ICSE 2025 EXAMINATION

Sample Question Paper - 2

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

(ii) The reaction between iron filings and sulphur powder is an example of:
- (a) Combination reaction
- (b) Decomposition reaction
- (c) Redox reaction
- (d) Endothermic reaction

(iii) Methylated spirit is used as a solvent to dissolve:
- (a) Phosphorus
- (b) Chlorophyll
- (c) Sulphur
- (d) All the above

(iv) Which is the nearest noble gas of oxygen atom?
(a) Argon
(b) Xenon
(c) Helium
(d) Neon

(v) **Assertion (A)**: Helium is highly reactive towards atmospheric oxygen.
Reason (R): Group 18 or zero group elements are called noble gases.
(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 the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

(vi) The atomic number of an element is 20. In modern periodic table, this element is placed in:
(a) 2^{nd} period
(b) 4^{th} period
(c) 1^{st} period
(d) 3^{rd} period

(vii) Which of the following metals is used in the laboratory preparation of hydrogen gas?
(a) Lead
(b) Sodium
(c) Aluminium
(d) Zinc

(viii) Impurities can be removed from hydrogen by passing it through:
(a) Lead chloride solution
(b) Lead iodide solution
(c) Silver nitrate solution
(d) Silver chloride solution

(ix) Which one of the following pollutants is suspended solids of smoke, dust, and vapour?
(a) Ozone
(b) Lead
(c) Chlorofluorocarbon
(d) Suspended particulate matter

(x) On moving down the group the atomic radii:
(a) Remains constant
(b) increases
(c) decreases
(d) first increases then decreases

(xi) **Assertion (A)**: Percentage of nitrogen in urea is 46.67%.
Reason (R): Percentage composition is the relative proportion of each element present in a compound, expressed as a percentage of the compound's total mass.
(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 of the following is a deliquescent salt?
(a) $MgCl_2$
(b) Na_2CO_3
(c) $MgSO_4$
(d) Na_2SO_4

(xiii) The graph of variation in volume (V) plotted against pressure (P) at a constant temperature is:
(a) Hyperbolic
(b) Straight line passing through origin
(c) Straight line parallel to the X-axis
(d) Parabolic

(xiv) The valency of Fe in FeO is:
(a) +1
(b) +2
(c) +3
(d) +2 and +3

(xv) Richa heated a brown substance in the air which turned black forming substance B. What would be substances A and B?
(a) A = Fe, B = FeO
(b) A = Ca, B = CaO
(c) A = Cu, B = CuO
(d) A = Mn, B = MnO

Question 2

(i) [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

(ii)

(a) Deduce the molecular formula of the following salts: [3]

A. Potassium bisulphide

B. Sodium nitrite

C. Calcium carbonate

(b) What is the valency of the underlined element in the following compounds? [2]

A. $Na\underline{AlO_2}$

B. $Fe(\underline{NO_3})_2$

(iii) Fill in the blanks: [5]

(a) Sulphur trioxide reacts with water vapour to form _____.

(a) Ozone is found in the upper layer of the atmosphere called _____.

(b) The full form of CFC is _____.

(c) Ozone absorbs the harmful _____ rays coming from the Sun.

(d) Excess accumulation of greenhouse gases is causing further warming of the Earth which results in _____.

(iv) The description of atomic particles of two elements X and Y is given below: [5]

	X	Y
Protons	8	8
Neutrons	8	9
Electrons	8	8

(a) What is the atomic number of Y?

(b) What is the mass number of X?

(c) What is the relation between X and Y?

(d) Which element/elements do they represent?

(e) Write the electronic configuration of X?

