

**General Instructions:**

Read the following instructions carefully and follow them:

This question paper contains 33 questions. All questions are compulsory.

This question paper is divided into five sections Section A, B, C, D and E.

Section A questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark

Section B questions number 17 to 21 are very short answer type questions. Each question carries 2 marks

Section C questions number 22 to 28 are short answer type questions. Each question carries 3 marks

Section D questions number 29 and 30 are case-based questions. Each question carries 4 marks

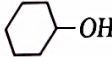
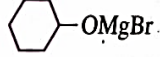

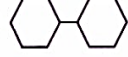
Section E questions number 31 to 33 are long answer type questions. Each question carries 5 marks

There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the sections except Section A.

Use of calculators is not allowed.

SECTION A

Questions no. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each. (16 × 1 = 16)

- In the reaction $\text{R-OH} + \text{HCl} \xrightarrow{\text{ZnCl}_2} \text{R-Cl} + \text{H}_2\text{O}$, what is the correct order of reactivity of alcohol?
(a) $1 < 2 < 3$ (b) $1 > 3 > 2$ (c) $1 > 2 > 3$ (d) $3 > 1 > 2$
- On mixing 20 ml of acetone with 30 ml of chloroform, the total volume of solution is
(a) < 50 (b) $= 50$ (c) > 50 (d) $= 10$
- In a dry cell the cathode is
(a) Zn container (b) MnO_2 (c) graphite (d) NH_4Cl
- Which of the following alcohols is not undergoing oxidation.
(a) Butanol (b) Butan-2-ol (c) 2-methylbutan-2-ol (d) 3-methylbutan-2-ol
- Ethanol on heating with conc. H_2SO_4 at 443K produced?
(a) $\text{C}_2\text{H}_5\text{OSO}_3\text{H}$ (b) $\text{C}_2\text{H}_5\text{-O-CH}_3$ (c) $\text{C}_2\text{H}_5\text{-O-C}_2\text{H}_5$ (d) Ethene
- In the reaction $\text{Cyclohexyl-Br} \xrightarrow[\text{dry ether}]{\text{Mg.}} \text{X} \xrightarrow[\text{dry ether}]{\text{H}_2\text{O}} \text{Y}$, compound 'Y' is
(a)  (b)  (c)  (d) 
- Nitrous acid on ethylamine gives mainly:
(a) ethyl nitrate (b) ethyl alcohol (c) nitroethane (d) ethane
- Out of the following the strongest base in aqueous medium is
(a) Methylamine (b) Dimethyl amine (c) Trimethyl amine (d) Aniline
- Unit of Molar Conductivity is.....?
- Arrange the following in the increasing order of their boiling points:
A : Butanamine, B: N,N-Dimethylethanamine, C: N-Ethylethanamine
a. $\text{C} < \text{B} < \text{A}$ b. $\text{A} < \text{B} < \text{C}$ c. $\text{A} < \text{C} < \text{B}$ d. $\text{B} < \text{C} < \text{A}$
- Solubility of gas in liquid decreases with rise in temperature because dissolution is an

- (a) Endothermic and reversible process (b) exothermic and reversible process
(c) endothermic and irreversible process (d) exothermic and irreversible process

12. The quantity of electricity required to obtain one mole of Al from Al_2O_3 is

- (a) 1F (b) 6F (c) 3F (d) 2F

For Questions number 13 to 16, two statements are given one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

- (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.

13. Assertion (A): p-nitroaniline is a weaker base than p-toluidine.

Reason (R): The electron donating NO_2 group in p-nitroaniline makes it a weaker base.

14. Assertion (A): enthalpy mix H for an ideal solution is not equal to zero.

Reason (R): F_{A-B} interactions in an ideal solution are same as between F_{A-A} and F_{B-B} interactions.

15. Assertion (A): Conductivity decreases for weak electrolyte and increases for strong electrolyte with decrease in concentration.

Reason (R): On dilution, the number of ions per unit volume that carry the current decreases.

16. Assertion (A): N-Ethylbenzene sulphonamide is soluble in alkali.

Reason (R): Hydrogen attached to nitrogen in sulphonamide is strongly acidic.

SEC-B

17. According to Raoult's law, what is meant by positive and negative deviations and how is the sign of $\Delta_{\text{sol}}H$ related to positive and negative deviations from Raoult's law?

18. Which one of the following compounds is more easily hydrolysed by KOH and why?

$\text{CH}_3\text{CHClCH}_2\text{CH}_3$ or $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$

19. What is the role of ZnCl_2 in a dry cell?

20. How do you convert the following: (Any two)

(i) Prop-1-ene to 1-fluoropropane

(ii) Chlorobenzene to 2-chlorotoluene

(iii) Methyl mag. bromide \rightarrow 2-Methylpropan-2-ol.

21. Explain why propanol has higher boiling point than that of the hydrocarbon, butane?

OR

Arrange the following in increasing order of their basic strength:

(i) $\text{C}_2\text{H}_5\text{NH}_2$, $\text{C}_6\text{H}_5\text{NH}_2$, NH_3 , $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$

(ii) $\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $(\text{C}_2\text{H}_5)_3\text{N}$, $\text{C}_6\text{H}_5\text{NH}_2$

SEC-C

22. Give one chemical test to distinguish between the following pairs of compounds:

(i) Methylamine and dimethylamine

(ii) Aniline and benzyl amine.

