COMPETENCY-FOCUSED PRACTICE QUESTIONS

ICSE – CLASS X

CHEMISTRY

PREFACE

With a growing emphasis on competency-based education globally, the educational landscape in India has also steered towards high-quality learning experiences that allow learners to incorporate critical thinking and problem-solving approaches. This approach goes beyond rote memorisation and focuses on developing the skills and knowledge that students need to apply in their real-world scenarios.

The Council for the Indian School Certificate Examinations (CISCE), as a national-level progressive examination board, has taken several steps to infuse competency-based education in CISCE schools through teacher capacity-building on item development for competency-based assessments and the incorporation of competency-focused questions at the ICSE and ISC levels from the examination year 2024.

To further facilitate the adoption of competency-based assessment practices in schools and to support teachers and students towards the preparation for attempting higher-order thinking questions in future board examinations, Item Banks of **Competency-Focused Practice Questions** for selected subjects at the ICSE and ISC levels have been developed. This Item Bank consists of a rich variety of questions, both objective and subjective in categories, aimed at enhancing the subject-specific critical and analytical thinking skills of the students.

In this Item Bank, each question is accompanied by the topic and cognitive learning domain/s that it intends to capture. The cognitive domains reflected in these questions include understanding, analysis, application, evaluation and creativity, along with some questions of the higher-order recall domain. The Answer Key at the end presents the possible answers to a given question, but it is neither limiting nor exhaustive.

These practice questions are also meant to serve as teacher resources for classroom assignments and as samplers to develop their own repository of competency-focused questions. Apart from offering a good practice of higher-order thinking skills, engaging with these questions would allow students to gauge their own subject competencies and use these *assessments for learning* to develop individual learning pathways.

During the development of this Item Bank, a large pool of questions was prepared by a team of experienced CISCE teachers. The questions that were finalised by the internal and external reviewers as being higher-order competency-focused questions have been collated in this item bank.

I acknowledge and appreciate all the ICSE and the ISC subject matter experts who have contributed to the development and review of these high-quality competency-focused questions for CISCE students.

We are hopeful that teachers and students will utilise these questions to support their teaching-learning processes.

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Dr. Joseph Emmanuel
Chief Executive & Secretary
CISCE

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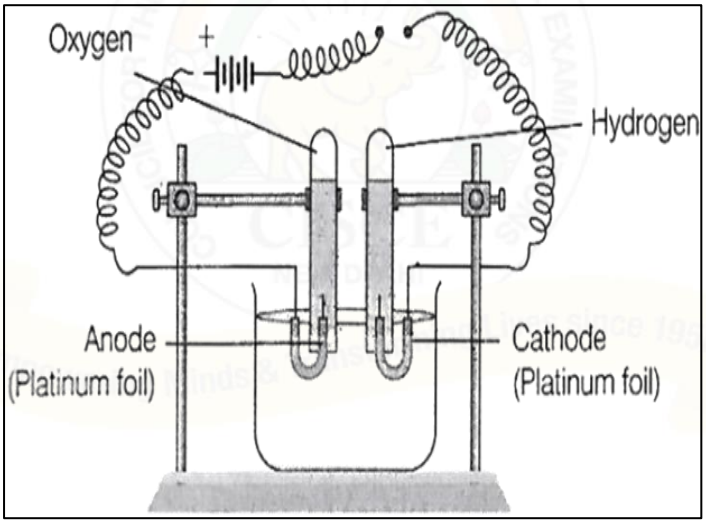
COMPETENCY-FOCUSED PRACTICE QUESTIONS

ICSE - CLASS X

Chemistry

I: Multiple Choice Questions (1 Mark Each)

S.No.	Questions
1.	*[Analytical Chemistry]* Ravi was asked to identify the cation present in the salt solution. He added one of the reagents given below and got a reddish-brown precipitate. The reagent that he used is: (a) Silver nitrate solution (b) Barium chloride solution (c) Ammonium hydroxide (d) Calcium chloride solution **[Understanding]**
2.	*[Study of Compounds]* Which metal does not react with HCl to form a colourless, odourless gas which burns with a pop sound? (a) Ca (b) Mg (c) Cu (d) Zn **[Recall & Understanding]**
3.	*[Study of Compounds]* Prateek added warm water to magnesium nitride, and a colourless gas evolved, which, when tested with phenolphthalein, turned it pink. The gas evolved is: (a) Carbon dioxide (b) Ammonia (c) Nitrogen (d) Hydrogen chloride **[Understanding]**

S.No.	Questions
4.	*[Organic Chemistry]* Which of the following statements about ethane is false? (a) It is a saturated hydrocarbon. (b) It undergoes a substitution reaction. (c) It is a gas at ordinary temperatures. (d) It has a triple bond between the carbon atoms. **[Recall & Understanding]**
5.	*[Metallurgy]* Thermite mixture is used to weld the broken ends of the iron girders. This mixture consists of ferric oxide and aluminium powder, which, when heated, produces molten iron. In this reaction, the aluminium powder acts as a/an _____ agent. (a) oxidising (b) reducing (c) dehydrating (d) corroding **[Application]**
6.	*[Electrolysis]*  The above diagram represents the electrolysis of acidulated water. The reaction occurring at the anode is: (a) $H_2SO_4 \rightarrow 2H^+ + SO_4^{2-}$ (b) $H_2O \rightarrow H^+ + OH^-$ (c) $H^+ + e^- \rightarrow H$, $2[H] + 2[H] \rightarrow H_2$ (d) $OH^- - e^- \rightarrow OH$, $[4OH] \rightarrow 2H_2O + O_2$ **[Recall & Understanding]**

S.No.	Questions
7.	*[Period Properties and Variations of Properties]*

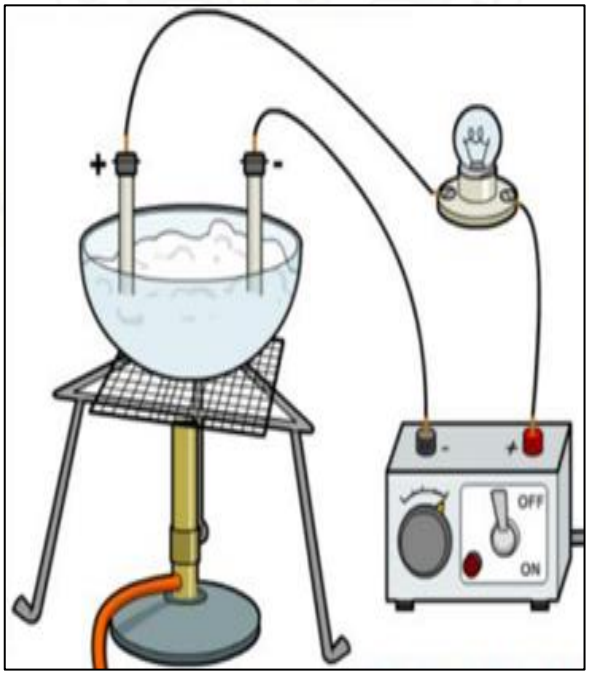
Group Numbers	**IA 1**	**IIA 2**	**IIIA 13**	**IVA 14**	**VA 15**	**VIA 16**	**VIIA 17**	**VIIIA 18**
	Li		D			O	J	Ne
	A	Mg	E	Si		H	K	
	B	C		F	G			L

With reference to the portion of the periodic table given above, identify the element having the largest atomic size:

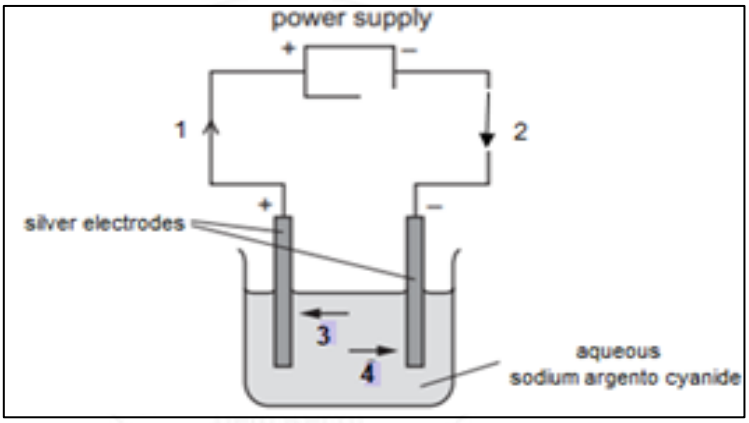
(a) Li
(b) B
(c) K
(d) L **[Understanding]**

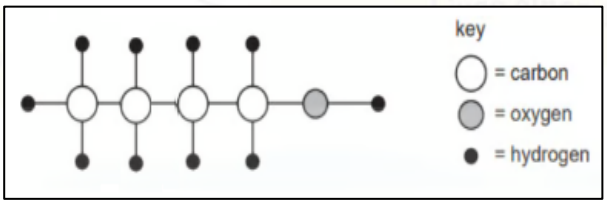
8. *[Electrolysis]*

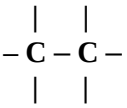
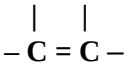
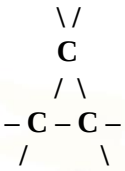
The picture given below shows an apparatus that a teacher used for demonstrating the properties of ionic substances. The teacher heats a sample of lead bromide in a crucible which contains two electrodes which are part of the circuit shown. The bulb does not light up. What is the best explanation for this?

