

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)

- | | |
|---------------------|-------------------|
| i) Quantum numbers | ii) Rate law |
| iii) HOMO | iv) catalyst |
| v) Transition state | vi) Formal charge |

5

b) Fill in the blanks.

- i) The rate constant for the first order reaction is.....if its half-life is one hour.
- ii) The dipole moment for NH_3 is..... than NF_3 .
- iii) Lewis structure for CO_3^{2-} is.....
- iv) The geometry for PCl_5 is..... as per hybridization concept.
- v) Tetraalkyl ammonium bromide is an example of..... catalyst

5

c) Match the following

5

Column A

1. Starch-iodine complex
2. Cr valence electrons (At.No.24)
3. BF_3
4. Water
5. SF_6

Column B

Octahedral
charge transfer complex
 sp^2 hybridization
specific acid
 $3d^4 4s^2$

Q.2 a) Draw resonating structures for :

2

- | | |
|------------------------------|-------------------|
| i) CH_3COO^- | ii) 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

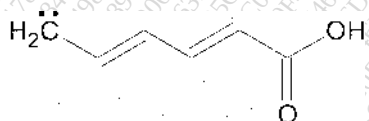
3

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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 3 hours. 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 ₆		
H ₂ <u>O</u>		
<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