TDC (CBCS) Odd Semester Exam., 2025

CHEMISTRY

(1st Semester)

Course No. : CHMHCC–101T

(Inorganic Chemistry)

$$\frac{Full\ Marks\ :\ 50}{Pass\ Marks\ :\ 20}$$

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* from the following :   2×2=4

    (a) Write de Broglie's equation and explain its significance in atomic structure.

    (b) What is the physical significance of Schrödinger's wave functions ψ and ψ^2?

    (c) State Pauli's exclusion principle with an example.

2. Answer any *one* of the following questions :   6

(a)   (i) Draw and explain the radial probability distribution curve for $1s$ and $2s$ orbitals of hydrogen atom.   3

(ii) Which set of quantum numbers are not permissible and why?   3

(1) $n = 5, l = 4, m = 0, m_s = \dfrac{1}{2}$

(2) $n = 3, l = 0, m = -1, m_s = -\dfrac{1}{2}$

(3) $n = 3, l = 1, m = 2, m_s = \dfrac{1}{2}$

(4) $n = 2, l = 2, m = 0, m_s = \dfrac{1}{2}$

(b)   (i) Write the electronic configuration of Mn^{2+}, Cu^{2+}, Al^{3+}.   3

(ii) State Aufbau's principle. How this rule governs the order of filling amongst $3d$ and $4s$ orbitals?   3

UNIT—II

3. Answer any *two* from the following :   2×2=4

(a)   Why is the second ionization energy of an atom always higher than the first ionization energy of an atom?

(b) What is electronegativity? How does it vary in period and a group in the periodic table?

(c) Electron affinity of fluorine is less than that of chlorine. Explain.

4. Answer any *one* from the following : 6

(a) (i) Calculate Z_{eff} faced by a 3s or 3p electron in phosphorus atom. 3

(ii) Write notes on the following scales of electronegativity : 3

(1) Pauling scale

(2) Mulliken scale

(b) (i) Explain that electron affinities of halogens are highest. 3

(ii) For each of the following pairs predict which has greater ionization energy : 3

(1) I, I⁻

(2) Br, Cl

(3) Li, Li⊕

UNIT—III

5. Answer any *two* from the following : 2×2=4

(a) What is radius ratio? What are the radius ratio ranges for coordination numbers 3, 4 and 6?

(b) What is lattice energy? How does stability of an ionic solid depend upon its lattice energy?

(c) Draw the resonance structure of the following :

    (i) CO_3^{2-}

    (ii) NO_3^-

    (iii) N_3^-
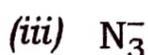
6. Answer any *one* from the following :   6

  (a) (i) Draw the MO diagram for NO. Write its MO configuration, bond order and magnetic behaviour.   3

      (ii) Using VSEPR theory, explain the formation and shape of the molecule NH_3, XeF_4.   3

  (b) (i) The geometries of H_2O and H_2S are the same but the bond angles of H_2O is higher than H_2S. Explain.   3

      (ii) Draw the Lewis dot structure and calculate the formal charge of the following :   3

        (1) CO_2

        (2) $\ddot{N}H_3$

        (3) O_3

(5)
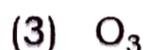
UNIT—IV

7. Answer any *two* from the following : $2 \times 2 = 4$

(a) Why is boiling point of NH_3 higher than that of PH_3?

(b) Given the electronegativities of H, Cl, Br, I as 2·1, 3·0, 2·8 and 2·4 respectively. Calculate the % ionic character of HCl, BHr and HI and arrange them in increasing order of % ionic character.

(c) NaCl is more ionic than CuCl. Explain.

8. Answer any *one* from the following : 6

(a) (i) Describe briefly the valence bond model of metallic bond. 3

(ii) Which of the following will have higher boiling point or melting point? Justify your answer : 3

(1) H_2S or H_2O

(2) Nitrophenol or Nitrobenzene

(b) (i) What is hydrogen bond? Describe briefly about intermolecular and intramolecular hydrogen bond with examples. 3

(*Turn Over*)

(ii) Arrange the following :   3

(1) NaF, NaCl, NaBr, NaI, in the increasing order of solubility in water.

(2) $BeCl_2$, $MgCl_2$, $CaCl_2$ in the increasing order of melting point.

UNIT—V

9. Answer any *two* from the following :   2×2=4

(a) Determine the oxidation number of (i) S in H_2SO_3 and (ii) P in PO_4^{3-}.

(b) What is meant by oxidation and reduction? Show that oxidation and reduction take place simultaneously.

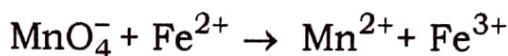(c) What is EMF of a cell? How Gibbs free energy is related with EMF of a cell?

10. Answer any *one* from the following :   6

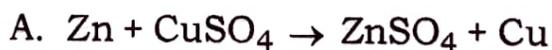(a) (i) From the following data, comment on the feasibility of the reaction :   3

$$Sn^{2+} + Cu \rightarrow Sn + Cu^{2+}$$

$$E^o_{Sn^{2+}/Sn} = -0·136 \ V, \ E^o_{Cu^{2+}/Cu} = 0·34 \ V$$

(*Continued*)

(ii) (1) Define oxidizing agent. 1

(2) Balance the following reaction : 2

$$MnO_4^- + Fe^{2+} \rightarrow Mn^{2+} + Fe^{3+}$$

(b) (i) Explain the principle and write the reaction involved in the estimation of Fe by $KMnO_4$. 3

(ii) (1) Define electrode potential. 1

(2) Identify the substance oxidized and reduced from the following reactions : 2

A. $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

B. $2Mg + O_2 \rightarrow 2MgO$

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