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Your JEE Guide

CBSE Class XII · Chemistry (043)

Sample Question Paper 7 · 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.	Which 0.1 M aqueous solution has the highest vapour pressure? (A) NaCl (B) $CaCl_2$ (C) glucose (D) $Al_2(SO_4)_3$	1
2.	Colligative properties depend on the: (A) nature of the solute (B) number of solute particles (C) chemical formula of the solute (D) colour of the solution	1
3.	Which metal is the strongest reducing agent in aqueous solution? (A) Na (B) Zn (C) Cu (D) Li	1
4.	The unit of the rate of a reaction is: (A) mol L^{-1} s^{-1} (B) mol s (C) s^{-1} (D) L mol^{-1} s^{-1}	1
5.	For many reactions, a 10 K rise in temperature near room temperature roughly: (A) does not change the rate (B) halves the rate (C) doubles the rate (D) increases the rate ten times	1
6.	Which of these ions is diamagnetic? (A) Cr^{3+} (B) Ti^{3+} (C) V^{3+} (D) Sc^{3+}	1

7.	EDTA is used to treat lead poisoning because it: (A) precipitates lead as PbS (B) forms a stable chelate with Pb^{2+} (C) oxidises lead (D) reduces lead to the metal	1
8.	The complex $[Pt(NH_3)_4]^{2+}$ is: (A) square planar (B) tetrahedral (C) octahedral (D) linear	1
9.	R–Cl + NaI (in dry acetone) → R–I + NaCl is called the: (A) Finkelstein reaction (B) Wurtz reaction (C) Sandmeyer reaction (D) Swarts reaction	1
10.	The best reagent to oxidise ethanol to ethanal without further oxidation is: (A) acidified $KMnO_4$ (B) acidified $K_2Cr_2O_7$ in excess (C) HNO_3 (D) PCC	1
11.	Formalin is an aqueous solution of: (A) ethanal (B) methanoic acid (C) methanal (about 40%) (D) methanol	1
12.	Two monosaccharide units in a disaccharide are joined by a: (A) hydrogen bond (B) glycosidic linkage (C) peptide bond (D) phosphodiester bond	1
13.	**Assertion (A):** 0.1 M NaCl solution has a higher osmotic pressure than 0.1 M glucose solution. **Reason (R):** Osmotic pressure depends on the number of solute particles. (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):** A mercury cell gives a nearly constant voltage during its life. **Reason (R):** Mercury is a liquid metal. (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):** Aldehydes are easily oxidised. **Reason (R):** Ketones are oxidised more easily than aldehydes. (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):** Methylamine is a weaker base than ammonia. **Reason (R):** The methyl group is electron-releasing (+I effect). (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.	A 5% (by mass) solution of cane sugar (M = 342) in water freezes at 271 K. Find the freezing point of a 5% solution of glucose (M = 180). (Freezing point of water = 273.15 K.) **OR** H_2S, a toxic gas, dissolves in water to give a 0.195 m solution at STP (pressure 0.987 bar). Find Henry's law constant.	2
18.	Find the emf of the cell Mg | Mg^{2+}(0.001 M) || Cu^{2+}(0.0001 M) | Cu at 298 K, given $E°_{cell}$ = 2.71 V.	2
19.	What is the instantaneous rate of a reaction? How is it found from a concentration–time graph?	2
20.	Zirconium and hafnium have almost identical atomic radii. Explain why, and give one consequence.	2
21.	Write the condensed structural formulae of (i) 4-tert-butyl-3-iodoheptane, (ii) 1,4-dibromobut-2-ene.	2

