QP Code : 19766

(3 Hours) **(Total Marks : 100**

N.B : 1. **All** questions are **compulsory**.
2. **Answers** to the **same question** must be **written together**.
3. **Figures** to the **right** indicate **full** marks.
4. The use of **log table / non-programmable calculator** is **allowed**.

1. (A) Select the correct option and complete the following sentences : **12**

(i) Decomposition of ethylene oxide is an example of _____ reaction.
(a) consecutive (b) parallel (c) reversible

(ii) The correct form of Arrhenius equation is _____.
(a) $k = A \cdot e^{Ea/RT}$ (b) $k = A \cdot e^{-Ea/RT}$ (c) $\log k = A \cdot e^{-Ea/RT}$

(iii) Which of the following shows positive deviation from Raoult's law? ___.
(a) $CHCl_3$ & C_2H_5OH (b) C_6H_6 & CCl_4 (c) C_6H_6 & $C_6H_5CH_3$

(iv) The conditions for an ideal solution are _____ and _____.
(a) $\Delta V = 0$ & $\Delta H \neq 0$ (b) $\Delta V = 0$ & $\Delta H = 0$ (c) $\Delta V \neq 0$ & $\Delta H = 0$

(v) Borax is synthesized from _____.
(a) bauxite (b) mica (c) tincal

(vi) In silica, central atom silicon undergoes _____ hybridization.
(a) sp (b) sp^2 (c) sp^3

(vii) _____ gas when inhaled in moderate quantities produces hysterical laughter.
(a) NO (b) N_2O (c) NO_2

(viii) Except _____, all the elements of group 15 form pentahalides.
(a) arsenic (b) bismuth (c) nitrogen

(ix) The _____ combination can not undergo Claisen-Schmidt reaction.
(a) $C_6H_5CHO + CH_3CHO$
(b) $C_6H_5CHO + CH_3COCH_3$
(c) $C_6H_5CH_2CHO + HCHO$

(x) The _____ solvents favour enol formation.
(a) polar and protic
(b) non-polar and aprotic
(c) polar and aprotic

(xi) Cyanohydrin has _____ groups.
(a) –CN and –OH (b) –CN and $-NH_2$ (c) –CN and $-NO_2$

(xii) $NaBH_4$ can reduce _____.
(a) >C=O and –CN (b) >C=O (c) >C=O and $-NO_2$

TURN OVER

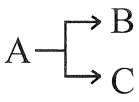
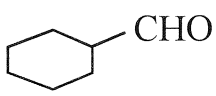
(B) State whether the following statements are **true** or **false** : **3**

(i) Phenol - Water system is an example of lower critical solution temperature.

(ii) Banana bond is a 3e – 2c bond.

(iii) If a compound contains both aldehyde and ketonic group, then the ketone is considered as the parent compound.

(C) Match the following columns : **5**

Column A	Column B
(i) Chain carriers	(p) $A \rightarrow B \rightarrow C$
(ii) Parallel reaction	(q) 
(iii) BF_3	(r) atoms and free radicals
(iv) Metalloid	(s) germanium
(v) 	(t) lewis acid
	(u) lead
	(v) cyclohexane carbaldehyde
	(w) carbaldehyde cyclohexane

2. (A) (i) Explain with suitable examples what is meant by : **5**

(a) parallel reactions.

(b) reversible reactions.

(ii) State the important assumptions of the collision theory of reaction rates. **3**

OR

(A) (i) Explain the terms "Upper critical solution temperature" and "lower critical solution temperature". **5**

(ii) State and explain Raoult's law. **3**

(B) (i) An organic liquid was subject to steam distillation. The liquid in the flask boiled at 90°C. The external pressure was found to be 9.789×10^4 Nm^{-2}. The vapour pressure of water at 90°C is 7.012×10^4 Nm^{-2}. The ratio of the weights of liquid to water in the distillate was found to be 2.47. Calculate the molecular weight of the liquid. **5**

[Given : Molecular weight of water = 18].

