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Your JEE Guide

CBSE Class XII · Chemistry (043)

Sample Question Paper 6 · 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 mole fraction of water in a 1 molal aqueous solution is about: (A) 0.018 (B) 1.0 (C) 0.5 (D) 0.982	1
2.	Which mixture shows negative deviation from Raoult's law? (A) carbon disulphide and acetone (B) benzene and toluene (C) chloroform and acetone (D) ethanol and acetone	1
3.	On dilution, the conductivity (specific conductance) of an electrolyte solution: (A) decreases (B) stays the same (C) increases (D) first increases, then decreases	1
4.	A first-order reaction is 50% complete in 30 minutes. It will be 75% complete in: (A) 45 min (B) 60 min (C) 90 min (D) 120 min	1
5.	Which reagent is commonly used to estimate Fe^{2+} ions by titration in acid medium? (A) Na_2CO_3 (B) NaCl (C) $KMnO_4$ (D) $AgNO_3$	1

6.	Actinoids show many oxidation states because: (A) they have very small atoms (B) the 5f, 6d and 7s levels have comparable energies (C) their 4f orbitals are full (D) they are radioactive	1
7.	The formula of potassium hexacyanidoferrate(III) is: (A) $K_2[Fe(CN)_6]$ (B) $K_4[Fe(CN)_6]$ (C) $K[Fe(CN)_6]$ (D) $K_3[Fe(CN)_6]$	1
8.	Which of these molecules is chiral? (A) $CH_3CH(OH)COOH$ (B) CH_3CH_2OH (C) $(CH_3)_2CHOH$ (D) $CH_2(OH)COOH$	1
9.	An alkyl halide heated with sodium in dry ether gives: (A) an alkene (B) an alkane (Wurtz reaction) (C) an alcohol (D) an ether	1
10.	Phenol heated with zinc dust gives: (A) cyclohexanol (B) benzoic acid (C) benzene (D) toluene	1
11.	Carboxylic acids have higher boiling points than alcohols of similar molar mass because they: (A) are ionic (B) have smaller molecules (C) cannot form hydrogen bonds (D) form hydrogen-bonded dimers	1
12.	Which amino acid is optically inactive? (A) glycine (B) valine (C) alanine (D) leucine	1
13.	**Assertion (A):** Azeotropic mixtures cannot be separated by fractional distillation. **Reason (R):** At the azeotropic composition, the liquid and the vapour have the same composition. (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):** The conductance of an electrolytic solution increases with temperature. **Reason (R):** The conductance of metals decreases with temperature. (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):** tert-Butyl bromide reacts readily by the SN1 mechanism. **Reason (R):** The tertiary carbocation formed is highly stable. (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):** Benzaldehyde gives a positive Fehling's test. **Reason (R):** Aromatic aldehydes do not reduce Fehling's solution. (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 molality of a solution of 2.5 g of ethanoic acid (CH_3COOH) in 75 g of benzene. **OR** What is meant by positive deviation from Raoult's law? Give one example. What are the signs of ΔH_{mix} and ΔV_{mix}?	2
18.	Why does the conductivity of a solution decrease with dilution while its molar conductivity increases?	2
19.	In a reaction R → P, the concentration of R falls from 0.03 M to 0.02 M in 25 minutes. Find the average rate in M min^{-1} and M s^{-1}.	2
20.	Why are zinc, cadmium and mercury soft metals with low melting points? Why is mercury a liquid at room temperature?	2
21.	Write the main product: (i) $CH_3CH_2OH + SOCl_2$ →; (ii) $CH_3CH{=}CH_2$ + HBr in the presence of a peroxide →.	2

Section C

22.	45 g of ethylene glycol ($C_2H_6O_2$) is mixed with 600 g of water. Find the freezing point of the solution (Kf = 1.86 K kg mol^{-1}).	3
23.	The molar conductivity of 0.001028 M acetic acid is 48.15 S cm^2 mol^{-1}, and its limiting molar conductivity is 390.5 S cm^2 mol^{-1}. Find its degree of dissociation and dissociation constant. **OR** Represent the cell in which Zn reduces Ag^+ ions. Find E°cell ($E°(Zn^{2+}/Zn) = -0.76$ V, $E°(Ag^+/Ag) = 0.80$ V), write the electrode reactions and state which electrode is negative.	3

