KENDRIYA VIDYALAYA SANGATHAN CHENNAI REGION
FIRST PRE-BOARD EXAMINATION (2024-25)
CLASS XII-CHEMISTRY

Max. Marks: 70 Time Allowed: 3 hours

General Instructions:

- There are 33 questions in this question paper with internal choice.
- SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 5 short answer questions carrying 2 marks each.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case- based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory. However, an internal choice is provided in some questions.
- 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.

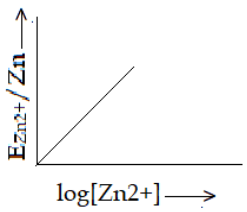
1. An organic compound 'X' on treatment with NH_3 gives Y which on heating gives 'Z'. Z when treated with Br_2 in the presence of KOH produces ethyl amine. Compound 'X' is

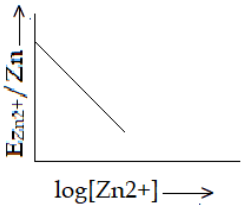
   A) CH_3COOH B) CH_3CH_2COOH C) $CH_3(CH_2)_2COOH$ D) $CH_3CH(CH_3)COOH$

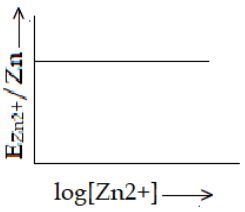
2. The electrode potential for Zinc electrode varies according to Nernst equation is

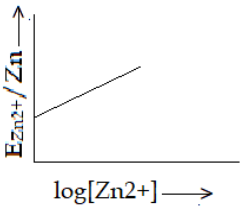
   $E_{Zn2+/Zn} = E^0_{Zn2+/Zn} - \frac{0.059}{2} log 1/[Zn2+]$

   The graph of $E_{Zn2+/Zn}$ vs $\log[Zn^{2+}]$ is

   A) 

   B) 

   C) 

   D) 

3. In a reaction, reactant concentration is increased 5 times and rate of reaction becomes 125 times. What is the order of reaction with respect to this reactant?

   A) 0 B) 1.5 C) 3 D) 2

4. Name the main product obtained when an alkyl halide is reacted with silver cyanide.
   (A) Alkyl cyanide (B) Alkyl isocyanide (C) Aliphatic amide (D) Carboxylic acid
5. The catalytic activity of the transition metals and their compounds is ascribed to:

   A) Their magnetic behavior B) Their incompletely filled d-orbitals

   C) Their chemical reactivity.

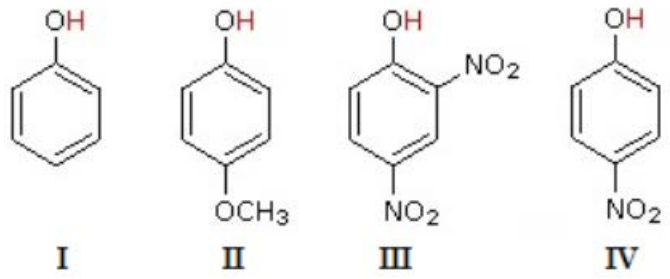
   D) Their ability to adopt multiple oxidation state and complexing ability.

6. The d-electronic configuration of Cr^{2+}, Mn^{2+}, Fe^{2+} and $Ni^{2+}$are: $3d^4$,$3d^5$,$3d^6$ and $3d^8$ respectively. Which of the following aqua complexes will exhibit the minimum paramagnetic behaviour?

   A) $[Ni(H_2O)_6]^{2+}$ B) $[Fe(H_2O)_6]^{2+}$ C) $[Cr(H_2O)_6]^{2+}$ D)$[Mn(H_2O)_6]^{2+}$

7. A reaction is first order with respect to reactant P having rate constant 6 min^{-1}.
If we start with [P] =0.5 mol L^{-1}, When would [P] reach the value of 0.05 mol L^{-1}?
A) 23.03s B) 25.5s C) 32.03s D) 18.53s

8. The acidic strength of the following compounds decreases in the order:



I II III IV

(a) II > I > III > IV (b) III > IV > I > II
(c) I > IV > III > II (d) IV > III > I > II

9. How does the increase in the pH affect the $K_2Cr_2O_7$ solution?
A) It cause the $K_2Cr_2O_7$ solution to release CrO_3 gas
B) It causes the coagulation of $K_2Cr_2O_7$ solution
C) It causes the $K_2Cr_2O_7$ solution to change its colour from orange to yellow
D) It doesn't bring about any change in the $K_2Cr_2O_7$ solution

10. Which of the following statement is true?
A) molecularity of reaction can be zero or a fraction.
B) molecularity has no meaning for complex reactions.
C) molecularity of a reaction is an experimental quantity
D) reactions with the molecularity three are very rare but are fast.

