Q. P. Code: 22573

(3 hrs) **[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) **5**

1. Polar covalent bond
2. Heterogeneous catalyst
3. Inductive effect
4. Charge transfer complex
5. First order reaction
6. HOMO

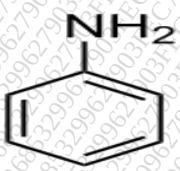
B. Fill in the blanks (any five) **5**

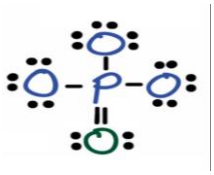
1. Ground state elect electronic configuration for Magnesium is--------
2. Lewis structure for Nitric acid (HNO_3) is --------
3. ---------- Orbital shows only one node
4. Tetracyanoethylene is an excellent acceptor, and it forms --------with electron rich systems such as hexamethylbenzene.
5. The formula for calculation of half-life for first order reaction is--------
6. Crown ether is an example of --------

C. Match the following **5**

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

Q2. A. Draw the resonating structures for **2**

a. 

b. 

Q2. B. Draw Molecular orbital diagram for Ethane. 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 the isotope effect ---------.and when k_H /k_D is less than one, we call the isotope effect --------

2. ------- element shows highest isotope effect

3. When isotope effect is seen not at rate determining step is called --------

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

Q3. A. Give Erying equation and Arrhenius rate law. Clearly name each term involved in expression **3**

B. Calculate rate constant in hr^{-1} for the first order reaction with half life of 360 min **2**

C. Define group orbital. Mention symmetry elements of MH_3 system. Enlist molecular orbitals for ammonia

D. Compare the energy of linear and bent form of MH_2 system using molecular orbital diagram **3**

Q4. A. Discuss molecular orbital theory **3**

B. What do you mean by second order mixing? State any four rules of QMOT. **3**

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

D. What is phase transfer catalysis? Give examples. **2**

Q5. A. State true or false **3**

i) Bond length for an alkane is larger than alkene

ii) KCl is less polarizable than NaCl

iii) Group electronegativity for nitro group is lower than chloro

B. Define reaction intermediate. Explain formation of any one. **3**

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

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

Q6. A. Complete the following table on the basis of hybridization**.** **3**

Molecule	**Hybridized state of underlined atom**	**Bond angle**
$\underline{S}F_6$		
$\underline{C}H_2=CH_2$		
$\underline{Be}F_2$		

B. Write a short note on general acid catalysis. **4**

C. Explain Kinetics vs thermodynamics control of reaction with suitable example**.** **4**
