

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions

- (i) This question paper contains **33 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 16 are multiple choice questions, carrying 1 mark each.
- (iii) Section B: Questions 17 to 21 are very short answer questions, carrying 2 marks each.
- (iv) Section C: Questions 22 to 28 are short answer questions, carrying 3 marks each.
- (v) Section D: Questions 29 to 30 are case-based questions, carrying 4 marks each.
- (vi) Section E: Questions 31 to 33 are long answer questions, carrying 5 marks each.
- (vii) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (viii) Use of calculators is not allowed.

Section A

1. The charge required for the reduction of 1 mol of MnO_4^- to MnO_2 is

- (A) 1F (B) 3F
(C) 5F (D) 6F

2. Which among the following is a false statement?

- (A) Rate of zero order reaction is independent of initial concentration of reactant. (B) Half-life of a zero order reaction is inversely proportional to the rate constant.
(C) Molecularity of a reaction may be zero. (D) For a first order reaction, $t_{1/2} = 0.693/k$.

3. The number of molecules that react with each other in an elementary reaction is a measure of the:

- (A) activation energy of the reaction (B) stoichiometry of the reaction
(C) molecularity of the reaction (D) order of the reaction

4. The element having $[\text{Ar}]3d^{10}4s^1$ electronic configuration is

- (A) Cu (B) Zn
(C) Cr (D) Mn

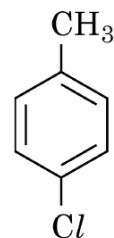
5. The complex ions $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]^{2+}$ and $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$ are called

- (A) Ionization isomers (B) Linkage isomers
(C) Co-ordination isomers (D) Geometrical isomers

6. The diamagnetic species is: [At. No. Co = 27, Fe = 26, Ni = 28]

- (A) $[\text{Ni}(\text{CN})_4]^{2-}$ (B) $[\text{NiCl}_4]^{2-}$
(C) $[\text{Fe}(\text{CN})_6]^{3-}$ (D) $[\text{CoF}_6]^{3-}$

7. Which is the correct IUPAC name for the compound shown?



- (A) Methylchlorobenzene
(B) Toluene
(C) 1-Chloro-4-Methylbenzene
(D) 1-Methyl-4-Chlorobenzene

8. What will be formed after oxidation reaction of secondary alcohol with chromic anhydride (CrO_3)?

- (A) Aldehyde (B) Ketone
(C) Carboxylic acid (D) Ester

9. The conversion of phenol to salicylic acid can be accomplished by

- (A) Reimer-Tiemann reaction (B) Friedel-Crafts reaction
(C) Kolbe reaction (D) Coupling reaction

10. Which of the following is/are examples of denaturation of protein?

- (A) Coagulation of egg white (B) Curdling of milk
(C) Clotting of blood (D) Both (A) and (B)

11. Nucleotides are joined together by

- (A) Glycosidic linkage (B) Peptide linkage
(C) Hydrogen bonding (D) Phosphodiester linkage
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12. Scurvy is caused due to deficiency of

- (A) Vitamin B1 (B) Vitamin B2
(C) Ascorbic acid (D) Glutamic acid
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13. **Assertion (A):** In a first order reaction, if the concentration of the reactant is doubled, its half-life is also doubled.

Reason (R): The half-life of a reaction does not depend upon the initial concentration of the reactant in a first order reaction.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.
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14. **Assertion (A):** Cu cannot liberate H_2 on reaction with dilute mineral acids.

Reason (R): Cu has positive electrode potential.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.
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15. **Assertion (A):** Aromatic primary amines cannot be prepared by Gabriel Phthalimide synthesis.

Reason (R): Aryl halides do not undergo nucleophilic substitution reaction with the anion formed by phthalimide.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.
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16. **Assertion (A):** Vitamin D cannot be stored in our body.

Reason (R): Vitamin D is fat soluble vitamin and is not excreted from the body in urine.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.
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Section B

17. (A) The rate constant for a zero order reaction $A \rightarrow P$ is $0.0030 \text{ mol L}^{-1}\text{s}^{-1}$. How long will it take for the initial concentration of A to fall from 0.10 M to 0.075 M?

OR

17. (B) The decomposition of NH_3 on platinum surface is zero order reaction. What are the rates of production of N_2 and H_2 if $k = 2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$?

18. Define the following terms:

- (a) Pseudo first order reaction
- (b) Half-life period of reaction ($t_{1/2}$)

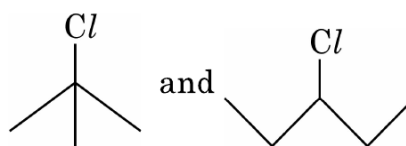
19. Examine the following observations:

- (a) Transition elements generally form coloured compounds.
- (b) Zinc is not regarded as a transition element.

