Roll No. ☐☐☐☐☐☐☐☐

Q.P. Code 56/1/1

CHEMISTRY (THEORY)

CBSE Class XII Board Examination 2026

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

General Instructions:

1. The paper has 33 questions in five sections (A to E); all of them must be answered.
2. Section A: Q1–16, multiple choice (Q13–16 Assertion-Reason), 1 mark each.
3. Section B: Q17–21, very short answer, 2 marks each.
4. Section C: Q22–28, short answer, 3 marks each.
5. Section D: Q29–30, case-based, 4 marks each.
6. Section E: Q31–33, long answer, 5 marks each.
7. There is no overall choice, but some questions in Sections B to E offer an internal choice (OR). Calculators are not allowed.

SECTION A

Q1–16 are multiple choice questions of 1 mark each (Q13–16 are Assertion-Reason).

1. Four graphs are shown. Which one is characteristic of a first order reaction? **1**

(A) t½ plotted against initial concentration $[R]_0$ is a straight line rising from the origin.

(B) t½ plotted against $[R]_0$ is a horizontal straight line.

(C) Rate plotted against concentration is a horizontal straight line.

(D) Rate plotted against concentration is a curve that falls steeply and then levels off.

(A) t½ vs $[R]_0$: straight line rising from origin

(B) t½ vs $[R]_0$: horizontal line

(C) Rate vs concentration: horizontal line

(D) Rate vs concentration: falling curve

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2. Among the following aqueous solutions, which one freezes at the lowest temperature? **1**

(A) 0.1 M glucose **(B)** 0.1 M $CaCl_2$

(C) 0.1 M KCl **(D)** 0.1 M urea

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3. Identify the element that is NOT regarded as a transition metal. **1**

(A) Sc **(B)** Ag

(C) Hg **(D)** Cu

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4. Which expression gives the fraction of molecules that have energy equal to or greater than the activation energy Ea? **1**

(A) $+\frac{E_a}{RT}$ **(B)** $e^{-E_a/RT}$

(C) $-\frac{E_a}{RT}$ **(D)** $e^{+E_a/RT}$

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5. An aqueous solution of $CuCl_2$ is electrolysed using platinum electrodes. What is observed? **1**

(A) Copper deposits at the anode **(B)** H_2 gas is evolved at the cathode

(C) O_2 gas is evolved at the anode **(D)** Cl_2 gas is evolved at the anode

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6. Aspirin is prepared by acetylating which compound? **1**

(A) Phenol **(B)** Salicylaldehyde

(C) 2-Hydroxybenzoic acid **(D)** Benzoic acid

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7. What is the secondary valency of cobalt in the complex ion $[Co(NH_3)_5(NO_2)]^{2+}$? **1**

(A) 5 **(B)** 1

(C) 4 **(D)** 6

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8. When phenol is treated with dilute nitric acid at low temperature (about 298 K), the product is: **1**

(A) 2,4,6-trinitrophenol
(B) o-nitrophenol only
(C) p-nitrophenol only
(D) a mixture of o- and p-nitrophenol

9. Pick the statement that is NOT correct for a pair of enantiomers. **1**

(A) Their chemical reactivity (towards achiral reagents) is the same.
(B) Their specific rotation is the same.
(C) Their melting/boiling points are the same.
(D) Their refractive index is the same.

10. Direct nitration of aniline (with nitrating mixture) gives which product distribution? **1**

(A) 51% ortho, 47% para, 2% meta
(B) 51% meta, 47% ortho, 2% para
(C) 51% para, 47% meta, 2% ortho
(D) 51% ortho, 47% meta, 2% para

11. Which of these amines has the lowest pKb (i.e. is the strongest base)? **1**

(A) $C_6H_5–N(CH_3)_2$
(B) $C_6H_5–NH(CH_3)$
(C) $C_6H_5–NH_2$
(D) $p\text{-}O_2N–C_6H_4–NH_2$ (4-nitroaniline)

12. Lack of which vitamin leads to increased fragility of red blood cells and weakness of muscles? **1**

(A) Vitamin A
(B) Vitamin K
(C) Vitamin E
(D) Vitamin D

13. Assertion (A): The two components of an azeotropic mixture cannot be separated by fractional distillation. **1**
Reason (R): An azeotrope boils at a constant temperature, and its liquid and vapour have the same composition.

(A) Both A and R are true, and R correctly explains A.
(B) Both A and R are true, but R does not explain A.
(C) A is true, but R is false.
(D) A is false, but R is true.

