

2024/FYUG/ODD/SEM/  
CHMDSC-101T/184

FYUG Odd Semester Exam., 2024

CHEMISTRY

( 1st Semester )

Course No. : CHMDSC-101T

( Inorganic Chemistry )

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks  
for the questions

UNIT—I

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

- (a) Write the limitations of Bohr's theory.
- (b) Draw the shapes of *p*- and *d*- orbitals.
- (c) State and explain Pauli's exclusion principle.

2. Answer *either* (a) and (b) or (c) and (d) : 10

- (a) State and explain Heisenberg's uncertainty principle. Mention its significance.

Calculate the uncertainty in the position of a mosquito with a mass of 1.50 mg and a speed of  $1.40 \text{ ms}^{-1}$ .  $3+2=5$

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- (b) What do you mean by normalized and orthogonal wave functions? What is meant by magnetic quantum number? Give its significance.  $3+2=5$
- (c) Write Schrödinger wave equation in three-dimensional Cartesian coordinates for H-atom. Mention the meaning of the terms involved in the equation. Explain the significance of  $\psi^2$ .  $3+2=5$
- (d) State and explain Hund's rule of maximum multiplicity by considering C, N, O as examples. State Aufbau principle and mention its limitations.  $3+2=5$

### UNIT—II

3. Answer any *two* from the following :  $2 \times 2 = 4$
- (a) Calculate the effective nuclear charge of 4s electron in potassium atom.
- (b) Arrange the following in the increasing order of ionic radius :  
 $Mg^{2+}$ ,  $F^-$ ,  $N^{3-}$ ,  $Na^+$ ,  $O^{2-}$
- (c) Differentiate between ionic radii and covalent radii.

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4. Answer either (a) and (b) or (c) and (d) : 10
- (a) Define electron gain enthalpy. Mention the factors on which electron gain enthalpy depends. Explain why electron gain enthalpy of chlorine is more negative than fluorine.  $2+1+2=5$
- (b) What is meant by electronegativity? How does hybridization affect electronegativity? Discuss Mulliken scale of electronegativity.  $1+1+3=5$
- (c) What is meant by van der Waals' radii? Explain the general trends of atomic radii in the periodic table with special reference to s- and p-block elements.  $2+3=5$
- (d) What are covalent radii? Discuss octahedral and tetrahedral covalent radii. Give two applications of ionization enthalpy.  $1+2+2=5$

### UNIT—III

5. Answer any *two* from the following :  $2 \times 2 = 4$
- (a) What is radius ratio rule?
- (b) Explain why  $He_2$  does not exist but  $He_2^+$ .
- (c) Mention two major postulates of VBT.

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( Turn Over )



6. Answer either (a) and (b) or (c) and (d) : 10

- (a) What is meant by hybridization?  
Differentiate between equivalent and non-equivalent hybrid orbitals.  
What is meant by resonance energy?  
Write its significance.  $1+2+1+1=5$
- (b) Draw the molecular orbital diagram of  $O_2$  molecule. Mention its bond order.  
Comment on its magnetic property.  $3+1+1=5$
- (c) Mention three major postulates of VSEPR theory. Discuss the shape of  $XeF_4$  using VSEPR theory.  $3+2=5$
- (d) What is meant by ionic character in a covalent bond?  
What is the limitation of radius ratio rule?  
Calculate the percentage of ionic character of HCl molecule. The bond length is 1.275 Å and observed dipole moment is 1.03D. (Charge of electron =  $4.8 \times 10^{-10}$  esu)  $1+1+3=5$

## UNIT—IV

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

- (a) What are p-type and n-type semiconductors? Give examples.
- (b) Write a brief note on dipole-dipole interaction.
- (c) What is meant by London force?

8. Answer either (a) and (b) or (c) and (d) : 10

- (a) What is band theory in metallic bonding?  
How does band theory explain the metallic character of Li?  $3+2=5$
- (b) Differentiate between semiconductor and insulator with examples.  
What is metal excess defect and metal deficiency defects in ionic solids?  $2+3=5$
- (c) What is meant by van der Waals' forces? What are the different types of van der Waals' forces?  
Discuss ion-dipole interaction with suitable examples.  $2+1+2=5$
- (d) What is meant by H-bonding? Describe various types of H-bonding with examples.  $1+4=5$

## UNIT—V

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

- (a) What is meant by standard electrode potential?
- (b) Write a note on electrolytic reduction process.
- (c) If the standard electrode potential of  $\text{Cu}^{2+}/\text{Cu}$  electrode is 0.34 V, what is the electrode potential at 0.01 M concentration of  $\text{Cu}^{2+}$ ? ( $T = 298 \text{ K}$ )

10. Answer *either* (a) and (b) or (c) and (d) : 10

- (a) What are primary and secondary standard substances in volumetric analysis? Give examples. Describe the principles involved in the volumetric analysis of Fe(II) with standard  $\text{K}_2\text{Cr}_2\text{O}_7$  solution and provide necessary chemical reactions.  $2+3=5$
- (b) Calculate the oxidation number of Mn in  $\text{MnO}_4^-$  and  $\text{MnO}_4^{2-}$ .

Balance the following redox reactions by ion-electron method :

- (i)  $\text{Cu} + \text{SO}_4^{2-} \rightarrow \text{Cu}^{2+} + \text{SO}_2$
- (ii)  $\text{Cr}_2\text{O}_7^{2-} + \text{Cl}^- \rightarrow \text{Cr}^{3+} + \text{Cl}_2$   $1+2+2=5$

(c) Write short notes on the following :  $2 \frac{1}{2} \times 2 = 5$

- (i) Mond process
- (ii) Electrolytic refining

(d) Discuss hydrometallurgy. What are the advantages and disadvantages of hydrometallurgy?  $3+2=5$

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