PRATAP PUBLIC SCHOOL KARNAL

MIDTERM CLASS - XII 2024-25
CHEMISTRY

TIME : 3 HRS.   M.M. 70

General Instructions :

- All questions are compulsory.
- Section A : Q. No. 1 to 18 are very short answer questions (objective type) and carry 1 mark each.
- Section B : Q. No. 19 to 25 are short answer (Type - 1 Questions) and carry 2 marks each.
- Section C : Q. No. 26 to 30 are short answer (Type - II Questions) and carry 3 marks each.
- Section D : Q. No. 31 and 32 are Case Study Type questions and carry 4 marks each.
- Section E : Q. No. 33 and 35 are also long answer questions and carry 5 marks each.

SECTION A : (*Objective Type Questions*, 1M)

1. 4L of 0.02 M aqueous solution of NaCl was diluted by adding 1 L of water. The molarity of the resultant solution is ....

    (a) 0.004   (b) 0.008   (c) 0.012   (d) 0.016

2. At a given temperature, osmotic pressure of a concentrated solution of a substance ....

    (a) is higher than that of a dilute solution   (b) is lower than that of a dilute solution

    (c) is same as that of a dilute solution

    (d) cannot be compared with osmotic pressure of dilute solution

3. Using the data given below find out the strongest reducing agent.

    $E^\circ_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33$ V ; $E^\circ_{Cl_2/Cl^-} = 1.36$ V ;

    $E^\circ_{MnO_4^-/Mn^{2+}} = 1.51$ V ; $E^\circ_{Cr^{3+}/Cr} = -0.74$ V.

    (a) Cl^- (b) Cr (c) Cr^{3+} (d) Mn^{2+}

4. Kohlrausch give the following relation for strong electrolytes :

    $$\Lambda_m = \Lambda_m^\circ - A\sqrt{C}$$

    Which of the following equality holds ?

    (a) $\Lambda_m = \Lambda_m^\circ$ as $C \longrightarrow \sqrt{\Lambda}$ (b) $\Lambda_m = \Lambda_m^\circ$ as $C \longrightarrow \infty$

    (c) $\Lambda_m = \Lambda_m^\circ$ as $C \longrightarrow 0$ (d) $\Lambda_m = \Lambda_m^\circ$ as $C \longrightarrow 1$

5. Which of the following solutions of KCl will have the highest value of molar conductivity ?

    (a) 0.01 M   (b) 1 M   (c) 0.5 M   (d) 0.1 M

6. Which of the following expressions is correct for the rate of reaction given below ?

    $$5Br^- (aq) + BrO_3^- (aq) + 6H^+ (aq) \longrightarrow 3Br_2(aq) + 3H_2O(l)$$

    (a) $\dfrac{\Delta[Br^-]}{\Delta t} = 5\dfrac{\Delta[H^+]}{\Delta t}$ (b) $\dfrac{\Delta[Br^-]}{\Delta t} = \dfrac{6}{5}\dfrac{\Delta[H^+]}{\Delta t}$

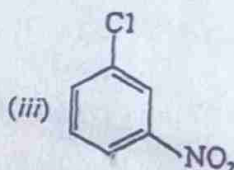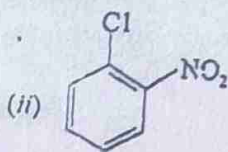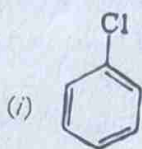(c) $\dfrac{\Delta[Br^-]}{\Delta t} = \dfrac{5}{6}\dfrac{\Delta[H^+]}{\Delta t}$

(d) $\dfrac{\Delta[Br^-]}{\Delta t} = 6\dfrac{\Delta[H^+]}{\Delta t}$

7. What is the activation energy for a reaction, if its rate doubles when the temperature is raised from 35°C ? $(R = 8.314\ J\ mol^{-1}K^{-1})$

   (a) $342\ kJ\ mol^{-1}$ (b) $269\ kJ\ mol^{-1}$ (c) $34.7\ kJ\ mol^{-1}$ (d) $15.1\ kJ\ mol^{-1}$

8. Toluene reacts with a halogen in the presence of iron (III) chloride giving *ortho* and *para* halo compound. reaction is

   (a) electrophilic elimination reaction

   (b) electrophilic substitution reaction

   (c) free radical addition reaction

   (d) nucleophilic substitution reaction

9. Reaction of 1-phenyl-2-chloropropane with alcoholic KOH gives mainly

   (a) 1-phenylpropene   (b) 3-phenylpropene   (c) 1-phenylpropan-3-ol   (d) 1-phenylpropan

10. Which of the following is the correct increasing order for the rate of reaction of the given compounds to nucleophilic substitution ?

