

**M.Sc. I Semester Degree Examination, April/May - 2023****CHEMISTRY****Concepts and Models of Inorganic Chemistry****(CBCS)**

Time : 3 Hours

Maximum Marks : 70

**Note :** Answer **any five** of the following questions with Question No.1 (Q1) **Compulsory**, each question carries **equal** marks.

1. (a) Construct the Born - Haber cycle for MgO and calculate the lattice energy of it using the given data:  $\Delta_f H = -602$  kJ/mol;  $\Delta_s H = +130$  kJ/mol;  $\Delta_{1i} H = +738$  kJ/mol;  $\Delta_{2i} H = +1450$  kJ/mol;  $\frac{1}{2} \Delta_d H = +250$  kJ/mol;  $\Delta_{1eg} H = -141$  kJ/mol;  $\Delta_{2eg} H = 780$  kJ/mol. **5+5+4=14**
- (b) Describe the relative stabilities of ionic compounds.
- (c) What are Fajan's rules ? How are they useful in explaining the degree of covalent character in ionic solids ?
  
2. (a) Discuss the bond order in delocalized  $\pi$ -bonding systems taking  $\text{CO}_3^{2-}$  and  $\text{NO}_3^-$ . **5+5+4=14**
- (b) Draw the M.O diagram of CO and explain its salient features. Comment on its bonding ability to d-block metals.
- (c) Write the factors affecting Coordination numbers.
  
3. (a) Describe the preparation and structure of Oxides and Oxy acids of nitrogen.
- (b) Discuss the synthesis and structure of boron hydrides. **5+5+4=14**
- (c) Write an account on noble gas compounds.
  
4. (a) Discuss the causes and consequences of Lanthanide contraction on the size of 4d and 5d lanthanides. **5+5+4=14**
- (b) Write a brief note on the applications of lanthanides.
- (c) Discuss the separation of trans uranium elements.



5. (a) Write an account on the theoretical basis of hardness and softness, of acids and bases. **5+5+4=14**
- (b) Discuss the effect of steric bulk factor on the strength of acid and bases.
- (c) Explain briefly the Bronsted-Lowry theory of acid and bases with suitable examples.
6. (a) Discuss the classification of silicates. Sketch and explain the structure of one silicate in each case. **5+5+4=14**
- (b) What are the postulates of VSEPR theory ? Using this model, predict and explain the shapes of  $\text{XeF}_2$ ,  $\text{XeO}_3\text{F}_2$ .
- (c) Give the preparation of tetraborane and discuss its structure.
7. (a) Explain the acid-base concept in non-aqueous media with suitable examples.
- (b) What are 'hard-soft acids and bases' ? Discuss the HSAB principle and its applications. **5+5+4=14**
- (c) Discuss the magnetic and spectral properties of lanthanides.
8. (a) Write a note on Solution effects with respect to liquid ammonia and anhydrous-sulphuric acid. **5+5+4=14**
- (b) How are sodalite and ZSM - 5 synthesized ? Why is ZSM - 5 considered as an efficient performance catalyst ?
- (c) How are the molecular orbitals of heteronuclear diatomic molecules different from homonuclear diatomic molecules ? Draw the MO diagram of NO molecule and comment on the bond order and magnetic properties of NO,  $\text{NO}^+$  and  $\text{NO}^-$  species.

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