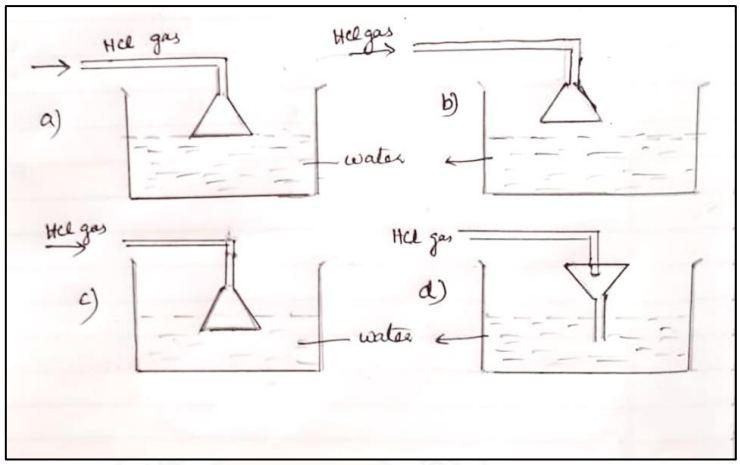


(a) The circuit is complete.
(b) Molten lead bromide does not conduct electricity.
(c) The sample of lead bromide was not heated up to the melting point by the teacher.
(d) The DC power supply was set up correctly. **[Analysis]**

S.No.	Questions
9.	*[Period Properties and Variations of Properties]* Element Y is in Group IIA of the Periodic Table. Y reacts with element Q to form an ionic compound. Which equation shows the process that takes place when Y forms ions? (a) $Y + 2e^- \rightarrow Y^{2+}$ (b) $Y - 2e^- \rightarrow Y^{2-}$ (c) $Y + 2e^- \rightarrow Y^{2-}$ (d) $Y - 2e^- \rightarrow Y^{2+}$ **[Understanding & Application]**
10	*[Electrolysis]* The diagram below shows a circuit used to electrolyse aqueous sodium argento cyanide. Which arrow indicates the movement of the silver ions in the electrolyte and of the electrons in the external circuit?  **Silver ions** **Electrons** (a) 3 1 (b) 3 2 (c) 2 4 (d) 4 1 **[Understanding & Application]**
11.	*[Mole Concept and Stoichiometry]* The relative atomic mass of nitrogen is 14, and that of hydrogen is 1. This means that (i)_____ of nitrogen has the same mass as (ii)_____ of hydrogen. **(i)** **(ii)** (a) An atom 28 molecules (b) An atom 7 molecules (c) A molecule 14 atoms (d) A molecule 7 atoms Which words correctly complete the gaps? **[Analysis]**

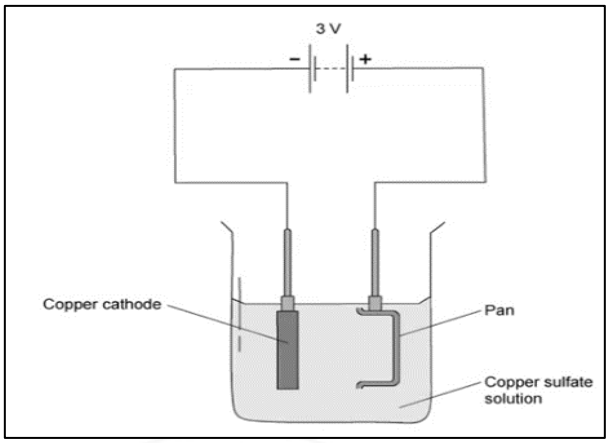
S.No.	Questions
12.	*[Study of Compounds]* A student reacts copper turnings with cold dilute nitric acid in a test tube. He tests the gas given off with moist red and blue litmus paper. What is the name of the gas that evolved and what is the final colour of the litmus paper? **Gas** **Final colour of the litmus paper** (a) NO No change in blue and red litmus paper (b) NO_2 Blue litmus turns red and no change in red litmus (c) N_2 No change in blue and red litmus paper (d) N_2O No change in blue and red litmus paper **[Understanding]**
13.	*[Chemical Bonding]* Which element forms a stable ion with the same electronic configuration as argon? (a) Magnesium (b) Fluorine (c) Chlorine (d) Sodium **[Recall & Understanding]**
14.	*[Organic Chemistry]*  The diagram below represents the molecule of an organic compound. What is the name of this compound? (a) Pentanol (b) Butanol (c) Butanoic acid (d) Pentanoic acid **[Understanding]**

S.No.	Questions
15.	*[Electrolysis]* When a compound was electrolysed using inert electrodes, the gas released at the anode made a glowing splinter rekindle. The electrolyte that will not produce such gas observation at the anode is: (a) diluted solution of NaCl. (b) concentrated solution of NaCl. (c) diluted solution of copper sulphate. (d) acidified water. **[Application]**
16.	*[Organic Chemistry]* Which of the following chains of hydrocarbons undergoes two steps of reactions to become saturated? (a)  (b)  (c)  (d)  **[Understanding & Analysis]**

S.No.	Questions
17.	*[Study of Compounds]* Given below are four different illustrations of preparing hydrochloric acid drawn by students. Which of these is the correct?  **[Evaluate]**
18.	*[Organic Chemistry]* When two organic compounds A and B react together in the presence of conc.H_2SO_4, a fruity smell evolved from one of the products. If A has the functional group [-O-H], which of the following stands for the functional group of B? (a) $-\overset{\overset{H}{|}}{C}=O$ (b) $-\overset{|}{C}=O$ (c) $-\overset{\overset{||}{O}}{C}-OH$ (d) $-O-$ **[Application & Analysis]**

S.No.	Questions
19.	*[Chemical Bonding]* Given below are four covalent compounds. (A) H_2O (B) CCl_4 (C) Cl_2 (D) NH_3 Which of the following represents the correct order when they are arranged in their increasing number of covalent bonds? (a) B < D <A < C (b) A < C < D < B (c) C < D < A < B (d) C < A < D < B **[Recall & Application]**
20.	*[Electrolysis]* The electrolytic cell used for the electrolysis of molten lead bromide is made of Silica. Which of the following properties of silica that is the reason for it not having much significance in the process of electrolysis? (a) Hard and strong (b) Non-conductor of electricity (c) Non- reactive (d) Withstands high temperature **[Understanding]**
21.	*[Organic Chemistry]* A distinctive reaction that takes place when ethanol is treated with acetic acid in the presence of concentrated sulphuric acid to give a fruity smell. P: The reaction is called esterification. Q: The reaction is called hydration. (a) Only P (b) Only Q (c) Both P and Q (d) Both P and Q are wrong **[Understanding]**
22.	*[Study of Acids, Bases and Salts]* The pH of the soil is tested, and for the better growth of crops, slightly alkaline soil is required. Which ion in the fertiliser will increase the alkalinity of the soil? (a) Hydronium ion (b) Hydroxyl ion (c) Hydrogen ion (d) Both hydroxyl and hydrogen **[Application]**

S.No.	Questions
23.	*[Chemical Bonding]* Ramu makes a detailed study on the values of electronegativity and the formation of compounds. Accordingly, he draws the following conclusion: The larger the electronegativity (EN) difference between the combining atoms, the more ionic bonds will form. If the EN difference is negligible, covalent bonds will form. So, which of the following values refers to covalent bonds? P: 3.0 and 3.0 Q: 0.9 and 3.0 (a) Only P (b) Only Q (c) Both P and Q (d) Neither P nor Q **[Application & Analysis]**
24.	*[Mole Concept and Stoichiometry]* 10g of magnesium carbonate reacts completely with excess dilute hydrochloric acid. What volume of carbon dioxide is formed at room temperature and pressure? [Mg=24, C=12, O=16] The equation for the reaction is: $MgCO_3 + 2HCl \rightarrow MgCl_2 + H_2O + CO_2$ (a) 2.8 dm^3 (b) 2.6 dm^3 (c) 2.2 dm^3 (d) 2.4 dm^3 **[Application]**

