

QP Code : 21716

(3 Hours)

[ Total Marks : 70

- N.B. : (1) All questions are compulsory  
 (2) Figures to the right indicate full marks.

1. (a) Explain the following terms (any five)

- (i) Order of reaction
- (ii) Atomic orbital
- (iii) Electrophilic catalysis
- (iv) Homogeneous catalyst
- (v) Symmetry elements
- (vi) Equilibrium Kinetics

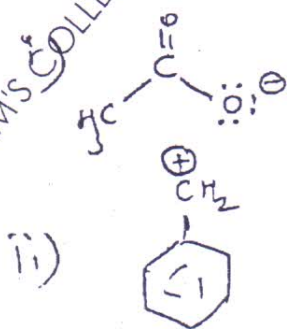
(b) Fill in the blank (any five)

- (i) An example for phase transfer catalyst is \_\_\_\_\_
- (ii) Formal charge on nitrogen is \_\_\_\_\_ for R-N<sup>+</sup>O
- (iii) Benzene-tetracyanoethane is an example of \_\_\_\_\_
- (iv) Lewis structure for H<sub>3</sub>PO<sub>4</sub> is \_\_\_\_\_
- (v) For first order reaction half life is 2200 seconds Hence the rate constant for reaction is \_\_\_\_\_
- (vi) Ground state electronic configuration of sodium is \_\_\_\_\_

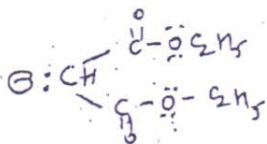
(c) Match the following :-

- | Group 'A'                              | Group 'B'                    |
|--|------------------------------|
| (i) $dyz$                              | (a) Specific acid catalysts  |
| (ii) $OH^{\ominus}$                    | (b) $3d^84s^2$               |
| (iii) Aldol condensation               | (c) $\pi$ symmetry           |
| (iv) Iodine-starch complex             | (d) Example of specific base |
| (v) Valence electron of Ni (At no. 28) | (e) Charge transfer          |

2. (a) Draw resonating structure for the following :-



- (b) Draw molecular orbital diagram for formaldehyde and indicate clearly HOMO and LUMO. 3
- (c) The ratio  $K_H/K_D$  is known by which name? What is the use of this ratio? ( $K$ = rate of reaction) 3
- (d) Enlist various types of catalysis. Explain nucleophilic catalysis with suitable example. 3
3. (a) Mention the symmetry operation for  $MH_3$  System. Enlist the molecular orbitals for  $MH_3$  System. 3
- (b) What is the effect of pyramidalization on energetics of MOs of planar  $CH_2$  system. 3
- (c) Explain use of Eyring plot for determination of activation parameters for reaction. 3
- (d) The half life for first order reaction is 133min. Calculate the percentage of reactant remaining after 200 min. 2
4. (a) Define group orbitals. In the following examples which group orbitals are participating ethane, ethylene, formaldehyde, methyl chloride. 3
- (b) Discuss any three rules of QMOT and support your answer with examples. 3
- (c) Explain the term "Fast kinetics". Give one application of it. Name any two methods to study them. 3
- (d) Explain phase transfer catalysis with suitable example. 2
5. (a) Draw resonating structure for the following molecule and indicate the most stable structure : 3



- (b) State types of carbocations and differentiate between them Explain their formation by using MOT. 3
- (c) A first order reaction was found to have energy of activation of  $1.25 \times 10^5$  J/mol. Calculate the temperature at which reaction will have a rate constant of  $0.0116 \text{ s}^{-1}$  frequency factor  $A = 5 \times 10^7 \text{ sec}^{-1}$ ,  $R = 8.314 \text{ J/kmol}$ . 2
- (d) Classify and discuss charge transfer complexes. 3
6. (a) Complete the following table on the basis of hybridization concept. 3

Molecule	Hybridized state of underlined atom	Bond angle
$H_2\underline{S}$		
$H_3C-\underline{C}H_3$		
$\underline{S}F_6$		

- (b) Write a note on specific acid catalysis with kinetic plots 4
- (c) State and explain Curtin-Hammett principle 2
- (d) Addition of HBr to 1,3 - butadiene gives 1, 2 - addition product at lower temperature and 1, 4-addition product at higher temperature. Explain the underlying principle. 2