APEEJAY SCHOOL, PANCHSHEEL PARK

CLASS XII
PRE-BOARD II EXAMINATION (2023-24)
SUBJECT - CHEMISTRY

Name of the student:

Time Allowed: 3 Hours

Date:

M.M. 70

General Instructions:
i. There are **33** questions in this question paper with internal choice.
ii. SECTION A consists of 16 multiple choice questions carrying 1 mark each.
iii. SECTION B consists of 5 short answer questions carrying 2 marks each.
iv. SECTION C consists of 7 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.

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. Which of the following solutions will have the highest conductivity at 298 K?   1
   a) 0.1 M H_2SO_4 solution
   b) 0.01 M H_2SO_4 solution
   c) 0.01 M CH_3COOH solution
   d) 0.1 M CH_3COOH solution

2. Which of the following reactions can result in ketones?   1
   a) Oxidation of primary alcohols
   b) Oxidation of secondary alcohols
   c) Dehydrogenation of tertiary alcohols
   d) Dehydrogenation of primary alcohols

3. Out of the following compounds, which is the most reactive towards β-elimination reaction?   1
   a) 2-Bromopentane
   b) 2-Bromo-2-methylbutane
   c) 1- Bromopentane
   d) 2-Bromo-3-methylbutane

4. The order of reactivity of the following alcohols with halogen acids is: 1

   (i) $CH_3CH_2-CH_2-OH$

   (ii) $CH_3CH_2-CH-OH$
                 |
                 CH_3

   (iii) $CH_3CH_2-\overset{\overset{\textstyle CH_3}{|}}{\underset{\underset{\textstyle CH_3}{|}}{C}}-OH$

   a) (i) > (ii) > (iii)
   b) (iii) > (ii) > (i)
   c) (ii) > (i) > (iii)
   d) (i) > (iii) > (ii)

5. Which of the following statement is **incorrect** about the collision theory of chemical reaction?   1
   a) It considers reacting molecules or atoms to be hard spheres and ignores their structural features.
   b) A number of effective collisions determine the rate of reaction.
   c) The collision of atoms or molecules possessing sufficient threshold energy results into the product formation.
   d) Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective.

6. The molar conductivity of CH_3COOH at infinite dilution is $390\ Scm^2/mol$. Using the graph and given information, the molar conductivity of CH_3COOK will be:
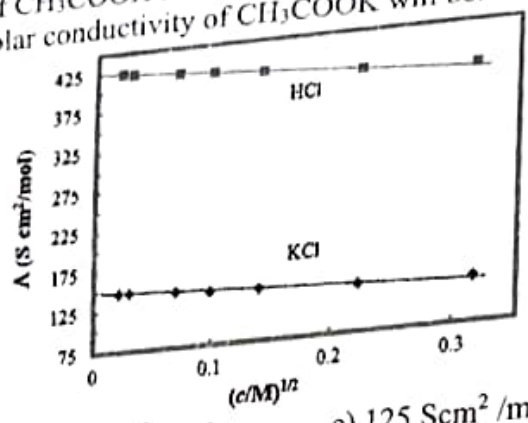
a) $100\ Scm^2/mol$ b) $150\ Scm^2/mol$ c) $125\ Scm^2/mol$ d) $115\ Scm^2/mol$ 1

7. Acetone combines with ethylene glycol in dry HCl gas to generate
a) hemiacetals   b) cyclic ketals   c) cyclic acetals   d) acetals   1

8. Which of the following has the maximum number of unpaired electrons?
a) Mn^{4+} b) Ti^{3+} c) V^{3+} d) Fe^{3+} 1

9. Glucose reacts with hydroxylamine to form an oxime. This confirms the presence of
a) straight chain of six carbon atoms   b) carbonyl group
c) primary alcoholic group   d) secondary alcoholic group   1

10. Which of the following statements is not correct for amines?
a) Most alkyl amines are more basic than ammonia solution.
b) pK_b value of ethylamine is lower than benzylamine.
c) CH_3NH_2 on reaction with nitrous acid releases NO_2 gas.
d) Hinsberg's reagent reacts with secondary amines to form sulphonamides.   1

. Which of the following observation is shown by 2 -phenyl ethanol with Lucas Reagent?
a) Turbidity will be observed within five minutes
b) No turbidity will be observed
c) Turbidity will be observed immediately
d) Turbidity will be observed at room temperature but will disappear after five minutes.   1

12. For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$;
if $\Delta[NH3]/\Delta t = 2 \times 10^{-4}\ mol\ L^{-1}s^{-1}$, the value of $-\Delta[H2]/\Delta t$ would be:
a) $1 \times 10^{-4}\ mol\ L^{-1}s^{-1}$ b) $3 \times 10^{-4}\ mol\ L^{-1}s^{-1}$ c) $4 \times 10^{-4}\ mol\ L^{-1}s^{-1}$ d) $6 \times 10^{-4}\ mol\ L^{-1}s^{-1}$

Given below are two statements labelled as **Assertion (A)** and **Reason (R)**
Select the most appropriate answer from the options given below for **question numbers 13 - 16.**
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

13. Assertion (A): Separation of Zr and Hf is difficult.   1
Reason (R): Zr and Hf lie in the same group of the periodic table.