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24.	Show that for a first-order reaction, the time for 99% completion is twice the time for 90% completion.	3
25.	Explain: (i) Mn_2O_7 is acidic while MnO is basic; (ii) CrO is basic but CrO_3 is acidic; (iii) the first ionisation enthalpies of 5d elements are higher than those of 3d and 4d elements.	3
26.	Explain: (i) $[Fe(CN)_6]^{3-}$ has a larger crystal field splitting than $[Fe(H_2O)_6]^{3+}$; (ii) what is meant by the stability constant of a complex; (iii) the chelate effect.	3
27.	Why does a nitro group at the ortho or para position increase the reactivity of chlorobenzene towards nucleophilic substitution, while one at the meta position does not? Give an example.	3
28.	(i) Why does anisole react with HI to give phenol and methyl iodide, not iodobenzene and methanol? (ii) Why does anisole undergo electrophilic substitution at the ortho and para positions?	3

Section D

29.	**Case study.** Many coastal cities get drinking water from desalination plants that use reverse osmosis. Sea water is pushed against a semipermeable membrane at high pressure so that pure water passes through and the salts are left behind. (i) The membrane used allows the passage of: (A) only the solvent (B) only the solute (C) both solute and solvent (D) neither *[1]* (ii) What condition must the applied pressure satisfy? *[1]* (iii) Taking sea water as 0.6 M NaCl, estimate its osmotic pressure at 300 K ($R = 0.0821$ L atm mol^{-1} K^{-1}). *[2]* **OR** (iii) Name a material used for the membrane and state why it is suitable. *[2]*	4
30.	**Case study.** Aldehydes and ketones with an α-hydrogen undergo aldol condensation with dilute alkali. Those without an α-hydrogen, such as methanal and benzaldehyde, undergo the Cannizzaro reaction with concentrated alkali instead. (i) Which of these undergoes the Cannizzaro reaction? (A) ethanal (B) propanal (C) methanal (D) propanone *[1]* (ii) Why does benzaldehyde not undergo aldol condensation? *[1]* (iii) How many products are possible in the cross-aldol reaction of ethanal and propanal? Name any two. *[2]* **OR** (iii) Write the Cannizzaro reaction of benzaldehyde. *[2]*	4

Section E

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31.	(a) Give two differences between a galvanic cell and an electrolytic cell. (b) Find the emf of the cell Ni | Ni^{2+}(0.001 M) || Ag^{+}(0.01 M) | Ag at 298 K ($E°(Ni^{2+}/Ni)$ = −0.25 V, $E°(Ag^{+}/Ag)$ = 0.80 V). **OR** (a) Explain how conductivity and molar conductivity vary with concentration. (b) The resistance of a cell containing 0.05 M NaOH is 31.16 Ω, and the cell constant is 0.367 cm^{-1}. Find the conductivity and molar conductivity.	5
32.	(a) Account for: (i) transition metal ions are generally coloured; (ii) Cu^{+} is unstable in aqueous solution; (iii) $E°(Mn^{3+}/Mn^{2+})$ is highly positive while $E°(Cr^{3+}/Cr^{2+})$ is negative. (b) Write the chromate–dichromate equilibrium and explain the effect of pH. **OR** (a) How is phenol manufactured from cumene? (b) How will you distinguish ethanol from phenol? (c) Arrange phenol, o-cresol and o-nitrophenol in increasing order of acid strength, with reasons.	5
33.	(a) Explain, with equations, (i) the Wolff–Kishner reduction, (ii) the aldol condensation of propanal, (iii) the Cannizzaro reaction of methanal. (b) Why are the α-hydrogens of aldehydes and ketones acidic? **OR** (a) Describe the double-helix structure of DNA. (b) What is denaturation of a protein? Give one example. (c) Which vitamins can be stored in the body and why?	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)** 0.982. *Working:* 55.5 mol of water and 1 mol of solute: 55.5/56.5.

2. **(C)** chloroform and acetone. *Working:* Hydrogen bonding between $CHCl_3$ and acetone makes A–B attractions stronger.

3. **(A)** decreases. *Working:* There are fewer ions per unit volume.

4. **(B)** 60 min. *Working:* Two half-lives.

5. **(C)** $KMnO_4$. *Working:* Permanganate oxidises Fe^{2+} and acts as its own indicator.