(iii) Propanol and 2-methylpropan-2-ol.

23 (i) Can we construct an electrochemical cell with two half-cells composed of ZnSO_4 solution and zinc electrodes?

Explain your answer.

(ii) Calculate the λ_m^0 for Cl^- ion from the data given below:

$$\lambda_{\text{MgCl}_2}^0 = 258.6 \text{ Scm}^2 \text{ mol}^{-1} \text{ and } \lambda_{\text{Mg}^{2+}}^0 = 106 \text{ Scm}^2 \text{ mol}^{-1}$$

(iii) The cell constant of a conductivity cell is 0.146 cm^{-1} , What is the conductivity of 0.01 M solution of an electrolyte at 298 K, if the resistance of the cell is 1000 ohm?

OR

Write product of Electrolysis of conc H_2SO_4 in platinum electrode

24. Mention the factors which affect the rate of a chemical reaction.

OR

Why ethanol is less acidic than phenol? Explain.

25. Henry's law constant for the molality of methane in benzene at 298 K is 4.27×10^5 mm Hg. Calculate the solubility of methane in benzene at 298 K under 760 mm Hg.

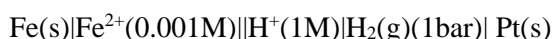
26. Write short notes on the following:

(i) Coupling reaction

(ii) Acetylation aniline

(iii) Gabriel phthalimide synthesis

27. Write the Nernst equation, standard Gibbs free energy and emf of the following cells at 298 K



Given $E^0_{\text{Fe}^{2+}|\text{Fe(s)}} = -0.14\text{V}$

28. With diagram write difference between positive and negative deviation.

SEC-D

Case base study

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

B. Which one of the following will have higher osmotic pressure in 1 M KCl or 1 M urea solution?

C. Name one SPM which can be used in the process of reverse osmosis.

D. What are isotonic solutions?

OR

Write van't Hoff equation for dilute solution?

30. Amines have a lone pair of electrons on nitrogen atom due to which they behave as Lewis base. Larger the value of K_b or smaller the value of p^{K_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 solutions. Aromatic amines are weaker bases than ammonia and aliphatic amines. Electron-donating groups such as $-\text{CH}_3$, $-\text{OCH}_3$, $-\text{NH}_2$, etc., increase the basicity while electron-withdrawing substituents such as $-\text{NO}_2$, $-\text{CN}$, halogens.etc. Decrease the basicity of amines. The effect of these substituents is more at p- than at m-positions.

A. Arrange the following compounds in increasing order of their acidic strength:

Methylamine, dimethylamine, aniline, N-methyl aniline

B. Rearrange the following in increasing order of their basic strength:

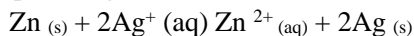
P-toluidine, N, N-dimethyl-p-toluidine, p-nitro aniline, aniline

C. Which is more acidic, aniline or ammonia?

D. $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution. Give reason.

SEC-E

31.a. Depict the galvanic cell in which the reaction takes place



- (i) Which of the electrodes is negatively charged?
- (ii) Calculate Gibbs free energy of the reaction?
- (iii) Define fuel cell. Write two fuels that can be used in fuel cells.

OR

- (b) (i) State the Kohlrausch law.
- (ii) Define Corrosion.
- (iii) Primary batteries and secondary batteries
- (iv) Give one example in each case.

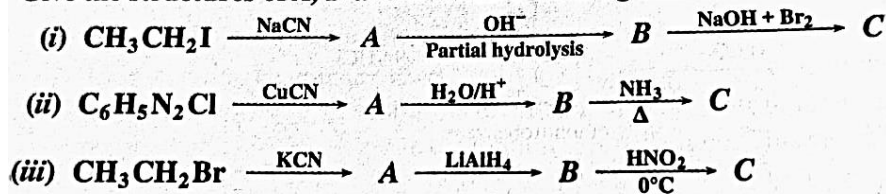
32. (a) (i) Ishan's automobile radiator is filled with 1.0 kg of water. How many grams of ethylene glycol (Molar mass 62 g/mol) must Ishan add to get the freezing point of the solution lowered to -2.8°C (for water K_f is 1.86 K kg/mol)

(ii) What type of deviation from Raoult's law is shown by ethanol and acetone mixture? Give reason.

OR

(b) (i) Boiling point of water at 750 mm Hg pressure is 99.68°C . How much sucrose (Molar mass = 342 g/mol) is to be added to 500 g of water such that it boils at 100°C : K_b for water = 0.52 K kg/mol).

33. A. **Give the structures of A, B and C in the following reactions:**



B Account for the following

- (i) benzyl chloride is highly reactive towards $\text{S}_{\text{N}}1$ reaction.
- (ii) Butan-2-ol is optically inactive, but it contains a chiral carbon.