

General Instructions

- All questions are compulsory.
- Section A : Q. no. 1 to 20 are very short answer questions (objective type) and carry 1 mark each.
- Section B : Q. no. 21 to 27 are short answer questions and carry 2 marks each.
- Section C : Q. no. 28 to 34 are long answer questions and carry 3 marks each.
- Section D : Q. no. 35 to 37 are also long answer questions and carry 5 marks each.
- There is no overall choice. However, an internal choice has been provided in two questions of two marks, two questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- Use log tables if necessary, use of calculators is not allowed.

Section - A**Passage Based Questions (Q. Nos. 1-5)**

Read the given passage and answer the following questions.

First order reaction means that, the rate of the reaction is proportional to the first power of the concentration

reactions, R. For the reaction, $R \longrightarrow P$, Rate = $\frac{d[R]}{dt} = k[R]$ and the integrating rate equation is

$k = \frac{1}{t} \ln \frac{[R]_0}{[R]}$ where, $[R]$ is final concentration and $[R]_0$ is initial concentration of reactant, respectively.

1. Give the example of first order reaction.
2. Plot the graph between $\log [R]_0 / [R]$ vs time (t) for a first order reaction.
3. Give the mathematical expression for the half-life of a first order reaction and also give the unit of rate constant.
4. Time required to decompose SO_2Cl_2 to half of its initial amount is 60 min. If the decomposition is a first order reaction, calculate the rate constant of the reaction.
5. A first order reaction takes 40 min. for 30% decomposition. Calculate the rate constant.

One Word Answer Type Questions (Q. Nos. 6-10)

Here, we have given some questions that relates is a particular term or substance. You are required to give the one word answer for all.

6. Name one of the common initiators used in free radical addition polymerisation.
7. Name the process of heating sulphide ore in the presence of oxygen, so as to convert it into oxide.
8. The graphical representation showing the variation of Gibbs energy with increase of temperature for the formation of oxides.
9. The solution containing equal molecules of D-glucose and D-fructose.
10. What type of reaction occurs in the formation of teflon polymer?

Multiple Choice Questions (Q. Nos. 11-15)

Here are four options for each question, out of these, only one is correct. You have to identify the correct option.

11. The commercial name of polyacrylonitrile is
(a) orlon(acrilan) (b) dacron (c) bakelite (d) melamine

12. Benzoic acid reacts with LiAlH_4 to give
(a) ethylbenzene (b) methylbenzene (c) phenol (d) benzyl alcohol
13. The molar mass of a few compounds are given below:
- | Compounds | Molar mass |
|---|------------|
| $\text{n-C}_4\text{H}_9\text{NH}_2$ | 73 |
| $(\text{C}_2\text{H}_5)_2\text{NH}$ | 73 |
| $\text{C}_2\text{H}_5\text{N}(\text{CH}_3)_2$ | 73 |
- The boiling point would be maximum for
(a) $\text{n-C}_4\text{H}_9\text{NH}_2$ (b) $(\text{C}_2\text{H}_5)_2\text{NH}$
(c) $\text{C}_2\text{H}_5\text{N}(\text{CH}_3)_2$ (d) boiling would be almost same
14. Why polysaccharides are called non-sugars?
(a) They yield large number of monosaccharide on hydrolysis
(b) They do not taste sweet
(c) They are reducing sugars
(d) They are non-reducing sugars
15. Which of the following effects is/are caused by exposure to CCl_4 ?
(a) Liver cancer in human
(b) Damage to nerve cells
(c) Coma, unconsciousness
(d) All of the above

Assertion-Reason (Q. Nos. 16-20)

In the following questions, a statement of Assertion is followed by a corresponding statement of Reason. Of the following statements, choose the correct one.