6. **(B)** the 5f, 6d and 7s levels have comparable energies. *Working:* Electrons from all three can take part in bonding.

7. **(D)** $K_3[Fe(CN)_6]$. *Working:* Fe(+3) with six CN^- gives a –3 complex ion.

8. **(A)** $CH_3CH(OH)COOH$. *Working:* Lactic acid has a carbon with four different groups.

9. **(B)** an alkane (Wurtz reaction). *Working:* $2RX + 2Na \rightarrow R–R + 2NaX$.

10. **(C)** benzene. *Working:* Zinc removes the oxygen.

11. **(D)** form hydrogen-bonded dimers. *Working:* Extensive hydrogen bonding, including dimers.

12. **(A)** glycine. *Working:* Glycine's α-carbon carries two H atoms.

13. **(A)** Both A and R are true, and R is the correct explanation of A. *Working:* Boiling does not change the composition, so distillation cannot separate them.

14. **(B)** Both A and R are true, and R is not the correct explanation of A. *Working:* Both are true, but R does not explain A; ions move faster and the solution's viscosity falls as temperature rises.

15. **(A)** Both A and R are true, and R is the correct explanation of A. *Working:* The stable intermediate makes the first step easy.

16. **(D)** A is false but R is true. *Working:* A is false; R is true and is the reason.

Section B

17. Moles = 2.5/60 = 0.0417 (1). Molality = 0.0417/0.075 ≈ 0.556 mol kg^{-1} (1).

OR The vapour pressure is higher than predicted because A–B attractions are weaker than A–A and B–B attractions; e.g. ethanol + acetone (1). $\Delta H_{mix} > 0$ and $\Delta V_{mix} > 0$ (1).

18. Conductivity depends on the number of ions per unit volume, which falls on dilution (1). Molar conductivity refers to one mole of electrolyte; on dilution the ions are freer (and weak electrolytes dissociate more), so it increases (1).

19. Rate = 0.01/25 = 4×10^{-4} M min^{-1} (1) = 6.67×10^{-6} M s^{-1} (1).

20. Their d orbitals are completely filled, so no d electrons take part in metallic bonding and the bonding is weak (1). In mercury the $6s^2$ electrons are held very tightly, so metallic bonding is

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weakest (1).

21. (i) CH_3CH_2Cl (with SO_2 and HCl) (1). (ii) $CH_3CH_2CH_2Br$, 1-bromopropane (anti-Markovnikov addition) (1).

Section C

22. Moles = 45/62 = 0.726; molality = 0.726/0.6 = 1.21 mol kg^{-1} (1). $\Delta T_f = 1.86 \times 1.21 \approx 2.25$ K (1). Freezing point ≈ –2.25 °C (271.9 K) (1).

23. α = 48.15/390.5 ≈ 0.123 (1½). $K_a = \frac{c\alpha^2}{1-\alpha} = \frac{0.001028 \times (0.123)^2}{0.877} \approx 1.78 \times 10^{-5}$ mol L^{-1} (1½).

OR Zn(s) | Zn^{2+}(aq) || Ag^+(aq) | Ag(s); $E^\circ_{cell} = 0.80 + 0.76 = 1.56$ V (1). Anode: $Zn \rightarrow Zn^{2+} + 2e^-$; cathode: $Ag^+ + e^- \rightarrow Ag$ (1). The zinc electrode is negative (1).

24. $t_{99\%} = \frac{2.303}{k}\log\frac{100}{1} = \frac{2.303 \times 2}{k}$ (1). $t_{90\%} = \frac{2.303}{k}\log\frac{100}{10} = \frac{2.303}{k}$ (1). So $t_{99} = 2t_{90}$ (1).

25. (i), (ii) In higher oxidation states the metal is more like a non-metal and its oxides are covalent and acidic; in low oxidation states the oxides are ionic and basic (2). (iii) Poor shielding by 4f electrons makes the effective nuclear charge on the 5d electrons larger (1).

26. (i) CN^- is a stronger field ligand than H_2O in the spectrochemical series (1). (ii) The equilibrium constant for formation of the complex from the metal ion and ligands; a larger value means a more stable complex (1). (iii) Complexes with chelating (polydentate) ligands are more stable than those with similar monodentate ligands (1).

