ICSE 2025 EXAMINATION

Sample Question Paper - 4

Chemistry

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

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) All gases have similar kinetic energy at a given pressure and _____ temperature.
- (a) given
- (b) standard
- (c) absolute
- (d) room

(ii) An oxidizing agent is a substance which:
- (a) Loose oxygen
- (b) Gains hydrogen
- (c) Gains oxygen
- (d) Both A and B

(iii) Which one of the following pollutants is produced by combustion of coal, petrol and diesel?
- (a) Sulphur dioxide
- (b) Lead
- (c) Suspended particulate matter
- (d) Carbon monoxide

(iv) A substance which gets oxidized in a redox reaction is a:
- (a) Oxidising agent
- (b) Reducing agent
- (c) Both oxidizing and reducing agent
- (d) None of these

(v) **Assertion (A)**: The empirical formula of hydrogen peroxide (H_2O_2) is HO.
Reason (R): The simplest ratio is 1:1 between the hydrogen and oxygen atoms in hydrogen peroxide molecule.
(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) What is the chemical formula of potassium plumbite?
(a) K_4PbO_4
(b) K_2PbO_2
(c) K_3PbO_3
(d) K_2PbO_3

(vii) Which of the following need to be constant for Charles' law?
(a) Pressure
(b) Volume
(c) Temperature
(d) None of the above

(viii) Which of these substances is a good reducing agent?
(a) NaOCl
(b) HI
(c) $FeCl_3$
(d) KBr

(ix) The addition of certain unwanted chemical substances in the air causing harmful effects is called as:
(a) Air pollution
(b) Toxicity
(c) Epidemic
(d) Ozone depletion

(x) The element which is virtually inactive towards water is:
(a) Au
(b) Al
(c) Ag
(d) Both A and C

(xi) **Assertion (A)**: An element is a pure substance which can neither be formed not decomposed into simple substances by ordinary physical or chemical methods.
Reason (R): A molecule is the smallest particle of an element that exhibits all the properties of that element.
(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) Which one of the following solutions is used for the removal of carbon dioxide gas in the purification of hydrogen gas?
(a) Caustic potash solution
(b) Lead nitrate solution
(c) Silver nitrate solution
(d) Sulphuric acid

(xiii) X (atomic mass = 37), Y (atomic mass = 81), and Z are three members of Dobereiner's triads. Atomic mass Z =?
(a) 120
(b) 125
(c) 130
(d) 135

(xiv) What is blue vitriol?
(a) $CuSO_4.5H_2O$
(b) $FeSO_4.5H_2O$
(c) $CuSO_4.7H_2O$
(d) $FeSO_4.7H_2O$

(xv) Which of the following is an example of a combination reaction between two compounds?
(a) Formation of water
(b) Formation of limestone
(c) Water contracts when cooled up to 4°C
(d) The specific heat capacity of water is 1 calorie/(gram°C)

Question 2

(i) The table given below shows the mass number and atomic number of five elements A, B, C, D and E. [5]

Element	Mass number	Atomic number
A	35	17
B	23	11
C	12	6
D	16	8
E	40	18

(a) To which group and period does element A belong?

(b) Choose from A, B, C, D and E, metal, non-metal and inert gas.

(c) Give the electronic configuration of elements A, B, C, D and E.

(ii) Match the following: [5]

Compound	Formula
1. Aluminate	(a) KOH
2. Chromate	(b) $CaCO_3$
3. Caustic Potash	(c) CrO_4^{-2}
4. Lime stone	(d) SiO_2
5. Silica	(e) AlO_2^{-2}

(iii) Fill in the blanks: [5]

(a) Pollutants such as NO_2, SO_2 and SO_3 dissolved in the moisture of air are the cause of _____.

(b) Excessive release of carbon dioxide in the atmosphere is the cause of _____ effect which produces global warming.

(c) The ozone layer prevents the harmful _____ radiation of the sun from reaching the earth.

(d) Decrease of the concentration of ozone in the stratosphere is the cause of formation of _____ holes.

(e) Ozone depletion is mainly caused by the active _____ atoms generated from CFC in the presence of UV radiation.

(iv) Find the valency of the given elements: [5]

(a) An element A atomic number 7 mass numbers 14

(b) B electronic configuration 2,8,8

(c) C electrons 13, neutrons 14

(d) D Protons 18 neutrons 22

(e) E Electronic configuration 2,8,8,1

(v) [5]

(a) Fill in the blanks.