(v) State the type of reaction: [5]

(a) $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

(b) $Zn(NO_3)_2 + 2NaOH \rightarrow Zn(OH)_2 + 2NaNO_3$

(c) $(NH_4)_2Cr_2O_7 \rightarrow N_2 + 4H_2O + Cr_2O_3$

(d) $2Na + Cl_2 \rightarrow 2NaCl$

(e) $2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$

SECTION-B

(Attempt any four questions)

Question 3

(i) Write a note on greenhouse effect. [2]

(ii) What are displacement reactions? Explain with an example. [2]

(iii) Define the following: [3]
- (a) Solution
- (b) Crystallisation
- (c) Hard water

(iv) State whether the given statements are true or false. [3]
- (a) In the long form of the periodic table, the elements are arranged in the ascending order of atomic mass number.
- (b) The number of shells is equal to the group number from which the element belongs.
- (c) Alkali metals are present in Group 1 of the periodic table.

Question 4

(i) Explain below two characteristics of chemical reaction with example: [2]
- (a) Formation of precipitate
- (b) Change of state

(ii) Write differences between Dalton's Atomic Theory and Modern Atomic Theroy. [2]

(iii) Explain why: [3]
- (a) Water is an excellent liquid to use in cooling systems.
- (b) A solution is always clear and transparent.
- (c) Lakes and rivers do not suddenly freeze in the winters.

(iv) What is meant by kinetic theory of gases? Write two postulates. [3]

Question 5

(i) Deduce the molecular formula of the following: [2]

(a) Calcium nitrate

(b) Sodium chloride

(ii) Give reason: In the manufacture of ammonia molybdenum is added. [2]

(iii) How to prepare hydrogen using acid and metals. Write the reaction of acids with below metals. [3]

(a) Mg

(b) Al

(c) Zn

(iv) Complete the following reaction with balanced equation. Write type of the reaction. [3]

(a) $CuCO_3 \xrightarrow{\Delta}$

(b) $Zn(NO_3)_2 \xrightarrow{\Delta}$

(c) $AgOH \xrightarrow{\Delta}$

Question 6

(i) What are isobars? Explain with an example. [2]

(ii) Tanvi was feeling dull and cold. Her Father told her to eat something so that she would feel energetic and warm. Tanvi wondered how the digestion of food would make her feel warm from the inside. Could you explain? [2]

(iii) The volume occupied by a certain gas was found to be 5.6 dm3 at 2 atmospheric pressure. If the pressure is increased by 20%, find the new volume of the gas. [3]

(iv) Why is the position of Hydrogen in the periodic table anomalous? [3]

Question 7

(i) Give the valency and the formulae of the following radicals: [3]

(a) Nitride

(b) Bicarbonate

(c) Sulphate

(ii) Explain the physical properties of water based on the below points. [3]

(a) Latent heat of fusion of ice

(b) Latent heat of vapourisation of water

(iii) At 17°C, a certain amount of a petrol occupies a capacity of 0.4 liter. What temperature should it be heated to so that its volume is (a) doubled, (b) reduced to half with the pressure remaining constant? [4]

Question 8

(i) [2]

(a)Name the incomplete period.

(b)What common feature is seen at the end of the 2^{nd} and 3^{rd} period?

(ii) 100 cm^3 of a gas at 27°C is cooled to 20°C at constant pressure. Calculate the volume of gas at 20°C. [2]

(iii) Explain with balanced chemical reaction of reaction of hydrogen with: [3]

(a) Chlorine

(b) Potassium

(c) Fe_2O_3

(iv) Write effects of global warming. [3]

Solution

SECTION A

Solution 1

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

Solution 2

(i)

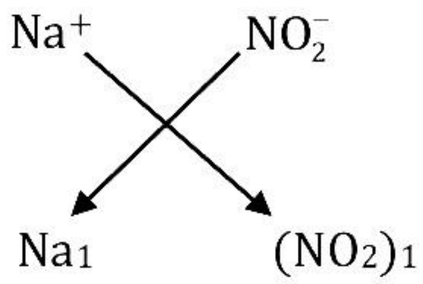
Column A	Answers
(a) Element short by 1 electron in octet	(v) Halogens
(b) Highly reactive metals	(iii) Alkali metals
(c) Non-reactive elements	(ii) Noble gases
(d) Elements of Groups 3 to 12	(i) Transition elements
(e) Radioactive elements	(vi) Actinides
(f) Elements with 2 electrons in the outermost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

