of Neutrons	No. of Electrons
Strontium	$^{88}_{38}Sr$	38	50	38
Chlorine	$^{35}_{17}Cl$	17	18	17
Uranium	$^{238}_{92}U$	92	146	92
Boron	$^{11}_{5}B$	5	6	5
Copper	$^{63}_{29}Cu$	29	34	29

(ii)

Column A	Answers
(a) Element short by 1 electron in octet	(v) Halogens
(b) Highly reactive metals	(iii) Alkali metals
(c) Non-reactive elements	(ii) Noble gases
(d) Elements of Groups 3 to 12	(i) Transition elements
(e) Radioactive elements	(vi) Actinides
(f) Elements with 2 electrons in the outermost orbit	(iv) Alkali earth metals

(iii)

(a) Less
(b) Atmosphere
(c) Troposphere
(d) Nitrogen, oxygen
(e) Acid rain

(iv)

(a) displacement
(b) double decomposition
(c) accelerate, decelerate, unaffected
(d) blue, white
(e) absorption
(f) high, catalyst

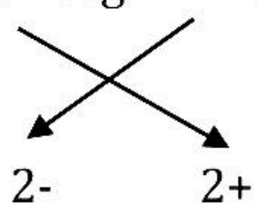
(v)

(a)

1. **Magnesium sulphate**

Symbol Mg SO_4

Valency: Mg^{2+} SO_4^{2}

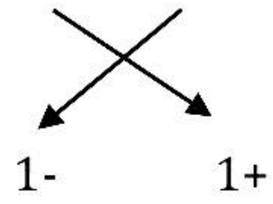


Formula: $Mg_2(SO_4)_2$ = **$MgSO_4$**

2. **Ammonium bicarbonate**

Symbol NH_4 HCO_3

Valency: NH_4^{+1} HCO_3^{1}

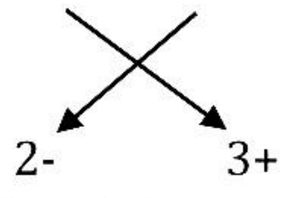


Formula: **NH_4HCO_3**

3. **Aluminium oxide**

Symbol Al O

Valency: Al^{3+} O^{2-}



Formula: **Al_2O_3**

SECTION-B

(Attempt any four questions)

Solution 3

(i)

(a) The chemical reaction which occurs with the absorption of energy in the form of light is called a photochemical reaction.
Example: Photosynthesis is a photochemical reaction.

$$6CO_2 + 12H_2O \xrightarrow[\text{light}]{\text{chlorophyll}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

(b) The chemical reaction which occurs with the absorption of electrical energy is called an electrochemical reaction.

(c) Example: On passing electric current, acidulated water forms hydrogen and oxygen.

(ii) Given:

Mass of solute = 100 gm

Mass of solvent = 3 kg

= 3000 gm

Mass of solution = mass of solute + mass of solvent

= 100 + 3000

= 3100 gm

$$\text{Concentration of solution} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$= \frac{100}{2500}$$

$$= 4\%$$

Concentration of solution is 4%.

(iii) The chlorofuloro carbons are decomposed by the ultraviolet rays to highly reactive chlorine which is produced in the atomic form.

$$CF_2Cl_2 \xrightarrow{\text{Ultraviolet rays}} \underset{\text{Free radical}}{CF_2Cl} + Cl$$

The free radical [Cl] reacts with ozone to form chlorine monoxide.

$Cl + O_3 \rightarrow ClO + O_2$

(chlorine monoxide)

This causes depletion of ozone layer. Chlorine monoxide then reacts with atomic oxygen to produce more chlorine free radicals.

$ClO + O \rightarrow Cl + O_2$

Again this free radical destroys ozone and the process continues giving rise to depletion of ozone layer.

(iv)

(a) $2AgNO_3 \xrightarrow{\Delta} 2Ag + 2NO_2 + O_2$

(b) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + 2H_2O + SO_2$

(c) $NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

Solution 4

(i) Respiration is considered an exothermic reaction because energy is released in this process. In the process of respiration, oxidation of glucose takes place.

(ii) As water is a polar compound, it decreases the electrostatic forces of attraction, resulting in free ions in aqueous solution. Hence, electrovalent compounds dissolve. Covalent compounds do not dissolve in water but dissolve in organic solvents. Organic solvents are non-polar; hence, these dissolve in non-polar covalent compounds

(iii) Magnesium and calcium ions of hard water combine with negative ions of soap to form a slimy precipitate of insoluble magnesium and calcium called scum. The formation of scum goes on as long as there are calcium and magnesium ions present. Till then, no soap lather will be formed and cleaning of the cloth will not be possible. Also, these precipitates are difficult to wash out from the fabrics. Hence, hard water is not suitable for washing purposes.

(iv) $KHCO_3 + HCl \rightarrow KCl + H_2O + CO_2$

8.4 g 20 g 24 g 4.4 g

Total mass of the reactants ($KHCO_3 + HCl$) = 8.4 + 20

= 28.4 g

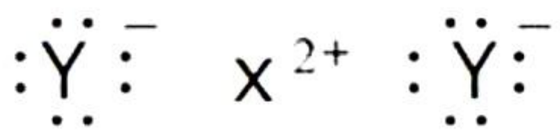
Total mass of the products ($KCl + H_2O + CO_2$) = 24 + 4.4

= 28.4 g

Because the total mass of the products is equal to the total mass of the reactants, the observations are in accordance with the law of conservation of mass.

Solution 5

(i) Nature of bond in XY_2 is an ionic bond.



