

**Q.P. Code : 00232**

**[Time: Three Hours]**

**[ Marks:70]**

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
  2. Answer all sub questions together.
  3. Figures to right indicate full mark.

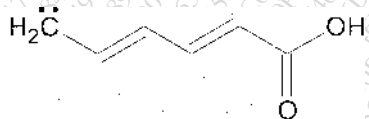
- Q.1 a) **Explain the terms (Any 5)** 5
- |                     |                   |
|---------------------|-------------------|
| i) Quantum numbers  | ii) Rate law      |
| iii) HOMO           | iv) catalyst      |
| v) Transition state | vi) Formal charge |
- b) **Fill in the blanks.** 5
- The rate constant for the first order reaction is.....if its half-life is one hour.
  - The dipole moment for  $\text{NH}_3$  is..... than  $\text{NF}_3$ .
  - Lewis structure for  $\text{CO}_3^{2-}$  is.....
  - The geometry for  $\text{PCl}_5$  is..... as per hybridization concept.
  - Tetralkyl ammonium bromide is an example of..... catalyst
- c) **Match the following** 5
- | <b>Column A</b>                    | <b>Column B</b>             |
|------------------------------------|-----------------------------|
| 1. Starch-iodine complex           | Octahedral                  |
| 2. Cr valence electrons (At.No.24) | charge transfer complex     |
| 3. $\text{BF}_3$                   | $\text{sp}^2$ hybridization |
| 4. Water                           | specific acid               |
| 5. $\text{SF}_6$                   | $3d^4 4s^2$                 |
- Q.2 a) **Draw resonating structures for :** 2
- |                              |                     |
|------------------------------|---------------------|
| i) $\text{CH}_3\text{COO}^-$ | ii) $\text{NO}_2^-$ |
|------------------------------|---------------------|
- b) Draw the molecular orbital diagram for ethane 3
- c) Define: primary isotope effect, Secondary isotope effect. State any one example to explain the concept 3
- d) Enlist various types of catalysis and explain electrophilic catalysis 3

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- Q.3 a) Elaborate on group orbitals of planar methyl by drawing molecular orbitals 3  
 b) Represent molecular orbitals of water molecule and clearly indicate where lone pairs on oxygen are sitting? 3  
 c) State Arrhenius rate law. Explain each term involved in it. 3  
 d) For a first order reaction calculate time required to complete 90% of the reaction if its half-life is 3hours. 2

- Q.4 a) Give strengths and weaknesses of Molecular orbital theory 3  
 b) State and explain any three rules for QMOT 3  
 c) Enlist various methods to follow fast kinetics and explain any one method 3  
 d) Add a note phase transfer catalysis 2

- Q.5 a) Draw the resonating structure for the given molecule. Indicate the most stable structure 3



- b) Explain the formation of carbanion by molecular orbital theory 3  
 c) The specific reaction rate at 273 K and 300 K are  $2.56 \times 10^{-5} \text{ sec}^{-1}$  and  $15.8 \times 10^{-4} \text{ Sec}^{-1}$ . Calculate the energy of activation ( $R= 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ) 2  
 d) What are charge transfer complexes? Discuss their applications 3

- Q.6 a) Complete the following table on the basis of hybridization concept 3

Molecule	Hybridization state of the underlined atom	Bond angle
<u>S</u> F <sub>6</sub>		
H <u>2</u> O		
<u>C</u> in Ethylene		

- b) Write a note on specific base catalysis 4  
 c) State and explain reactivity and selectivity principle 2  
 d) 'Sulfonation of naphthalene at 80°C gives naphthalene-1-sulfonic acid and at 160°C gives naphthalene-2-sulfonic acid'-  
 State clearly name of kinetically controlled product and thermodynamically controlled product in above reaction 2