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Your JEE Guide

CBSE Class XII · Chemistry (043)

Sample Question Paper 2 · 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 boiling point? (A) NaCl (B) K_2SO_4 (C) urea (D) glucose	1
2.	Which pair of liquids forms a nearly ideal solution? (A) ethanol and water (B) phenol and aniline (C) n-hexane and n-heptane (D) acetone and chloroform	1
3.	Standard electrode potentials are measured with reference to the: (A) standard hydrogen electrode (B) zinc electrode (C) copper electrode (D) calomel electrode at any pressure	1
4.	For a zero-order reaction, the rate is independent of the: (A) nature of the reactant (B) temperature (C) catalyst (D) concentration of the reactant	1
5.	The half-life of a zero-order reaction is: (A) $\frac{1}{k[R]_0}$ (B) $\frac{2k}{[R]_0}$ (C) $\frac{0.693}{k}$ (D) $\frac{[R]_0}{2k}$	1
6.	Which element of the 3d series shows the highest oxidation state? (A) Fe (B) Mn (C) Zn (D) Cr	1

7.	The coordination number of cobalt in $[Co(en)_3]^{3+}$ is: (A) 2 (B) 3 (C) 6 (D) 4	1
8.	Which of the following is an ambidentate ligand? (A) NO_2^- (B) NH_3 (C) H_2O (D) en	1
9.	Chloroform kept in air and light slowly forms a poisonous gas: (A) phosgene ($COCl_2$) (B) chlorine (C) carbon monoxide (D) methane	1
10.	The Lucas test is used to distinguish between: (A) aldehydes and ketones (B) primary, secondary and tertiary alcohols (C) phenols and alcohols (D) primary and secondary amines	1
11.	Benzaldehyde with concentrated NaOH gives: (A) benzoic acid only (B) benzene and sodium formate (C) toluene (D) benzyl alcohol and sodium benzoate	1
12.	On prolonged heating with HI, glucose gives: (A) sorbitol (B) gluconic acid (C) n-hexane (D) glucose pentaacetate	1
13.	**Assertion (A):** Ethylene glycol is added to the water in car radiators in cold countries. **Reason (R):** Ethylene glycol lowers the freezing point of water. (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):** Fluorine has the highest standard reduction potential among the halogens. **Reason (R):** Fluorine is the strongest oxidising agent. (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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15.	**Assertion (A):** Primary amines have higher boiling points than tertiary amines of similar molar mass. **Reason (R):** Primary amines form intermolecular hydrogen bonds; tertiary amines cannot. (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
16.	**Assertion (A):** DNA contains the base uracil. **Reason (R):** In RNA, uracil takes the place of thymine. (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.	222.6 g of ethylene glycol ($C_2H_6O_2$) is dissolved in 200 g of water. Find the molality of the solution. **OR** Calculate the mass of urea (NH_2CONH_2) needed to make 2.5 kg of a 0.25 molal aqueous solution.	2
18.	The conductivity of 0.20 M KCl at 298 K is 0.0248 S cm^{-1}. Find its molar conductivity.	2
19.	For the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$, write the relation between the rates of disappearance of N_2O_5 and of formation of NO_2 and O_2.	2
20.	Write the electronic configuration of zinc (Z = 30). Why is zinc not regarded as a transition element?	2
21.	Give reasons: (i) alkyl halides, though polar, are immiscible with water; (ii) Grignard reagents must be prepared under anhydrous conditions.	2

Section C

22.	1.00 g of a non-electrolyte dissolved in 50 g of benzene lowers its freezing point by 0.40 K. Find the molar mass of the solute (Kf of benzene = 5.12 K kg mol^{-1}).	3
23.	A current of 1.5 A is passed through copper sulphate solution for 10 minutes. Find the mass of copper deposited at the cathode (Cu = 63.5 g mol^{-1}, F = 96 500 C mol^{-1}). **OR** Write the reactions at the anode and cathode of a lead storage battery during discharge. Why does the density of its acid fall during discharge?	3

