

Sample Question Paper Class XII
Subject: Chemistry

Max. Marks: 70

Max. Time: 3 Hours

General Instructions:

- I. All questions are compulsory.
- II. This Question Paper has four sections of Section A, B, C, and D.
- III. Section A has all Multiple-Choice Questions. Out of which Q 1 to Q 12, each question carries 1 mark and 2 marks has single correct answer.
- IV. Section B has Very Short Answer type questions from Q 13 to Q 19. Each question carries 2mark.
- V. Section C has Short Answer type questions from Q 21to Q 26. Each question carries 3 marks.
- VI. Section D has Long Answer type questions from Q 26 to Q 30. Each question carries 5 marks.

S.no	Question	Marks
Section A		
1	Which of the following correctly represents the Nernst equation for a Zn–Cu cell? A. $E = E^\circ - \frac{0.059}{2} \log \frac{[Cu^{2+}]}{[Zn^{2+}]}$ B. $E = E^\circ + \frac{0.059}{2} \log \frac{[Cu^{2+}]}{[Zn^{2+}]}$ C. $E = E^\circ - 2 \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$ D. $E = E^\circ + 2 \log [Zn^{2+}]$	1
2	A metallurgical company is designing a process to separate a mixture containing several trivalent lanthanide ions. During testing, the chemists observe that even after multiple fractional crystallizations, the ions do not separate easily because their ionic radii are extremely close to one another. Which scientific principle best explains this difficulty, and what practical consequence of that principle is being observed? A. Poor shielding by 4f electrons causes lanthanide expansion, making the ions too large to separate easily. B. Poor shielding by 4f electrons causes lanthanide contraction, resulting in similar ionic sizes that make separation difficult. C. Strong shielding by 5d electrons causes lanthanide expansion, leading to identical reactivity among the ions. D. Strong shielding by 4f electrons causes lanthanide contraction, creating identical electronic configurations.	1

3	Which transition metal ion is colorless? A. Ti^{4+} B. Fe^{2+} C. Cu^{2+} D. Mn^{2+}	1
4	Phenol is more acidic than ethanol because: A. Phenoxide ion is unstable B. Phenoxide ion is resonance-stabilized C. O–H bond is weaker in phenol D. Phenol is more polar	1
5	Students debate why amines are more basic than ammonia. Which action is most scientific? A. Compare electron density on nitrogen B. Discuss textbook examples blindly C. Ignore inductive effect D. Look at boiling points only	1
6	Alcohols undergo dehydration in presence of: A. Dilute HCl B. Concentrated H_2SO_4 C. Pyridine D. NaOH (aq)	1
7	In a laboratory activity, group of three students working together, out of which two students disagree while preparing a solution: - Student A insists that <i>adding solute first and then diluting to the mark</i> will correctly produce a 0.1 M NaCl solution. - Student B argues that <i>adding water to 100 mL first and then adding the solute</i> will also give the same molarity since the final volume will be “approximately the same.” As the third member of the group, analyse the disagreement and choose the most constructive response so that conflict among them can be resolved easily. A. Support Student B because small volume changes do not matter in laboratory preparation. B. Ask both students to follow their own methods and compare the results later. C. Explain that Student A is correct because molarity is defined by the final volume, and therefore the solute must be dissolved first and then diluted exactly to the mark. D. Encourage both students to stop arguing and proceed with any method so that the experiment is completed quickly.	1

8	In an experiment, haloalkanes react faster with CN^- ions than alkanes do. Which property of haloalkanes causes this behavior? A. Haloalkanes have stronger C–H bonds than alkanes B. Haloalkanes contain a polar C–X bond, making the carbon atom electron-deficient C. Alkanes have a positively charged carbon atom, attracting CN^- D. Haloalkanes do not undergo nucleophilic substitution reactions	1
9	a) A group studying kinetics observes that doubling reactant concentration sometimes does not double the rate. Which concept explains this? A. Zero-order kinetics B. Rate law exponent C. Molecularity D. Activation energy b) For a first-order reaction, the quantity that remains constant throughout is: A. Half-life B. Rate constant C. Rate of reaction D. Molecularity	1+1
10	a) During a class discussion on the oxidation of alcohols, two students disagree: - Student A argues that primary alcohols always oxidize directly to carboxylic acids, regardless of the reagent used. - Student B insists that primary alcohols first form aldehydes, and with controlled conditions, the oxidation can stop at the aldehyde stage. Choose the correct option ? A. Support Student A because primary alcohols can never stop at the aldehyde stage and always form carboxylic acids. B. Support Student B because primary alcohols first form aldehydes, and mild oxidizing agents (like PCC) allow the reaction to stop at the aldehyde stage. C. Tell both students that oxidation of alcohols is unpredictable and depends entirely on experimental luck. D. Tell both students to avoid debating and directly memorize the reaction sequence without understanding b) Which reagent is commonly used to distinguish between primary and tertiary alcohols based on the rate of formation of an alkyl halide? A. Lucas reagent B. Tollen's reagent C. Fehling's solution D. Brady's reagent	1+1