S.No.	Questions
25.	*[Electrolysis]* The diagram shown is a wrong attempt to electroplate a pan with copper:  Which of the following could have been done to copper plate a pan? (a) To change DC to AC. (b) To change the electrolyte from copper sulphate to cobalt sulphate. (c) Connect the pan to the negative electrode. (d) To induce a higher current. **[Application]**
26.	*[Metallurgy]* During the extraction of aluminium by Hall Heroult's process, the carbon rods are replaced continuously. This is because: (a) It minimises heat loss by radiation. (b) It enhances the mobility of ions. (c) The carbon anode is consumed. (d) It lowers the fusion point. **[Understanding]**

S.No.	Questions
27.	*[Study of Acids, Bases and Salts]* Which of the following observations correctly shows the action of indicator on sodium hydroxide solution? **[Application]**

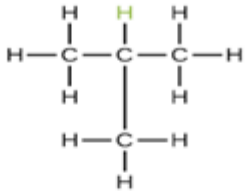
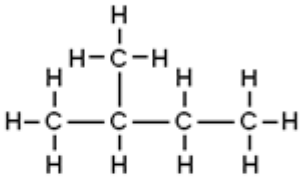
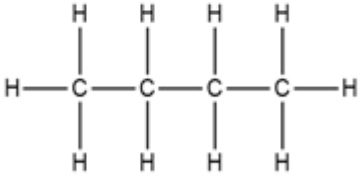
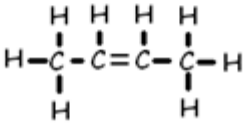
	Indicator	**methyl orange**	**phenolphthalein**
(a)	P	orange to yellow	remains colourless
(b)	Q	orange to pink	remains colourless
(c)	R	orange to yellow	colourless to pink
(d)	S	remains orange	remains pink

28. *[Electrolysis]*

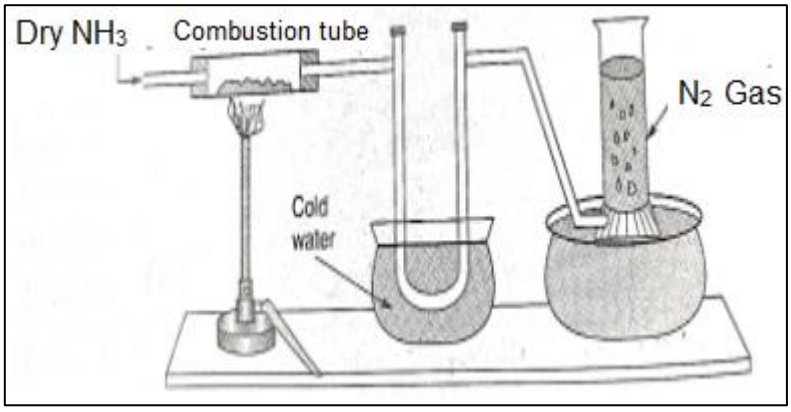
When electrolysis of molten lead bromide is carried out, the products formed at the respective electrodes are:

	At the positive electrode	**At the negative electrode**
(a)	Bromine	Lead
(b)	Bromine	Hydrogen
(c)	Lead	Bromine
(d)	Lead	Oxygen

[Application]

S.No.	Questions
29.	*[Organic Chemistry]* The following are the structural diagrams of certain hydrocarbons: (a)  (b)  (c)  (d)  Which two structures are related to each other? (a) A and B (b) B and C (c) C and D (d) A and C **[Recall & Application]**
30.	*[Chemical Bonding]* The electronic configuration of X is 2,8,6. It gains 'Y' electrons into its valence shell to attain the nearest noble gas electronic configuration and gets converted to an ion Z. X, Y, and Z, respectively, are: (a) Sodium, one, electropositive (b) Beryllium, two, electronegative (c) Oxygen, six, electronegative (d) Sulphur, two, electronegative **[Understanding & Application]**

S.No.	Questions
31.	*[Periodic Properties and Variations of properties]* Which of the following arrangements is INCORRECT as per the property stated against it? (a) Li > Be > N > O (Metallic character) (b) CI > F > Br >I (Electron gain enthalpy) (c) O^{2-} > F^- > Mg^{2+} >Na^+ (Ionic radii) (d) I > Br > CI > F (Number of shells) **[Analysis & Application]**
32.	*[Organic Chemistry]* Baking soda ($NaHCO_3$), when added to vinegar, evolves a gas. Which of these statements is true about the evolution of gas? I. It turns limewater milky. II. It extinguishes the burning splinter. III. It acts as a non-metallic oxide IV. It has a pungent odour. (a) I and IV (b) I and II (c) I, II and III (d) III and IV **[Recall & Understanding]**
33.	*[Electrolysis]* The statements below show the results when three metal strips, P, Q, and R, are placed in blue copper sulphate solution. P- Solution turns green. Q- Solution becomes colourless. R- Solution remains blue. Which of the following metals could be P, Q, and R? (a) P-Al, Q-Zn, R- Fe (b) P-Zn, Q-Fe, R- Ag (c) P-Fe, Q-Zn, R-Ag (d) P- Zn, Q-AI, R– Fe **[Application]**

S.No.	Questions
34.	*[Study of Compounds]*  Study the above diagram and choose the correct option related to the content given below: Compound X reacts with ammonia in the combustion tube, which leaves a residue Y. Identify X and Y, as well as the property Z of ammonia demonstrated in this particular reaction. (a) X= CuO, Y=black, Z = reducing property. (b) X=PbO, Y = yellow, Z=oxidising property. (c) X=CuO, Y =yellow, Z =oxidising property. (d) X=PbO, Y=black, Z=reducing property. **[Analysis]**
35.	*[Study of Compounds]* **Assertion (A):** Few drops of dilute acid is added to a solution of zinc sulphide, a colourless gas is formed with a rotten egg odour. **Reason (R)**: Gas formed does not turn moist lead acetate paper silvery black. (a) Both A and R are true. (b) A and R are true, but R is the correct explanation of A. (c) A is true, but R is not the correct explanation of A. (d) Both A and R are false. **[Recall & Understanding]**
36.	*[Metallurgy]* **Assertion (A):** Hall Heroult's process is used to get pure aluminium from its oxide. **Reason (R):** Aluminium generally is not found in aluminium oxide form. (a) Both A and R are correct. (b) A is correct, but R is not a true explanation of A. (c) A is correct, and R is a true explanation of B. (d) Both A and R are incorrect. **[Understanding]**

S.No.	Questions
37.	*[Organic Chemistry]* **Assertion (A):** Alkenes, alkynes and alkanes are examples of homologous series. **Reason (R):** Organic compounds of the homologous series have similar structures but different chemical properties. (a) Both A and R are true. (b) Both A and R are false. (c) A is true but R is not the correct explanation of A. (d) A is false but R is true. **[Recall & Understanding]**
38.	*[Mole Concept and Stoichiometry]* **Assertion (A)**: The atomic mass of oxygen is 16 a.m.u; therefore, its gram atomic mass is 16g. **Reason (R)**: The atomic mass of an element expressed in grams is called gram atomic mass. (a) A is true, and R is the correct explanation of A. (b) Both A and R are true, but R is not a true explanation of A. (c) Both A and R are false. (d) R is false, but A is a true explanation. **[Analysis & Application]**

II: Fill in the Blanks (1 Mark Each)

S.No.	Questions
39.	*[Mole Concept and Stoichiometry]* Fill in the blanks by choosing the correct options given in the brackets: An aqueous solution of gas X turns red litmus blue, so it must contain (i)_____ (hydrogen/ hydroxyl) ions. When this solution is added in excess to copper sulphate solution, it turns to (ii) _____ (deep blue/ pale blue) solution. Gas X is also a good (iii)_____(oxidising/reducing) agent, which in excess reacts with a greenish-yellow gas to form dense white fumes of (iv) _____ (hydrogen chloride/ammonium chloride). **[Understanding & Application]**
40.	*[Study of Compounds]* Ammonia can convert heated copper oxide to copper. This shows that ammonia is a _____ (reducing agent/oxidising agent). **[Understanding]**