14. Assertion (A): In phenols the –OH group sends the incoming electrophile to the meta position. **1**
Reason (R): The –OH group of phenol activates the benzene ring for electrophilic substitution.

(A) Both A and R are true, and R correctly explains A.
(B) Both A and R are true, but R does not explain A.
(C) A is true, but R is false.
(D) A is false, but R is true.

15. Assertion (A): Actinoids exhibit a wide range of oxidation states. **1**
Reason (R): Actinoids are radioactive.

(A) Both A and R are true, and R correctly explains A.

(B) Both A and R are true, but R does not explain A.

(C) A is true, but R is false.

(D) A is false, but R is true.

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16. Assertion (A): Glucose pentaacetate does not react with hydroxylamine ($H_2N–OH$). **1**
Reason (R): This shows that glucose has a free –CHO group.

(A) Both A and R are true, and R correctly explains A.

(B) Both A and R are true, but R does not explain A.

(C) A is true, but R is false.

(D) A is false, but R is true.

SECTION B

Q17–21 are very short answer questions of 2 marks each.

17. A mixture of phenol and aniline deviates from Raoult's law. State the type of deviation with reason. How does the boiling point of the mixture compare with that expected? **2**

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18. Give two reasons why aryl halides (haloarenes) are much less reactive than alkyl halides towards nucleophilic substitution. **2**

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19. Give the IUPAC names of: **2**
(i) $[Ag(NH_3)_2][Ag(CN)_2]$
(ii) $K_3[Fe(C_2O_4)_3]$

OR

(i) Suggest a chemical test to show that $[Co(NH_3)_5SO_4]Cl$ and $[Co(NH_3)_5Cl]SO_4$ are ionisation isomers.
(ii) What is the chelate effect? Give one example.

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20. Distinguish between: **2**
(i) a peptide linkage and a glycosidic linkage
(ii) essential and non-essential amino acids

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21. The reaction $2A + B \rightarrow 2C$ occurs in a single (elementary) step. If the volume of the reaction vessel is reduced to one-third of its original value, how does the rate change? Does the order of the reaction change? **2**

SECTION C

Q22–28 are short answer questions of 3 marks each.

22. The gas-phase decomposition $C_2H_5Cl(g) \rightarrow C_2H_4(g) + HCl(g)$ is first order. The total pressure was 0.30 atm at t = 0 s and 0.50 atm at t = 30 s. Find the rate constant. (log 3 = 0.48) **3**

23. Answer: **3**

(i) Why is the equilibrium constant Kc linked to E°cell and not to Ecell?

(ii) Metals A and B have standard electrode potentials −0.24 V and +0.80 V respectively. Which of them can displace hydrogen from dilute H_2SO_4?

(iii) Write the reaction taking place in a lead storage battery while it is being charged.

OR

What kind of battery is the mercury cell? Why is it better than a dry cell? Write the overall cell reaction of the mercury cell.

24. 0.61 g of benzoic acid (M = 122 g mol^{-1}) is dissolved in 5 g of CS_2, in which it dimerises to the extent of 88%. Find the boiling point of the solution. (Boiling point of CS_2 = 46.2 °C, Kb = 2.3 K kg mol^{-1}) **3**

25. Write the reactions of D-glucose with: **3**

(a) HI (on prolonged heating)

(b) bromine water

(c) concentrated HNO_3

26. Explain: **3**

(a) Carboxylic acids boil at higher temperatures than alcohols of similar molar mass.

(b) The α-hydrogens of aldehydes and ketones are acidic.

(c) Ammonia and its derivatives do not add to the carbonyl group in a strongly acidic medium.

27. Write the chemical reaction for each: **3**

(a) Reimer–Tiemann reaction

(b) Kolbe's reaction

(c) Friedel–Crafts acylation of anisole

28. A compound X (C_4H_9Br) gives an alcohol with aqueous KOH, and the rate depends only on [X]. An optically active isomer Y of X reacts with aqueous KOH at a rate that depends on both [Y] and [KOH]. **3**

(a) Give the structures of X and Y.

(b) Which of X and Y would undergo racemisation, and why?

(c) Which one gives a product with inversion of configuration, and why?

SECTION D

Q29–30 are case-based questions of 4 (2 + 1 + 1) marks each, with an internal choice.