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24.	For a reaction A + B → products, doubling [A] doubles the rate, and doubling [B] makes the rate four times. Write the rate law, the overall order and the unit of k.	3
25.	Explain why transition metals (i) form interstitial compounds, (ii) form alloys easily, (iii) act as good catalysts.	3
26.	Explain with one example each: (i) linkage isomerism, (ii) ionisation isomerism, (iii) geometrical isomerism in coordination compounds.	3
27.	Write the mechanism of the acid-catalysed dehydration of ethanol to ethene at 443 K.	3
28.	Give three observations that cannot be explained by the open-chain structure of glucose.	3

Section D

29.	**Case study.** Red blood cells keep their shape in 0.9% (mass/volume) sodium chloride solution, called normal saline. In more concentrated salt solution they shrink, and in pure water they swell and may burst. These effects are due to osmosis. (i) A solution with the same osmotic pressure as blood is called: (A) hypertonic (B) hypotonic (C) isotonic (D) saturated *[1]* (ii) Why do red blood cells shrink in a hypertonic solution? *[1]* (iii) Find the osmotic pressure of a 0.1 M glucose solution at 300 K (R = 0.0821 L atm mol^{-1} K^{-1}). *[2]* **OR** (iii) Why is the osmotic pressure of 0.1 M NaCl about twice that of 0.1 M glucose? *[2]*	4
30.	**Case study.** The –OH group of phenol strongly activates the benzene ring towards electrophilic substitution. With bromine water, phenol instantly gives a white precipitate. With dilute nitric acid at low temperature it gives a mixture of o- and p-nitrophenols. (i) The white precipitate formed with bromine water is: (A) bromobenzene (B) 2,4,6-tribromophenol (C) o-bromophenol (D) p-bromophenol *[1]* (ii) Why does the –OH group activate the ring? *[1]* (iii) How can o- and p-nitrophenol be separated? Give a reason. *[2]* **OR** (iii) Write the Reimer–Tiemann reaction of phenol. *[2]*	4

Section E

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31.	(a) Write equations for (i) the Hoffmann bromamide degradation of ethanamide, (ii) the carbylamine reaction of aniline, (iii) the coupling of benzenediazonium chloride with phenol. (b) How is aniline prepared from benzene? **OR** Account for: (a) aniline is a weaker base than ammonia; (b) methylamine solution precipitates $Fe(OH)_3$ from ferric chloride solution; (c) aromatic diazonium salts are more stable than aliphatic ones. (d) Write the diazotisation of aniline.	5
32.	(a) Derive the integrated rate equation for a first-order reaction. (b) The half-life of a first-order reaction is 3 hours. Find the time needed for 70% of the reaction to be complete. **OR** (a) Explain how a catalyst increases the rate of a reaction, with an energy profile diagram. (b) Write the Arrhenius equation and explain the meaning of each term. (c) Does a catalyst change ΔH or the equilibrium constant?	5
33.	(a) How is potassium dichromate prepared from chromite ore? Write the equations. Write its reaction with Fe^{2+} ions in acid. (b) Find the spin-only magnetic moment of Mn^{2+} (Z = 25). **OR** (a) Explain the stereochemistry of SN2 and SN1 reactions of an optically active alkyl halide. (b) What is a chiral molecule? Which of 1-chlorobutane and 2-chlorobutane is chiral?	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. **(B)** K_2SO_4. *Working:* K_2SO_4 gives three ions per formula unit (i = 3).

2. **(C)** n-hexane and n-heptane. *Working:* Similar molecules with similar intermolecular forces.

3. **(A)** standard hydrogen electrode. *Working:* SHE is assigned E° = 0.

4. **(D)** concentration of the reactant. *Working:* Rate = $k[R]^0 = k$.

5. **(D)** $\frac{[R]_0}{2k}$. *Working:* Set $[R] = [R]_0/2$ in $[R] = [R]_0 - kt$.

6. **(B)** Mn. *Working:* Mn shows +7 (as in $KMnO_4$).

7. **(C)** 6. *Working:* Ethane-1,2-diamine is bidentate: 3 × 2.

8. **(A)** NO_2^-. *Working:* It can bind through N (nitrito-N) or O (nitrito-O).

9. **(A)** phosgene ($COCl_2$). *Working:* $2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$; it is stored in dark bottles.