S.No.	Questions
41.	*[Mole Concept and Stoichiometry]* The number of hydrogen atoms present in 1 mole of sulphuric acid and 1 mole of sulphurous acid are (X) and (Y), respectively. Relationship between X and Y is _____ (X=Y / cannot compare X and Y). **[Application]**
42.	*[Organic Chemistry]* Hydrocarbon X decolourises bromine in carbon tetrachloride, and hydrocarbon Y does not decolourise bromine water. Both of the compounds burn with a sooty flame. The molecular formula of X and Y is _____ (C_5H_{12} and C_4H_8 / C_5H_8 and C_4H_{10}). **[Understanding]**
43.	*[Organic Chemistry]* The number of chain isomers possible for an alkane with 5 carbon atoms are _____ (3 / 4). **[Application]**
44.	*[Chemical Bonding]* Cations are _____ (oxidised/ reduced) ions due to the _____(gain/loss) of electrons by the neutral atom. **[Understanding]**
45.	*[Organic Chemistry]* If a hydrocarbon has the formula of $C_{50}H_{98}$, then it is likely to undergo _____a/an (addition/ substitution) reaction, and the hydrocarbon is a/an _____ (saturated/ unsaturated hydrocarbon). **[Application]**
46.	*[Periodic Properties and Variations of properties]* The atomic size of Boron is 0.88 A^o, and that of nitrogen is 0.70 A^o. Nitrogen lies to the _____ (left/ right) of Boron. **[Application]**
47.	*[Electrolysis]* The _____ (higher/ lower) is the position of the cation in the electrochemical series, the greater the difficulty of it being discharged at the cathode. **[Understanding]**
48.	*[Study of Compounds]* The correct order of increasing volatility of the acids is _____. (a) $HCl < CH_3COOH < HNO_3$ (b) $CH_3COOH < HCl < HNO_3$ (c) $HNO_3 < HCl < CH_3COOH$ (d) $HCl < HNO_3 < CH_3COOH$ **[Understanding & Application]**

S.No.	Questions
49.	*[Metallurgy]* Nikita wanted to gift her friend a decorative piece that is quite hard and strong, doesn't get corroded and can be polished. She selected a statue that matched her criteria as it was made of an alloy whose main constituent was _____. (a) Cu (b) Al (c) Fe (d) Zn **[Recall & Application]**

III: Match the following (5 Marks Each)

S.No.	Questions
50.	*[Periodic Properties and Variations of Properties]*

	Column A		Column B
(a)	Alkali metals	(i)	Be, C, O, F
(b)	Alkaline earth metals	(ii)	F, Cl, Br, I
(c)	Atomic radius decreases	(iii)	P, Al, Na, S
(d)	Non-metallic character decreases	(iv)	K, Na, Li, Rb
(e)	Period 3 elements	(iv)	Ba, Ca, Sr, Ra

[Recall]

S.No.	Questions
51.	*[Analytical Chemistry]* Match the reactants in column A to their methods of preparation in column B. **[Understanding & Application]**

	Column A		**Column B**
(a)	Zinc Oxide + Sulphuric acid	(i)	Synthesis
(b)	Iron + Chlorine	(ii)	Precipitation
(c)	Barium chloride + Sodium sulphate	(iii)	Neutralization
(d)	Magnesium + Hydrochloric acid	(iv)	Neutralization by titration
(d)	Potassium hydroxide + Nitric acid	(v)	Displacement

52. *[Study of Acids, Bases and Salts]*

	Column A		**Column B**
(a)	Acidic oxide	(i)	Metallic oxides that react with both acids and bases
(b)	Basic oxide	(ii)	Non-metallic oxides
(c)	Amphoteric oxide	(iii)	Non-metallic oxides that do not react with both acids and bases
(d)	Neutral oxide	(iv)	Amphoteric oxide
(e)	Aluminium oxide	(v)	Metallic oxide

[Analysis]

53. *[Metallurgy]*

	Column A		**Column B**
(a)	Element with atomic no. 19	(i)	Acid salt
(b)	Element with atomic no. 9	(ii)	Non-metal
(c)	Sodium aluminate	(iii)	Metal
(d)	Sodium bisulphite	(iv)	Hall Heroult's process
(e)	Calcium fluoride	(v)	Baeyer's process

[Understanding]

S.No.	Questions

54. *[Mole Concept and Stoichiometry, Study of Compounds, Organic Chemistry]*

	Column A		**Column B**
(a)	64g of Oxygen gas	(i)	Platinum
(b)	1 mole of Oxygen gas	(ii)	Molybdenum
(c)	Ostwald's process	(iii)	Alcohol
(d)	Haber's process	(iv)	44.8 Litres
(e)	Esterification	(v)	6.023×10^{23} Molecules

[Recall, Understanding & Application]

55. *[Periodic Properties and Variations of Properties]*

Match the descriptions in Column A with a corresponding **left-to-right order** of arrangement of elements in Column B.

	Column A		**Column B**
(a)	Increasing number of shells	(i)	F > Cl > Br
(b)	Increasing reactivity	(ii)	Cl > F > Br
(c)	Decreasing electron affinity	(iii)	Ca >Mg > Be
(d)	Decreasing electronegativity	(iv)	F < Cl < Br
(e)	Decreasing metallic character	(v)	Br < Cl < F

[Analysis]

56. *[Study of Compounds]*

Match the given processes in column A with the corresponding product formation steps in column B.

	Column A		**Column B**
(a)	Haber's process	(i)	Dissolution of the gas in water
(b)	Ostwald process	(ii)	Condensation of the gas
(c)	Hall- Heroult's process	(iii)	Coating of metal on cathode
(d)	Contact process	(iv)	Molten metal collected from cathode
(e)	Electroplating	(v)	Is the solution of the gas in a non-aqueous solution

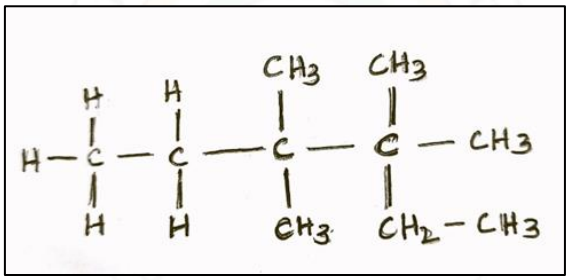
[Recall & Application]

S.No.	Questions
57.	*[Analytical Chemistry, Study of Compounds]* Match the column A with column B: (Note: answers should not be repeated) **[Recall & Understanding]**
58.	*[Study of Compounds, Organic Chemistry]* Match the column A with column B: **[Understanding & Application]**

	Column A		**Column B**
(a)	Calamine	(i)	Ammonium nitrate
(b)	Funnel arrangement	(ii)	Nitrite radical
(c)	An explosive	(iii)	Sulphuric acid
(d)	Brown Ring test	(iv)	Hydrochloric acid
(e)	Non-volatile acid	(v)	Zinc carbonate
		(vi)	Nitrate radical

	Column A		**Column B**
(a)	Neon	(i)	Ammonium ion
(b)	Methane	(ii)	Hydronium ion
(c)	Ammonia gas in water	(iii)	Magnesium hydroxide
(d)	An ion with a lone pair of electrons	(iv)	Non-polar covalent compound
(e)	A weak electrolyte	(v)	Zero electron affinity

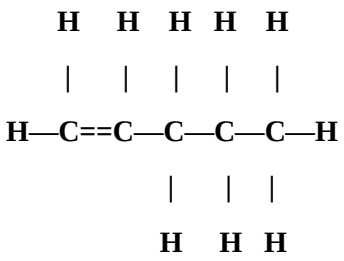
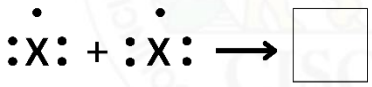
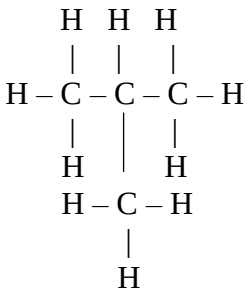
IV: One Word Answer (1 Mark Each)

S.No.	Questions
59.	*[Analytical Chemistry]* Name a positive non-metallic radical which is basic in nature. **[Understanding]**
60.	*[Organic Chemistry]* How many electrons are present in one molecule of CH_4? **[Understanding]**
61.	*[Organic Chemistry]* Identify the longest carbon chain and mention the number of carbons present in it.  **[Analysis & Application]**
62.	*[Mole Concept and Stoichiometry]* Gas M occupies a volume of 1000 c.c and contains X molecules. How many molecules will be present in gas N occupying a volume of 250 c.c? **[Understanding]**
63.	*[Periodic Properties and Variations of Properties]* Element X belongs to period 2 and group 1 of the periodic table. State the formula of the chloride of the element X. **[Understanding & Application]**
64.	*[Study of Compounds]* Anurag added dilute H_2SO_4 to a given sample X and heated the mixture. He observed that a gas was liberated which had a foul smell of rotten eggs and it turned moist lead acetate paper silvery black. Name the gas evolved in the above case. **[Understanding]**
65.	*[Organic Chemistry]* Name the alkyl component of acetic acid. **[Understanding]**