(ii)

Acidic radical	Basic radical
SO_4^{2-}	Fe^{2+}
NO_2^-	Ni^{2+}

(iii)

(a) $Zn \rightarrow Zn^{2+} + 2e^-$ (Oxidation)

$Pb^{2+} + 2e^- \rightarrow Pb$ (Reduction)

(b) $Zn \rightarrow Zn^{2+} + 2e^-$ (Oxidation)

$Cu^{2+} + 2e^- \rightarrow Cu$ (Reduction)

(c) $Cl_2 + 2e^- \rightarrow 2Cl^-$ (Reduction)

$2Br^- \rightarrow Br_2 + 2e^-$ (Oxidation)

(iv) Initial volume of gas $V_1 = 400$ cm3

Initial pressure of gas $P_1 = 520$ mm Hg

$$\text{The 30\% of initial pressure} = 520 \times \frac{30}{100} = 156$$

$$\text{Final pressure } P_2 = 156 + 520 = 676 \text{ mm Hg}$$

Final volume of gas $V_2 = ?$

$$P_1V_1 = P_2V_2$$

$$520 \times 400 = 676 \times V_2$$

$$V_2 = \frac{520 \times 400}{676} = 307.69 \text{ cm}^3$$

Solution 6

(i) 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.

(ii) Acid rain changes the pH of soil. The acid present in acid rain such as nitric acid, nitrous acid, sulphuric acid and sulphurous acid increases the acidity of the soil. It removes calcium and potassium minerals, i.e. the basic ingredients from the soil lose their fertility. The hydrogen ions H^+ which are added to the soil when acid rain falls to the Earth interact chemically with existing soil minerals.

(iii)

$$V_1 = 960 \text{ ml}$$

$$T_1 = 27°C + 273 = 300 \text{ K}$$

Applying Charles'law

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

$$\text{Hence, } V_2 = \frac{T_2 \times V_1}{T_1}$$

Substituting the values

$$V_1 = \frac{450 \times 960}{300} = 1440\,\text{ml}$$

New volume = 1440 ml

(iv)

(a) Hydrogen gas. When red litmus is introduced into the solution, it turns blue.

(b) $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2\uparrow$

(c) The solution turns blue.

Solution 7

(i)

(a) Ba metal will form ions readily because the ionization energy decreases down the group as the size increases.

(b) On moving down the group, the number of electrons in the outermost shell, i.e. valence electrons remain the same. So, the valency in a group remains the same, i.e. 2.

(c) As the atomic size increases, the element can easily give away the valence shell loosely bound electrons. Thus, both electro-positivity and metallic nature increase down the group. Hence, the periodicities in terms of electro-positivity and metallic nature are shown below:

Electro positivity: Be < Mg < Ca < Sr < Ba

Metallic nature: Be < Mg < Ca < Sr < Ba

(ii)

(a) C, N, O and F are non-metals present in period 2 while Na, Mg and Al are metals in period 3.

(b) The element of period 3 with valency 4 is Silicon.

(c) The element in period 3 which does not form an oxide is Argon.

(iii) Let the required temperature be "t" °C.

$V_1 = 500\ cm3, T_1 = (273 + 20)\ K = 293\ K$

$V_2 = 250\ cm3, T_2 = (273 + t)\ K$

By Charles' law,

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

Substituting the values,

$$\therefore \quad \frac{500}{293} = \frac{250}{273 + t}$$

$$\text{or } 500(273 + t) = 250 \times 293$$

$$\text{or } 2(273+t) = 293$$

$$\text{or } 273+t=\frac{293}{2}=146.5\text{K}$$

$$\text{or } t=146.5-273=-126.5^{\circ}\text{C}$$

The gas would occupy half its volume at $-126.5\ ^{\circ}C$.

If the volume is doubled at same pressure.

$V_1 = 500\ cm^3$, $T_1 = (273 + 20)\ K = 293\ K$

$V_3 = 1000\ cm^3$, $T_2 = (273 + t)\ K$

By Charles' law,

$$\frac{V_1}{T_1}=\frac{V_3}{T_2}$$

Substituting the values,

$$\therefore \quad \frac{500}{293}=\frac{1000}{273+t}$$

$$\text{or } 500(273+t)=1000\times 293$$

$$\text{or } (273+t) = 2\times 293$$

$$\text{or } 273+t=586\text{K}$$

$$\text{or } t = 313^{\circ}\text{C}$$

Solution 8

(i)

(a) An anion is formed by the gain of electrons. In the chloride ion, the number of electrons is more than the number of protons. The effective positive charge in the nucleus is less, so less inward pull is experienced. Hence, the size expands.

(b) The ionisation potential of the element increases across a period because the atomic size decreases due to an increase in the nuclear charge, and thus, more energy is required to remove the electron(s).

(ii) $P_1 = Z$, $P_2 = 5\ atm$, $V_1 = 400\ cm^3$, $V_2 = 200\ cm^3$

$P_1V_1 = P_2V_2$

$Z \times 400 = 5 \times 200$

$$Z=\frac{5\times 200}{400}=2.5\,\text{atm}$$

(iii)

(a) Bosch process

(b) $CO + H_2 + H_2O \xrightarrow[450^\circ C]{Fe_2O_3/Cr_2O_3} 2H_2 + CO_2$

(c) The hydrogen obtained by this process contains the impurities of carbon monoxide in traces and carbon dioxide. Carbon monoxide can be removed by passing it through ammoniacal cuprous chloride solution. Carbon dioxide can be removed by passing through cold water under pressure.

(iv)

(a) Endothermic reaction

(b) Exothermic reaction

(c) Endothermic reaction