20. Name the following coordination compounds according to IUPAC norms:

- (a) $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$
- (b) $[\text{CrCl}_2(\text{en})_2]\text{Cl}$

21. (a) In the following pair of halogen compounds, which compound undergoes $\text{S}_{\text{N}}1$ reaction faster and why?



(b) Arrange the following compounds in increasing order of their reactivity towards $\text{S}_{\text{N}}2$ displacement:

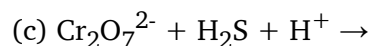
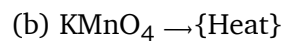
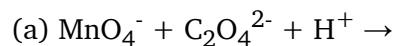
2-Bromo-2-methylbutane, 1-Bromopentane, 2-Bromopentane.

Section C

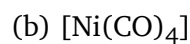
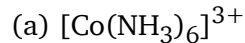
22. At 25 °C the saturated vapour pressure of water is 24 mm Hg. Find the saturated vapour pressure of a 5% aqueous solution of urea at the same temperature. (Molar mass of urea = 60 g mol⁻¹)

23. The electrical resistance of a column of 0.05 M NaOH solution of area 0.8 cm² and length 40 cm is 5×10^3 ohm. Calculate its resistivity, conductivity and molar conductivity.

24. Complete and balance the following chemical equations:



25. Using valence bond theory, explain the hybridization and magnetic character of the following:



[At. no.: Co = 27, Ni = 28]

26. (a) Define the following:

(i) Enantiomers

(ii) Racemic mixture

(b) Why is chlorobenzene resistant to nucleophilic substitution reaction?

27. (A) Explain the following reactions and write chemical equation involved:

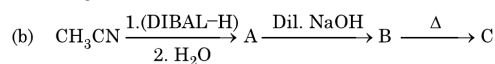
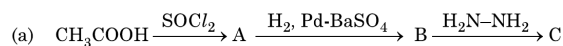
(a) Wolff-Kishner reduction

(b) Etard reaction

(c) Cannizzaro reaction

OR

27. (B) Write the structures of A, B and C in the following sequence of reactions:



28. Define the following terms:

(a) Glycosidic linkage

(b) Invert sugar

(c) Oligosaccharides

29(a). Read the passage and answer: The spontaneous flow of the solvent through a semipermeable membrane from a pure solvent to a solution or from a dilute solution to a concentrated solution is called osmosis. The phenomenon of osmosis can be demonstrated by taking two eggs of the same size. In an egg, the membrane below the shell and around the egg material is semipermeable. The outer hard shell can be removed by putting the egg in dilute hydrochloric acid. After removing the hard shell, one egg is placed in distilled water and the other in a saturated salt solution. After some time, the egg placed in distilled water swells-up while the egg placed in salt solution shrinks. The external pressure applied to stop the osmosis is termed as osmotic pressure (a colligative property). Reverse osmosis takes place when the applied external pressure becomes larger than the osmotic pressure.

(a) Define reverse osmosis. Name one SPM which can be used in the process of reverse osmosis.

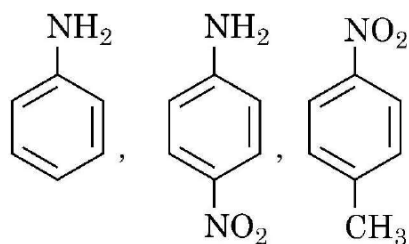
29(b)(i). (b)(i) What do you expect to happen when red blood corpuscles (RBC's) are placed in 0.5% NaCl solution?

29(b)(ii). (b)(ii) Which one of the following will have higher osmotic pressure in 1M KCl or 1M urea solution. Justify your answer.

29(c). (c) Why osmotic pressure is a colligative property?

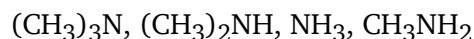
30(a). Read the passage and answer: Amines have a lone pair of electrons on nitrogen atom due to which they behave as Lewis base. Greater the value of K_b or smaller the value of pK_b , stronger is the base. Amines are more basic than alcohols, ethers, esters, etc. The basic character of aliphatic amines should increase with the increase of alkyl substitution. But it does not occur in a regular manner as a secondary aliphatic amine is unexpectedly more basic than a tertiary amine in aqueous solutions. Aromatic amines are weaker bases than ammonia and aliphatic amines. Electron releasing groups such as $-CH_3$, $-OCH_3$, $-NH_2$, etc., increase the basicity while electron-withdrawing substituents such as $-NO_2$, $-CN$, halogens etc., decrease the basicity of amines. The effect of these substitute is more at p- than at m- position.