Section C

22.	Two elements A and B form compounds AB_2 and AB_4. Dissolved in 20 g of benzene, 1 g of AB_2 lowers the freezing point by 2.3 K and 1 g of AB_4 by 1.3 K (Kf = 5.1 K kg mol^{-1}). Find the atomic masses of A and B.	3
23.	The limiting ionic conductivities are Ca^{2+} 119.0, Mg^{2+} 106.0, Cl^- 76.3 and SO_4^{2-} 160.0 S cm^2 mol^{-1}. Find $\Lambda°_m$ for $CaCl_2$ and $MgSO_4$, and state the law used. **OR** In the electrolysis of aqueous NaCl, why is hydrogen (not sodium) formed at the cathode and chlorine (not oxygen) at the anode?	3
24.	The rate constants of a reaction at 500 K and 700 K are 0.02 s^{-1} and 0.07 s^{-1}. Find the activation energy and the frequency factor.	3
25.	Explain: (i) actinoid contraction is greater than lanthanoid contraction; (ii) the chemistry of actinoids is more complicated than that of lanthanoids; (iii) name a lanthanoid that shows the +4 oxidation state.	3

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26.	Name the type of isomerism shown by each pair: (i) $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$; (ii) $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$; (iii) $[Co(NH_3)_5(NO_2)]^{2+}$ and $[Co(NH_3)_5(ONO)]^{2+}$.	3
27.	Write one method each, with equations, to prepare alkyl halides from (i) alcohols, (ii) alkenes. (iii) What is the Swarts reaction?	3
28.	How will you convert (i) aniline to benzene, (ii) aniline to phenol, (iii) benzamide to aniline?	3

Section D

29.	**Case study.** In electroplating, a thin layer of a metal is deposited on an object by electrolysis. To silver-plate a spoon, the spoon is made one electrode and a silver rod the other, in a solution containing silver ions. (i) The spoon to be plated is made the: (A) anode (B) cathode (C) salt bridge (D) reference electrode *[1]* (ii) Name a suitable electrolyte. *[1]* (iii) Find the mass of silver deposited by a current of 2 A in 15 minutes (Ag = 108 g mol^{-1}). *[2]* **OR** (iii) How much charge is needed to deposit 1 mol of silver? *[2]*	4
30.	**Case study.** Enzymes are biological catalysts. Almost all of them are proteins. They speed up reactions in the body enormously, work best at body temperature and a particular pH, and are very specific. (i) Most enzymes are: (A) carbohydrates (B) proteins (C) lipids (D) nucleic acids *[1]* (ii) How does an enzyme speed up a reaction? *[1]* (iii) Why do enzymes lose their activity at high temperatures? *[2]* **OR** (iii) Give one example of an enzyme and the reaction it catalyses. *[2]*	4

Section E

31.	(a) Derive the relation between E°cell and the equilibrium constant of a cell reaction. (b) Find the equilibrium constant of $Cu(s) + 2Ag^+(aq) \rightleftharpoons Cu^{2+}(aq) + 2Ag(s)$, given E°cell = 0.46 V at 298 K. **OR** (a) What are azeotropes? Give one example of each type. (b) Heptane and octane form an ideal solution. At 373 K their vapour pressures are 105.2 kPa and 46.8 kPa. Find the vapour pressure of a mixture of 26.0 g of heptane and 35.0 g of octane.	5

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32.	(a) Draw the splitting of d orbitals in a tetrahedral field. Why is Δt smaller than Δo? (b) Explain why $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic. (c) Write the IUPAC name of $[Co(NH_3)_5Cl]Cl_2$. **OR** (a) Write the addition of sodium hydrogensulphite to an aldehyde. How is it used to purify aldehydes? (b) Why does semicarbazide react with a carbonyl group through only one of its $–NH_2$ groups?	5
33.	(a) How is aniline obtained from nitrobenzene? What happens when aniline reacts with bromine water? Why is aniline acetylated before nitration? (b) Why is the order of basicity of methylamines different in the gas phase and in water? **OR** (a) Classify carbohydrates with one example of each class. (b) Why is the hydrolysis product of sucrose called invert sugar?	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. **(C)** glucose. *Working:* Glucose does not dissociate, so it has the fewest particles.

2. **(B)** number of solute particles. *Working:* Definition.

3. **(D)** Li. *Working:* Li has the most negative standard electrode potential (about −3.05 V).

4. **(A)** mol L^{-1} s^{-1}. *Working:* Change in concentration per unit time.

5. **(C)** doubles the rate. *Working:* The temperature coefficient is usually about 2 to 3.