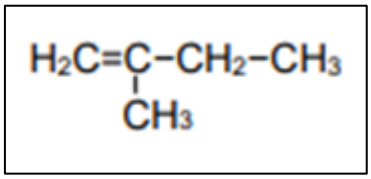
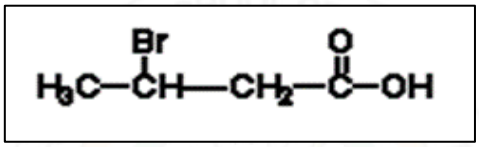
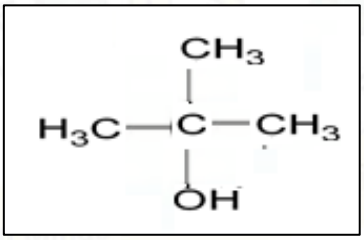
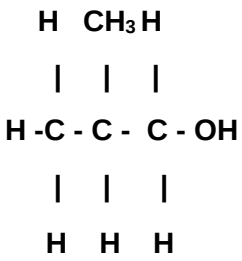
S.No.	Questions
66.	*[Mole Concept and Stoichiometry]* 28g of nitrogen and 44g of carbon dioxide at the same conditions of temperature and pressure occupy the same amount of space. What term describes such space occupied by any gas? **[Understanding]**
67.	*[Study of Compounds]* When copper reacts with a hot dilute solution, reddish-brown fumes are observed. Another compound, P, having the same anion that is present in the hot solution on heating, melts into a colourless liquid, releasing only oxygen gas without any coloured fumes. Identify P. **[Recall & Application]**
68.	*[Metallurgy]* Calcite ($CaCO_3$), a sedimentary rock, is found most abundantly in many geological environments. It has a perfect cleavage in 3 directions, which makes it the most difficult rock to cut, and moreover, the labour of cutting calcite is also very high. What term related to metallurgy will suitably describe Calcite in the context of extracting calcium from calcite? **[Application]**

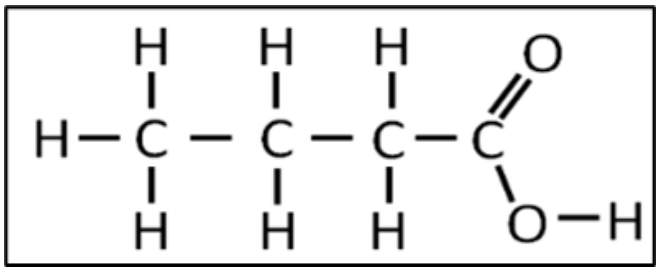
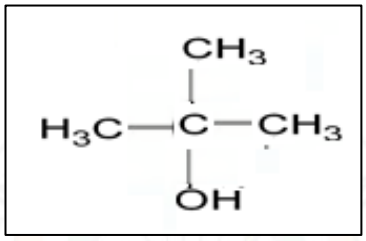
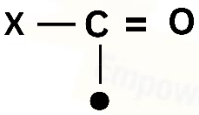
V: Structural diagram (1 Mark Each)

S.No.	Questions
69.	*[Organic Chemistry]* Draw the structural diagram of the product obtained when ethene reacts with chlorine. **[Application]**
70.	*[Organic Chemistry]* An organic acid on cooling below 16.5°C crystallises out in the pure form, forming a crystalline mass resembling ice. Draw the structural diagram of this carboxylic acid. **[Understanding]**
71.	*[Chemical Bonding]* Magnesium ribbon is added to dilute HCl. A gas is liberated along with the formation of a compound. Draw an electron dot diagram to show the structure of the compound that is formed. **[Application]**

S.No.	Questions
72.	*[Organic Chemistry]* Draw the chain Isomer for the following organic compound.  **[Application]**
73.	*[Chemical Bonding]* Calcium hydroxide dissolves in water and forms a positive ion and a negative ion. Draw the structure of the negative ion. **[Recall & Application]**
74.	*[Organic Chemistry]* Draw the structure of the following organic compounds: 2 – methyl butane **[Create]**
75.	*[Chemical Bonding]*  The equation given above represents the molecule formation of element X. Fill in the box with the electron dot structure of the molecule. **[Understanding]**
76.	*[Chemical Bonding]* Draw an isomer of the given structure:  **[Understanding & Application]**

VI: IUPAC Names (1 Mark Each)

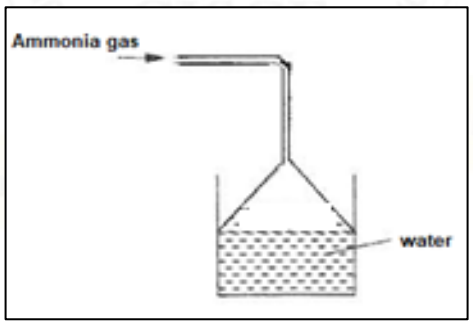
S.No.	Questions
77.	*[Organic Chemistry]* Give the IUPAC name of the following organic compounds:  **[Understanding & Application]**
78.	*[Organic Chemistry]*  **[Understanding & Application]**
79.	*[Organic Chemistry]*  **[Understanding & Application]**
80.	*[Organic Chemistry]*  **[Understanding]**

S.No.	Questions
81.	*[Organic Chemistry]*  **[Understanding]**
82.	*[Organic Chemistry]*  **[Understanding]**
83.	*[Organic Chemistry]* Give the IUPAC name of the compound represented below:  Where, **C** stands for Carbon, **O** for oxygen, **X** for hydrogen, ● for ethyl group **[Understanding & Application]**

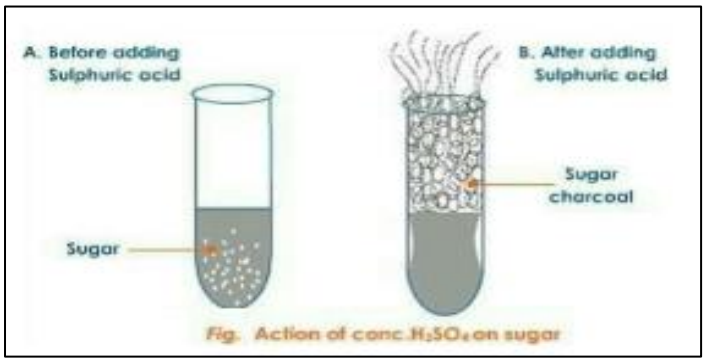
VII: Very Short Answer Questions (1 Mark Each)

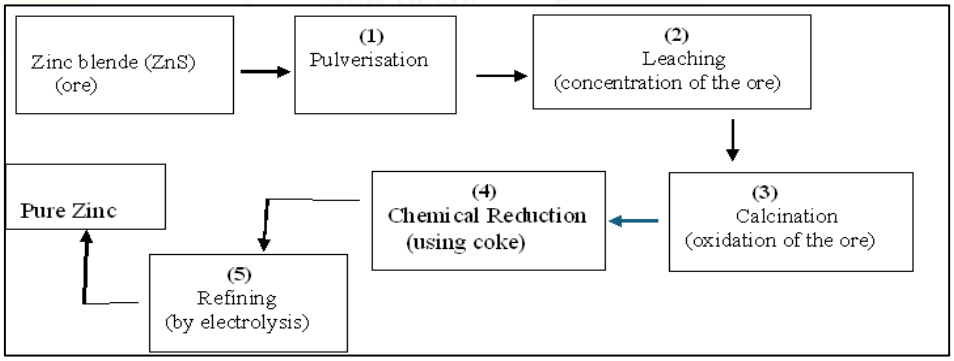
S.No.	Questions
84.	*[Analytical Chemistry]* Calcium hydroxide solution is used to detect the presence of carbon dioxide gas, while sodium hydroxide is NOT. Justify. **[Understanding]**
85.	*[Study of Compounds]* Hydrogen chloride fumes in the air. Justify. **[Application]**
86.	*[Metallurgy]* During the extraction of aluminium bauxite, its principal ore is reduced by the electrolytic method. Why? **[Understanding]**
87.	*[Organic Chemistry]* Why is pure acetic acid also called glacial acetic acid? **[Understanding]**
88.	*[Metallurgy]* A fuse wire is an alloy made of tin and lead. It is a safety device that prevents the damage of electronic gadgets due to excessive flow of current. Can copper replace tin when making alloys? Justify your answer. **[Application]**
89.	*[Organic Chemistry]* Ethyl alcohol is a colourless liquid. It is used as a major constituent in alcoholic beverages and also in the manufacture of many chemicals. When a Chemical Manufacturing Unit ordered ethyl alcohol, they were supplied with a purple-coloured alcohol instead of a colourless one. State the reason and the purpose of this colour change. **[Understanding]**
90.	*[Periodic Properties and Variations of Properties]* Ionisation energies of 4 elements A, B, C and D are 496, 403, 520 and 419 KJ/mol, respectively. If these elements belong to the same group in the Periodic Table, which element will occupy the top position in the group? Justify your answer. **[Understanding & Application]**

