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PRE-BOARD II (2022-23)
CHEMISTRY THEORY (043)

CLASS-XII

Max. Marks: 70

Time : 3 hours

General Instructions:

Read the following instructions carefully.

- (i) There are 35 questions in this question paper with internal choice.
- (ii) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- (iii) SECTION B consists of 7 very short answer questions carrying 2 marks each.
- (iv) SECTION C consists of 5 short answer questions carrying 3 marks each.
- (v) SECTION D consists of 2 case-based questions carrying 4 marks each.
- (vi) SECTION E consists of 3 long answer questions carrying 5 marks each.
- (vii) All questions are compulsory.
- (viii) Use of log tables and calculators is **not** allowed.
- (ix) This question paper has 6 no. of printed pages.

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. The alcohol which will react immediately with Lucas reagent is: (1)
(a) isobutyl alcohol (b) n-butanol (c) tert-butyl alcohol (d) sec-butyl alcohol
2. Which one of the following reactions will follow Markovnikov's addition? (1)
(a) $C_2H_6 + HBr$ (b) $C_3H_6 + HCl$ (c) $C_3H_8 + HBr$ (d) $C_3H_7OH + HCl$
3. $KMnO_4$ is coloured due to: (1)
(a) d-d transitions (c) unpaired electrons in d orbital of Mn
(b) charge transfer from ligand to metal (d) charge transfer from metal to ligand
4. The decomposition of dimethyl ether is a fractional order reaction. The rate is given as (1)
$$\text{Rate} = K (P_{CH_3OCH_3})^{3/2}$$

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

(a) $\text{bar min}^{-1}, \text{bar}^2 \text{min}^{-1}$ (c) $\text{bar min}^{-1}, \text{bar}^{-1/2} \text{min}^{-1}$
(b) $\text{bar}^{1/2} \text{min}^{-1}, \text{bar}^2 \text{min}^{-1}$ (d) $\text{bar min}^{-1}, \text{bar}^{1/2} \text{min}^{-1}$
5. For a reaction: $X \longrightarrow Z$, the rate of reaction becomes twenty seven times when the concentration of X is increased three times. What is the order of the reaction? (1)
(a) 0 (b) 1 (c) 2 (d) 3

6. Given that the standard electrode potentials (E°) of metals are:
 $K^+|K = -2.93$ V, $Ag^+|Ag = 0.80$ V, $Cu^{2+}|Cu = 0.34$ V,
 $Cr^{3+}|Cr = -0.74$ V, $Fe^{2+}|Fe = -0.44$ V.

$Mg^{2+}|Mg = -2.37$ V

Arrange these metals in increasing order of their reducing power.

- (a) $Ag^+|Ag < Cu^{2+}|Cu < Fe^{2+}|Fe < Cr^{3+}|Cr < Mg^{2+}|Mg < K^+|K$
 (b) $K^+|K < Cu^{2+}|Cu < Fe^{2+}|Fe < Ag^+|Ag < Mg^{2+}|Mg < Cr^{3+}|Cr$
 (c) $Ag^+|Ag < Cr^{3+}|Cr < Fe^{2+}|Fe < Cu^{2+}|Cu < Mg^{2+}|Mg < K^+|K$
 (d) $Ag^+|Ag < Cu^{2+}|Cu < Fe^{2+}|Fe < Cr^{3+}|Cr < K^+|K < Mg^{2+}|Mg$

7. Aniline on nitration gives:

- (a) o-nitroaniline (b) m-nitroaniline (c) p-nitroaniline (d) all of these

8. Which of the following ligands form a 'chelate' complex with metal ion?

- (a) H_2O (b) CN^- (c) $C_2O_4^{2-}$ (d) Cl^-

9. What among these will undergo Cannizzaro's reaction?

- (a) C_6H_5CHO (b) CH_3CHO (c) C_3H_7CHO (d) CH_3COCH_3

10. The most convenient method to prepare primary (1°) amine containing one carbon atom less is:

- (a) Gabriel phthalimide synthesis (c) Hoffmann bromamide reaction
 (b) Reductive amination of aldehydes (d) Reduction of isonitrile

11. In the Finkelstein reaction there is an exchange of chloride ion with:

- (a) fluoride ion (b) iodide ion (c) alcoholic group (d) cyanide group

12. The unit of rate and rate constant are same for:

- (a) zero order reaction (c) second order reaction
 (b) first order reaction (d) third order reaction

13. All the lanthanoids show +3 as the common oxidation state, but Ce shows +4 state because

- (a) it has variable ionization enthalpy.
 (b) it has a tendency to attain alkali metal configuration.
 (c) it has a tendency to attain f^0 configuration.
 (d) it resembles Pb^{4+} .