10. **(B)** primary, secondary and tertiary alcohols. *Working:* $ZnCl_2$/conc. HCl gives turbidity at different rates.

11. **(D)** benzyl alcohol and sodium benzoate. *Working:* Cannizzaro reaction; benzaldehyde has no α-hydrogen.

12. **(C)** n-hexane. *Working:* This shows that its six carbon atoms are in a straight chain.

13. **(A)** Both A and R are true, and R is the correct explanation of A. *Working:* It acts as an antifreeze by depressing the freezing point.

14. **(B)** Both A and R are true, and R is not the correct explanation of A. *Working:* Both are true, but being a strong oxidising agent is a consequence of the high E°, not its explanation.

15. **(A)** Both A and R are true, and R is the correct explanation of A. *Working:* Hydrogen bonding raises the boiling point.

16. **(D)** A is false but R is true. *Working:* A is false: DNA contains thymine. R is true.

Section B

17. n = 222.6/62 = 3.59 mol (1). Molality = 3.59/0.200 ≈ 17.95 mol kg^{-1} (1).

OR 0.25 mol (15 g) of urea per 1000 g of water gives 1015 g of solution (1). For 2500 g: 15 × 2500/1015 ≈ 37 g of urea (1).

18. $\Lambda_m = \frac{1000\kappa}{c}$ (1) $= \frac{1000 \times 0.0248}{0.20} = 124$ S cm^2 mol^{-1} (1).

19. $-\frac{1}{2}\frac{d[N_2O_5]}{dt} = \frac{1}{4}\frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$ (2).

20. [Ar]$3d^{10}4s^2$ (1). Its d orbitals are completely filled both in the atom and in its common ion Zn^{2+} (1).

21. (i) They cannot form hydrogen bonds with water, and the energy released in new attractions is less than that needed to break water's hydrogen bonds (1). (ii) Grignard reagents react with

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water to form alkanes: RMgX + H_2O → RH + Mg(OH)X (1).

Section C

22. $\Delta T_f = K_f \frac{w_2 \times 1000}{M_2 w_1}$ (1). $M_2 = \frac{5.12 \times 1.00 \times 1000}{0.40 \times 50}$ (1) = 256 g mol^{-1} (1).

23. Q = It = 1.5 × 600 = 900 C (1). $Cu^{2+} + 2e^- \rightarrow Cu$, so 2 × 96 500 C deposit 63.5 g (1). Mass = 63.5 × 900/193 000 ≈ 0.296 g (1).

OR Anode: $Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$ (1). Cathode: $PbO_2 + SO_4^{2-} + 4H^+ + 2e^- \rightarrow PbSO_4 + 2H_2O$ (1). Sulphuric acid is used up and water is formed, so the density falls (1).

24. Rate = $k[A][B]^2$ (1). Overall order 3 (1). Unit of k: $L^2\ mol^{-2}\ s^{-1}$ (1).

25. (i) Small atoms such as H, C and N fit into the voids of their crystal lattices (1). (ii) Their atomic radii are similar, so one metal can replace another in the lattice (1). (iii) They show variable oxidation states and provide surfaces for adsorption, forming unstable intermediates (1).

26. (i) An ambidentate ligand binds through different atoms: $[Co(NH_3)_5(NO_2)]Cl_2$ and $[Co(NH_3)_5(ONO)]Cl_2$ (1). (ii) An ion inside and outside the sphere exchange places: $[Co(NH_3)_5SO_4]Br$ and $[Co(NH_3)_5Br]SO_4$ (1). (iii) Different arrangements of ligands in space: cis and trans $[Pt(NH_3)_2Cl_2]$ (1).

27. Step 1: protonation of ethanol to form the ethyloxonium ion $CH_3CH_2OH_2^+$ (1). Step 2: loss of water to form the carbocation $CH_3CH_2^+$ (slow step) (1). Step 3: loss of H^+ to form $CH_2{=}CH_2$ (1).

28. It does not give Schiff's test or form the hydrogensulphite addition product with $NaHSO_3$ (1). Glucose pentaacetate does not react with hydroxylamine, showing no free –CHO group (1). Glucose exists in two crystalline forms, α and β, explained by the cyclic hemiacetal structure (1).