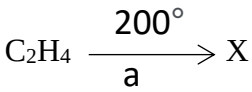
VIII: Short Answer Questions (2 Marks Each)

S.No.	Questions
91.	*[Study of Acids, Bases and Salts]* Some general rules for the solubility of salts in water are listed. • Carbonates are insoluble (except ammonium carbonate, potassium carbonate and sodium carbonate). • Chlorides are soluble (except lead (II) chloride and silver chloride). • Nitrates are soluble. • Sulphates are soluble (except barium sulphate, calcium sulphate and lead (II) sulphate). Which substances produce an insoluble salt when aqueous solutions of them are mixed? Justify your answer. (a) Copper nitrate and magnesium chloride (b) Zinc chloride and ammonium nitrate (c) Silver nitrate and zinc chloride (d) Potassium carbonate and sodium sulphate **[Analysis]**
92.	*[Study of Compounds]* Ammonia gas is passed into water as shown below:  (a) When a red litmus paper was dropped into the resulting solution, it turned blue. Which ions in the solution would have resulted for the colour change in the litmus paper? (b) Why is the funnel kept in an inverted position? **[Understanding]**

S.No.	Questions
93.	*[Study of Compounds]* In the Haber's process, the optimum yield of ammonia is obtained when a temperature of 450° C -500° C, a pressure of 200 atmospheres, an iron catalyst and promoter molybdenum are used. $N_2 + 3H_2 \rightleftharpoons 2NH_3 + \text{heat}$ How and why would the yield of ammonia be affected if the temperature was raised to 600°C? **[Application]**
94.	*[Organic Chemistry]* Give the structural formula and the name of the organic product formed when equal volumes of methane and chlorine react together. **[Understanding]**
95.	*[Organic Chemistry]* Complete combustion of one mole of a hydrocarbon produced four moles of carbon dioxide and four moles of water only. (a) Write the equation for the combustion reaction. (b) Draw the structure of the hydrocarbon. **[Understanding & Application]**
96.	*[Study of Compounds]* To the acid prepared by the contact process, Barium chloride solution is added. State *one* observation and write an equation for the reaction that occurs. **[Recall & Understanding]**
97.	*[Study of Compounds]* Platinum catalyst is used in the catalytic oxidation of ammonia. (a) Write an equation for the reaction that occurs in the above case. (b) Why does the platinum continue to glow even after the heating is discontinued? **[Recall & Understanding]**

S.No.	Questions
98.	*[Study of Compounds]* With reference to the reaction occurring in the given figure: -  Fig. Action of conc H_2SO_4 on sugar (a) Write an equation for the reaction. (b) State the property of sulphuric acid exhibited in the above case. **[Application]**
99.	*[Study of Compounds]* Brown ring test is used for the identification of nitrate ions. (a) Why is freshly prepared Ferrous sulphate solution used in the above test? (b) What is the chemical name of the brown ring? **[Understanding]**
100.	*[Mole Concept and Stoichiometry]* Ravi heated 367.5 g of $KClO_3$ in a test tube. The decomposition of potassium chlorate took place according to the equation. $2KClO_3 \rightarrow 2KCl + 3O_2$ Find: (a) the volume of the colourless and odourless gas liberated during the experiment. (b) the weight of the residue left behind in the test tube. **[Application]**
101.	*[Metallurgy]* For construction work the alloy of Aluminium i.e. Duralumin is used rather than pure Aluminium. Give two valid reasons. **[Application]**
102.	*[Mole Concept and Stoichiometry]* Ram took 5 moles of carbon atoms in a container, and Krish took 5 moles of sodium atoms in another container of the same volume. (a) Whose container is heavier? (b) Which container has a larger number of atoms? **[Understanding & Application]**

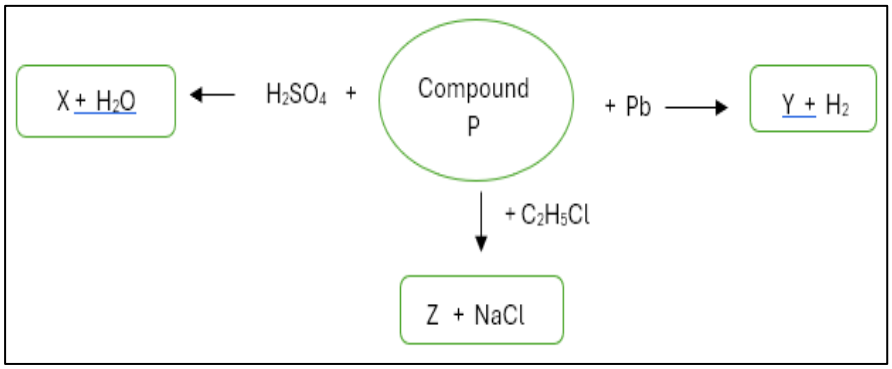
S.No.	Questions
103.	*[Analytical Chemistry]* A, B and C are three elements which undergo chemical reactions according to the following equations: $A_2O_3 + 2B \rightarrow B_2O_3 + 2A$ $3CSO_4 + 2B \rightarrow B_2(SO_4)_3 + 3C$ $3CO + 2A \rightarrow A_2O + 3C$ Answer the following questions: (a) Which element is the most reactive? (b) Which element is the least reactive? **[Analysis & Application]**
104.	*[Electrolysis]* PQ_2 is a hard crystalline solid having high melting and boiling points. It is a good conductor of electricity in both molten and aqueous forms. (a) The conductivity of PQ_2 is due to the presence of free _____ (ions, molecules, electrons) (b) During electrolysis of aqueous PQ_2, if thickening of the cathode and thinning of the anode is observed, the anode material will be _____. (graphite, metal P) **[Understanding & Application]**
105.	*[Metallurgy]* A student was asked to draw the flowchart for the extraction of zinc from zinc blende based on the principles of Metallurgy. What he drew is given below. 2 steps out of the 5 were incorrect. Identify and correct them.  **[Understanding & Application]**

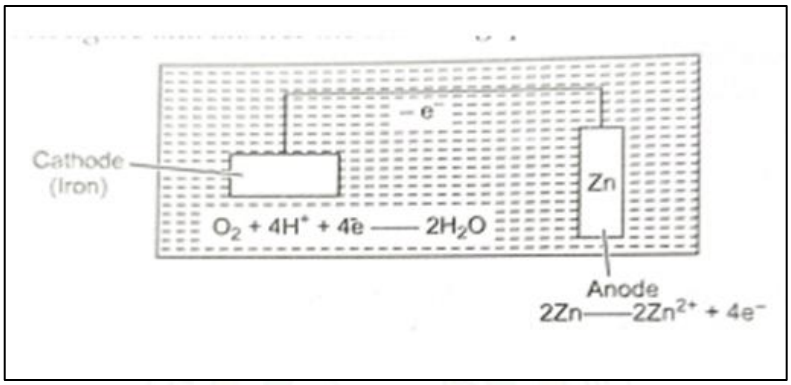
S.No.	Questions
106.	*[Organic Chemistry]*  Given above is the representation of the conversion of ethene to a saturated hydrocarbon X, where 'a' stands for the catalyst. (a) Identify 'a'. (b) Give the complete chemical equation for the conversion of C_2H_4 to X. **[Understanding]**
107.	*[Organic Chemistry]* The description of an organic compound is as follows: (a) Molecular formula is C3H8O. (b) Functional group is attached to the first carbon atom. (c) Reacts with sodium at room temperature with brisk effervescence, releasing hydrogen gas. Identify the compound and draw its structure. **[Understanding]**

IX: Long Answer Questions (3 Marks Each)

S.No.	Questions
108.	*[Metallurgy]* With respect to the Hall Heroult process related to the extraction of aluminium, justify the following: (a) Powdered Coke is sprinkled over the electrolytic mixture undergoing electrolytic reduction. (b) Graphite anodes are continuously replaced during the electrolysis. (c) Cryolite and fluorspar must be added to the electrolytic mixture. **[Recall & Understanding]**