(ii) A solution of two liquids A & B exhibits ideal behaviour. The mole fraction of A is 0.4, the vapour pressure of the pure component A is 0.5bar and that of B is 0.3bar. Calculate the partial vapour pressure of A and B in solution. **3**

OR

(B) (i) The rate constant of a reaction increases by 7%. When the temperature is raised from 300 K to 310 K. Calculate the energy of activation of the reaction [R = 8.314 $J.K^{-1}$ mol^{-1}]. **5**

(ii) For the first order reaction, $2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$ the frequency factor A is $4.13 \times 10^{13} s^{-1}$ and Ea is 103.35 kJ mol^{-1}. What is the rate constant at 300 K? [R = 8.314 J K^{-1} mol^{-1}]. **3**

(C) Write a note on azeotropic mixtures. **4**

OR

(C) Give the merits of collision theory. **4**

3. (A) (i) What are electron deficient compounds? Discuss bonding in diborane molecule. **5**

(ii) Draw the structure of tetraborane molecule and calculate the total number of electrons involved. **3**

OR

(A) (i) Discuss the Czochralski's pulling technique for preparation of single crystals of germanium. **5**

(ii) Name the elements of group 14. Give their electronic configuration. **3**

(B) (i) How is silicon tetrachloride prepared? Discuss structure and bonding involved in silicon tetrachloride. **5**

(ii) Draw and describe the structure of silica. **3**

OR

(B) (i) Discuss the preparation, properties and structure of nitric oxide. **5**

(ii) Give a brief account of halides of group 15 elements. **3**

(C) With reference to elements of boron family, explain the trend in the following: **4**

(i) atomic radii and ionization energy.

(ii) melting and boiling points.

OR

(C) Explain the following : 4

(i) Ammonia is highly soluble in water but other hydrides are less soluble.

(ii) NO_2 is coloured, while N_2O_4 is colourless.

4. (A) (i) Explain the mechanism of Cannizzaro reaction. 5

(ii) Give preparation of propanoic acid from ethyl acetoacetate. 3

OR

(A) (i) (a) Write a note on Rosenmund reduction. 3

(b) What are stabilised enols? 2

(ii) How will you obtain 2-pentanone from acetyl acetone? 3

(B) (i) (a) Discuss the preparation of aldehydes and ketones by oxidation of alcohols using PCC. 3

(b) Discuss the reduction of crotonaldehyde by using $LiAlH_4$. 2

(ii) Give the mechanism of acid catalysed enolisation. 3

OR

(B) (i) (a) How will you obtain $C_6H_5COCH_3$, $C_6H_5COC_6H_5$ and $C_6H_5CO\,CH_2\,C_6H_5$ from benzene using Friedel-Craft's acylation? 3

(b) Explain with reaction what happens when cinnamaldehyde is added to $LiAlH_4$. 2

(ii) Discuss the general mechanism of acid catalyzed nucleophilic addition to carbonyl group. 3

(C) Give the preparation of acetal and cyclic ketal. 4

OR

(C) Complete the following reactions and find A and B : 4

(i) $H_3C{-}CO-CH_3 + CH_3 - NH_2 \rightarrow A \xrightarrow{H^+} B.$

(ii) $C_6H_5\,CO\,CH_3 + C_6H_5 - NH\,NH_2 \rightarrow A.$

(iii) $C_6H_5\,CHO + NaHSO_3 \rightarrow A.$

5. Attempt **any four** of the following :

(A) At 287°C at a concentration of 1 $mol.dm^{-3}$, the number of AB molecules colliding per second is $5\times10^{30} cm^{-3}$. If the activation energy of the reaction, 5

$$2AB \rightarrow A_2 + B_2 \text{ is } 1.76\times10^5 \text{ Jmol}^{-1}$$

Calculate the number of AB molecules reacting per cm^3 per second.

(B) State and explain Nernst Distribution law. 5

(C) How is borax prepared from Colemanite mineral? Discuss the properties and uses of borax. 5

(D) With respect to manufacture of ammonia by Haber's process, explain the following physicochemical principles. 5

(i) Effect of temperature.

(ii) Effect of concentration.

(E) Explain the mechanism of Benzoin condensation. 5

(F) Give the IUPAC name of CH_3CHO, give its preparation from ethyne. 5

What happens when C_6H_5CHO is treated with $CH_3 - CH_2 - Mg - Br$ and the product obtained is further hydrolysed?
