CBSE Class 12 Chemistry: Sample Paper 1

Based on NCERT · the board's 2026-27 pattern | Time: 3 hours · **Maximum marks: 70**

1. There are 33 questions in this question paper, with internal choice. All questions are compulsory.
2. Section A has 16 multiple-choice questions of 1 mark each, the last four of them assertion-reason. Section B has 5 very short answer questions of 2 marks, Section C 7 short answer questions of 3 marks, Section D 2 case-based questions of 4 marks and Section E 3 long answer questions of 5 marks.
3. Internal choice is given in one question in Section B, one in Section C, in a part of each case in Section D and in all three questions in Section E; attempt only one of the alternatives.
4. Log tables and calculators are not allowed.
5. For the assertion-reason questions, choose: (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.

Section A (16 × 1 mark)

1. Which statement about order and molecularity is correct? [1]

(a) Molecularity is found by measuring the rate at different concentrations.
(b) Molecularity can be zero for a reaction on a metal surface.
(c) Order has meaning only for elementary reactions.
(d) Order can be zero or a fraction, but molecularity cannot.

2. Given E°/V: $Na^+|Na$ −2.71, $Mg^{2+}|Mg$ −2.36, $Al^{3+}|Al$ −1.66, $Zn^{2+}|Zn$ −0.76. The strongest reducing agent among the four metals in aqueous solution is [1]

(a) Zn
(b) Na
(c) Mg
(d) Al

3. Which of the following isomers of $C_5H_{13}N$ has the highest boiling point? [1]

(a) N,N-dimethylpropan-1-amine
(b) N-methylbutan-1-amine
(c) pentan-1-amine
(d) N-ethyl-N-methylethanamine

4. How many structurally different monochloro products can form when 2,3-dimethylbutane, $(CH_3)_2CH–CH(CH_3)_2$, undergoes free radical chlorination? [1]

(a) 1
(b) 2
(c) 3
(d) 4

5. 2.8 g of KOH (56 g mol^{-1}) is dissolved in water and the solution is made up to 250 mL. Its molarity is [1]

(a) 0.0112 M
(b) 0.050 M
(c) 0.20 M
(d) 2.0 M

6. Which carbon–halogen bond has the lowest bond enthalpy? [1]

(a) $CH_3–F$
(b) $CH_3–Cl$
(c) $CH_3–Br$
(d) $CH_3–I$

7. 2-Methylpent-2-ene, $(CH_3)_2C=CH–CH_2CH_3$, is treated with ozone and then with zinc dust and water. The products are [1]

(a) propanone and propanoic acid
(b) ethanal and butan-2-one
(c) two molecules of propanal
(d) propanone and propanal

8. The coordination number of cobalt in $[Co(en)_2(NO_2)Cl]^+$ is [1]

(a) 4
(b) 6
(c) 5
(d) 3

9. 1-Bromobutane is heated in a sealed tube at 373 K with a large excess of ethanolic ammonia, and the salt is then treated with NaOH. The amine obtained as the major product is [1]

(a) tetrabutylammonium hydroxide
(b) N-butylbutan-1-amine
(c) N,N-dibutylbutan-1-amine
(d) butan-1-amine

10. Which of the following dissolves readily in benzene but hardly at all in water? [1]

(a) sodium chloride
(b) anthracene
(c) sugar
(d) potassium chloride

11. An aqueous solution of a salt of which of the following ions is pink? [1]

(a) Ni^{2+}
(b) Cr^{3+}
(c) Mn^{2+}
(d) Cu^{2+}

12. Which of the following is a tertiary alcohol? [1]

(a) $(CH_3)_2CH-CH_2-OH$
(b) $CH_3-CH_2-C(CH_3)(OH)-CH_2-CH_3$
(c) $CH_3-CH(OH)-CH(CH_3)_2$
(d) $C_6H_5-CH_2-CH_2-OH$

13. Assertion (A): 1-Chloro-3-nitrobenzene is converted to 3-nitrophenol by aqueous NaOH only under conditions about as severe as those for chlorobenzene. Reason (R): A nitro group at the meta position cannot take up, by resonance, the negative charge that develops on the ring when OH^- attacks the carbon carrying chlorine. [1]

(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.

14. Assertion (A): The metal–carbon bond in $[Cr(CO)_6]$ has both σ and π character. Reason (R): Carbon of CO donates a lone pair into a vacant metal orbital, while the metal donates a filled d pair into the vacant antibonding π* orbital of CO. [1]

(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.