11	a) A glucose sample gives a silver mirror test even though it does not contain a free – CHO group in its cyclic form. Why is this possible? A. Glucose undergoes dehydration to form formaldehyde B. Glucose contains ketone groups that reduce Tollen’s reagent C. Glucose can open its ring to form a free aldehyde group in solution D. Glucose reacts with silver ions directly without any structural change b) Which of the following is a reducing sugar? A. Sucrose B. Starch C. Cellulose D. Maltose	1+1
12	While calculating the molar mass of a solute using freezing point depression, a teacher presents two situations: • Situation A: A very high ΔT_f indicates the solute has a higher molar mass than expected. • Situation B: A very high ΔT_f indicates the solute dissociates into more particles, giving a lower apparent molar mass. Which statement is scientifically correct? A. Situation A is correct because ΔT_f is directly proportional to molar mass. B. Situation A is correct because a higher ΔT_f always means fewer particles in solution. C. Situation B is correct because dissociation increases the van’t Hoff factor i, increasing ΔT_f and decreasing the calculated molar mass. D. Both situations are correct since ΔT_f cannot determine dissociation effects.	1
Section B		
13	During an experiment, a student connects a Zn electrode to a Cu electrode in their respective salt solutions. Write the cell reaction that will occur when the cell starts working.	2
14	In a reaction mixture, the rate of reaction suddenly doubles when the temperature is increased slightly. What does this observation indicate about the activation energy of the reaction? Explain briefly.	2
15	A chemist notices that lanthanides form many similar-sized compounds with gradual decrease across the series. Which property of lanthanides explains this observation explain with example?	2
16	During a discussion on coordination complexes, two students disagree about the role of groups that donate lone-pair electrons to the central metal ion. • Student A says these groups act as <i>ligands</i> because they donate electron pairs.	2

	Student B thinks these groups behave like <i>Lewis acids</i> since a bond is formed with the metal ion. explain how the students should evaluate both viewpoints and correctly identify the role of these groups.	
17	A student prepares an ether by reacting ethanol with sodium ethoxide. Name and draw the structure of the ether formed.	2
18	A. Name the amino acids has to be supplemented in the diet? B. When two amino acids combine to form a dipeptide, which type of bond links them?	2
19	Suggest two environmentally safer alternatives to CFCs and justify why they are safer.	2

Section C		
20	In a rural water-treatment facility, three engineers disagree about the reason behind the unusually fast corrosion of an iron storage tank that is partially buried in moist soil near a wastewater outlet. Engineer A argues that corrosion increases because moist soil acts as an electrolyte, creating multiple tiny galvanic cells on the tank's surface. Engineer B insists that wastewater contamination introduces oxidizing impurities, speeding up the cathodic reaction. Engineer C believes the real issue is the lack of protection methods such as galvanization or sacrificial anode protection. As the team leader, guide the group toward a safe and scientific decision. (a) Evaluate the viewpoints of all three engineers and explain which parts of their reasoning are scientifically valid. (b) Suggest two electrochemical methods the team can agree upon to prevent corrosion. (c) Explain how reaching a common scientific understanding and applying these methods will help ensure community safety.	3
21	Calculate EMF of cell: $\text{Zn} \mid \text{Zn}^{2+}(0.02M) \parallel \text{Cu}^{2+}(0.2M) \mid \text{Cu}$ $E_{\text{cell}}^{\circ} = 1.10 \text{ V}$	3

22	During an environmental study, a team observes that a pollutant decomposes with a constant half-life regardless of its initial concentration. To predict how long it will take for 90% of the pollutant to degrade in a lake, they need the integrated rate equation for a first-order reaction. Using this real-life scenario, derive the first-order integrated rate equation and explain how it helps estimate pollution decay.	3
23	Two different chemical compounds are described below: Compound A - It is a powerful oxidizing agent with the metal in its +7 oxidation state. - It produces a purple colour in solution. - It is commonly used in water purification and bleaching, and gets reduced to Mn^{2+} in acidic medium. Compound B - It is a green-coloured compound of chromium in the +6 oxidation state. - It is a strong oxidizing agent in acidic medium and converts alcohols to aldehydes/ketones. - It is used in leather tanning and laboratory oxidation reactions. Identify Compound A and Compound B. Justify your answer with one characteristic property for each.	3
24	A pharmaceutical chemist needs to choose between an $\text{S}_{\text{N}}1$ or $\text{S}_{\text{N}}2$ mechanism for synthesizing a drug molecule. The substrate can rearrange under certain conditions, and the reaction must avoid by-products. Using this situation, compare $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ mechanisms, analyze which mechanism is suitable for a rearrangement-prone substrate, and justify your choice with examples.	3
25	A forensic scientist receives two colorless liquid samples from a crime scene one is an aldehyde, the other a ketone. For quick identification at the site, only simple qualitative tests can be used. Suggest three chemical tests, explain how each test works, and interpret how the results would help distinguish the aldehyde from the ketone in a real forensic investigation.	3
26	Explain the structure, classification, and biological functions of carbohydrates,	3
Section D		
27	(a) State and explain Raoult's law. (b) Derive the formula for elevation of boiling point. (c) Significance of molal elevation constant.	1+2+2
28	Explain the mechanism of nucleophilic addition in aldehydes and ketones. Discuss how the presence of α -hydrogen affects reactivity using suitable reactions.	1+2+2

29	Discuss CFT for octahedral complexes - Splitting of d orbitals - CFSE - High spin vs low spin - Color - magnetic properties	1+1+1+1+1
30	During a group research project on Amines, three students present different viewpoints about the behaviour, preparation and uses of amines: - Student A argues that <i>“Amines are simply organic derivatives of ammonia, and their basicity only depends on the availability of the lone pair on nitrogen.”</i> - Student B disagrees and believes that <i>“The basic strength of amines also depends on solvent effects, substituent groups, and molecular interactions, not just on the lone pair.”</i> - Student C adds another perspective, saying that <i>“Amines are not only important in chemistry labs but also have huge significance in medicines, dyes, and biological systems, so understanding their properties requires an open-minded approach.”</i> - Explain the factors affecting basicity of amines. - Give chemical and physical property of amines. - Give two important applications of amines in real life.	2+2+1