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Your JEE Guide

CBSE Class XII · Chemistry (043)

Sample Question Paper 5 · Session 2026-27

Time allowed: 3 hours **Maximum marks: 70**

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This is an original practice paper written to the official CBSE 2026-27 design; it is not issued by CBSE.

General instructions:

1. There are 33 questions in this question paper with internal choice.
2. Section A consists of 16 multiple-choice questions carrying 1 mark each.
3. Section B consists of 5 very short answer questions carrying 2 marks each.
4. Section C consists of 7 short answer questions carrying 3 marks each.
5. Section D consists of 2 case-based questions carrying 4 marks each.
6. Section E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

Section A

1.	The SI unit of molality is: (A) mol L^{-1} (B) g L^{-1} (C) mol m^{-3} (D) mol kg^{-1}	1
2.	Isotonic solutions have the same: (A) vapour pressure of solute (B) volume (C) osmotic pressure (D) density	1
3.	In a galvanic cell, oxidation takes place at the: (A) voltmeter (B) anode (C) cathode (D) salt bridge	1
4.	The molecularity of an elementary reaction cannot be: (A) zero (B) two (C) three (D) one	1
5.	A common unit of activation energy is: (A) K (B) s^{-1} (C) mol L^{-1} s^{-1} (D) kJ mol^{-1}	1
6.	The 4f series (lanthanoids) begins with the element after: (A) thorium (B) lutetium (C) lanthanum (D) cerium	1

7.	Which of these is a strong-field ligand? (A) I^- (B) CN^- (C) Cl^- (D) F^-	1
8.	The number of geometrical isomers of $[Co(NH_3)_3Cl_3]$ is: (A) 2 (B) 1 (C) 4 (D) 3	1
9.	Ethyl bromide heated with alcoholic KOH gives mainly: (A) diethyl ether (B) ethanol (C) ethene (D) ethane	1
10.	Which alcohol gives a ketone on oxidation? (A) propan-2-ol (B) ethanol (C) 2-methylpropan-2-ol (D) propan-1-ol	1
11.	Which is the strongest acid? (A) HCOOH (B) $ClCH_2COOH$ (C) CH_3COOH (D) CF_3COOH	1
12.	Which of the following is a non-reducing sugar? (A) maltose (B) sucrose (C) lactose (D) glucose	1
13.	**Assertion (A):** Raising the temperature increases the rate of a reaction. **Reason (R):** At a higher temperature more molecules have energy greater than the activation energy. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1
14.	**Assertion (A):** Potassium permanganate is used as an oxidising agent in acidic medium. **Reason (R):** Potassium permanganate is purple in colour. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1
15.	**Assertion (A):** Chloroform is stored in dark-coloured, completely filled bottles. **Reason (R):** Chloroform is non-volatile. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1

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16.	**Assertion (A):** Aniline is a stronger base than ammonia. **Reason (R):** The lone pair on nitrogen in aniline is delocalised into the benzene ring. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1

Section B

17.	Find the mole fraction of ethylene glycol ($C_2H_6O_2$) in a solution containing 20% of it by mass. **OR** People who take a lot of salt sometimes have swollen tissues (oedema). Explain this using osmosis.	2
18.	Find E°cell for Cr | Cr^{3+} || Cd^{2+} | Cd, given E°(Cr^{3+}/Cr) = −0.74 V and E°(Cd^{2+}/Cd) = −0.40 V. Find ΔG° (F = 96 500 C mol^{-1}).	2
19.	For a reaction A + B → products, the initial rates are: [A] (M) | 0.1 | 0.2 | 0.1 [B] (M) | 0.1 | 0.1 | 0.2 Rate (M s^{-1}) | 2×10^{-3} | 4×10^{-3} | 8×10^{-3} Find the order with respect to A and B.	2
20.	Write ionic equations for the reaction of acidified permanganate with (i) iron(II) ions, (ii) oxalate ions.	2
21.	Which reacts faster by SN2, 1-bromobutane or 2-bromobutane? Explain.	2