11. Amongst the following which will react fastest with HCl and $ZnCl_2$.
A) Butan-2-ol B) 2-Methylpropan-2-ol C) 2-Methylpropan-1-ol D) Butan-1-ol

12. Which of the following statements about "denaturation" given below are correct?
i) Denaturation of proteins causes loss of secondary and tertiary structure of protein.
ii) Denaturation leads to the conversion of double strand of DNA into single strand.
iii) Denaturation affects primary structure which gets distorted.
A) i and ii B) i and iii C) ii and iii D) i , ii and iii

13. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Stronger ligands cause larger splitting in an octahedral field.
Reason (R): The magnitude of tetrahedral splitting is smaller than that of octahedral complexes.
Select the most appropriate answer from the options given below:
(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.

14. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): boiling points of alcohols are much higher than those of alkanes, halo alkanes or ethers of comparable molecular masses.

Reason (R): Strong intermolecular hydrogen bonding exists in Alcohols.

Select the most appropriate answer from the options given below:

(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.

15. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Vitamin C can be stored in our body.

Reason (R): Vitamin C is water soluble and is excreted from the body in urine

Select the most appropriate answer from the options given below:

(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.

16. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): During the nitration of aniline, 47% of the product formed is meta-substituted.

Reason (R): During the nitration of aniline, anilinium ion is formed that has the meta-directing — NH_3^+ group.

Select the most appropriate answer from the options given below:

(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.

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.

17. Depression of freezing point of 0.01molal aq.CH_3COOH solution is 0.02046°C.What is the pH of CH_3COOH solution, assuming that molality is equal to molarity.

($[H^+] = C\alpha$, $K_f = 1.86$ K Kgmol^{-1})

OR

1.00 molal aqueous solution of trichloroacetic acid (CCl_3COOH) is heated to its boiling point. The solution has the boiling point of 100.8°C. Determine the van't Hoff factor for trichloroacetic acid. (K_b for water = 0.512 K Kg mol^{-1})

18. Write the main product and its IUPAC name formed when

a) Chlorobenzene undergoes nitration reaction.

b) Isopropyl chloride is treated with NaI in acetone.

19. Write the Nernst equation and find the emf of the following cell at 298K

$Mg/Mg^{2+}_{(0.001M)}//Cu^{2+}/Cu_{(0.0001M)}$ $E^0Mg^{2+}/Mg = -2.36V$ $E^0Cu^{2+}/Cu = 0.34V$ (log10=1)

20. Write down the structures and names of the products formed when D-glucose is treated with:

(i) Bromine water (ii) Hydrogen Iodide (Prolonged heating).

21. What type of structural isomerism is exhibited by the following compounds?

(a) $[Cr(NH_3)_5Cl]SO_4$ (b) $[Cr(NH_3)_6][Co(CN)_6]$

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.

22. A metal complex having composition $Cr(NH_3)_4Cl_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B gives a pale yellow precipitate soluble in concentrated ammonia.

(i) Write the formulae of isomers A and B.

(ii) State the hybridisation of chromium in each of them.

(iii) Calculate the magnetic moment (spin only value) of the isomer A

OR

(i) Write the IUPAC name of $[Co(NH_3)_4(H_2O)Cl]Cl_2$

(ii) Justify the formation of a low spin complex and a high spin complex taking the examples of $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$ on the basis of "crystal field splitting energy".

23. Compound 'A' with molecular formula C_4H_9Br is treated with aq.NaOH. The rate of this reaction depends upon the concentration of the compound 'A' only. When another isomer 'B' of this compound, which is optically active treated with aq.NaOH solution, the rate of reaction is found to be dependent on concentration of 'B' and NaOH.

