

- N.B. : (1) All questions are compulsory
(2) Answer all sub questions together

1.(a) Explain the terms (Any 5)**5**

- Symmetry elements
- Half life
- Arrhenius equation
- Catalyst
- General base
- Energy of activation

1.(b) Fill in the blanks**5**

- Ground state elect electronic configuration for nitrogen is-----
- BF_3 shows---- type of hybridization
- quantum number gives idea about size of an atom
- Methane molecule has a bond angle of -----
- The half life for a first order reaction is 10 min, hence the rate constant is -----

1.(c) Match the following**5**

- | | |
|--------------------------------|-------------------------|
| i) Valence electron of Mn (25) | π symmetry |
| ii) dx | Linear geometry |
| iii) BeCl_2 | $3d^5 4s^2$ |
| iv) Starch-iodine | H_3O^+ |
| v) Specific acid | Charge transfer complex |

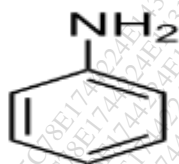
2.(a) Draw the resonating structures for**2**

- NO_2^-
- CO_3^{2-}

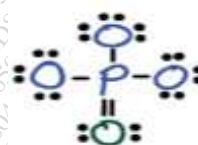
2.(b) Explain formation of ethylene by molecular orbital theory**3****2.(c) Add a note on isotope effect****3****2.(d) State and explain electrophilic and nucleophilic catalysis****3**

- 3.(a) Elaborate on formation of planar methyl group 3
 3.(b) By using molecular orbital theory explain presence of lone pairs on water molecule 3
 3.(c) Give the significance of Eyring equation 3
 3.(d) For a reaction following first order kinetics calculate half life if 30 % reaction gets completed in 1 hour. 2
 4.(a) Elaborate on molecular orbital theory 3
 4.(b) State and explain any three rules for QMOT 3
 4.(c) What is fast kinetics? How to calculate rate constants for the same? 3
 4.(d) Explain phase transfer catalysis 2
 5.(a) Draw resonating structures for 3

a.



b.



- 5.(b) Discuss the formation of carbon radical by molecular orbital theory 3
 5.(c) A first order reaction was found to have energy of activation of 2.15×10^4 J/mol. Calculate the temperature at which reaction will have a rate constant of 0.030 sec^{-1} . Frequency factor $A = 5 \times 10^{13} \text{ sec}^{-1}$ and $R = 8.314 \text{ J/kmol}$. 2
 5.(d) Add a note on charge transfer complexes 3
 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>P</u> Cl ₅		

- 6.(b) Derive an expression for specific base catalysis and show relevant kinetic plots 4
 6.(c) State and explain Hammond's postulate 2
 6.(d) Explain microscopic reversibility principle 2