(i) [structure: benzene ring with Cl]

(ii) [structure: benzene ring with Cl and NO₂]

(iii) [structure: benzene ring with Cl and NO₂]

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

11. A compound (X) with the molecular formula C_3H_8O can be oxidised to another compound (Y) whose mol formula is $C_3H_6O_2$. The compound (X) may be

   (a) $CH_3CH_2-O-CH_3$

   (b) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

   (c) $CH_3-CH_2-CH_2-OH$

   (d) CH_3-CH_2-CHO

12. Phenol on being heated with concentrated H_2SO_4 and then with concentrated HNO_3 gives

   (a) *o*-Nitrophenol   (b) 2, 4, 6-trinitrophenol   (c) *p*-nitrophenol   (d) *m*-nitrophenol
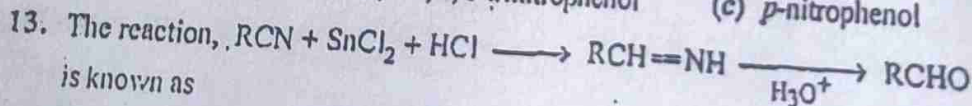
13. The reaction, $RCN + SnCl_2 + HCl \longrightarrow RCH{=}NH \xrightarrow{H_3O^+} RCHO$ is known as

   (a) Etard reaction

   (b) Haloform reaction

   (c) Gattermann-Koch reaction

   (d) Stephen reaction

14. A compound (A) with molecular formual $C_5H_{10}O$, forms a phenyl hydrazone and gives negative Tolle iodoform tests. The compound on reduction gives *n*-pentane. The compound (A) is

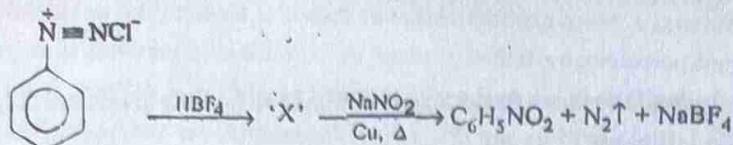   (a) pentan-3-one   (b) pentanal   (c) pentanol   (d) pentan-2-one

15. Which of the following reagents is/are used for the conversion of ethanoic acid to ethanoic anhydride ?

   (a) $SOCl_2, \Delta$ (b) PCl_3, Δ (c) P_2O_5, Δ (d) All of these

16. The best reagent for converting 2-phenylpropanamide into 2-phenylpropanamine is ....

   (a) excess H_2 (b) Br_2 in aqueous NaOH

   (c) iodine in the presence of red phosphorus   (d) $LiAlH_4$ in ether

17. Name the product(s) formed during the reaction of primary aliphatic amines with nitrous acid at room t ture ?

(a) $RN_2^+Cl^-$ (b) ROH   (c) Both (a) and (b)   (d) None of these

18. The intermediate 'X' in the following reaction is

$$\underset{\overset{\displaystyle\overset{+}{N}=NCl^-}{\bigcirc}}{}\xrightarrow{HBF_4} \text{'X'} \xrightarrow[Cu, \Delta]{NaNO_2} C_6H_5NO_2 + N_2\uparrow + NaBF_4$$

(a) $C_6H_5N=BF_4$ (b) $C_6H_5\overset{+}{N}_2=B\overline{F}_4$ (c) $C_6H_5N_2^+BF_2^-$ (d) $C_6H_5N=NBF_4$

SECTION B : *(Short Answer (Type-I Questions, 2M)*

19. How will you convert:
    (i) Bromobenzene to 2-bromoacetophenone ?   (ii) 2-Bromobutane to But-2-ene ?

Or

An alkyl halide (A) molecular formula $C_6H_{13}Cl$ on treatment with alcoholic KOH gives two isomeric alkenes (B) and (C) of molecular formula C_6H_{12}. Both alkenes on hydrogenation give 2, 3-dimethylbutane. Write the structures of (A), (B) and (C).   2

20. Explain why :
    (i) Dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.
    (ii) Alkyl haldies though polar are immiscible with water.   2

21. Write the chemical equation involved in the following :
    (i) Kolbe's reaction   (ii) Williamson synthesis   2

22. Write the names of the reagents and equations for the preparation of the following ethers by williamson's synthesis :
    (i) 1-Propoxypropane   (ii) 2-Methoxy-2-methylpropane   2

23. How the following will be obtained ? (Write chemical equations only).
    (i) Picric acid from phenol   (ii) Benzoquinone from phenol.   2

24. What happens when :
    (i) Propanone is treated with methylmagnesium iodide and then hydrolysed, and
    (ii) Benzene is treated with CH_3COCl in presence of anhydrous $AlCl_3$?