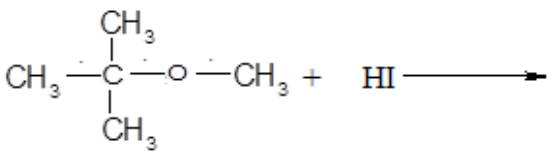
a) Write structural formula of both compounds 'A' and 'B'.

b) Out of these two compounds which one will be converted to products with racemic mixture and why?

24. A 0.05M NaOH solution offered a resistance of 31.6Ω in a conductivity cell at 298K. If the cell constant of the conductivity cell is 0.367 cm^{-1}, find out the conductivity and molar conductivity of the sodium hydroxide solution.

25. Write the final product(s) in each of the following reaction:

(i) $C_6H_5OH \xrightarrow[(ii)\ H^+]{(i)\ CHCl_3 + aq.\ NaOH}$

(ii) 

(iii) $CH_3\text{-}\ CH_2\text{-}CH_2\text{-}CH_2\text{-}\ OH + SOCl_2 \rightarrow$

26. A) Give chemical tests to distinguish between the following pairs of compounds

Petan-2-one and Petan-3-one

B) Arrange the following in the increasing order of their property indicated

i) Acetaldehyde, Acetone, Methyl tert butyl ketone (reactivity towards NH_2OH).

ii) Ethanol, ethanoic acid, ethanal (boiling point)

27. A good secondary cell can undergo a large number of discharging and charging cycles. Name the secondary cell commonly used in automobiles and invertors. Write the anode, cathode and overall reactions take place in this cell when it is in use.

28. A) Name the linkages responsible for the formation of proteins and DNA.

B) Vitamins are the organic compounds which are required for the healthy growth and functioning of animal organism. Deficiency of which vitamin causes

i) Pernicious anaemia ii) Rickets

SECTION D

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

29. The basicity of amines of different classes does not follow a simple pattern because the number of groups bonded to nitrogen affects the electron density at the nitrogen atom. And, the stability of the conjugate acid in the solvent has a major effect on basicity. Thus, the basicity of amines can be explained only for amines with similar structures at the nitrogen atoms. The basicity of an amine is increased by electron-donating groups and decreased by electron withdrawing groups. Aryl amines are less basic than alkyl-substituted amines because some electron density provided by the nitrogen atom is distributed throughout the aromatic ring. Basicity is expressed using Kb values measured from the reaction of the amine with water. An alternate indicator of basicity is pKb, which is −log Kb. A strong base has a large Kb and a small pKb. The basicity of amines is also expressed by the acidity of their conjugate acids. A strong base has a weak conjugate acid, as given by a small value of Ka and a large pKa.

S.NO	NAME OF BASE	pKa of its conjugated acid
1	Ethylamine	10.75
2	Diethylamine	10.98
3	Triethylamine	10.76
4	Aniline	4.63
5	Pyrimidine	1.3
6	Pyrrolidine	11.27

i) Arrange all bases from S.No 1 to 6 in the increasing order of their basic strength. (2)

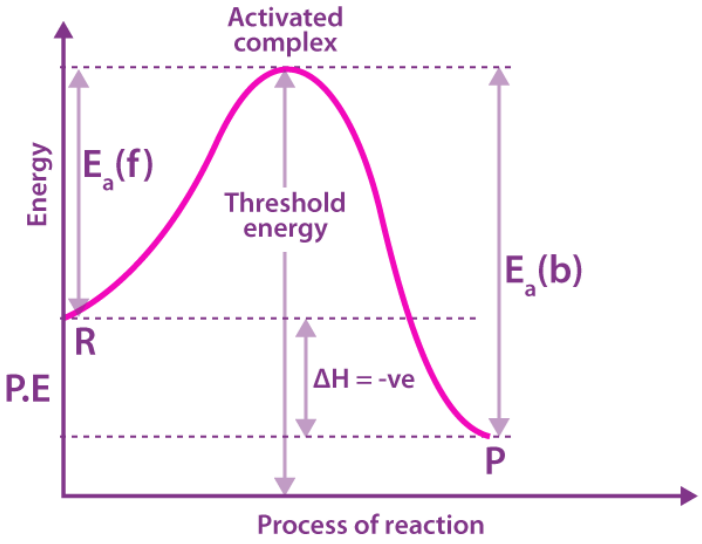
ii) Write the factors which affect the basicity of amines. (1)

iii) Out of aniline and ethyl amine, which is less basic and why? (1)