(ii)

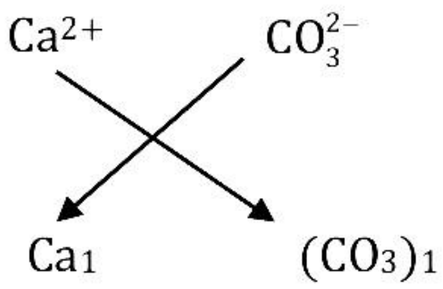
(a) K^+ HS^-

K_1 $(HS)_1$

$= KHS$

(b) 

$= NaNO_2$

(c) 

$= CaCO_3$

(b)

A. -1

B. -1

(iii)

(a) Sulphuric acid
(b) Stratophere
(c) Chlorofluorocarbons
(d) Ultraviolet
(e) Global warming

(iv)

(a) Atomic number of Y = no. of electrons/protons = 8
(b) Mass number of X = no. of protons + no. of neutrons = 8 + 8 = 16
(c) X and Y are isotopes because they have the same atomic number.
(d) X and Y represent oxygen because oxygen has atomic number 8.
(e) Atomic number of oxygen is 8. Therefore, electronic configuration will be 2, 6.

(v)

(a) Redox reaction
(b) Double decomposition–precipitation
(c) Thermal decomposition
(d) Synthesis
(e) Simple displacement

SECTION-B

(Attempt any four questions)

Solution 3

(i) The greenhouse effect is the process of heating up the Earth's atmosphere due to trapping of the Sun's infrared radiations reflected from the Earth's surface by gases like carbon dioxide, water vapour, nitrous oxide, ozone, and methane which are called greenhouse gases.

These gases act as a thermal blanket and do not allow the heat energy to escape, thus causing the heating up of the atmosphere. It is due to the greenhouse effect of gases like carbon dioxide that the planet Earth is ideally warm for the survival of life on it. However, excess accumulation of greenhouse gases is causing further warming of the earth. This is called global warming which could be hazardous.

(ii) Displacement reactions are those reactions in which one element takes the place of another element in a compound. The more reactive element displaces the less reactive element from its compound.

$AB + C \rightarrow AC + B$

Example:

$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

Here, zinc displaces copper from copper sulphate solution to form zinc sulphate and copper.

(iii)

(a) Solution: A homogeneous mixture of two or more substances which are chemically non-reacting, whose composition can be varied within certain limits is called a solution.

(b) Crystallisation: It is the process by which crystals of a substance separate out on cooling its hot saturated solution

(c) Hard water: Water is said to be hard when it does not readily form lather with soap.

(iv)

(a) False. The correct statement is as follows:

In the long form of the periodic table, the elements are arranged in the ascending order of atomic number.

(b) False. The correct statement is as follows:

The number of shells is equal to the period number from which the element belongs.

(c) True.

Solution 4

(i) Characteristics of chemical reaction:

(a) Formation of precipitate: Some chemical reactions are characterised by the formation of a precipitate. The precipitate is an insoluble solid substance.

(b) Change of state: In some reactions, a change of a state is observed. The reaction starts with solid or liquid reactants and ends up with gaseous products and *vice versa*.

$NH_3(g) + HCl(g) \rightleftharpoons NH_4Cl(s)$

(ii)

	Dalton's Atomic Theory	**Modern Atomic Theory**
1.	Atoms are indivisible particles.	Atoms are divisible into sub-atomic particles such as protons, neutrons and electrons.
2.	Atoms can neither be created nor destroyed.	Atoms can be created and destroyed by nuclear fusion and fission.

(iii)

(a) Water is an excellent liquid to use in cooling systems because of its ability to absorb large quantities of heat as a cooling agent.

(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 always 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.

(iv) Any substance whether solid, liquid or gas is made up of tiny particles (atoms, molecules or ions) which are in constant motion. This is called the kinetic theory of matter.

