NOTE: i) All the questions are compulsory.
     ii) Figures to the right indicate full marks
     iii) Use of non –programmable calculator / log table is allowed

Q.1. Answer the following:

A. Multiple choice questions   (Attempt any 9)   **[09]**

1. Maximum work done by the system can be obtained at the expense of _____
   a.Gibbs free energy   b. Helmholtz Free energy   c.Volume d.Velocity

2. _____ is for the system at equilibrium.
   a. $\Delta G=0$ b. $\Delta G<0$ c. $\Delta G>0$ d. $\Delta S=0$

3. _____ is a measure of escaping tendency for real gases.
   a.fugacity   b.Velocity   c. Density   d. Sensitivity

4. Maximum work done by the system can be obtained at the expense of _____
   a.Gibbs free energy b. Helmholtz Free energy   c.   Volume   d.Velocity

5. _____ are called non-directional bonds.
   a. covalent bonds   b. Ionic bonds   c. Hydrogen   d. Metallic

6. The p-orbital is in the shape of a _____
   a.Sphere   b.Dumbbell   c.Pear shaped   d. Bell shaped

7. Which one of the following is not a strong bond?
   a.Covalent   b.Metallic   c.Ionic   d.Vander waals bond

8. A type of enthalpy cycle which is used to calculate lattice energy ?
   a. Hess's Law   b. Born Haber Cycle   c. Haber Process d. Contact Process

9. An organometallic bond is defined as the bond between_____
   a.metal and nonmetal b.Carbon and metal c.Carbon and nonmetal d. Carbon and metalloid

10. Cumene on air oxidation gives _____
    a.Cumene hydroperoxide b.Benzoic acid c.Isopropyl Benzene d.Phenol

11. Resorcinol is a type of _____ phenol.
    a .Monohydric b.Dihydric c.trihydric d.tetrahydric

12. Acidic nature of phenol is due to_____
    a.Phenolic group b. Benzene group c.Hydrogen bonding d.resonance stabilization

B. Match the following.   **[3]**
i)EquivalentConductance   a) Grignard's reagent
ii)Sigma bond .   b) λeq
iii) RMgX   c) Stronger

C. Write true or false.   **[3]**
1. If ΔG is Positive the reaction is non spontaneous .
2. Molecular orbitals are polycentric.
3. Epoxides are also called oxiranes.

Q.2 Answer the following (Attempt any four):

[20]

1. Show that Decrease in Helmholtz free energy of constant temperature gives maximum work done.
2. State and explain kohlrausch's law of independent migration of ion.
3. Derive Gibbs - Duhem Equation.
4. Discuss the factors that influence or affect transport numbers.
5. Describe the moving boundary method to determine the transport number of ion.
6. Derive the Expression for Gibb's free energy gives net work.

Q.3 Answer the following. Attempt any four:

1. Explain with the help of the MOT the magnetic nature of N_2 molecule [20]
2. What is hybridization? Explain the role of hybridization by giving suitable examples.
3. Give applications of Born Haber Cycle.
4. Discuss the conditions for the formation of ionic bonds.
5. Describe the structure of Zinc blende. How does it differ from wurtzite structure?
6. Calculate the lattice energy of NaCl crystal from the following data by the use of Born Haber Cycle.

Heat of atomization of sodium = 108.7 KJ mol^{-1}

Heat of atomization of chlorine = 120. KJ mol^{-1}

Ionization Potential of Sodium = 493.7 KJ mol^{-1}

Electron affinity of chlorine (Cl) = -365.3 KJ mol^{-1}

Heat of formation of NaCl = 410. KJ mol^{-1}

Q.4 Answer the following Attempt any four:

[20]

1. Differentiate between SN^2 and SN^1 reaction
2. Explain fries rearrangement with suitable example
3. Explain elimination - addition mechanism.
4. Give the ring opening reactions of epoxide by : a) Hydrolysis in acidic condition
b) Reaction with HX c)Reaction with ROH d) Reaction with RMgX e)Reaction with HCN
5. Explain any two preparation of phenol
6. Write down IUPAC /nomenclature of the following compound.

a) C_2H_5Li

c) H_2C-CH_2 (epoxide structure with O)

e) (cyclohexene oxide structure)

b) (cyclopentane ring with OH and H_5C_2 substituents)

d) (cyclohexane ring with OH and NO_2 substituents)