Section C

22.	Benzene boils at 353.23 K. When 1.80 g of a non-volatile solute is dissolved in 90 g of benzene, the boiling point rises to 354.11 K. Find the molar mass of the solute (Kb = 2.53 K kg mol^{-1}).	3
23.	Predict the products of electrolysis of (i) aqueous $AgNO_3$ with silver electrodes, (ii) aqueous $AgNO_3$ with platinum electrodes, (iii) dilute H_2SO_4 with platinum electrodes.	3
24.	The rate of a reaction doubles for every 10 °C rise in temperature. How many times faster is it at 60 °C than at 20 °C? What is the temperature coefficient? **OR** A plot of ln k against 1/T for a reaction is a straight line of slope −5000 K. Sketch the graph and find the activation energy (R = 8.314 J K^{-1} mol^{-1}).	3

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25.	Why do transition elements show variable oxidation states? Why is the highest oxidation state of a metal often shown in its oxides or fluorides?	3
26.	Using valence bond theory, explain the hybridisation, shape and magnetic behaviour of $[Co(NH_3)_6]^{3+}$.	3
27.	Write the mechanism of the SN2 reaction of chloromethane with hydroxide ion. Why does it lead to inversion of configuration?	3
28.	Write the products formed when phenol reacts with (i) bromine in CS_2 at low temperature, (ii) sodium hydroxide and CO_2 under pressure followed by acid, (iii) chloroform and aqueous NaOH followed by acid.	3

Section D

29.	**Case study.** Food spoils because of chemical reactions and the growth of microbes. Keeping food in a refrigerator slows spoilage. For many reactions near room temperature, the rate roughly doubles for a 10 K rise. (i) Rates increase with temperature mainly because: (A) molecules become heavier (B) more collisions have energy above the activation energy (C) the activation energy falls (D) the volume decreases *[1]* (ii) Why does a refrigerator slow down spoilage? *[1]* (iii) If the rate doubles between 300 K and 310 K, find the activation energy ($R = 8.314\ J\ K^{-1}\ mol^{-1}$). *[2]* **OR** (iii) How does a catalyst speed up a reaction? Does it change the position of equilibrium? *[2]*	4
30.	**Case study.** Glucose, $C_6H_{12}O_6$, has an aldehyde group and five hydroxyl groups, but it does not give some reactions typical of aldehydes. In solution it exists mostly as a six-membered ring, in two forms called α and β, which differ only at C-1. (i) Glucose is an: (A) aldohexose (B) ketohexose (C) aldopentose (D) ketopentose *[1]* (ii) What are anomers? *[1]* (iii) Give one piece of evidence for the cyclic structure of glucose. *[2]* **OR** (iii) Which functional groups of glucose are shown by its reaction with acetic anhydride and with HCN? *[2]*	4

Section E

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31.	(a) Show that Raoult's law is a special case of Henry's law. (b) The vapour pressure of water at 293 K is 17.535 mm Hg. Find its vapour pressure when 25 g of glucose is dissolved in 450 g of water. **OR** (a) Define osmosis and osmotic pressure. (b) Find the osmotic pressure in pascals of a solution made by dissolving 1.0 g of a polymer of molar mass 185 000 g mol^{-1} in 450 mL of water at 37 °C.	5
32.	(a) State Faraday's first and second laws of electrolysis. (b) A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes with a current of 5 A for 20 minutes. Find the mass of nickel deposited (Ni = 58.7 g mol^{-1}). **OR** (a) Explain the collision theory of reaction rates, including the roles of activation energy and orientation. (b) Draw the energy profile of an exothermic reaction and show the effect of a catalyst.	5
33.	(a) How will you convert (i) nitrobenzene to benzoic acid, (ii) aniline to p-bromoaniline, (iii) benzenediazonium chloride to iodobenzene? (b) Why are amines less acidic than alcohols of comparable molar mass? **OR** (a) Classify vitamins on the basis of solubility, with two examples each, and name the deficiency diseases of vitamins A and B_{12}. (b) State two functions of nucleic acids.	5

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Answers and Marking Scheme

Marks for each step are shown in brackets. Any correct alternative method gets full credit.

Section A

1. **(D)** mol kg^{-1}. *Working:* Moles of solute per kilogram of solvent.

2. **(C)** osmotic pressure. *Working:* Definition.

3. **(B)** anode. *Working:* Electrons are released at the anode.