6. **(D)** Sc^{3+}. *Working:* Sc^{3+} is $3d^0$.

7. **(B)** forms a stable chelate with Pb^{2+}. *Working:* The water-soluble chelate is excreted.

8. **(A)** square planar. *Working:* Pt^{2+} ($5d^8$) forms dsp^2 complexes.

9. **(A)** Finkelstein reaction. *Working:* Halogen exchange; NaCl precipitates in acetone.

10. **(D)** PCC. *Working:* Pyridinium chlorochromate stops at the aldehyde.

11. **(C)** methanal (about 40%). *Working:* Used to preserve biological specimens.

12. **(B)** glycosidic linkage. *Working:* An oxide linkage formed by loss of water.

13. **(A)** Both A and R are true, and R is the correct explanation of A. *Working:* NaCl gives about twice as many particles.

14. **(B)** Both A and R are true, and R is not the correct explanation of A. *Working:* Both are true, but the constant voltage is because the overall reaction involves no ions in solution.

15. **(C)** A is true but R is false. *Working:* A is true. R is false: ketones resist oxidation because it needs a C–C bond to break.

16. **(D)** A is false but R is true. *Working:* A is false: the +I effect makes methylamine more basic. R is true.

Section B

17. ΔTf for sugar = 2.15 K; ΔTf $\propto$ molality, and for equal mass percentages molality $\propto$ 1/M (1). ΔTf(glucose) = 2.15 × 342/180 ≈ 4.09 K, so the freezing point ≈ 269.07 K (1).

OR x(H_2S) = 0.195/(0.195 + 55.5) ≈ 0.0035 (1). $K_H = \frac{p}{x} = \frac{0.987}{0.0035} \approx 282$ bar (1).

18. $E = E^\circ - \frac{0.059}{2} \log \frac{[Mg^{2+}]}{[Cu^{2+}]}$ (1) = 2.71 − 0.0295 log 10 ≈ 2.68 V (1).

19. The rate at a particular instant, i.e. −d[R]/dt (1). Draw a tangent to the curve at that time; its slope gives the rate (1).

20. Lanthanoid contraction offsets the expected increase in size from Zr (4d) to Hf (5d) (1). They have very similar properties and occur together, so they are difficult to separate (1).

21. (i) $CH_3CH_2CH(I)CH(C(CH_3)_3)CH_2CH_2CH_3$ (1). (ii) $BrCH_2CH{=}CHCH_2Br$ (1).

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Section C

22. $M(AB_2) = 5.1 \times 1 \times 1000/(2.3 \times 20) \approx 110.9$; $M(AB_4) = 5.1 \times 1000/(1.3 \times 20) \approx 196.2$ g mol^{-1} (1½). 2B = 85.3, so B ≈ 42.6 u; A = 110.9 − 85.3 ≈ 25.6 u (1½).

23. Kohlrausch's law of independent migration of ions (1). $\Lambda^\circ(CaCl_2) = 119.0 + 2 \times 76.3 = 271.6$ S cm² mol^{-1} (1). $\Lambda^\circ(MgSO_4) = 106.0 + 160.0 = 266.0$ S cm² mol^{-1} (1).

OR Water ($E^\circ = -0.83$ V) is reduced far more easily than Na^+ ($E^\circ = -2.71$ V), so H_2 forms (1½). Oxygen evolution needs a large overpotential, so Cl^- is oxidised to Cl_2 in practice (1½).

24. $\log \frac{0.07}{0.02} = \frac{E_a}{2.303 \times 8.314}\left(\frac{700-500}{700\times500}\right)$ (1). $E_a \approx 18.2$ kJ mol^{-1} (1). $A = ke^{E_a/RT} = 0.02 \times e^{18230/(8.314\times500)} \approx 1.6$ s^{-1} (1).

25. (i) 5f electrons shield the nuclear charge even more poorly than 4f electrons (1). (ii) Actinoids show many oxidation states and are radioactive, making their study difficult (1). (iii) Cerium (Ce^{4+}) (1).

