[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) -------- is an example of parallel reaction.

(a) Nitration of phenol (b) Oxidation of benzyl alcohol

(c) Reduction of benzaldehyde

(ii) The units of energy of activation are ------ .

(a) $kJmol^{-1}$ (b) kJK^{-1} (c) $kJK^{-1}mol^{-1}$

(iii) A consecutive reaction is represented as ---------- .

(a) $A \rightarrow B \rightarrow C$ (b) $A \rightleftarrows B + C$ (c) $A \rightleftarrows B \rightleftarrows C$

(iv) ------ extraction process is more efficient.

(a) Single (b) Double (c) Multiple

(v) The completely miscible solution can be separated by --------- .

(a) Separating funnel (b) evaporation (c) fractional distillation

(vi) -------- shows negative deviation from Raoult's law.

(a) $CHCl_3$ and acetone (b) C_6H_6 and C_2H_5OH (c) $C_6H_5CH_3$ and C_6H_6

(vii) A mixture of ammonia and air at about 800°C in the presence of Pt gauze forms --------- .

(a) N_2O (b) NO (c) NH_2OH

(viii) ---------- compound is related to Haber's process.

(a) CO_2 (b) NH_3 (c) NO_2

(ix) ---------- is the most explosive.

(a) NCl_3 (b) PCl_3 (c) $AsCl_3$

(x) ---------- does not exist in free form.

(a) BF_3 (b) BCl_3 (c) BH_3

(xi) An aqueous solution of borax is ---------- .

(a) neutral (b) acidic (c) basic

(xii) ---------- is not a borane.

(a) B_2H_6 (b) B_3H_6 (c) B_4H_{10}

(xiii) ------ can be obtained from aliphatic primary amine and ketone.

(a) Enamine (b) Iminium salt (c) Imine

(xiv) Gattermann-Koch formylation uses a mixture of ------ .

(a) DME and $POCl_3$ (b) CO and HCl (c) CO and $POCl_3$

(xv) ----- is formed during the synthesis of 2-pentanone from ethyl acetoacetate.

(a) CH_3COOH (b) CO_2 (c) CH_3CHO

(xvi) Alkyl groups make the carbon in the carbonyl group -------- .

(a) less nucleophilic (b) less electrophilic (c) more electrophilic

(xvii) Cynohydrin contains ---------- groups.

(a) $–NO_2$ and –CN (b) –OH and –CN (c) $–NH_2$ and -CN

(xviii) --------- may be obtained by treating one mole of Grignard reagent with ethyl formate.

(a) Ketone (b) Aldehyde (c) Primary alcohol

(B) State whether the following statements are true or false. (any **three**) **3**

(i) Chlorination of toluene is an example of reversible reaction.

(ii) A homogeneous mixture consists of a single phase.

(iii) There are two bridging hydrogen atoms in diborane.

(iv) NO_2 is released by heating $Pb(NO_3)_2$.

(v) The hybridization of ‘C’ and ‘O’ in carbonyl group is $sp\text{-}sp^2$.

(vi) Aldehydes are typically more reactive than ketones.

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

(i)	Benzene + Toluene	(a)	Group 13 element
(ii)	Chain carriers	(b)	Group 14 element
(iii)	Silicon	(c)	Group 15 element
(iv)	Bismuth	(d)	Ideal solution
(v)	Claisen-Schmidt reaction	(e)	Non – ideal soution
(vi)	Knoevenagel condensation	(f)	Atoms and free radicals
		(g)	Aromatic aldehyde having α - H atom
		(h)	Active methylene compound
		(i)	Base catalysed aldol type reaction

2. Attempt any **four** of the following. **20**

(A) Explain with suitable examples, what is meant by consecutive reactions and parallel reactions.

(B) Give an expression for the rate constant of a bimolecular reaction in terms of the activated complex theory.

(C) If the rate of reaction approximately doubles when temperature rises from 35^0C to 45^0C, calculate the energy of activation of the reaction. [R = 8.314$JK^{-1}mol^{-1}$]

(D) State and explain Nernst distribution law. What are the conditions under which the law is strictly valid ?

(E) State and explain Raoult's law. Draw vapour pressure – composition curve and explain positive and negative deviation from Raoult's law.

(F) A mixture of water and aniline boils at a temperature of 88.6 ^{0}C at pressure of 1.013 X 10^5 Nm^{-2}. The vapour pressure of water at this temperature is 8.688 X 10^4 Nm^{-2}. Find the composition of the distillate.

3. Attempt any **four** of the following. **20**

(A) Which is considered as strong Lewis acid, BF_3 or BCl_3 ? Explain

(B) Draw the structure of tetraborane. Explain various bonds involved in the structure. Calculate total number of electrons involved in the bonding.

(C) Write one method of preparation of $SiCl_4$. Explain its structure and bonding.

(D) With a diagram, explain Czochralski pulling technique for purification of silicon.

(E) Name, formulate the hydrides of nitrogen family. Explain trend for their thermal stability.

(F) Write a note on Bosch-Haber process.

4. Attempt any **four** of the following.

(A) Explain the mechanism of Benzoin condensation. **5**

(B) i) How will you obtain $C_6H_5COCH_3$, $C_6H_5COC_6H_5$ and $C_6H_5COCH_2C_6H_5$ from benzene using Friedel Craft acylation? **3**

ii) Discuss the reduction of 3-pentanone by using $NaBH_4$. **2**

(C) i) Give the Mechanism of base catalyzed enolisation. **3**

ii) How is secondary alcohol obtained from Grignard reagent. **2**

(D) i) Explain the general mechanism of acid catalyzed nucleophilic addition to carbonyl compound. **3**

ii) Explain the preparation of cyclic acetal from ethanal. **2**

(E) Give preparation of: **5**

i) 2-pentanone from acetyl acetone

ii) succinic acid from ethyl acetoacetate.

(F) i) How are aldehyde and ketone obtained by hydration of alkyne? **3**

ii) What are stabilized enols? **2**

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

(A) Compare the collision theory with the activated complex theory highlighting the relative merits of each theory. **5**

(B) What are partial miscible liquids? Explain the term “lower critical solution temperature”. **5**

(C) What is borax? Explain any two methods used for its synthesis. **5**

(D) What is silica? Explain its structure and bonding. Why is it inert? **5**

(E) Explain the mechanism of Cannizzaro reaction. **5**

(F) i) Write note on Rosenmund reduction. **3**

ii) Discuss the reduction of 2-butanone by using $LiAlH_4$. **2**