29. *Amines are basic and form salts with acids; aliphatic amines are stronger bases than NH_3 while aryl amines are weaker. 1° and 2° amines are acylated by acid chlorides; aryl amines are very reactive towards electrophiles (o/p substitution). Hinsberg's reagent distinguishes 1°, 2° and 3° amines, and arenediazonium salts are used to make aryl halides, nitriles, phenols and arenes.* **4**

(a) (i) In water, why is CH_3NH_2 a stronger base than $(CH_3)_3N$?

(ii) Give structures of A and B: CH_3CONH_2 —(NaOBr)→ A —(C_6H_5COCl, base)→ B.

(b) A compound X (C_3H_9N) gives with Hinsberg's reagent a product that is insoluble in alkali. Identify X.

(c) Why is the $–NH_2$ group of aniline acetylated before nitration?

OR

(b) How would you convert aniline into benzonitrile?

30. *Valence bond theory explains the formation, magnetism and shape of complexes. Crystal field theory treats ligands as point charges that remove the degeneracy of the metal d orbitals; different electron arrangements result in strong and weak fields.* **4**

(a) In an octahedral field, which d orbitals are raised in energy as the ligands approach? Give the reason.

(b) Using CFT, write the d-electron configuration of the central ion in (i) $[CoF_6]^{3-}$ (ii) $[Co(NH_3)_6]^{3+}$. (Co = 27)

(c) Both $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$ are tetrahedral, but the first is paramagnetic and the second diamagnetic. Why? (Ni = 28)

OR

(c) State the hybridisation and magnetic nature of $[Fe(CN)_6]^{3-}$. (Fe = 26)

SECTION E

Q31–33 are long answer questions of 5 marks each.

31. (i) An organic compound X has molecular formula $C_5H_{10}O$. Draw X if it: **5**

(I) gives a negative Tollens' test but a positive iodoform test;

(II) gives neither Tollens' nor iodoform test but undergoes aldol condensation;

(III) undergoes Cannizzaro reaction.

(ii) How can each of these be converted into benzoic acid? (I) Acetophenone (II) Ethylbenzene

OR

Answer briefly:

(i) Draw the 2,4-dinitrophenylhydrazone of benzaldehyde.

(ii) Arrange in increasing order of reactivity towards HCN: di-tert-butyl ketone, acetaldehyde, acetone.

(iii) Give a simple chemical test to tell benzoic acid from ethyl benzoate.

(iv) Name the reagent that converts ethanenitrile into ethanal.

(v) Give the structure of X: cyclohexanol $\xrightarrow{(CrO_3)}$ X.

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32. (i) Standard electrode potentials $E^\circ(M^{2+}/M)$ in volts are: V −1.18, Cr −0.91, Mn −1.18, Fe −0.44, Co −0.28, Ni −0.25, Cu +0.34. Using these: **5**

(I) Why do the values show an irregular trend?

(II) Why is $E^\circ(Cu^{2+}/Cu)$ unusually positive?

(III) Why is $E^\circ(Mn^{2+}/Mn)$ highly negative?

(ii) Write ionic equations for the oxidation of I^- by $KMnO_4$ in (a) acidic and (b) neutral/faintly alkaline solution.

OR

Answer:

(i) Name a lanthanoid that shows (I) the +4 oxidation state (II) the +2 oxidation state.

(ii) Why are transition metals good catalysts?

(iii) Why does Cr have a higher melting point than Mn?

(iv) What happens when an acidic solution of $KMnO_4$ is kept for some time? Write the equation and name the type of reaction.

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33. Find the emf and ΔG of this cell at 298 K: **5**

$Mg(s) \mid Mg^{2+}(0.01\ M) \parallel Ag^+(0.001\ M) \mid Ag(s)$

Given $E^\circ(Mg^{2+}/Mg) = -2.37$ V, $E^\circ(Ag^+/Ag) = +0.80$ V, 1 F = 96500 C mol^{-1}, log 10 = 1.

OR

For the cell reaction $2AgCl(s) + H_2(g, 0.4\ atm) \rightarrow 2Ag(s) + 2H^+(0.1\ M) + 2Cl^-(0.2\ M)$, $\Delta G^\circ = -43500$ J mol^{-1}. Find the emf of the cell at 25 °C. (log 10 = 1, 1 F = 96500 C mol^{-1})

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Questions restated from the CBSE Class XII Board Examination 2026 (set 56/1/1) for practice. Reading passages and map items are described, not reproduced.