- (a) Both Assertion and Reason are correct statements and Reason is the correct explanation of the Assertion.
(b) Both Assertion and Reason are correct statements, but Reason is not the correct explanation of the Assertion.
(c) Assertion is correct, but Reason is incorrect statements.
(d) Assertion is incorrect, but Reason is correct statement
16. **Assertion** In the presence of enzyme, substrate molecules can be attacked by the reagent effectively.
Reason Active sites of enzymes hold the substrate molecule in a suitable position.
17. **Assertion** Cr and Cu are extra stable elements in the 3d-series.
Reason Half and completely filled set of orbitals are relatively more stable.
18. **Assertion** o-nitrophenol is less volatile than p-nitrophenol.
Reason There is intramolecular hydrogen bonding in o-nitrophenol and intermolecular hydrogen bonding in p-nitrophenol.
19. **Assertion** Carboxylic acids are more acidic than phenols.
Reason The carboxylate ion is less stabilised than phenoxide ion.
20. **Assertion** Most of the synthetic polymers are non-biodegradable.
Reason Polymerisation induces toxic character in organic molecules.

SECTION B

(Short Answer Type Questions, 2M)

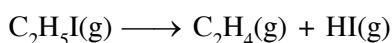
21. (i) The decomposition of dimethyl ether leads to the formation of CH_4 , H_2 and CO and the reaction rate is given by $\text{rate} = k [\text{CH}_3\text{OCH}_3]^{3/2}$. The rate of reaction is followed by increase in pressure in a closed vessel, so the rate can also be expressed in terms of the partial pressure of dimethyl ether, i.e. $\text{rate} = k [p_{\text{CH}_3\text{OCH}_3}]^{3/2}$.

If the pressure is measured in bar and time in minutes, then what are the units of rate and rate constant?

- (ii) Can a reaction have negative activation energy? Explain.

Or

The first order rate constant for the decomposition of ethyl iodide by the reaction,



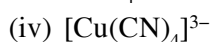
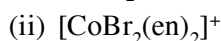
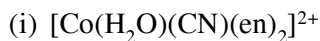
at 600 K is $1.60 \times 10^{-5} \text{ s}^{-1}$. Its energy of activation is 209 kJ. Calculate the rate constant of the reaction at 700 K.

22. Justify the formation of a low spin complex and a high spin complex taking examples of $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{FeF}_6]^{3-}$ respectively.
23. Express the relation among cell constant resistance of the solution in the cell and conductivity of the solution. How is molecule conductivity of a solution related to its conductivity ?

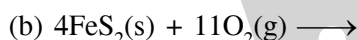
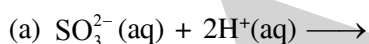
Or

The molar conductivity of a 1.5 M solution of an electrolyte is found to be $138.9 \text{ Scm}^2 \text{ mol}^{-1}$. Calculate the conductivity of this solution.

24. Specify the oxidation number of metals the following coordination entities:

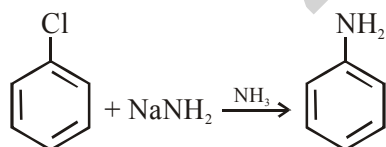


25. Write the structure of the products formed:



26. Out of 2-chloroethanol and ethanol, which is more acidic and why?

27. Chlorobenzene in the presence of strong base such as NaNH_2 undergoes nucleophilic substitution reaction.



The steps involved in the above reaction are as follows

Step 1 Abstraction of ortho proton of chlorobenzene.

Step 2 Elimination of chloride ion leading to formation of benzyne intermediate.

Step 3 Benzyne intermediate is highly unstable and reactive. It gets attacked by NH_2 to form substituted product.

Step 4 Addition of proton by carbanion. Using the information given above and write the reaction for steps involved in the above mechanism.

SECTION C

(Long Answer Type I Questions, 3M)

28. Answer the following questions :
- Glycine exists as a Zwitter ion but o- and p-aminobenzoic acids do not. Give reason.
 - What is a prosthetic group?
 - What are the two monosaccharides units present in the sugar in milk?
29. What are analgesic medicines? How are they classified and when are they commonly recommended for use?
30. Determine the amount of CaCl_2 ($i = 2.47$) dissolved in water to make a solution of 2.5 L. The osmotic pressure of the solution is 0.75 atm at 27°C .

Or

Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2L of water at 25°C , assuming that, it is completely dissociated [$R = 0.0821\text{L atm mol}^{-1}\text{K}^{-1}$].