The Postulates of the kinetic theory of gases

1. Composition of matter
   Matter is composed of small particles—atoms, molecules and ions.
2. Inter-particle space
   The particles have spaces between them. These spaces are referred to as inter-particle/inter-molecular spaces.

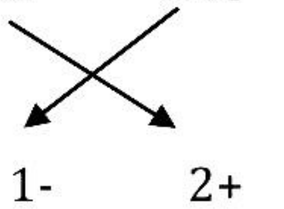
Solution 5

(i)

(a) Calcium nitrate

Symbol Ca NO_3

Valency: Ca^{2+} NO_3^{1-}

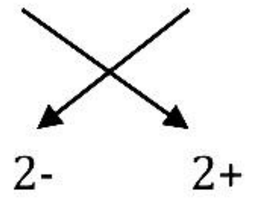


Formula: **$Ca(NO_3)_2$**

(b) Sodium chloride

Symbol Na Cl

Valency: Na^{2+} Cl^{2-}



Formula: Na_2Cl_2 = **NaCl**

(ii) Substances which influence the rate of a chemical reaction by improving the efficiency of the catalyst are called promoters. In the manufacture of ammonia, iron acts as a catalyst. Molybdenum is added and functions as a promoter by improving the efficiency of iron.

$$N_2 + 3H_2 \xrightarrow[\text{molybdenum}]{\text{Iron+}} 2NH_3$$

(iii) General methods of preparation of hydrogen from the reaction of metals with acids:

- Hydrogen is displaced from acids when the latter reacts with some metals (more reactive than hydrogen). The extent to which this reaction occurs for a given metal also gives the activity series of metals.
- The metals placed near the top of the series are the most reactive, while those placed near the bottom are the least reactive.
- When dilute hydrochloric acid or dilute sulphuric acid reacts with the metals above hydrogen in the activity series, they produce hydrogen. However, the metals below hydrogen in the activity series do not.

(a)	Magnesium	$Mg + 2HCl \rightarrow MgCl_2 + H_2\uparrow$
(b)	Aluminium	$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2\uparrow$
(c)	Zinc	$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$

(iv)

(a) $CuCO_3 \xrightarrow{\Delta} CuO + CO_2\uparrow$ (Thermal decomposition of metal carbonates)

(b) $2Zn(NO_3)_2 \xrightarrow{\Delta} 2ZnO + 4NO_2 + O_2\uparrow$ (Thermal decomposition of metal nitrates)

(c) $4AgOH \xrightarrow{\Delta} 4Ag + 2H_2O + O_2\uparrow$ (Thermal decomposition of metal hydroxides)

Solution 6

(i) Isobars are atoms of different elements with the same mass number but different atomic numbers. For example, two elements calcium ${}^{40}_{20}Ca$ and argon ${}^{40}_{18}Ar$. The number of electrons in these atoms is different, but the mass number of both these elements is 40. That is, the total number of nucleons is the same in the atoms of this pair of elements.

(ii) Digestion of food by our body is an example of a decomposition reaction.
The starch present in the food we eat decomposes into glucose and sugar. Proteins undergo decomposition to from amino acids. Proteins undergo decomposition to form amino acids. Fats and oils are decomposed to fatty acids and finally oxidized by respiration into carbon dioxide and water.

$$\text{Starch} \xrightarrow{\text{Enzymes}} \text{Glucose} \xrightarrow{[O]} CO_2 + H_2O + \text{Energy}$$

(iii) Initial volume of gas $V_1 = 5.6\ dm^3$

Initial pressure of gas $P_1 = 2$ atm

The 20% of initial pressure $= 2 \times \frac{20}{100} = \frac{4}{10} = 0.4$

Final pressure $P_2 = 0.4 + 2 = 2.4$ atm

Final volume $V_2 = ?$

$P_1V_1 = P_2V_2$

$2 \times 5.6 = 2.4 \times V_2$

$V_2 = \frac{5.6 \times 2}{2.4} = 4.67\ dm^3$

(iv) Hydrogen is the first element in the periodic table. Its atomic number is 1.