Or

Write the reactions involved in the following :
    (i) Hell-Volhard Zelinsky reaction   (ii) Decarboxylation reaction   2

25. Identify compounds [A] and [B] in the following reactions and write their names :

$$C_6H_7N \xrightarrow[0°C]{NaNO_2/HCl} [A] \xrightarrow{'B'} \underset{\bigcirc}{}\text{—}Cl$$
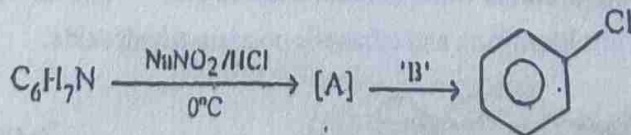
Or

Arrange the following in increasing order of their basic strength :
(i) $C_2H_5NH_2$, $C_6H_5CH_2$, NH_3, $C_6H_5CH_2NH_2$ and $(C_2H_5)_2NH$

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(ii) $C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$, $C_6H_5NH_2$

SECTION C : (Short Answer (Type-II Questions, 3M)

26. Give reasons for the following:

    (i) Measurement of osmotic pressure method is preferred for the determination of molar mass of macromolecules such as proteins and polymers.

    (ii) Aquatic animals are more comfortable in cold water than in warm water.

    (iii) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.　3

27. The cell in which the following reaction occurs $2Fe^{3+}(aq) + 2I^-$ (aq) $\longrightarrow 3Fe^{2+}$ (aq) + I_2 (s) has $E°_{cell} = 0.236$ V at 298 K. Calculate the standard Gibbs energy and the equilibrium constant of the cell reaction.

3

28. Answer the following questions :

    (i) identify the order of reaction from the following unit for its rate constant : $[mol^{-1} s^{-1}]$

    (ii) The conversion of molecules from A to B follow second order kinetics. If concentration of A is increased to three times, how will it affect the rate of formation of B ?

    (iii) Write the expression of integrated rate equation for zero order reaction.

Or

A first order reaction is 50% complete in 80 minutes at 300 K and in 10 minutes at 320 K. Calculate activation energy (E_a) for the reaction.

($R = 8.314 JK^{-1} mol^{-1}$) (Given : $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$)

3

29. Name the reagents used in the following reactions.

    (i) Oxidation of a primary alcohol to carboxylic acid. (ii) Oxidation of a primary alcohol to aldehyde.

    (iii) Bromination of phenol to 2,4,6-tribromophenol.

Or

Explain the following :

(i) Ethers are kept in coloured bottles filled upto brim.

(ii) C_2H_5OH and CH_3OCH_3 both have same molar mass but C_2H_5OH is liquid at room temperature and CH_3OCH_3 is gas.

(iii) What is power alcohol ? What is its use ?

Write equations involved in the following reactions :

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(i) Ethanamine reacts with acetyl chloride.

(ii) Aniline reacts with bromine water at room temperature.

(iii) Aniline reacts with chloroform and ethanolic potassium hydroxide.

3

TION D : (Case Study Type Questions, 4M)

Case Study 1 :

he rate law for a chemical reaction relates the reaction rate with the concentrations or partial pressures of the

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reactants. For a general reaction $aA + bB \longrightarrow C$ with no intermediate steps in its reaction mechanism, meaning that it is an elementary reaction, the rate law is given by $r = k[A]^x[B]^y$, where [A] and [B] express the concentrations of A and B in moles per litre. Exponents x and y vary for each reaction and are determined experimentally. The value of k varies with conditions that affect reaction rate, such as temperature, pressure, surface area, etc. The sum of these exponents is known as overall reaction order. A zero order reaction has a constant rate that is independent of the concentration of the reactant. A first order reaction depends on the concentration of only one reactant. A reaction is said to be second order when the overall order is two. Once we have determined the order of the reaction, we can go back and plug in one set of our initial values and solve for k.

Read the given passage carefully and give the answer of the following questions :

(i) Calculate the overall order of a reaction which has the following rate expression :
$$\text{Rate} = k[A]^{1/2}[B]^{3/2}$$

(ii) What is the effect of temperature on rate of reaction ?

(iii) A first order reaction takes 77.78 minutes for 50% completion. Calculate the time required for 30% completion of this reaction (log 10 = 1, log 7 = 0.8450).

Or

·A first order reaction has a rate constant 1×10^{-3} per sec. How long will 5g of this rectant take to reduce to 3 g ? (log 3 = 0.4771 ; log 5 = 0.6990)

32. **Case Study 2 :**   4

The carbon-oxygen double bond is polarised in aldehydes and ketones due to higher electronegativity of oxygen relative to carbon. Thereforem they undergo nucleophilic addition reactions with a number of nucleophiles such as HCN, $NaHSO_3$, alcohols, ammonia derivatives and Grignard reagents. Aldehydes are easily oxidised by mild oxidising agents as compared to ketones. The carbonyl group of carboxylic acid does not give reactions of aldehydes and ketones. Carboxylic acids are considerably more acidic than alcohols and most of simple phenols.