1. K = °C + _____
2. 1 dm3 = _____cm3
3. 1 torr = _____mm of Hg

(b) Define:

1. Boyles' law
2. Charles' law

SECTION-B

(Attempt any four questions)

Question 3

(i) Which of the following changes are endothermic or exothermic? [2]

(a) Dissolution of quick lime in water

(b) Dissolution of ammonium chloride in water

(ii) What are physical and chemical tests for water? [2]

(iii) [3]

(a) Which of the following is true/false? If the answer is false, then explain the correct answer.

1. The valency of an element with atomic number 3 is 3.
2. The ionisation energy tends to increase as one move from left to right across a period.

(b) Name any one pollutant, its origin, and its harmful effect.

(iv) Name the following: [3]

(a) Two metals that react with very dilute nitric acid to liberate hydrogen.

(b) A salt that is insoluble in all mineral acids.

(c) A gas having a rotten egg smell.

Question 4

(i) Balance the following reactions: [2]

(a) $NH_3 + Cl_2 \rightarrow NH_4Cl + N_2$

(b) $CaOCl_2 + NH_3 \rightarrow CaCl_2 + N_2 + H_2O$

(ii) Electrovalent compounds have high melting and boiling points, while covalent compounds have low melting and boiling points. [2]

(iii) What are stalagmites and stalactites? How are they formed? [3]

(iv) Arrange the following as per the instructions given in the brackets: [3]

(a) Cs, Na, Li, K, Rb (increasing order of metallic character).

(b) Mg, Cl, Na, S, Si (decreasing order of atomic size).

(c) Cl, F, Br, I (increasing order of electron affinity)

Question 5

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

(ii) Calculate the percentage of phosphorus in $Ca_3 (PO_4)_2$. [2]

(iii) From the knowledge of the activity series, name a metal that shows the following properties: [3]

(a) It reacts readily with cold water.

(b) It displaces hydrogen from hot water.

(c) It displaces hydrogen from dilute HCl.

(iv) A gas occupies a volume of 116 ml at 180°C and 8 atm. What will be the volume of the sample of the gas at STP? [3]

Question 6

(i) Answer the following questions in one word. [2]

(a) What is the charge on canal rays? b

(b) e/m ratio is constant in which rays?

(ii) How acid rains are formed? [2]

(iii) Complete and balance the following equations: [3]

(a) $Al + NaOH + H_2O \rightarrow$

(b) $Fe + HCl \rightarrow$

(c) $H_2S + Cl_2 \rightarrow$

(iv) A gas occupies 200 cm^3 at temperature 30°C and pressure 720 mm. Find the volume of the gas at 5°C and 740 mm of Hg. [3]

Question 7

(i) Give the names of the following compounds: [3]

(a) HClO

(b) $HClO_3$

(c) $HClO_4$

(ii) Explain why? [3]

(a) Water is a very good cooling agent to use in cooling systems.

(b) A solution always appears clear and transparent.

(c) Lakes and rivers do not suddenly freeze in the winters.

(iii) A gas of volume 22.4 L weighs 70 g at STP. Calculate the weight of the gas f it occupies a volume of 20 L at 27 °C and 700 mm Hg of pressure. [4]

Question 8

(i) Name the following. [2]

(a) An alkali metal in period 3 and halogen in period 2.

(b) The noble gas with 3 shells.

(ii) Convert the following on the kelvin scale: [2]

(a) 100°C

(b) 20°C

(c) -273°C

(d) 0°C

(iii) Give the electron structure of the following compounds. [3]

(a) Magnesium chloride

(b) Calcium chloride

(c) Ethyne

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

Solution

SECTION A

Solution 1

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

Solution 2

(i)

(a)

Element	Group	Period	Element Configuration		
			K	L	M
A	17	3	2	8	7

(b)

Metal	Non-metal	Inert gas
B	A	E
	B	
	C	

(c)

Element	Element Configuration		
	K	**L**	**M**
A	2	8	7
B	2	8	1
C	2	4	__
D	2	6	__
E	2	8	8

(ii)

Column I	Column II
1. Aluminate	(e) AlO_2^{-2}
2. Chromate	(c) CrO_4^{-2}
3. Caustic Potash	(a) KOH
4. Lime stone	(b) $CaCO_3$
5. Silica	(d) SiO_2

(iii)

(a) acid rain
(b) greenhouse
(c) ultraviolet
(d) ozone
(e) chlorine

(iv)

(a) Element A
Atomic number = 7 = Number of electrons = 2,
Valency of A = 8 – 5 = 3
(b) Element
Electronic configuration 2, 8, 8
Valency of B = Zero
(c) Element C has 13 electrons
Electronic configuration = 2, 8,
Valency of C = 3
(d) Element
Protons = 18 = Electrons = 2, 8,
Valency of D = Zero
(e) Element
Electronic configuration = 2, 8, 8, 1

(v)

