Time : 3 Hours   **Total Marks : 100**

Please check whether you have got the right question paper.

N.B. : 1. All Questions are compulsory.

2. Figures to the right indicate full marks.

3. Use of log-table / nonprogrammable calculator is allowed.

4. Answers for the same question as far as possible should be written together.

1. (A) Select the correct option and complete the following sentences. (any **twelve**)   **12**
    (i)   Solution is a _____ mixture of two or more non-reacting substances.
            (a) homogeneous   (b) simple   (c) heterogeneous
    (ii)   By fractional distillation constituents of _____ can be separated.
            (a) non ideal solution (b) ideal solution (c) any mixture
    (iii)   The plot of log k versus T^{-1} is linear with a _____ slope.
            (a) positive   (b) negative   (c) zero
    (iv)   In a chain reaction, the reactive intermediates like atoms or free radicals
            are produced in chain _____ step.
            (a) termination   (b) inhibition   (c) initiation
    (v)   Chlorination of toluene is an example of _____ reaction.
            (a) consecutive   (b) parallel   (c) reversible
    (vi)   The temperature at which two conjugate solutions merge into one another
            to form a single layer is called _____.
            (a) distillation temperature   (b) critical solution temperature
            (c) evaporation temperature.
    (vii)   In diborane molecule, number of terminal B-H bonds are _____ .
            (a) 2   (b) 4   (c) 6
    (viii) Molecular formula of borax is _____.
            (a) $Na_2B_4O_7.10H_2O$ (b) $NaB_4O_7.10H_2O$ (c) $Na_2B_4O_6.10H_2O$
    (ix)   Silicon tetrachloride has _____ structure.
            (a) triangular   (b) octahedral   (c) tetrahedral
    (x)   _____ is the incorrect statement.
            (a) Silicon is extensively used as a semiconductor
            (b) Silicon occurs in free state in nature
            (c) SiO_2 is inert
    (xi)   Thermal stability of hydrides _____ gradually from NH_3 to BiH_3.
            (a) increases   (b) decreases   (c) remains same
    (xii)   In nitrous oxide, oxidation state of nitrogen is _____ .
            (a) +1   (b) +2   (c) +3
    (xiii) The aldehyde used in the Knoevenagal reaction has _____ .
            (a) α-H atom   (b) α- and β-H atom   (c) no α-H atom

    (xiv)   The hybridisation of 'C' and 'O' in the >C = O group is _____ .
            (a) sp^3-sp^3 (b) sp^2-sp^2 (c) sp^3-sp^2

63816   **Page 1 of 4**

(xv)   Friedel Craft acylation of benzene can be carried out by using _____ .
          (a) CH_3COCl (b) CH_3COOH (c) CH_3OCH_3

(xvi)   The general structure of enamine is _____ .

         (a) $>C=C=N-$ (b) $>C=C-N<$ (c) $>C-C-N<$

(xvii)   The aldehyde used in the Cannizzaro reaction has _____ .
          (a) α-H atom   (b) α- and β-H atom   (c) no α-H atom

(xviii)   _____ may be prepared by the action of one mole of CH_3MgI on ethyl formate followed by hydrolysis of addition product.
          (a) Methanol   (b) Acetaldehyde   (c) Isopropyl alcohol

(B)   State whether the following statements are true or false. (any **three**)   **3**
     (i)   For the study of distribution ratio, the two solvents must be miscible with each other.
     (ii)   Ideal solutions obey Dalton's law.
     (iii) BH_3 does not exist in free form.
     (iv)   In silicon dioxide each silicon atom is bonded to four oxygen atoms and each oxygen atom is bonded to two silicon atoms.
     (v)   If a compound contains both aldehyde and ketonic group, then the aldehyde is considered as the parent compound.
     (vi)   Ketones are usually more reactive towards nucleophilic reagent than aldehydes.