Section D

29. (i) (C) isotonic.
(ii) Water moves out of the cells into the more concentrated solution by osmosis.
(iii) π = CRT = 0.1 × 0.0821 × 300 ≈ 2.46 atm. **OR** NaCl dissociates into Na^+ and Cl^- (van't Hoff factor about 2), doubling the number of solute particles.

30. (i) (B) 2,4,6-tribromophenol.
(ii) Its lone pair is delocalised into the ring by resonance, increasing electron density, especially at the ortho and para positions.
(iii) By steam distillation: o-nitrophenol is steam-volatile because of intramolecular hydrogen bonding, while p-nitrophenol is held by intermolecular hydrogen bonds. **OR** Phenol + $CHCl_3$ + aqueous NaOH (then H^+) gives salicylaldehyde (2-hydroxybenzaldehyde).

Section E

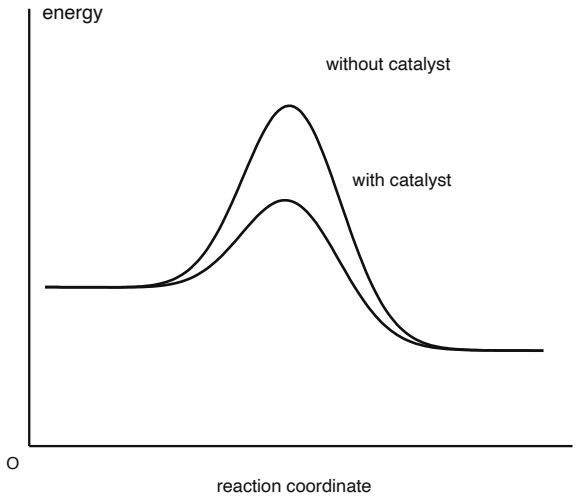
31. (a) (i) $CH_3CONH_2 + Br_2 + 4NaOH \rightarrow CH_3NH_2 + Na_2CO_3 + 2NaBr + 2H_2O$ (1). (ii) $C_6H_5NH_2 + CHCl_3 + 3KOH \rightarrow C_6H_5NC + 3KCl + 3H_2O$; foul-smelling isocyanide (1). (iii) $C_6H_5N_2^+Cl^-$ + C_6H_5OH (alkaline) → p-hydroxyazobenzene, an orange dye (1). (b) Nitration with conc. HNO_3/H_2SO_4 gives nitrobenzene; reduction with Sn/HCl (or Fe/HCl) gives aniline (2).

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OR (a) The lone pair of N in aniline is delocalised into the ring and is less available (1). (b) Methylamine is a stronger base than water; it gives OH^- ions, which precipitate $Fe(OH)_3$ (1). (c) The positive charge of the aryl diazonium ion is delocalised over the ring (1). (d) $C_6H_5NH_2 + NaNO_2 + 2HCl$ (273–278 K) $\rightarrow C_6H_5N_2^+Cl^- + NaCl + 2H_2O$ (2).

32. (a) $-\frac{d[R]}{dt} = k[R]$, so $\int \frac{d[R]}{[R]} = -k\int dt$ (1); $\ln[R] = -kt + \ln[R]_0$ (1); $k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$ (1). (b) k = 0.693/3 = 0.231 h^{-1}; $t = \frac{2.303}{0.231}\log\frac{100}{30} \approx 5.2$ h (2).

OR (a) It provides an alternative path with a lower activation energy (1). Diagram (1):



(b) $k = Ae^{-E_a/RT}$: A is the frequency factor, E_a the activation energy, R the gas constant and T the temperature (2). (c) No; it changes neither ΔH nor K, only how quickly equilibrium is reached (1).

33. (a) $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$ (1). $2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$, then $Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$ (1). $Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$ (1). (b) Mn^{2+} is $3d^5$ with 5 unpaired electrons: $\mu = \sqrt{5 \times 7} \approx 5.92$ BM (2).

OR (a) SN2: backside attack in one step gives inversion of configuration (1½). SN1: the planar carbocation is attacked from either side, giving racemisation (1½). (b) A molecule not superimposable on its mirror image (1). 2-Chlorobutane is chiral: C-2 carries four different groups (1).

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