15. Assertion (A): Potassium dichromate is used as a primary standard in volumetric analysis. Reason (R): The chromate ion is tetrahedral. [1]

(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.

16. Assertion (A): Aniline reacts with bromine water at room temperature to give a white precipitate of 2,4,6-tribromoaniline. Reason (R): The $-NH_2$ group is a powerful activating group that makes the ortho and para positions centres of high electron density. [1]

(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.

Section B (5 × 2 marks)

17. A 2.0 kg sample of water from a hill stream contains 16 mg of dissolved oxygen. Express this concentration in ppm by mass, and state why ppm is used here rather than mass percentage. [2]

18. Carnallite, $KCl·MgCl_2·6H_2O$, and $K_4[Fe(CN)_6]$ each contain two simple salts combined in a fixed ratio. Classify each as a double salt or a coordination compound, and name the ions each gives in aqueous solution. [2]

19. Write the two steps by which 1-phenylethan-1-one, $C_6H_5COCH_3$, is converted to ethylbenzene by the Wolff–Kishner reduction. [2]

Or *Write the equation for the conversion of butan-2-one into butane by the Clemmensen reduction, giving the reagents.*

20. Write the equation for the manufacture of methanol today, with the catalyst and conditions, and state the main use of methanol. [2]

21. A first order reaction has $k = 6.93 \times 10^{-3}$ min^{-1}. How long will it take for 87.5% of the reactant to be used up? [2]

Section C (7 × 3 marks)

22. Ethyl ethanoate can be made from ethanol (i) with ethanoic acid and a little concentrated H_2SO_4, or (ii) with ethanoyl chloride in pyridine. Write both equations. Why is water removed as it forms in (i), and what is the role of pyridine in (ii)? [3]

23. A student sets up the cell $Zn(s) \mid Zn^{2+}(0.10\ M) \parallel Ni^{2+}(aq) \mid Ni(s)$ and reads its emf at 298 K as 0.451 V. Write the cell reaction and the Nernst equation for the cell, and find the concentration of Ni^{2+} in the cathode compartment. Given $E°(Zn^{2+}|Zn) = -0.76$ V, $E°(Ni^{2+}|Ni) = -0.25$ V, $2.303RT/F = 0.059$ V. [3]

Or *A student sets up the cell $Fe(s) \mid Fe^{2+}(0.0010\ M) \parallel Cu^{2+}(aq) \mid Cu(s)$ and reads its emf at 298 K as 0.839 V. Write the cell reaction and the Nernst equation for the cell, and find the concentration of Cu^{2+} in the cathode compartment. Given $E°(Fe^{2+}|Fe) = -0.44$ V, $E°(Cu^{2+}|Cu) = 0.34$ V, $2.303RT/F = 0.059$ V.*

24. A student has 4-methylaniline and methylbenzene dissolved together in ether. Describe, with equations, how she separates them and recovers the amine. [3]

25. A sugar Y, $C_5H_{10}O_5$, shows the following: (i) on prolonged heating with HI it gives n-pentane; (ii) it forms an oxime with hydroxylamine; (iii) bromine water oxidises it to a monocarboxylic acid with five carbon atoms; (iv) with acetic anhydride it gives a stable tetraacetate. Deduce what each observation shows, write the open-chain structure of Y and classify it. [3]

26. One mole of $IrCl_3·4NH_3$ gives one mole of AgCl at once with excess $AgNO_3$(aq). Iridium has coordination number 6 in it. (a) Write its formula. (b) State the primary and the secondary valence of iridium and what each corresponds to today. (c) How many geometrical isomers can the complex ion have? [3]

27. Write the major product and the reagents for (i) bromination of bromobenzene and (ii) Friedel–Crafts acetylation of bromobenzene. (iii) Why are harsher conditions needed than for benzene? [3]

28. For water, $T_f = 273.15$ K and $\Delta fus\ H = 6.01$ kJ mol^{-1}. Calculate K_f of water from these data and compare it with the tabulated value. ($R = 8.314$ J mol^{-1} K^{-1}, $M_1 = 18$ g mol^{-1}) [3]

Section D (2 × 4 marks)

29. Read the passage and answer the questions that follow. [4]

A student studies a gas-phase reaction A + B → C + D. Reactant molecules must pass through an activated complex before they form products, and the energy needed to reach it is the activation energy. The figure plots potential energy against the reaction coordinate for the reaction alone (solid curve) and for the same reaction with a catalyst added (dashed curve). Both paths start from the same reactants and end at the same products. Read the energies from the figure to answer the questions.