(a)

1. K = °C + __273_____
2. 1 dm3 = ___1000____cm3
3. 1 torr = __760_____mm of Hg

(b)

1. Boyle's law: At constant temperature, the volume of a given mass of a dry gas is inversely proportional to its pressure.
   $V \propto 1/P$ (At constant temperature)

2. Charles' law: At constant pressure, the volume of a given mass of a dry gas increases or decreases by 1/273 of its original volume at 0°C for each degree centigrade rise or fall in temperature.
   $V \propto T$ (At constant pressure)

SECTION-B

(Attempt any four questions)

Solution 3

(i)

(a) Exothermic reaction

(b) Endothermic reaction

(ii) Physical test for water: Water can be tested by the verification of any of its physical properties such as boiling point and freezing point.

Chemical test for water: On adding a few drops of water to white anhydrous copper sulphate, it changes to blue due to formation of hydrated copper sulphate ($CuSO_4.5H_2O$). On adding water to blue crystals of cobalt chloride, it turns pink ($COCl_2.6H_2O$).

(iii)

(a)

1. False. Valency of an element with atomic number 3 is 1.
2. True.

(b) Pollutants, its origin and harmful effect:

Pollutants	Origin	Harmful effect
Carbon monoxide (CO)	It is produced by incomplete combustion of fuels such as petrol, diesel and wood and also cigarettes.	It reduces oxygen carrying capacity of blood which causes retardation and dizziness.
Carbon dioxide (CO_2)	It is produced by burning of coal, oil and natural gases.	It reduces oxygen levels.
Chlorofluorocarbons (CFC)	It is released by refrigerators and air conditioning systems.	It causes reduction in the ozone layer that protects us from harmful ultraviolet rays of the Sun.

(iv)

(a) Magnesium and manganese

(b) Calcium sulphate

(c) Hydrogen sulphide

Solution 4

(i)

(a) $8NH_3 + 3Cl_2 \rightarrow 6NH_4Cl + N_2$

(b) $3CaOCl_2 + 2NH_3 \rightarrow 3CaCl_2 + N_2 + 3H_2O$

(ii) 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) In some limestone caves, conical pillar-like objects hang from the roof and some rise from the floor. These are formed by water containing dissolved calcium hydrogen carbonate continuously dropping from the cracks in the rocks. Release of pressure results in the conversion of some hydrogen carbonate to calcium carbonate.

$Ca(HCO_3)_2 \rightarrow CaCO_3 + CO_2 + H_2O$

This calcium carbonate little by little and slowly deposit on both roof and floor of the cave.

The conical pillar which grows downwards from the roof is called stalactite and the one which grows upward from the floor of the cave is called stalagmite.

These meet after a time. In a year, some grow less than even a centimetre, but some may be as tall as 100 cm.

$CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$

$MgCO_3 + CO_2 + H_2O \rightarrow Mg(HCO_3)$

If the water flows over beds of gypsum ($CaSO_4.2H_2O$), a little bit of gypsum gets dissolved in water and makes it hard.

(iv)

(a) $Li < Na < K < Rb < Cs$

(b) $Na > Mg > Si > S > Cl$

(c) $I < Br < Cl < F$

Solution 5

(i) 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.

(ii) Relative molecular mass of $Ca_3(PO_4)_2$

$= (40.07 \times 3) + (30.9 \times 2) + (16 \times 8)$

$= 120.21 + 61.8 + 128$

$= 310.01$

310.01 g $Ca_3(PO_4)_2$ contains 61.8 g P.

(iii)

(a) Sodium

(b) Magnesium

(c) Zinc

(iv) Given:

$T_1 = 180 + 273 = 453$ K

$P_1 = 8$ atm

$V_1 = 116$ ml

At STP,

$T_2 = 273$ K

$P_2 = 1$ atm

$V_2 = ?$

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

$$V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2}$$

$$= \frac{8 \times 116 \times 273}{453 \times 1}$$

$$V_2 = 559.25 \text{ ml}$$

The volume of the gas at STP is 559.25 ml.

Solution 6

(i)

(a) Positive

(b) Cathode rays

(ii) Acid rain refers to rain which has pH less than 5.6. It is mainly caused by atmospheric pollutants.

Natural sources: Bacterial decomposition, forest fires, volcanic eruptions.

Man-made sources: Industries and smelting plants, automobile exhausts, power plants etc.

Oxides of nitrogen and sulphur interact with water vapour in presence of sunlight in the atmosphere to form nitric acid and sulphuric acid mist respectively. This mist remains as vapours at high temperatures and condenses at low temperatures. These acid mix with rain (snow or fog) and fall down on the Earth resulting in acid rain.