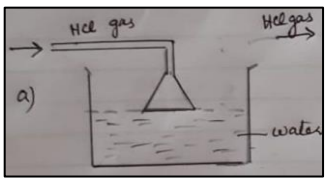
S.No.	Questions
109.	*[Study of Compounds]* Write complete and balanced equations for the reactions occurring in the following cases: (a) Passing dry ammonia gas over heated lead oxide placed in a combustion tube to produce a silvery grey metal. (b) When concentrated nitric acid is reacted with zinc to produce a reddish-brown gas. (c) When concentrated sulphuric acid oxidises sulphur to produce a gas which turns acidified potassium dichromate paper green. **[Understanding]**
110.	*[Analytical Chemistry]* Give balanced equations for the conversions A, B and C. $Zn \xrightarrow{A} ZnCl_2 \xrightarrow{B} Zn(OH)_2 \xrightarrow{C} ZnSO_4$ **[Understanding & Application]**
111.	*[Electrolysis]* Rohan wants to electroplate a spoon with nickel. (a) To which electrode should he connect the article to be electroplated? (b) Write the equation for the reaction that will occur at the cathode. (c) What should the anode be made up of? **[Understanding & Application]**
112.	*[Mole Concept and Stoichiometry]* Amit found that 30g of a gas occupied 1000 c.c at STP. (a) What will the gram molecular weight and the vapour density of this gas be? (b) How many molecules of this gas will be present in 44.8 l of it? **[Understanding]**
113.	*[Study of Acids, Bases and Salts]* An element X combines with oxygen to form an oxide X_2O_3. This oxide is a good conductor of electricity and can be reduced to its metal only by electrolysis. (a) Write the equation for the reaction formed when the oxide (X_2O_3) combines with hydrochloric acid. (b) How many valence electrons are present in the outermost shell of X? (c) Will element X undergo oxidation or reduction? **[Understanding & Application]**

S.No.	Questions
114.	*[Analytical Chemistry]* Observe the reactions given below and answer the following questions:  (a) Identify compound P. (b) Give the chemical formula of Z. (c) Write the reaction taking place between the identified compound P and sulphuric acid. (d) Name compound Y. **[Understanding & Application]**
115.	*[Periodic Properties and Variations of Properties]* Study the information given in the table below and answer the questions that follow. (Note- the letters do not represent the actual symbols of the elements) Element / Electronic configuration / Ionisation energy $kjmol^{-1}$: X / 2,2 / 900; Y / 2,8,2 / 738; Z / 2,8,8,2 / 590 (a) Explain why element X has highest ionisation energy. (b) To which period does Z belong? (c) Draw the electron dot structure of the compound formed between Z and oxygen. **[Analysis & Application]**
116.	*[Study of Acids, Bases and Salts]* A student prepared a Potassium sulphite solution in the lab and added few drops of barium nitrate solution to it. He observed a white precipitate being formed in the test tube. On addition of dilute hydrochloric acid to the white precipitate and mixing it, he observed that the precipitate disappeared. (a) Name the white precipitate. (b) Write a balanced chemical equation for the reaction between dilute hydrochloric acid and the white precipitate. (c) Name the gas evolved in the above reaction. **[Application]**

S.No.	Questions
117.	*[Mole Concept and Stoichiometry]* The empirical formula of a hydrocarbon is C_2H_3.The hydrocarbon has a relative molecular mass of 54. (At wt: H = 1, C = 12) (a) What is the molecular formula of the hydrocarbon? (b) Draw the structural formula of the hydrocarbon. (c) Give the general formula of the hydrocarbon. **[Application]**
118.	*[Electrolysis]*  Study the given figure and answer the given questions: (a) Identify the application of electrolysis demonstrated above. (b) Which metal is protected in the above process? (c) Why should the metal be protected? **[Application]**
119.	*[Organic Chemistry]* Nita's father bought a basket of ripe mangoes. While opening it she found a small sachet containing a white crystalline powder along with the mangoes. She was told that it is a chemical that releases a gas when it comes in contact with moisture, that induces ripening of fruits. (a) Name the chemical powder in the sachet. (b) Name the gas. (c) Give a balanced chemical equation for the reaction that results in the evolution of this gas. **[Understanding & Application]**
120.	*[Periodic Properties and Variations of Properties]* Atomic number of element M is 12 and it forms an ionic compound with element L. (a) Which of the following atomic numbers will match L? i. 14 ii. 10 iii. 8 (b) What is the name given to the members of the group to which element M belongs? (c) Draw the electron dot structure of the compound formed between M and L. **[Understanding & Application]**

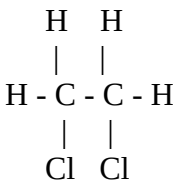
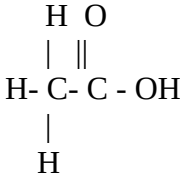
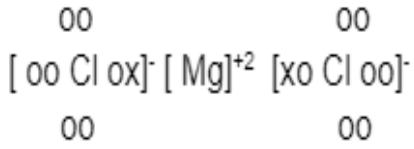
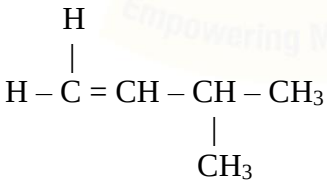
S.No.	Questions
121.	*[Study of Compounds]* When two dry gases, oxygen and X, are passed over heated platinum, reddish-brown fumes are seen in the receiving flask, as shown in the figure. (a) Name the gas X. (b) Give equation(s) for the reaction(s) that resulted in the formation of brown fumes. **[Understanding & Application]**

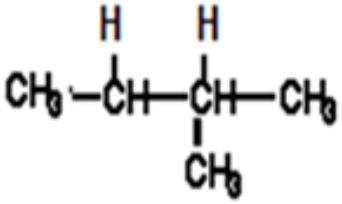
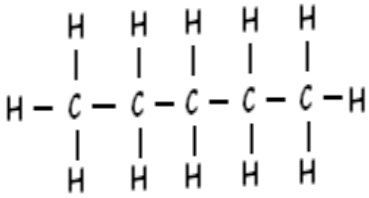
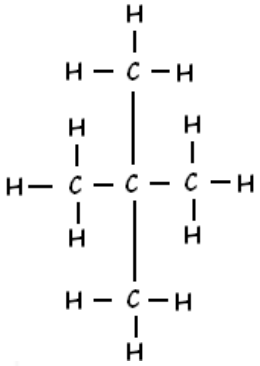
Answer Key

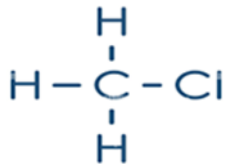
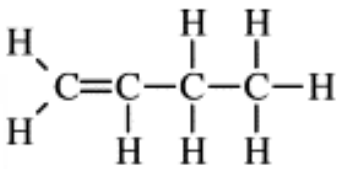
S.No.	Expected Answers
1.	(c) Ammonium hydroxide
2.	(c) Cu
3.	(b) Ammonia
4.	(d) It has a triple bond between the carbon atoms.
5.	(b) Reducing
6.	(d) $OH^- - e^- \rightarrow OH$, $[4OH] \rightarrow 2H_2O + O_2$
7.	(b) B
8.	(c) The sample of lead bromide was not heated up to the melting point by the teacher.
9.	(d) $Y - 2e^- \rightarrow Y^{2+}$
10.	(d) 4, 1
11.	(b) An atom / 7 molecules.
12.	(a) NO. No change in blue and red litmus paper.
13.	(c) Chlorine
14.	(b) Butanol
15.	(b) concentrated solution of NaCl.
16.	**(c)** $\overset{\vert}{\mathbf{C}} \equiv \overset{\vert}{\mathbf{C}}$
17.	(a) 
18.	(c) $\mathbf{-\overset{\Vert}{C}-OH}$

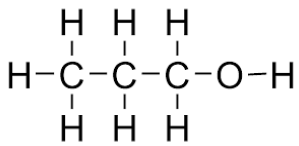
S.No.	Expected Answers
19.	(d) C < A < D < B
20.	(a) Hard and strong
21.	(a) Only P
22.	(b) Hydroxyl ion
23.	(a) Only P
24.	(b) 2.6 dm^3
25.	(c) Connect the pan to negative electrode.
26.	(c) The carbon anode is consumed.
27.	(c) R
28.	(a)
29.	(d) A and C
30.	(d) Sulphur, two, electronegative
31.	(c) $O^{2-} > F^- > Mg^{2+} > Na^+$ (Ionic radii)
32.	(c) I, II and III
33.	(c) P-Fe, Q-Zn, R-Ag
34.	(a) X= CuO, Y=black, Z = reducing property
35.	A is true, but R is not the correct explanation of A.
36.	(a) Both A and R are correct.
37.	(c) A is correct but R is not the correct explanation of A.
38.	(a) A is true, and R is the correct explanation of A.
39.	(i) hydroxyl (ii) deep blue (iii) reducing agent (iv) ammonium chloride
40.	Reducing agent
41.	X=Y