(C)   Match the column. (any **five**)   **5**

(i)	Temperature coefficient	(a)	Odd electron molecule
(ii)	Raoult's law	(b)	Tetrahedral
(iii)	NH_3	(c)	$\dfrac{k_{(T+10)}}{k_T}$
(iv)	Nitric oxide	(d)	$H_5C_2OOC\text{-}CH_2\text{-}COOC_2H_5$
(v)	Acetal	(e)	$x_2 = \dfrac{p^0 - p}{p^0}$
(vi)	Diethyl malonate	(f)	$CH_3\text{-}C \begin{smallmatrix} OC_2H_5 \\ \\ OC_2H_5 \end{smallmatrix}$ with H
		(g)	$K = \dfrac{C_1}{C_2}$
		(h)	Square planar
		(i)	$CH_2\text{-}COOC_2H_5$ $\vert$ $CH_2\text{-}COOC_2H_5$

63816

2. Attempt any **four** of the following. **20**
   (A) State and explain Nernst's distribution law. What are its important applications?
   (B) State Raoult's law. With the help of suitable diagrams explain positive and negative deviations from Raoult's law.
   (C) The vapour pressures of pure benzene and toluene at 40°C are $2.453 \times 10^4 Nm^{-2}$ and $7.864 \times 10^3 Nm^{-2}$ respectively. Mole fraction of benzene in the solution is 0.40. Assume that the solution is an ideal one. Calculate
      (i) the partial pressure of benzene and toluene
      (ii) the total vapour pressure of the solution and
      (iii) the mole fraction of benzene in the vapour above the solution.
   (D) State the important assumptions of the collision theory of reaction rates. What are the drawbacks of this theory?
   (E) What is meant by 'energy of activation' in kinetic studies? How it is determined experimentally?
   (F) For the reaction, $C_2H_5I + OH^- \rightarrow C_2H_5OH + I^-$, the rate constants were found to be 5.03×10^{-2} at 289 K and 6.71 at 333K. Calculate the energy of activation for the reaction. [$R = 8.314$ J mol^{-1} K^{-1}]

3. Attempt any **four** of the following. **20**
   (A) Among BF_3 and BCl_3, who is strong Lewis acid ? Explain.
   (B) Draw a structure of tetraborane. How many terminal and bridge bonds are in its structure ? Calculate total number of electrons involved in it.
   (C) What is silica ? Why is it inert ?
   (D) Explain zone refining technique for the purification of germanium.
   (E) Find oxidation state of nitrogen in N_2O and N_2O_5 and explain their structures.
   (F) Explain synthesis of ammonia by Bosh - Haber process.

4. Attempt any **four** of the following.
   (A) i) Give preparation of benzaldehyde and acetophenone by oxidation of alcohol by using PCC. **3**
      ii) Discuss the reduction of 3-phenyl-2-propenal by using LiAlH$_4$. **2**
   (B) i) Explain general mechanism of acid catalyzed nucleophilic addition to carbonyl compound. **3**
      ii) How is primary alcohol obtained from Grignard reagent? **2**
   (C) Give preparation of: **5**
      i) 2-butanone from acetyl acetone
      ii) succinic acid from ethyl acetoacetate.
   (D) i) Write a note on Rosenmund reduction. **3**
      ii) How benzaldehyde cynohydrin and benzaldehyde phenyl hydrazone are obtained from benzaldehyde? **2**
   (E) i) Give the mechanism of base catalyzed enolisation. **3**
      ii) Discuss the reduction of 2-butenal by using NaBH$_4$. **2**
   (F) Explain the mechanism of Claisen-Schmidt reaction. **5**

63816 **Page 3 of 4**

5. Attempt any **four** of the following.
   (A) What are the important steps involved in a chain reaction? Explain the steps   **5**
       involved in the reaction between hydrogen and bromine.
   (B) At 560 K, at a concentration of 1 mol dm^{-3}, the number of XY molecules colliding   **5**
       per cm^3 per second is 5×10^{30}. If the activation energy of the reaction,
       $2XY \rightarrow X_2 + Y_2$ is 1.76×10^5 J mol^{-1}, calculate the number of XY molecules reacting
       per cm^3 per second. [R= 8.314 J mol^{-1} K^{-1}]
   (C) Write a note on formation of trihalides and pentahalides of the elements of nitrogen   **5**
       family.
   (D) With suitable diagram, explain Czochralski pulling technique for purification of   **5**
       silicon.
   (E) i) Write a note on Gattermann – Koch formylation.   **3**
       ii) What are active methylene compounds? Why are they considered as carbon   **2**
          acids?
   (F) Explain the mechanism of benzoin condensation.   **5**

==   **XXXXXX** ==