OR

iii) Compare the basicity of toluidine and Aniline. (1)

30. All chemical processes are affected by the temperature at which the process is occurring, although the exact change in reaction rate with temperature is unique for any process. However, many reaction rates will approximately double for each 10°C increase in temperature, and this rule of thumb can be a helpful guide in understanding the effects of temperature changes. The temperature dependence of the rate of a chemical reaction can be accurately explained by Arrhenius equation.



$$k = A\, e^{-Ea/RT}$$

$$\log k = \log A - Ea/2.303RT$$

Increasing the temperature of the substance increases the fraction of molecules, which collide with energies greater than Ea, it will result in an increase in the rate of the reaction and an exponential increase in the rate constant.

i) The rate constant for the first order decomposition of H_2O_2 is given by the following equation: $\log k = 14.34 - 1.25 \times 10^4/T$. Calculate Ea for this reaction($R=8.314 JK^{-1}mol^{-1}$) (2)

ii) What is activation energy? (1)

iii) k (The rate constant), Ea (Activation energy) and A(Arrhenius constant) are $3x10^{-4}s^{-1}$, $104.4 kJmol^{-1}$ and $6.0x10^{14}s^{-1}$ respectively. What is the value of 'k' at infinite temperature? ($T \rightarrow \infty$) (1)

OR

iii) Give two conditions which must be satisfied by molecules to undergo effective collisions.

SECTION E

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

31. A) A solution of two liquids boils at a temperature more than the boiling point of either of them. What type of deviation will be shown by the solution formed in terms of Raoult's law? Give one example for such mixture. Graphically represent this deviation.

B) An equimolar mixture of benzene and toluene form an ideal solution. Calculate the composition in vapour phase. ($P^o_{(Benzene)} = 600mmHg$, $P^o_{(Toluene)} = 200mmHg$

OR

i) " Two volatile and miscible liquids can be separated by fractional distillation into pure components". Is it a true statement? Justify your answer.

ii) Two elements A and B form compounds having formula AB_2 and AB_4. When dissolved in 20g of benzene (C_6H_6), 1g of AB_2 lowers the freezing point by 2.3K whereas 1g of AB_4 lowers it by 1.3K. The molal depression constant for benzene is 5.1 K Kg mol^{-1}. Calculate the atomic masses of A and B.

32. Attempt the following questions:

a) Transition metals have very high melting point. Out of Cr and Fe, which one has higher melting point and why?

b) Name a member of Lanthanoid series which can exhibit +4 oxidation state and why is it stable in this oxidation state?

c) Mn^{2+} is much more resistant than Fe^{2+} towards oxidation. Explain this observation by giving an appropriate reason.

d) How does the conversion of Na_2CrO_4 to $Na_2Cr_2O_7$ carried out?

e) Out of Sc^{3+}, Co^{2+} and Cr^{3+}ions, only Sc^{3+} is colourless in aqueous solutions. Give reason.

OR

A) A blackish brown coloured solid 'A' when fused with alkali metal hydroxides in presence of air, produces a dark green coloured compound 'B' which on electrolytic oxidation in alkaline medium gives a dark purple coloured compound C. Identify A, B, and C and write the reaction involved.

B) What is lanthanide contraction? Mention any two consequences.

33. (a) Illustrate the following name reactions giving a chemical equation in each case:

(i) Clemmensen reaction (ii) Cannizzaro's reaction

(b) Describe how the following conversions can be brought about:

(i) Propanone to propene

(ii) Ethylbenzene to benzoic acid

(iii) Ethanal to But-2-enal

OR

(a) Illustrate the following name reactions:

(i) Hell–Volhard–Zelinsky reaction

(ii) Cross aldol condensation

(b) An organic compound with the molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollen's reagent and undergoes cannizaro reaction. On vigorous oxidation, it gives 1,2-Benzenedicarboxylic acid. Identify the compound and write equations for the reactions involved.