- It is has only one electron in its outermost (valence) shell. Hence, it belongs to the first group and the first period of the periodic table. Though the properties of hydrogen should be similar to those of the other members of the 1st group, but this is not the case.
- This is because some of the properties of hydrogen resemble the properties of group IA elements (Alkali metals) and some of it resembles the properties of Halogens (VIIA), so hydrogen was put at the top of the periodic table so that the symmetry of the modern periodic table is not disturbed,

Solution 7

(i)

	Radicals	Formula	Valency
(a)	Nitride	N^{3-}	−3
(b)	Bicarbonate	HCO_3^-	−1
(c)	Sulphate	SO_4^{2-}	−2

(ii)

(a) Latent heat of fusion of ice:

- The amount of heat energy required by ice to change into water is called the latent heat of fusion of ice.
- The latent heat of fusion of ice is 336 J/g or 80 cal/g.
  In the reverse process, 336 joules of heat is released when 1 g of water solidifies to form 1 g of ice at 0°C.

(b) Latent heat of vapourisation of water:

- The energy required to change water into its vapour at its boiling point without any change in temperature is called the latent heat of vaporisation of water.
- The latent heat of vaporisation of water is 2260 J/g or 540 cal/g.
- In the reverse process, 2260 joules of heat is released when 1 g of steam condenses to form 1 g of water at 100°C.

(iii)

(a) $V_1 = 0.4$ L

$V_2 = 0.4 \times 2$L

$T_1 = 17°C\ (17 + 273) = 290$ K

$T_2 = ?$

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

$$\frac{0.4}{290} = \frac{0.8}{T_2}$$

$$T_2 = 290 \times 2 = 580$$

$$T_2 = 580 - 273 = 307\,°C$$

(b) $V_1 = 0.4$ L

$V_2 = 0.4 / 2 = 0.2$ L

$T_1 = 17°C\ (17 + 273) = 290$ K

$T_2 = ?$

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

$$\frac{0.4}{290} = \frac{0.2}{T_2}$$

$$T_2 = 145\,K$$

$$T_2 = 145 - 273 = -128\,°C$$

Solution 8

(i)

(a) Seventh period is an incomplete period.

(b) At the end of 2nd and 3rd period, there is a presence of an inert gas having eight electrons in the valence shell having stable electronic configuration following octet rule.

(ii) Initial volume of gas (V_1) = 100 cm^3

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

Final volume (V_2) =

Final temperature (T_2) = 20 + 273 = 293 K

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

$$\frac{100}{300} = \frac{V_2}{293}$$

$$V_2 = \frac{100 \times 293}{300}$$

$$= 97.66\ cm^3$$

(iii)

(a) Hydrogen and chlorine (in their equal volumes) react slowly in diffused sunlight but reacts explosively in direct sunlight. A spontaneous reaction takes place with the release of a large amount of energy.

$H_2 + Cl_2 \xrightarrow{\text{Sunlight}} 2HCl$

(b) Dry hydrogen when passed over heated metals, such as Na, K and Ca, reacts to give their corresponding hydrides. The hydride formed further reacts with water to form hydrogen gas.

$2K + H_2 \rightarrow 2KH$

(c) Hydrogen reduces metal oxides to give metals; i.e. hydrogen is a reducing agent. Thus, metal is liberated from metal oxide when hydrogen gas is passed over strongly heated metal oxide. Colour changes from brown to grey as metal oxide changes to metal.

$Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$

(iv) Effects of Global Warming

1. Due to global warming, the ice at the poles of the Earth starts melting. This could cause a rise in the sea level which could further result in flooding of coastal areas. Even a 0.5 m to 1.5 m rise in the sea level can cause flooding of coastal cities.
2. It is alarming and we need to take essential measures to control the rise in the proportion of carbon dioxide and other greenhouse gases.
3. Global warming can lead to change in rain pattern as well as shift in crop zones. For example, wheat producing zones will shift from Russia and Canada to less fertile polar regions.