Read the given passage carefully and give the answer of the following questions :

(i) Write the name of the product when an aldehyde reacts with excess alcohol in presence of dry HCl.

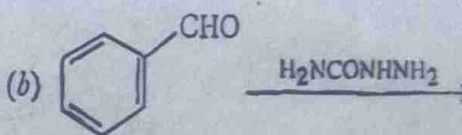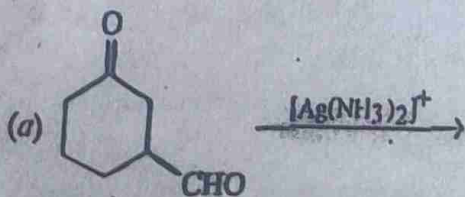(ii) Why carboxylic acid is a stronger acid than phenol ?

(iii) (a) Arrange the following compounds in increasing order of their reactivity towards CH_3MgBr :
$$CH_3CHO, \ (CH_3)_3C-\underset{\underset{O}{\|}}{C}-CH_3, \ CH_3-\underset{\underset{O}{\|}}{C}-CH_3$$
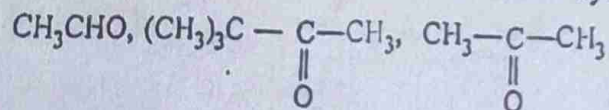
(b) Write a chemical test to distinguish between propanal and propanone.

Or

Write the main product in the following :

(a) $\xrightarrow{[Ag(NH_3)_2]^+}$

(b) $\xrightarrow{H_2NCONHNH_2}$ 4

33. (i) What type of deviation from Raoult'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.

(ii) 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 100 g water, calculate the resultant vapour pressure of the solution.

Or

(i) A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K.

Given : Molar mass of sucrose = 342 g mol^{-1},

Molar mass of glucose = 180 g mol^{-1}

(ii) Define the following terms :

(a) Molality (m)
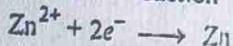
(b) Abnormal molar mass   5

34. (i) The molar conductivities of NH_4^+ and Cl^- ion are 73.8 S cm^2 mol^{-1} and 76.2 S cm^2 mol^{-1} respectively. The conductivity of 0.1 M NH_4Cl is 1.29×10^{-2} S cm^{-1}. Calculate its molar conductivity and degree of dissociation.

(ii) Calculate the half-cell potential at 298 K for the reaction

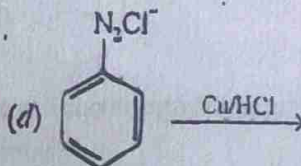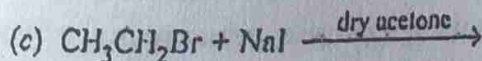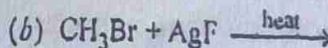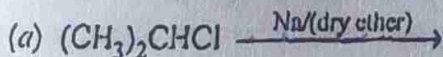$$Zn^{2+} + 2e^- \longrightarrow Zn$$

If $[Zn^{2+}]$ = 0.1 M and $E^{\circ}_{(Zn^{2+}/Zn)}$ = -0.76 V ,

Or

(i) Why does the cell voltage of a mercury cell remain constant during its lifetime ?

(ii) Write the reaction occurring at anode and cathode and the products of electrolysis of *aq.* KCl.

(iii) What is the pH of HCl solution when the hydrogen gas electrode shows a potential of -0.59 V at standard temperature and pressure ?   5

35. (i) Chlorine atom of chlorobenzene is much less reactive as compared to chlorine atom of ethyl chloride. Why ?

(ii) What are electrophilic substitution reactions ? Explain its mechanism with an example of aryl halide.

Or

(i) Write the formula of the main products formed by the following chemical reactions :

(a) $(CH_3)_2CHCl \xrightarrow{\text{Na/(dry ether)}}$

(b) $CH_3Br + AgF \xrightarrow{\text{heat}}$

(c) $CH_3CH_2Br + NaI \xrightarrow{\text{dry acetone}}$

(d) [benzene ring with N_2Cl^- group] $\xrightarrow{\text{Cu/HCl}}$

(ii) What happens when :

(a) ethyl chloride is treated with NaI in the presence of acetone

(b) chlorobenzene is treated with Na metal in the presence of dry ether

(c) methyl chloride is treated with KNO_2.

Write chemical equations in support of your answer.   5

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