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**B.M.S. COLLEGE FOR WOMEN, AUTONOMOUS**

BENGALURU – 560004

SEMESTER END EXAMINATION – SEPTEMBER 2023

B.Sc in Chemistry – 4<sup>th</sup> Semester**INORGANIC AND PHYSICAL CHEMISTRY**

(NEP Scheme 2021-22 Onwards)

Course Code: CHE04DSC04

Duration: 2½ Hours

QP Code: 4014

Max. Marks: 60

- Instructions: 1. Question paper has three Parts. Answer all the parts.  
2. Write chemical equations and diagrams wherever necessary.*

**PART–A****Answer any FIVE of the following questions. Each question carries TWO marks. (5X2=10)**

1. Mention the type of ionic structure in (i) cadmium iodide (ii) titanium oxide.
2. What are intrinsic semiconductors? Give an example.
3. State I law of thermodynamics.
4. A solution of an electrolyte has resistance of  $50\Omega$  when placed in conductivity cell having cell constant  $221\text{m}^{-1}$  at  $298\text{K}$ . Calculate specific conductance.
5. Arrange the following in the increasing order of polarization: CsCl, NaCl, KCl, LiCl.
6. Explain heterogeneous catalysis reaction with an example.
7. Draw the graph for the conductometric titration of a strong acid versus strong base

**PART–B****Answer any FOUR of the following questions. Each question carries FIVE marks. (4X5=20)**

8. a. Construct a Born Haber cycle of NaCl and calculate its heat of formation from the following data :
  - a) Lattice energy of NaCl is  $-788\text{ kJ/mol}$
  - b) Bond energy of chlorine is  $+244\text{ kJ/mol}$
  - c) Electron affinity of chlorine is  $-349\text{ kJ/mol}$
  - d) Heat of sublimation of sodium atom is  $+108\text{ kJ/mol}$
  - e) Ionization enthalpy of sodium atom is  $+496\text{ kJ/mol}$b. What is the co-ordination number of a crystal if radius ratio is 0.155 to 0.225? (4+1)
9. a.  $\text{BeCl}_2$  is linear whereas  $\text{BF}_3$  is planar. Explain based on hybridization theory.  
b. Define resonance. (4+1)

10. a. Explain intermediate compound formation theory of catalysis with an example.  
b. Mention a limitation of Freundlich adsorption isotherm. (4+1)
11. a. Write the postulates of Debye Huckel theory of strong electrolytes.  
b. Calculate transport number of  $\text{Cl}^-$  if  $\text{Ag}^+$  has transport number 0.52. (3+2)
12. a. Write a note on two dimensional close packing in ionic solids.  
b. Set up the molecular orbital energy diagram of CO. (3+2)
13. a. Molar conductance of HCl, NaCl and  $\text{CH}_3\text{COONa}$  at infinite dilution are  $425 \times 10^{-4} \text{Sm}^2\text{mol}^{-1}$ ,  $125 \times 10^{-4} \text{Sm}^2\text{mol}^{-1}$  and  $91 \times 10^{-4} \text{Sm}^2\text{mol}^{-1}$  respectively. Calculate the degree of dissociation of 0.01M acetic acid, if molar conductance of 0.01M acetic acid is  $16.3 \times 10^{-4} \text{Sm}^2\text{mol}^{-1}$ .  
b. State zeroth law of thermodynamics. (3+2)

### PART-C

Answer any THREE of the following questions. Each question carries TEN marks. (3X10=30)

14. a. Compare the structures of  $\text{NH}_3$  and  $\text{NH}_4^+$  based on VSEPR theory.  
b. Draw the unit lattice of caesium chloride.  
c. Calculate the limiting radius ratio of co-ordination number 4. (4+3+3)
15. a. Explain  $sp^2$  hybridisation with an example.  
b. On the basis of MOT, explain why oxygen is paramagnetic whereas nitrogen is diamagnetic.  
c. Calculate bond order in  $\text{O}_2$ . (4+4+2)
16. a. Derive the expression for Langmuir adsorption isotherm.  
b. Write Michaelis Menten equation and mention the terms.  
c. Define entropy. Calculate entropy change when one mole of ethanol is evaporated at 351K. Heat of vapourisation of ethanol 39.84kJ/mole. (4+3+3)
17. a. Explain the experimental determination of rate constant of inversion of cane sugar.  
b. Calculate  $E_a$  of a reaction if rate constants are  $3.6 \times 10^{-5} \text{s}^{-1}$  and  $7.2 \times 10^{-5} \text{s}^{-1}$  at 298K and 338K respectively. (3)  
c. Write the postulates of Arrhenius theory. (4+3+3)
- 18 a. Describe Ostwald's isolation method of determining order of a reaction.  
b. Write the three different types of hybrid orbitals that can be formed by combining s,p and d orbitals of an atom? What is the geometry in each case?  
c. Calculate the entropy change involved in the isothermal reversible expansion of 2 moles of an ideal gas from a volume of  $2 \text{ dm}^3$  to  $10 \text{ dm}^3$  at 300K ( $R=8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ )  
d. Write Arrhenius equation and mention the terms in it. (3 +3+2+2)

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