(iii)

(a) $2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$

(b) $Fe + 2HCl \longrightarrow FeCl_2 + H_2$

(c) $H_2S + Cl_2 \longrightarrow 2HCl + S$

(iv) Given:

$T_1 = 30 + 273 = 303$ K

$P_1 = 720$ mm of Hg

$V_1 = 200\ cm^3$

$T_2 = 5 + 273 = 278$ K

$P_2 = 740$ mm of Hg

$V_2 = ?$

We know,

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

$$V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2}$$

$$= \frac{720 \times 200 \times 278}{303 \times 740}$$

$$V_2 = 178.53 cm^3$$

Volume of the gas will be 178.53 cm_3

Solution 7

(i)

(a) Hypochlorous acid

(b) Chloric acid

(c) Perchloric acid

(ii)

(a) Water is an excellent liquid to use in cooling systems because of its high specific heat.

(b) A water- soluble solid disappears in a solution where the solvent is water, and water has the property of being clear and transparent. So, the solution is also clear and transparent.

(c) Lakes and rivers do not freeze suddenly in winters because of the high specific latent heat of solidification, i.e., the amount of heat released when 1 g of water solidifies to form 1 g of ice at 0°C. It is about 336 J/g or 80 cal/g.

(iii)

(a) Given:

$T_1 = 27°C$

$= 27 + 273$

$T_1 = 300$ K

$V_1 = 20$ L

P1 = 700 mm Hg

$T_2 = 37°C$

$P_2 = 760$ mm Hg

$V_2 = ?$

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

$$\frac{700\times20}{300}=\frac{760\times V_2}{273}$$

$$V_2=\frac{91\times7}{76}=\frac{637}{38}=16.76\text{L}$$

The volume of the gas will be 16.76 L

(b) 22.4 liters of the gas at STP weighs = 70 g

16.76 liters of the gas at STP weighs = 16.76 × 70 / 22.4 = 52.38 g

Solution 8

(i)

(a) Na and F alkali metals are present in period 3 and halogen in period 2.

(b) Argon gas have 3 shells.

(ii) We know,

0°C = 273 K

(a) 100°C =

100 + 273= 373 K

(b) 20°C

20 + 273 = 293 K

(c) -273 °C

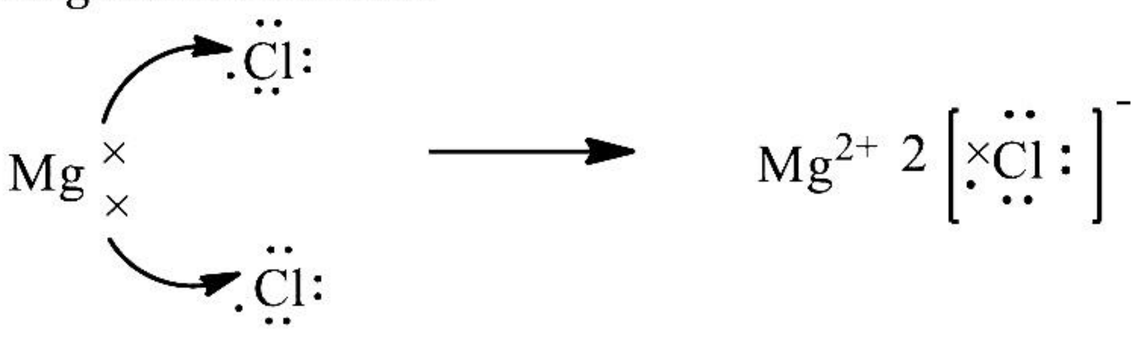
-273 + 273 = 0 K

(d) -40°C

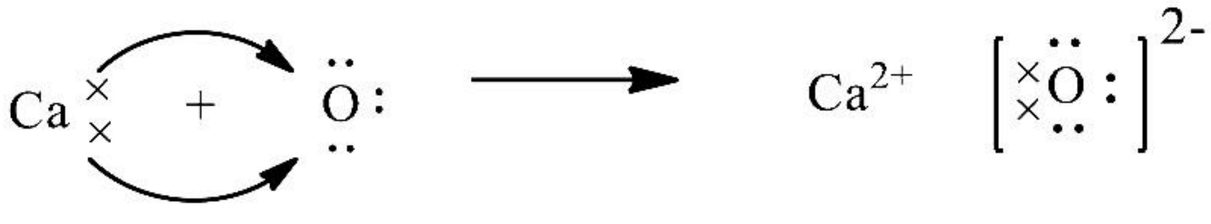
-40 + 273 = 233 K

(iii)

(a) Magnesium chloride



(b) Calcium chlorid



(c) Ethyne

(iv) 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.