14. The Rosenmund reaction can produce which of the following carbonyl compounds?

- (a) Methanol (b) Benzaldehyde (c) Butanone (d) Ethanoic acid

Directions: In the following questions, numbering from 15 to 18, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
 (c) Assertion (A) is true but reason (R) is false.
 (d) Assertion (A) is false but reason (R) is true.

15. **Assertion (A):** Aldehydes and ketones, both react with Tollen's reagent to form silver mirror. (1)
Reason (R): Both aldehydes and ketones contain a carbonyl group.
16. **Assertion (A):** When a solution is separated from the pure solvent by a semipermeable membrane, the solvent molecules pass through the membrane from pure solvent side to the solution side. (1)
Reason (R): Iso-osmotic solutions have got different osmotic pressure.
17. **Assertion (A):** $E_{Ag^+|Ag}$ increases with increase in concentration of Ag^+ ions. (1)
Reason (R): $E_{Ag^+|Ag}$ has a positive value.
18. **Assertion (A):** Tertiary amines are more basic than corresponding secondary and primary amines in gaseous state. (1)
Reason (R): Tertiary amines have three alkyl groups which cause +I effect.

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. Show that in a first order reaction, time required for completion of 99.9% is 10 times of half-life ($t_{1/2}$) of the reaction. (2)

20. Give the plausible explanation for the following : (2)

- (a) Glucose doesn't give 2, 4-DNP test.
 (b) The two strands in DNA are not identical but are complementary.

OR

How do you explain the absence of aldehyde group in the penta-acetate of D-glucose? (2)

21. Explain why- (2)

- (a) the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride?
 (b) alkyl halides, though polar, are immiscible with water?

22. Write IUPAC name of the complex $[Co(en)_2(NO_2)Cl]^+$. What type of geometrical isomerism is shown by this complex? (2)

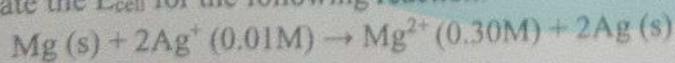
OR

Using IUPAC norms, write the formulae for the following complexes: (2)

(a) Hexaaquachromium (III) chloride

(b) Sodium trioxalatoferrate (III)

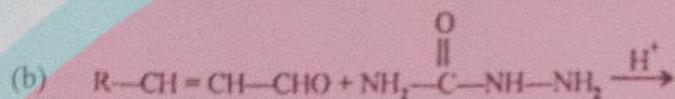
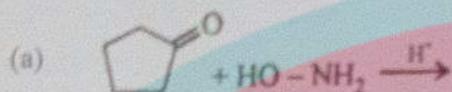
23. Calculate the E_{cell} for the following reaction: (2)



$$E^{\circ}_{cell} = 3.17 V \quad (\log 3 = 0.477, \log 10 = 1)$$

24. A reaction is second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant is- (a) doubled, and (b) reduced to half? (2)

25. Predict the products of the following reactions:



SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

26. Write a short note on the following reactions with an example for each :- (3)

- Hell Volhard Zelinsky reaction
- Reimer-Tiemann reaction

27. Explain on the basis of valence bond theory that $[Ni(CN)_4]^{2-}$ ion with square planar structure is diamagnetic and the $[NiCl_4]^{2-}$ ion with tetrahedral geometry is paramagnetic. (3)

28. Answer the following questions :- (any two) (3)

- Define reverse osmosis.
- Why aquatic animals are more comfortable in cold water?
- Why the vapour pressure of the solution decreases on addition of non-volatile solute to a volatile solvent?

29. Answer any three questions out of the following :- (3)

- Give a chemical test to distinguish between ethylamine and aniline.
- Write chemical equations for-
Reaction of ethanolic NH_3 with C_2H_5Cl .
- Write chemical equations for the following conversion-
 CH_3-CH_2-Cl into $CH_3-CH_2-CH_2-NH_2$.
- Write structure and IUPAC name of the amide which gives propanamine by Hoffmann bromamide reaction.
- How will you convert 4-nitrotoluene to 2-bromobenzoic acid?