27. The negative charge of the intermediate carbanion is delocalised onto the $–NO_2$ group when it is at o/p, stabilising it (1½). At the meta position this delocalisation onto NO_2 is not possible (½). For example, 4-nitrochlorobenzene gives 4-nitrophenol with aqueous NaOH at 443 K (1).

28. (i) The O–C(aryl) bond has partial double-bond character and the phenyl cation is unstable, so I^- attacks the methyl carbon (SN2) (1½). (ii) The $–OCH_3$ group donates electron density into the ring by resonance, mainly at o and p positions (1½).

Section D

29. (i) (A) only the solvent (water).
(ii) It must be greater than the osmotic pressure of the sea water.
(iii) $\pi = iCRT = 2 \times 0.6 \times 0.0821 \times 300 \approx 29.6$ atm, so more than about 30 atm must be applied.
OR Cellulose acetate; it is permeable to water but not to the dissolved ions.

30. (i) (C) methanal.
(ii) It has no α-hydrogen atom.
(iii) Four: 3-hydroxybutanal, 3-hydroxy-2-methylpentanal, 3-hydroxypentanal and 3-hydroxy-2-methylbutanal (any two). **OR** $2C_6H_5CHO$ + conc. NaOH → $C_6H_5CH_2OH + C_6H_5COONa$.

Section E

31. (a) A galvanic cell converts chemical energy to electrical energy through a spontaneous reaction; an electrolytic cell uses electrical energy to drive a non-spontaneous reaction. The anode is negative in a galvanic cell but positive in an electrolytic cell (2). (b) $Ni + 2Ag^+ \rightarrow Ni^{2+} + 2Ag$, $E^\circ = 1.05$ V (1). $E = 1.05 - \frac{0.059}{2}\log\frac{0.001}{(0.01)^2} = 1.05 - 0.0295$ (1) ≈ 1.02 V (1).

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OR (a) Conductivity falls on dilution (fewer ions per unit volume); molar conductivity rises (2). (b) $\kappa = 0.367/31.16 \approx 0.0118$ S cm^{-1} (1½). $\Lambda_m = 1000\kappa/c \approx 235.6$ S cm^2 mol^{-1} (1½).

32. (a) (i) Partly filled d orbitals allow d–d transitions in the visible region (1). (ii) It disproportionates: $2Cu^+ \rightarrow Cu^{2+} + Cu$, because Cu^{2+} has a much higher hydration enthalpy (1). (iii) Mn^{2+} (d^5) is very stable, so Mn^{3+} is readily reduced; Cr^{3+} (t_2g^3) is more stable than Cr^{2+}, so Cr^{2+} is readily oxidised (1). (b) $2CrO_4^{2-}$ (yellow) + $2H^+ \rightleftharpoons Cr_2O_7^{2-}$ (orange) + H_2O; acid gives dichromate, alkali gives chromate (2).

OR (a) Cumene is oxidised by air to cumene hydroperoxide, which with dilute acid gives phenol and acetone (2). (b) Neutral $FeCl_3$ gives a violet colour with phenol but not with ethanol (1). (c) o-Cresol < phenol < o-nitrophenol; $-CH_3$ releases electrons and destabilises the phenoxide ion, while $-NO_2$ withdraws electrons and stabilises it (2).

33. (a) (i) $>C=O + NH_2NH_2 \rightarrow >C=NNH_2$ (hydrazone); heating with KOH in ethylene glycol gives $>CH_2 + N_2$ (1). (ii) $2CH_3CH_2CHO$ (dil. NaOH) $\rightarrow CH_3CH_2CH(OH)CH(CH_3)CHO$, which on heating gives 2-methylpent-2-enal (1). (iii) $2HCHO$ + conc. NaOH $\rightarrow CH_3OH + HCOONa$ (1). (b) The carbonyl group withdraws electrons, and the carbanion (enolate) formed is resonance-stabilised (2).

OR (a) Two polynucleotide strands are coiled around a common axis in opposite directions; the bases pair by hydrogen bonds, A with T and G with C (2). (b) Loss of the biological activity of a protein when heat or pH changes disrupt its secondary and tertiary structures, e.g. coagulation of egg white on boiling (2). (c) Fat-soluble vitamins (A, D, E, K), which are stored in the liver and fatty tissues (1).

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