26. (i) Coordination isomerism (1). (ii) Hydrate (solvate) isomerism (1). (iii) Linkage isomerism (1).

27. (i) ROH + HCl (anhydrous $ZnCl_2$) → RCl + H_2O (1). (ii) $CH_3CH{=}CH_2 + HBr \rightarrow CH_3CHBrCH_3$ (Markovnikov) (1). (iii) Heating an alkyl chloride or bromide with a metallic fluoride such as AgF or Hg_2F_2 gives an alkyl fluoride (1).

28. (i) Diazotise, then treat with H_3PO_2 (hypophosphorous acid) (1). (ii) Diazotise, then warm the diazonium solution with water (1). (iii) Hoffmann bromamide degradation with Br_2 and NaOH (1).

Section D

29. (i) (B) cathode, where Ag^+ is reduced to Ag.
(ii) Silver nitrate solution (or potassium dicyanoargentate(I), $K[Ag(CN)_2]$, for a smoother coat).
(iii) Q = 2 × 900 = 1800 C; mass = 108 × 1800/96 500 ≈ 2.01 g. **OR** 1 F = 96 500 C.

30. (i) (B) proteins.
(ii) It provides a path with a lower activation energy.
(iii) Heat denatures the protein: its folded structure, including the active site, is lost. **OR** Invertase converts sucrose into glucose and fructose (or maltase: maltose to glucose; pepsin: proteins to peptides).

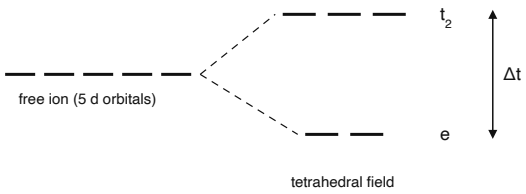
Section E

31. (a) At equilibrium E = 0, so $E^\circ = \frac{0.059}{n}\log K$ (2). (b) $\log K = \frac{2\times0.46}{0.059} \approx 15.6$ (2), so K ≈ 3.9 × 10^{15} (1).

OR (a) Mixtures that boil at constant temperature with the same composition in liquid and vapour; minimum-boiling: ethanol–water (about 95% ethanol); maximum-boiling: nitric acid–water (about 68% HNO_3) (2). (b) n(heptane) = 0.26, n(octane) = 0.307, x(heptane) ≈ 0.459 (1). p = 0.459 × 105.2 + 0.541 × 46.8 ≈ 73.6 kPa (2).

32. (a) In a tetrahedral field the e set is lower and t_2 higher; there are only four ligands and none point directly at the d orbitals, so $\Delta t \approx (4/9)\Delta o$ (2):

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(b) Ni^{2+} is $3d^8$. Cl^- is weak-field: sp^3, tetrahedral, two unpaired electrons. CN^- is strong-field: electrons pair, dsp^2, square planar, no unpaired electrons (2). (c) Pentaamminechloridocobalt(III) chloride (1).

OR (a) $RCHO + NaHSO_3 \rightarrow RCH(OH)SO_3Na$, a crystalline addition product (1½). It is separated and decomposed with dilute acid or alkali to give back the pure aldehyde (1½). (b) The lone pair on the N next to the C=O group is delocalised by resonance, so only the terminal $–NH_2$ is nucleophilic (2).

33. (a) Reduction with Sn/HCl or Fe/HCl (1). With bromine water it gives a white precipitate of 2,4,6-tribromoaniline (1). Nitration of aniline gives oxidation products and much meta product (anilinium ion); acetylation moderates the activating effect and protects $–NH_2$, giving mainly the para product (1). (b) In the gas phase basicity follows the +I effect: 3° > 2° > 1°; in water, solvation of the protonated amine by hydrogen bonding and steric factors also matter, giving 2° > 1° > 3° for methylamines (2).

OR (a) Monosaccharides (glucose), oligosaccharides such as disaccharides (sucrose), and polysaccharides (starch, cellulose) (3). (b) Sucrose is dextrorotatory; its hydrolysis gives glucose (+) and fructose (–), and the mixture is laevorotatory, so the sign of rotation is inverted (2).

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