

(3 Hours)

[Total Marks 70]

**N.B. 1. All Questions are compulsory.****2. Figure to right indicate full marks****Q1. A. Explain the following terms (Any five)**

1. Field effect
2. Molecularity of reaction
3. Polar covalent bond
4. Charge transfer complex
5. Catalyst
6. Orbital

5

**B. Fill in the blanks (Any five)**

1. Ground state electronic configuration for Fluorine is \_\_\_\_\_.
2. Lewis structure for Sulphuric acid ( $H_2SO_4$ ) is \_\_\_\_\_.
3. Formal charge on oxygen in  $H_3O^+$  ion is \_\_\_\_\_.
4. Tetracyanoethylene is an excellent acceptor, and it forms \_\_\_\_\_ with electron rich systems such as hexamethylbenzene.
5. The formula for calculation of half-life for first order reaction is \_\_\_\_\_.
6. Crown ether is an example of \_\_\_\_\_.

5

**C. Match the following**

5

Column I

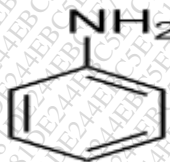
Column II

- |                                |                             |
|--------------------------------|-----------------------------|
| 1. $dx^2-y^2$                  | a) Charge transfer          |
| 2. Carbon in alkane            | b) example of specific base |
| 3. Starch iodine complex       | c) sigma symmetry           |
| 4. $OH^-$                      | d) $3d^7 4s^2$              |
| 5. Valence electron of Co (27) | e) $sp^3$ hybridized        |

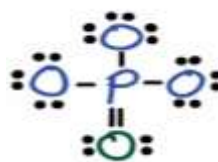
**Q2. A. Draw the resonating structures for**

2

a.



b.

**B. Draw Molecular orbital diagram for Ethene. Indicate HOMO and LUMO.**

3

**C. Fill in the blanks on the basis of Kinetic isotopic effect.**

3

1. When  $k_H / k_D$  is greater than one, we call it ----- isotope effect.

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2. When  $k_H/k_D$  is less than one, we call it ----- isotope effect.  
 3. Maximum isotope effect is observed in ----- element

D. Define turn over number. Explain metal ion catalysis with example. 3

Q3. A. Give Eyring equation and Arrhenius rate law. State how they differ from each other. 3

B. Calculate rate constant in  $\text{hr}^{-1}$  for the reaction with half-life 720 min. 2

C. Define Molecular orbital. Compare the energy of linear and bent form of  $\text{MH}_2$  system using molecular orbital diagram. 3

D. Why Pyramidal form of  $\text{MH}_3$  system is more stable than planar form? 3

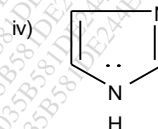
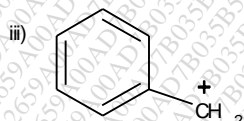
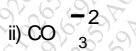
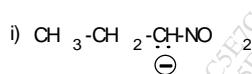
Q4. A. What do you mean by First order mixing? State any four rules of QMOT. 3

B. Define fast kinetics. Enlist the method to study fast kinetics. Explain any one. 3

C. What is phase transfer catalysis? Give example of phase transfer catalyst. 2

D. Mention symmetry elements of  $\text{MH}_3$  system. Enlist molecular orbitals for  $\text{MH}_3$  with number of electrons in each orbital with suitable example. 3

Q5. A. Draw resonating forms for following structure (Any 2) 3



B. Define reaction intermediate. Explain formation of any one by Molecular orbital theory 3

C. A first order reaction was found to have energy of activation of  $2.15 \times 10^4 \text{ J/mol}$ .

Calculate the temperature at which reaction will have a rate constant of  $0.030 \text{ sec}^{-1}$ .

Frequency factor  $A = 5 \times 10^{13} \text{ sec}^{-1}$  and  $R = 8.314 \text{ J/kmol}$ . 2

D. Write a short note on Charge transfer complexes. 3

Q6. A. Complete the following table on the basis of hybridization 4

Molecule	Hybridized state of underlined atom	Bond angle
<u>S</u> $\text{F}_6$		
<u>C</u> $\text{H}_2=\text{C}\text{H}_2$		
<u>Be</u> $\text{Cl}_2$		
<u>P</u> $\text{Cl}_5$		

B. Write a short note on general base catalysis. 4

C. Explain "Kinetics vs thermodynamics control" of reaction with suitable example. 3