31. (i) Write the Nernst equation for the cell reaction in the Daniell cell. How will the E_{cell} be affected when concentration of Zn^{2+} ions is increased?
- (ii) Suggest a way to determine the Λ_m° value of water.
- (iii) Why is alternating current used instead of direct current in measuring the electrolytic conduction?
32. What do you understand by shape selective catalysis? Why are zeolites good shape-selective catalysts?
33. (a) Give chemical tests to distinguish between the following pair of compounds.
- Ethanal and Propanone
 - Pentan-2-one and Pentan-3-one
- (b) Arrange the following compounds in increasing order of their acid strength: Benzoic acid, 4 Nitrobenzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid.

OR

Compare the reactivity of benzaldehyde and ethanal towards nucleophilic addition reactions. Write the cross aldol condensation product between benzaldehyde and ethanal.

34. Define and write an example for the following :
- Broad spectrum antibiotics.
 - Analgesics

Section - D

35. (i) The e.m.f. of the following cell at 298 K is 0.1745 V
- $$\text{Fe(s)}/\text{Fe}^{2+}(0.1\text{M})//\text{H}^+(\text{xM})/\text{H}_2(\text{g})(1\text{ bar})/\text{Pt(s)}$$
- Given : $E_{\text{Fe}^{2+}/\text{Fe}}^0 = -0.44\text{V}$

Calculate the H^+ ions concentration of the solution at the electrode where hydrogen is being produced.

- (ii) Aqueous solution of copper sulphate and silver nitrate are electrolysed by 1 ampere current for 10 minutes in separate electrolytic cells. Will the mass of copper and silver deposited on the cathode be same or different ? Explain your answer.

OR

- (a) Calculate the degree of dissociation of 0.0024 M acetic acid if conductivity of this solution is $8.0 \times 10^{-5} \text{ S cm}^{-1}$.

Given $\lambda_{\text{H}^+}^0 = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$; $\lambda_{\text{CH}_3\text{COO}^-}^0 = 40.9 \text{ S cm}^2 \text{ mol}^{-1}$

(b) Solutions of two electrolytes 'A' and 'B' are diluted. The limiting molar conductivity of 'B' increase to a smaller extent while that of 'A' increases to a much larger extent comparatively. Which of the two is a strong electrolyte ? Justify your answer.

36. An organic compound A' with molecular formula C_7H_7NO reacts with $Br_2/aqKOH$ to give compound B', which upon reaction with $NaNO_2$ & HCl at $0^\circ C$ gives C'.

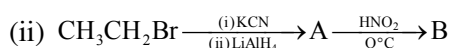
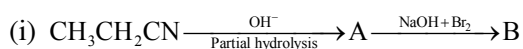
Compound C' on heating with CH_3CH_2OH gives a hydrocarbon D'. Compound B' on further reaction with Br_2 water gives white precipitate of compound E'. Identify the compound A, B, C, D & E also justify your answer by giving relevant chemical equations.

OR

(a) How will you convert.

- (i) Aniline into Fluorobenzene.
- (ii) Benzamide into Benzylamine.
- (iii) Ethanamine to N,N-Diethylethanamine.

(b) Write the structures of A and B in the following :



37. (a) When a chromite ore (A) is fused with an aqueous solution of sodium carbonate in free excess of air, a yellow solution of compound (B) is obtained. This solution is filtered and acidified with sulphuric acid to form compound (C). Compound (C) on treatment with solution of KCl gives orange crystals of compound (D). Write the chemical formulae of compounds A to D.

(b) Describe the cause of the following variations with respect to lanthanoids and actinoids.

- (i) Greater range of oxidation states of actinoids as compared to lanthanoids.
- (ii) Greater actinoid contraction as compared to lanthanoid contraction.
- (iii) Lower ionisation enthalpy of early actinoids as compared to the early lanthanoids.

OR

(a) What happens when

- (i) Manganate ions (MnO_4^{2-}) undergoes disproportionation reaction in acidic medium ?
- (ii) Lanthanum is heated with sulphur ?

(b) Explain the following trends in the properties of the members of the first series of transition elements :

- (i) $E^0(M^{2+}/M)$ value for copper is positive (+0.34V) in contrast to the other members of the series.
- (ii) Cr^{2+} is reducing while Mn^{3+} is oxidising, though both have d^4 configuration.
- (iii) The oxidising power in the series increases in the order $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$.