14. Assertion(A): Acetic acid does not undergo Haloform reaction.   1
Reason(R): Acetic acid has no alpha hydrogens.

15. Assertion(A): Sucrose is called an invert sugar.   1
Reason(R): On hydrolysis, sucrose brings the change in the sign of rotation from dextro (+) to laevo (−).

16. **Assertion(A):** Aldehydes undergo aldol condensation only if it has α-hydrogen.
Reason(R): The α-hydrogen in aldehydes is acidic in nature because the anion formed by the loss of the α-hydrogen is resonance stabilized.

1

SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

2

17. Account for the following:
   a) The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.
   b) p-nitrochlorobenzene undergoes nucleophilic substitution faster than chlorobenzene.

   OR

   a) Which of the following compounds will react faster in S_N1 reaction with the –OH ion? why?
   $CH_3—CH_2—Cl$ or $C_6H_5—CH_2—Cl$
   b) How would you prepare diphenyl from Benzene?

2

18. a) What happens when acetone is reacted with semicarbazide in acidic medium? (Write the reaction involved)
   b) Draw the structure of expected product when benzaldehyde is reacted with concentrated NaOH.

2

19. a) Give one difference between amylose and amylopectin.
   b) Name one fat soluble vitamin and the disease caused due to its deficiency.

2

20. A 1.00 molal aqueous solution of trichloroacetic acid (CCl_3COOH) is heated to its boiling point. The solution has the boiling point of 100.18°C. Determine the van't Hoff factor for trichloroacetic acid. (K_b for water $= 0.512$ K kg mol^{-1})

2

21. A first order reaction has a rate constant 1.15×10^{-3} S^{-1}. How long will 5 g of this reactant take to reduce to 3 g?

2

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

3

22. Write the equations involved in the following reactions: **(any three)**
   a) Reimer - Tiemann reaction
   b) Kolbe's reaction
   c) Acylation of Anisole
   d) Hydroboration-Oxidation reaction

3

23. Using Valence bond theory, explain the following in relation to the paramagnetic complex $[CoF_6]^{3-}$
   a) Type of hybridization
   b) Calculate spin only magnetic moment value
   c) Type of complex – inner, outer orbital complex

3

24. Write the Nerst equation and calculate emf of the following cells at 298 K; ($E°(Fe^{2+}/Fe = -0.44$ V)
   Fe (s) / Fe^{2+} (0.001 M) // H$^+$ (1 M) / H$_2$ (g) (1 bar) / Pt (s)

3

25. A reaction is first order with respect to A and second order with respect to B.
   a) Write the differential rate equation.
   b) How is the rate affected on increasing the concentration of B three times?
   c) How is the rate affected when the concentrations of both A and B are doubled?

3

26. How would you bring about the following conversions?
   a) Propanone to Propene
   b) Benzoic acid to Benzaldehyde
   c) Bromobenzene to 1-phenylethanol

3

3

27. Write IUPAC nomenclature of following compounds:
a) $CH_3CH(Br)CH_2COOH$
b) $CH_3CH(CH_3)CH_2CH_2OH$
c)

3
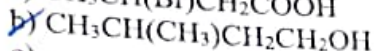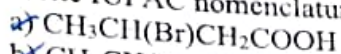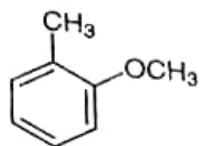
28. Write the reactions of D-glucose which can't be explained by its open-chain structure. How can cyclic structure of glucose explain these reactions?

SECTION D

The following questions are case -based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow. (1+1+2) marks each.

4

29. Temperature has a marked effect on the rate of reaction. For most of the reactions, the rate of reaction becomes nearly double for every 10 degrees rise in temperature. The effect of temperature is usually expressed in terms of temperature coefficient. The quantitative dependence of reaction rate on temperature was first explained by Swante Arrhenius. Arrhenius proposed a simple equation known as Arrhenius equation $k = Ae^{-Ea/RT}$ This equation provides a relationship between the rate constant (k) of a reaction and the temperature of the system. A is the Arrhenius factor or pre-exponential factor, Ea is the activation energy and R is the gas constant.

a) Define 'activation energy' of a reaction.
b) The plot of log k vs X is linear with slope = $- Ea/2.303R$. What is X?
c) Can a reaction have zero activation energy? Justify.

OR

c) How does a catalyst affect the rate of a reaction? Explain with respect to the Arrhenius equation.

30. Metal complexes show different colours due to d-d transitions. The complex absorbs light of specific wavelength to promote the electron from t2g to eg level. The colour of the complex is due to the transmitted light, which is complementary of the colour absorbed.
The wave number of light absorbed by different complexes of Cr ion are given below:

Complex	Wavenumber of light absorbed (cm-1)	Energy of light absorbed(kJ/mol)
$[CrA_6]^{3-}$	13640	163
$[CrB_6]^{3+}$	17830	213
$[CrC_6]^{3+}$	21680	259
$[CrD_6]^{3-}$	26280	314

4

Answer the following questions:
a. Out of the ligands 'A', 'B', 'C' and 'D', which ligand causes maximum crystal field splitting? Why?