30. The conductivity of $0.001028 \text{ mol L}^{-1}$ acetic acid is $4.95 \times 10^{-5} \text{ S cm}^{-1}$. Calculate the degree of dissociation if Λ_m^0 for acetic acid is $390.5 \text{ S cm}^2 \text{ mol}^{-1}$. (3)

SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passages carefully and answer the questions that follow.

31. Proteins are the most abundant biomolecules of the living system. The chief sources of proteins are milk, cheese, pulses, fish, meat, peanuts, etc. They are found in every part of the body and form a fundamental basis of the structure and functions of life. These are also required for the growth and maintenance of the body. The word protein is derived from the Greek word, 'proteios' meaning 'primary' or of 'prime importance'. Chemically, proteins are the polymers in which the monomeric units are the α -amino acids. Amino acids contain an amino ($-\text{NH}_2$) and carboxylic ($-\text{COOH}$) functional groups. Depending upon the relative position of the amino group with respect to the carboxylic group, the amino acids can be classified as α , β , and γ -amino acids. Amino acids which are synthesized by the body are called non-essential amino acids. On the other hand, those amino acids which cannot be synthesized in the human body and are supplied in the form of diet are called essential amino acids.

- (a) What type of bonding helps in stabilizing the α -helix structure of proteins? (1)
- (b) What is the effect of denaturation on the structure of proteins? (1)
- (c) Why amino acids show amphoteric behavior? Give reaction also showing this behaviour. (2)

OR

- (c) What is the difference between globular and fibrous proteins?

32. In normal life we rarely come across pure substances. Most of these are mixtures containing two or more pure substances. The air around us is a mixture of gases primarily oxygen and nitrogen; the water we drink contains very small amounts of various salts dissolved in it. Our blood is a mixture of different components. Vapour pressure of a liquid solution is the pressure exerted by the vapours in equilibrium with the liquid solution at a particular temperature. The properties that depend on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution are called colligative properties.

- (a) Explain why on addition of 1 mol of NaCl to 1 litre of water, the boiling point of water increases, while addition of 1 mol of methyl alcohol to one litre of water decreases its boiling point. (1)
- (b) State any one difference between hypotonic and hypertonic solution. (2)
- (c) Explain the following phenomena with the help of Henry's law. (1)

Painful condition known as bends.

OR

Feeling of weakness and discomfort in breathing at high altitude.

SECTION E

The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

33. Answer the following questions:—

- (a) What is the order of the reaction with respect to A and B if the initial rate of reaction (r_0) was measured for different initial concentrations of A and B as given below: (3)

A/ mol L ⁻¹	0.20	0.20	0.40
B/ mol L ⁻¹	0.30	0.10	0.05
r_0 / mol L ⁻¹ s ⁻¹	5.07×10^{-5}	5.07×10^{-5}	2.03×10^{-4}

- (b) If half-life period of a first order reaction is 'X' and 3/4th life period of the same reaction is 'Y', how X and Y are related to each other? ($\log 2 = 0.3010$) (2)

OR

- (a) A first order reaction takes 100 minutes for completion of 60% of the reaction. Find the time when 90% of the reaction will be completed. ($\log 10 = 1$, $\log 4 = 0.6020$) (3)

- (b) Derive integrated rate law expression for first order reaction and calculate its half life. (2)

34. (a) Two moles of an organic compound 'A' on treatment with NaOH gives two compounds 'B' and 'C'. Compound 'B' on dehydrogenation with Cu at 573 K gives 'A' while acidification of 'C' yields carboxylic acid 'D' with molecular formula of CH₂O₂. Identify the compounds A, B, C and D and write all chemical reactions involved. (4)

- (b) o-nitrophenol has lower boiling point than p-nitrophenol. Explain. (1)

OR

- (a) How will you carry out the following conversions? (3)

- Acetylene to Ethanal
- Toluene to p-nitrobenzoic acid
- Acetone to 2-Methylpropan-2-ol

- (b) Give reasons: (2)

- Chloroacetic acid is stronger than acetic acid. Why?
- Why esterification of acid chloride with ethanol is usually carried out in the presence of pyridine?

35. Answer the following questions:—

- How is the variability in oxidation states of transition metals different from that of the p-block elements? (1x5)
- Out of Cu⁺ and Cu²⁺, which ion is unstable in aqueous solution and why?
- Orange colour of Cr₂O₇²⁻ ion changes to yellow when treated with an alkali. Why?
- Transition metals and their compounds are known to be as catalysts.
- Zn, Cd, Hg are soft metals. Why?