4. **(A)** zero. *Working:* At least one molecule must take part.

5. **(D)** kJ mol^{-1}. *Working:* It is an energy per mole.

6. **(C)** lanthanum. *Working:* Cerium (Z = 58) to lutetium (Z = 71).

7. **(B)** CN^-. *Working:* CN^- is near the end of the spectrochemical series.

8. **(A)** 2. *Working:* fac and mer isomers.

9. **(C)** ethene. *Working:* Dehydrohalogenation (elimination).

10. **(A)** propan-2-ol. *Working:* Secondary alcohols give ketones.

11. **(D)** CF_3COOH. *Working:* Three strongly electron-withdrawing F atoms stabilise the anion.

12. **(B)** sucrose. *Working:* Both anomeric carbons are used in the glycosidic bond.

13. **(A)** Both A and R are true, and R is the correct explanation of A. *Working:* R explains A.

14. **(B)** Both A and R are true, and R is not the correct explanation of A. *Working:* Both are true, but its colour is not why it oxidises; Mn(+7) is readily reduced to Mn^{2+}.

15. **(C)** A is true but R is false. *Working:* A is true (it forms phosgene in air and light). R is false: chloroform is volatile.

16. **(D)** A is false but R is true. *Working:* A is false: aniline is weaker, as R explains.

Section B

17. In 100 g: 20/62 = 0.323 mol glycol and 80/18 = 4.444 mol water (1). x = 0.323/4.767 ≈ 0.068 (1).

OR More salt raises the concentration of body fluids outside the cells and in the tissues (1); water is retained in these spaces by osmosis, causing swelling (1).

18. $E°_{cell} = -0.40 - (-0.74) = 0.34$ V (1). $2Cr + 3Cd^{2+} \rightarrow 2Cr^{3+} + 3Cd$, n = 6; $\Delta G° = -6 \times 96\,500 \times 0.34 \approx -196.9$ kJ mol^{-1} (1).

19. Doubling [A] doubles the rate: first order in A (1). Doubling [B] makes it four times: second order in B (1).

20. (i) $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$ (1). (ii) $2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$ (1).

21. 1-Bromobutane (1). It is a primary halide, so the nucleophile approaches the carbon with less steric hindrance (1).

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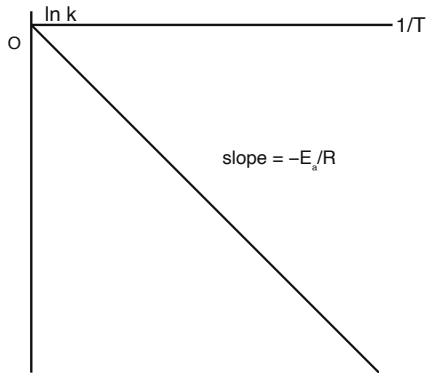
Section C

22. ΔTb = 0.88 K (1). $M_2 = \frac{K_b \times w_2 \times 1000}{\Delta T_b \times w_1} = \frac{2.53 \times 1.8 \times 1000}{0.88 \times 90}$ (1) ≈ 57.5 g mol^{-1} (1).

23. (i) Silver is deposited at the cathode and the silver anode dissolves (1). (ii) Silver at the cathode; O_2 at the anode (water is oxidised) (1). (iii) H_2 at the cathode and O_2 at the anode (1).

24. Temperature coefficient = k(T + 10)/k(T) = 2 (1). A 40 °C rise means four doublings (1): 2^4 = 16 times faster (1).

OR Graph (1):



ln k = ln A – E_a/RT, so the slope = –E_a/R (1). E_a = 5000 × 8.314 ≈ 41.6 kJ mol^{-1} (1).

25. The (n – 1)d and ns electrons have similar energies, so different numbers of them can take part in bonding (1½). Oxygen and fluorine are small and highly electronegative and can stabilise high oxidation states; oxygen can also form multiple bonds (1½).

26. Co^{3+} is $3d^6$; NH_3 pairs the electrons, leaving two 3d orbitals empty (1). d^2sp^3 hybridisation (inner orbital), octahedral shape (1). No unpaired electrons, so diamagnetic (1).

