2023
B.A./B.Sc.
First Semester
CORE – 1
CHEMISTRY
Course Code: CHC 1.11
(Inorganic Chemistry - I)

Total Mark: 70   *Pass Mark: 28*
Time: 3 hours

Answer <u>five</u> *questions, taking* <u>one</u> *from each unit.*

UNIT–I

1. (a) State and explain Heisenberg's uncertainty principle.   2
    (b) Write electronic configuration of the following: $1 \times 4 = 4$
    　　(i) K (at.no. 19)   (ii) Cr (at.no. 24)
    　　(iii) Ca^{2+} (at.no. 20)   (iv) S^{-2} (at.no.16)
    (c) Calculate Z_{eff} for 3d electron in $2 \times 3 = 6$
    　　(i) Cu atom (at.no.29)   (ii) Mn atom (at.no. 25)
    　　(iii) Co atom (at.no. 27)
    (d) What are the significance of ψ and ψ^2.   2

2. (a) What are radial nodes? Draw the shapes of 2py, 3py and 4py
    　　orbitals showing radial node or nodes. $1 + 3 = 4$
    (b) Mention different types of quantum numbers. What are the values of
    　　n, l and m for $2 + 4 = 6$
    　　(i) 3d orbital   (ii) 4f orbital
    　　(iii) 5p orbital   (iv) 6s orbital
    (c) Draw the curves of 1s, 2s and 3s orbital for $R^2_{n,l}$ Vs r.   3
    (d) State Aufbau principle.   1

UNIT–II

3. (a) Write the general electronic configuration of d and f-block elements.
    　　Give any three each of their general characteristics. $2 + 3 = 5$

(b) What is ionisation potential? Explain shielding and penetration effect of electron affects the magnitude of ionisation potential.   1+2+2=5

(c) What do you mean by electronegativity? Explain Pauling scale of electronegativity.   1+3=4

4. (a) What are s and p block elements? Write any two general characteristics in each case.   2+2=4

(b) Define the following terms   1×5=5
   (i) Atomic radius   (ii) Crystal radius
   (iii) Van der Waals radius   (iv) Covalent radius
   (v) Isoelectronic ions

(c) What is electropositive character? Justify the following: 1+2×2=5
   (i) Size of cation is smaller than size of anion
   (ii) Electron affinity of nitrogen is negative

UNIT–III

5. (a) Define ionic bond. What are the factors favouring the formation of ionic compounds.   1+3=4

(b) Derive Madelung constant.   4

(c) Explain the two important metallic properties.   2

(d) Write short notes on the following: 2×2=4
   (i) Instantaneous dipole–induced interactions
   (ii) Insulators

6. (a) Write the general characteristics of ionic compounds.   4

(b) Explain theory of hydrogen bonding by valence bond treatment.   4

(c) Give the four applications of Born–Haber cycle.   2

(d) Write short notes on the following: 2×2=4
   (i) Hydrogen Bonding
   (ii) Energetics of dissolution process.

UNIT–IV

7. (a) Write any three conditions for writing the Lewis dot structure. Draw the Lewis dot structure of CCl_4 and CO_2.   3+2=5

(b) Write the molecular orbital configuration of NO molecule. Determine the bond order and draw the MO energy level diagram. $1+1+3=5$

(c) Based on VSEPR theory, discuss the shape of PCl_5 and BO_3^{3-}. $2+2=4$

8. (a) What is formal charge? Calculate the formal charges on the atoms in CO_3^{2-} and NO_2^- ions. $1+2+2=5$

(b) Give the molecular orbital configuration of O_2^+ and O_2^- ions. Calculate their bond order and give reasons which is more stable. $2+2+1=5$

(c) Based on VSEPR theory, dicuss the shapes of H_2O and H_3O^+ ion. $2+2=4$

UNIT–V

9. (a) What do you mean by polarisation of ions? 3

(b) Explain how percent ionic character of a polar covalent bond depends on electronegativity difference. 6

(c) CH_4, CCl_4 and CH_3Cl molecules all have tetrahedral structures but the dipole moment of CH_3Cl is not zero where as that of CH_4 and CCl_4 are zero. Explain. 5

10. (a) Define standard electrode potential. 3

(b) What are frost diagrams? Explain with an example. 6

(c) Explain the redox stability in water. 5

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