OR

a) Which of the two, 'A' or 'D' will be a weak field ligand? Why?
b) Which of the complexes will be violet in colour? $[CrA_6]^{3-}$ or $[CrB_6]^{3+}$ and why? (Given: If 560 -570 nm of light is absorbed, the colour of the complex observed is violet.)
g) If the ligands A, B, C and D attached to Cr^{3+} ion in the complexes are water, cyanide ion, chloride ion, and ammonia (not in this order)
Identify the ligands A, B, C and D write the formula and IUPAC names of the following complexes:
i) $[CrA_6]^{3-}$
ii) $[CrC_6]^{3+}$

4

SECTION E

31. A colourless substance 'A' (C_6H_7N) is sparingly soluble in water and gives a water-soluble compound 'B' on treating with mineral acid. On reacting with $CHCl_3$ and alcoholic potash 'A' produces an obnoxious smell due to the formation of compound 'C'. Reaction of 'A' with benzenesulphonyl chloride gives compound 'D' which is soluble in alkali. With $NaNO_2$ and HCl, 'A' forms compound 'E'. Identify compounds 'A' to 'E'.   5

OR Part for Q - 31

Predict the reagent or the product in the following reaction sequence:
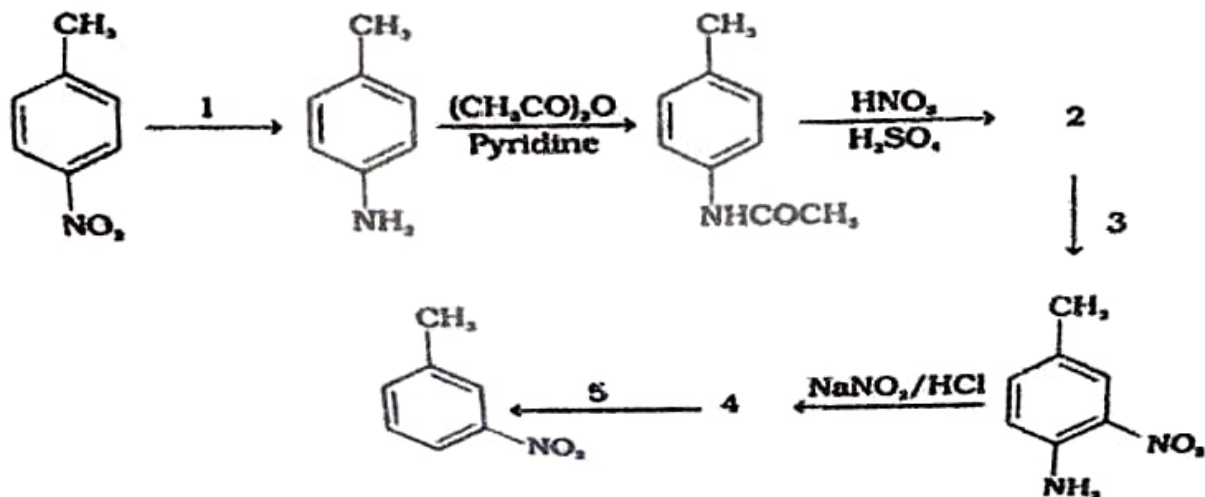
32. a) What is the effect of temperature on the solubility of glucose in water?   5

b) Ibrahim collected a 10mL each of fresh water and ocean water. He observed that one sample labelled "P" froze at 0 °C while the other "Q" at -1.3°C. Ibrahim forgot which of the two, "P" or "Q" was ocean water. Help him identify which container contains ocean water, giving rationalization for your answer.

c) Calculate Van't Hoff factor for an aqueous solution of $K_3[Fe(CN)_6]$ if the degree of dissociation (α) is 0.852. What will be boiling point of this solution if its concentration is 1 molal? (K_b=0.52 K kg/mol)

OR Part for Q - 32

a) What type of deviation from Roult's Law is expected when phenol and aniline are mixed with each other? What change in the net volume of the mixture is expected? Graphically represent the deviation.

b) The vapour pressure of pure water at a certain temperature is 23.80 mm Hg. If 1 mole of a non-volatile non-electrolytic solute is dissolved in 100g water. Calculate the resultant vapour pressure of the solution.

33. Attempt **any five** of the following: 5

a) Which of the following ions will have a magnetic moment value of 1.73 BM?
   Sc^{3+}, Ti^{3+}, Ti^{2+}, Cu^{2+}, Zn^{2+}

b) Which one out of Ni or Zn will be preferred as a sacrificial electrode? Why? (Given standard electrode potentials of Ni, Fe and Zn are -0.25 V, -0.44 V and -0.76 V respectively.)

c) The second ionization enthalpies of chromium and manganese are 1592 and 1509 kJ/mol respectively. Explain the lower value of Mn.

d) Give two similarities in the properties of Sc and Zn.

e) What is actinoid contraction? What causes actinoid contraction?