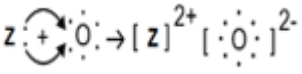
S.No.	Expected Answers
42.	C_5H_8 and C_4H_{10}
43.	3
44.	Oxidised, loss
45.	Addition, unsaturated hydrocarbon
46.	Right
47.	Higher
48.	(d) HCl < HNO_3< CH_3COOH
49.	(a) Cu
50.	(a) iv (b) v (c) i) (d) ii (e) iii
51.	(a) iii (b) i (c) ii (d) v (e) iv
52.	(a) ii (b) v (c) i (d) iii (e) iv
53.	(a) iii (b) ii (c) v (d) i (e) iv
54.	(a) iv (b) v (c) i (d) ii (e) iii
55.	(a) iv (b) v (c) ii (d) i (e) iii
56.	(a) ii (b) i (c) iv (d) v (e) iii
57.	(a) v (b) iv (c) i (d) vi (e) iii
58.	(a) v (b) iv (c) i (d) ii (e) iii
59.	Ammonium / NH_4^+
60.	10
61.	6
62.	X/4
63.	XCl
64.	Hydrogen sulphide gas

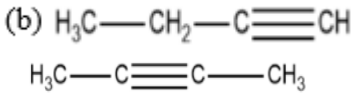
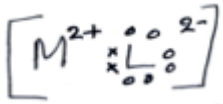
S.No.	Expected Answers
65.	-CH_3 (methyl)
66.	Molar volume
67.	Sodium nitrate / Potassium nitrate
68.	Mineral
69.	
70.	
71.	
72.	
73.	

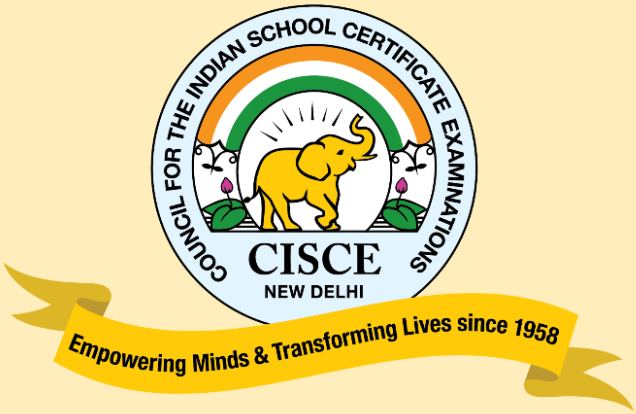
S.No.	Expected Answers
74.	
75.	
76.	 Or 
77.	2-methyl -1-butene
78.	3-bromobutanoic acid
79.	2-methyl propan-2-ol
80.	2-methyl propanol
81.	Butanoic acid
82.	3-methyl hexane
83.	Propanal
84.	Carbon dioxide gas forms a white ppt with calcium hydroxide, while with sodium hydroxide, it does not.
85.	Hydrogen chloride is highly soluble even in the minute traces of moisture present in the air.
86.	The bond between aluminum and oxygen is very strong / aluminum oxide is very stable. It cannot be reduced by common reducing agents like carbon, carbon monoxide or hydrogen.

S.No.	Expected Answers
87.	Pure acetic acid, on cooling below 16.5°C, crystallises out to form a crystalline mass resembling ice.
88.	No, because the melting point of copper is very high.
89.	A coloured dye is added to ethyl alcohol to denature it so as to prevent the misuse (consumption) of alcohol.
90.	Element C will top the group because ionisation energy decreases down the group.
91.	(c) silver nitrate and zinc chloride Silver chloride is formed, which is an insoluble precipitate, while for all others, no precipitate is formed
92.	(a) OH ions/ hydroxyl ions (b) To prevent back suction of water or to increase area of absorption
93.	As the forward reaction is exothermic (1) increasing the temperature will make the reaction to reverse and thereby decrease (1) the yield of ammonia.
94.	 Chloromethane / methyl chloride
95.	(a) $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$ (b) 
96.	A white ppt. is formed $H_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2HCl$
97.	(a) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ (b) The platinum continues to glow even after heating is discontinued because the reaction is exothermic.
98.	(a) $C_{12}H_{22}O_{11} \xrightarrow{\text{conc. } H_2SO_4} 12C + 11H_2O$ (b) Conc. H_2SO_4 is a dehydrating agent

S.No.	Expected Answers
99.	(a) If Ferrous sulphate is left exposed to air for some time, then it will be oxidised to ferric sulphate and it will not respond to the test. (b) Nitroso ferrous sulphate.
100.	(a) $KClO_3$ = 122.5 KCl = 74.5 245g of $KClO_3$ liberates 67.2 l of O_2 367.5g of $KClO_3$ gives 67.2 x 367.5/245= **100.8** l of O_2 (b) 2x122.5g of $KClO_3$ forms 74.5g of KCl 367.5g of $KClO_3$ forms 74.5 x 367.5/245=**111.75**g of KCl
101.	Duralumin is light and strong, while aluminium is light and weak. It is also unaffected by moist air. It is corrosion-resistant and has high tensile strength.
102.	(a) Krish's container is heavier (b) Both the containers have the same number of atoms.
103.	(a) B (b) C
104.	(a) Ions (b) Metal P
105.	(a) Step 2: Froth floatation instead of leaching (b) Step 3: Roasting instead of calcination
106.	(a) Nickel (b) $C_2H_4 + H_2 \xrightarrow[Ni]{200°C} C_2H_6$
107.	Propanol Structure 

S.No.	Expected Answers
108.	(a) Prevents burning of carbon anodes in air or prevents heat loss by radiation. (b) Carbon anodes are oxidized and hence consumed (c) Lowers the fusion point of the mixture or enhances the conductivity of the mixture or enhances the mobility of the mixture.
109.	(a) $NH_3 + 3PbO \rightarrow 3Pb + 2H_2O + 2NO_2$ (b) $Zn + 4HNO_3 \rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2$ (c) $2H_2SO_4 + S \rightarrow 3SO_2 + 2H_2O$
110.	(a) $Zn + 2HCl \rightarrow ZnCl_2 + 2HCl$ (b) $ZnCl_2 + 2NaOH \rightarrow Zn(OH)_2 + 2NaOH$ (c) $Zn(OH)_2 + H_2SO_4 \rightarrow ZnSO_4 + 2H_2O$
111.	(a) Cathode (b) $Ni^{+2} + 2e \rightarrow Ni$ (c) Block of nickel
112.	(a) 1000c.c of the gas weighs 30g So 22400c.c of the gas weighs 30 x22400/1000 = 672g Molecular weight of the gas = **672g** (1) V.D of the gas = 672/2 = **336** (1) (b) 22.4litres of the gas contains 6.023×10^{23} molecules So, 44.8 litres of the gas contain $6.023 \times 10^{23} \times 2$ molecules = **12.046×10^{23} molecules** (1)
113.	(a) $X_2O_3 + 6HCl \rightarrow 2XCl_3 + 3H_2O$ (b) 3 (c) Oxidation
114.	(a) NaOH (b) C_2H_5OH (c) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$ (d) Sodium plumbite
115.	(a) As the number of shells are less the attraction by the nucleus on the electrons is more so more energy is required to remove the electron from the outermost shell (b) Fourth period (c) 
116.	(a) Barium sulphite (b) $BaSO_3 + 2HCl \rightarrow BaCl_2 + H_2O + SO_2$ (c) Sulphur dioxide

S.No.	Expected Answers
117.	(a) C_4H_6 (b)  or (c) C_nH_{2n-2}
118.	(a) Electroplating (b) Iron (c) To prevent from rusting.
119.	(a) Calcium Carbide (b) (ethyne/acetylene) (c) $CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$
120.	(a) c) 8 (b) Alkaline earth metals (c) 
121.	(a) NH_3 (b) $4NH_3 + 5O_2 \xrightarrow{800°C} 6H_2O + 4NO$ $2NO + O_2 \rightarrow 2NO_2$



Council for the Indian School Certificate Examinations
47-48, 3rd Floor, Pragati House,
Nehru Place, New Delhi – 110019