(a) Arrange the following in the increasing order of their basic character. Give reason:



30(b). (b) Why pK_b of aniline is more than that of methylamine?

30(c)(i). (c)(i) Arrange the following in the increasing order of their basic character in an aqueous solution. Give reason:



30(c)(ii). (c)(ii) Why ammonolysis of alkyl halides is not a good method to prepare pure amines?

Section E

31. (A) (a) Give IUPAC name of $\text{CH}_3\text{-CH=CH-CHO}$.

(b) Give a simple chemical test to distinguish between propanal and propanone.

(c) How will you convert the following:

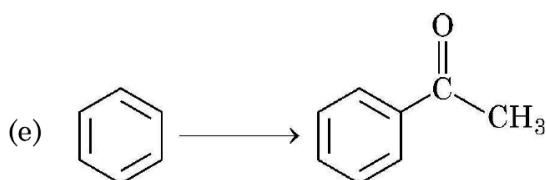
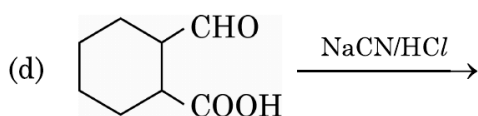
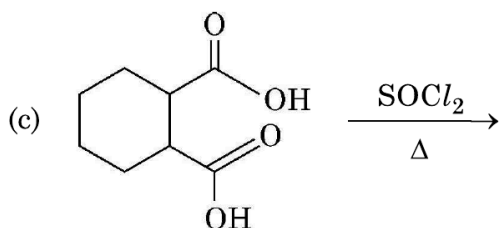
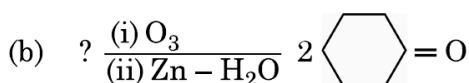
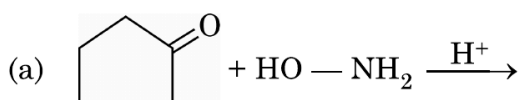
(i) Toluene to benzoic acid

(ii) Ethanol to propan-2-ol

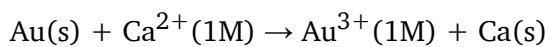
(iii) Propanal to 2-hydroxy propanoic acid

OR

31. (B) Complete each synthesis by giving missing starting material, reagent or products:



32. (A) (a) Calculate the standard Gibbs energy ($\Delta_r G^\circ$) of the following reaction at 25°C :

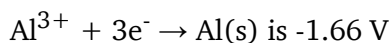
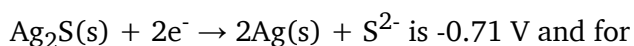


$$E^\circ_{\text{Au}^{3+}/\text{Au}} = +1.5 \text{ V}, E^\circ_{\text{Ca}^{2+}/\text{Ca}} = -2.87 \text{ V}$$

Predict whether the reaction will be spontaneous or not at 25°C .

$$[1 \text{ F} = 96500 \text{ C mol}^{-1}]$$

(b) Tarnished silver contains Ag_2S . Can this tarnish be removed by placing tarnished silverware in an aluminium pan containing an inert electrolytic solution such as NaCl ? The standard electrode potential for half reaction:



OR

32. (B) (a) Define the following:

(i) Cell potential

(ii) Fuel cell

(b) Calculate emf of the following cell at 25 °C:



Given: $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.40 \text{ V}$, $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$

[log 10 = 1]

33. (A) An organic compound 'A', molecular formula $\text{C}_2\text{H}_6\text{O}$ oxidises with CrO_3 to form a compound 'B'. Compound 'B' on warming with iodine and aqueous solution of NaOH gives a yellow precipitate of compound 'C'. When compound 'A' is heated with conc. H_2SO_4 at 413 K gives a compound 'D', which on reaction with excess HI gives compound 'E'. Identify compounds 'A', 'B', 'C', 'D' and 'E' and write chemical equations involved.

OR

33. (B) (a) Write chemical equations of the following reactions:

(i) Phenol is treated with conc. HNO_3

(ii) Propene is treated with B_2H_6 followed by oxidation by $\text{H}_2\text{O}_2/\text{OH}^-$.

(iii) Sodium t-butoxide is treated with CH_3Cl .

(b) Give a simple chemical test to distinguish between butan-1-ol and butan-2-ol.

(c) Arrange the following in increasing order of acid strength:

phenol, ethanol, water

- End of Question Paper -