(a) The activation energy of the forward reaction without the catalyst is [1]

(a) 80 kJ mol^{-1} (b) 130 kJ mol^{-1}
(c) 110 kJ mol^{-1} (d) 40 kJ mol^{-1}

(b) The enthalpy change ΔH of the reaction is [1]

(a) −30 kJ mol^{-1} (b) 30 kJ mol^{-1}
(c) −80 kJ mol^{-1} (d) −110 kJ mol^{-1}

(c) Find the activation energy of the backward reaction C + D → A + B along each path, and state what you notice about how the catalyst changes the forward and backward barriers. [2]

Or *Using the figure, explain why the catalyst changes neither ΔH nor the equilibrium constant of the reaction.*

30. Read the passage and answer the questions that follow. [4]

A health camp at a school in Nashik finds four students whose symptoms point to a vitamin deficiency. The doctor notes each student's usual diet and recommends changes in food rather than vitamin pills, explaining that an excess of a vitamin can also be harmful and that pills should be taken only on a doctor's advice.

Student	Main symptom
Ravi	night blindness
Meena	bleeding gums
Arjun	convulsions
Fatima	soft bones that bend under the body's weight (rickets)

(a) Meena's diet lacks [1]

(a) vitamin C (b) vitamin D
(c) vitamin K (d) vitamin B_{12}

(b) The vitamins missing in which two students can be stored in the liver and adipose tissue? [1]

(a) Meena and Arjun (b) Ravi and Fatima
(c) Ravi and Meena (d) Arjun and Fatima

(c) Name the vitamin Arjun lacks, give two foods that supply it, and state whether it is fat soluble or water soluble. [2]

Or *Name the vitamin Fatima lacks, give one source of it that is not a food, and name the disease its deficiency causes in adults.*

Section E (3 × 5 marks)

31. (a) Write the reduction half-reactions of permanganate ion in (i) strongly acidic and (ii) neutral solution, naming the manganese product in each. (b) 25.0 mL of an acidified iron(II) solution needs 15.0 mL of 0.020 M $KMnO_4$ for complete oxidation. Write the balanced ionic equation and calculate the molarity of the iron(II) solution. (c) Why is sulphuric acid, not hydrochloric acid, used to acidify the solution? [5]

Or *(a) Write balanced ionic equations for the oxidation, by acidified permanganate, of (i) nitrite ion and (ii) sulphite ion. (b) Calculate the volume of 0.020 M $KMnO_4$ needed to oxidise 25.0 mL of 0.040 M sodium nitrite solution in acid. (c) State the manganese product in this titration, and why the titration is not done in hydrochloric acid.*

32. (a) State Faraday's first and second laws of electrolysis. (b) A current of 5.0 A is passed for 3860 s through molten $MgCl_2$. Calculate the mass of magnesium deposited at the cathode and the volume of chlorine set free at the anode (molar volume 22.7 L at 1 bar and 273 K; Mg = 24 g mol^{-1}; F = 96500 C mol^{-1}). (c) Why is magnesium made from the molten chloride and not by a chemical reducing agent? [5]

Or *(a) State Faraday's first and second laws of electrolysis. (b) Aluminium is made by electrolysing aluminium oxide dissolved in cryolite. If a current of 9.65 A is passed for 3000 s, calculate the quantity of electricity in faradays and the mass of aluminium deposited (Al = 27 g mol^{-1}, F = 96500 C mol^{-1}). (c) Why can aluminium not be deposited by electrolysing an aqueous solution of an aluminium salt?*

33. (a) Write, as numbered steps, the mechanism of the acid-catalysed esterification of propanoic acid with methanol. (b) Write the equation for the conversion of propanoic acid into propanoyl chloride with thionyl chloride, and say why this reagent is preferred. [5]

Or *(a) Write the equations for the conversion of butanoic acid into butanoyl chloride by PCl_5, PCl_3 and $SOCl_2$, and say which reagent is preferred and why. (b) Butanoic acid is heated with ethanol and concentrated H_2SO_4. Write the equation and state the role of the acid in the first step of the mechanism.*