27. OH^- attacks the carbon from the side opposite to Cl in one step (1), passing through a transition state in which C is partly bonded to both OH and Cl (1). The other three groups flip over like an umbrella, so the configuration is inverted (1).

28. (i) o- and p-bromophenol (1). (ii) Salicylic acid (Kolbe's reaction) (1). (iii) Salicylaldehyde (Reimer–Tiemann reaction) (1).

Section D

29. (i) (B) more collisions are effective.
(ii) At low temperature, fewer molecules have the energy needed to react, so the reactions that spoil food are slower.
(iii) $\log 2 = \frac{E_a}{2.303R} \cdot \frac{10}{300 \times 310}$, so E_a ≈ 53.6 kJ mol^{-1}. **OR** It provides a path of lower activation energy; it does not change the equilibrium constant, only the time taken to reach equilibrium.

30. (i) (A) aldohexose.
(ii) Cyclic isomers that differ only in configuration at the anomeric carbon (C-1 in glucose), such as α- and β-glucose.
(iii) Any one: it does not react with $NaHSO_3$ or give Schiff's test; its pentaacetate does not react with hydroxylamine; it exists in α and β forms (mutarotation). **OR** Acetylation gives a pentaacetate (five –OH groups); HCN gives a cyanohydrin (a carbonyl group).

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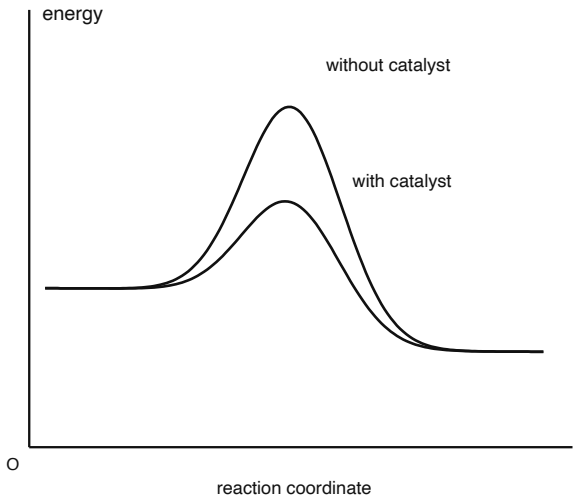
Section E

31. (a) Henry's law $p = K_H x$; for a volatile component in a solution p = p°x, which has the same form with $K_H = p^\circ$ (2). (b) n_2 = 25/180 = 0.139 mol; n_1 = 450/18 = 25 mol (1). $x_2 \approx 0.0055$ (1). p = 17.535 × (1 – 0.0055) ≈ 17.44 mm Hg (1).

OR (a) The flow of solvent through a semipermeable membrane from a dilute to a more concentrated solution (1); osmotic pressure is the extra pressure that just stops this flow (1). (b) π = (n/V)RT = (1/185 000)/(0.45 × 10^{-3} m^3) × 8.314 × 310 (2) ≈ 31 Pa (1).

32. (a) The mass deposited is proportional to the charge passed; for the same charge, masses of different substances are proportional to their equivalent masses (2). (b) Q = 5 × 1200 = 6000 C (1). $Ni^{2+} + 2e^- \rightarrow Ni$: m = 58.7 × 6000/(2 × 96 500) (1) ≈ 1.82 g (1).

OR (a) Molecules must collide to react; only collisions with energy at least equal to the activation energy and with proper orientation are effective; rate = $PZe^{-E_a/RT}$ (3). (b) Diagram (2):



33. (a) (i) Reduce to aniline (Sn/HCl), diazotise, treat with CuCN to get benzonitrile, then hydrolyse (1). (ii) Acetylate the $–NH_2$ group, brominate (para product), then hydrolyse the amide (1). (iii) Warm with KI solution (1). (b) N is less electronegative than O, so the N–H bond is less polar and the amide ion $R–NH^-$ is less stable than the alkoxide ion (2).

OR (a) Fat-soluble: A, D, E, K; water-soluble: B group and C (2). Vitamin A: night blindness (xerophthalmia); vitamin B_{12}: pernicious anaemia (1). (b) DNA carries hereditary information and directs protein synthesis through RNA; RNA takes part in protein synthesis (2).

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