

TDC Odd Semester Exam., 2020
held in July, 2021

CHEMISTRY

(Honours)

(1st Semester)

Course No. : CHMH-101

(Inorganic Chemistry—I)

Full Marks : 35

Pass Marks : 12

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. (a) Explain the 'radial function' and 'radial distribution function' of an orbital. 2
- (b) Find out the radii of first and second Bohr orbits of Be^3 ion. (Given, radius of H atom is 0.529 \AA .) 2

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- (c) Show diagrammatically the variation of radial distribution function with r for $3s$, $3p$ and $3d$ orbitals in a hydrogen atom. Compare their orbital electronegativity. 3

2. (a) State Heisenberg's uncertainty principle and explain its significance. Suppose an electron is confined within the nucleus of diameter 10^{-14} metre. Find the uncertainty in determination of its velocity. 2+2=4

- (b) An electron in a hydrogen atom in its ground state absorbs 1.5 times as much as energy as the minimum required for its escape from the atom. What is the wavelength of the emitted electron? Given, 13.6 eV energy is needed for ionization and $m = 9.109 \times 10^{-28} \text{ gm}$ (m mass of electron). 3

UNIT—II

3. (a) Explain the basis of Pauling's electronegativity scale. 2
- (b) Calculate the electronegativity of chlorine in Mulliken's scale and hence find out the electronegativity of the same element in Pauling's scale.

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(Continued)

(3)

- Given, electron affinity of chlorine = 4.0 eV per atom; ionization energy of chlorine = 13.0 eV per atom. 3
- (c) "Dipole moment of CO is less than expected from the electronegativity difference." Explain. 2
4. (a) What is meant by 'partial ionic character of a covalent bond'? What are its consequences? 3
- (b) Using Born-Haber cycle and the following given data, calculate the electron affinity of chlorine : 4
- $$\begin{array}{ll} H_f(\text{RbCl}) & 102.9 \text{ kcal mol}^{-1} \\ \text{IP}(\text{Rb}) & 95 \text{ kcal mol}^{-1} \\ H_{\text{sub}}(\text{Rb}) & 20.5 \text{ kcal mol}^{-1} \\ D_{(\text{Cl}_2)} & 54 \text{ kcal mol}^{-1} \\ U_{(\text{RbCl})} & 166 \text{ kcal mol}^{-1} \end{array}$$

UNIT—III

5. (a) What are nanomaterials? Compare properties of nanomaterials with bulk materials. 1+2=3

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(4)

- (b) Illustrate with diagram, the gas phase synthesis of nanomaterials. Comment on the advantages of this method. 3+1=4
6. (a) Classify nanomaterials based on their dimension. Give examples. 3
- (b) Write a short note on the wet chemical synthesis and application of gold nanoparticles (AuNPs). 4

UNIT—IV

7. (a) Write the preparation and use of perchloric acid. 2
- (b) Describe the Cavendish method for isolation of the noble gases. 2
- (c) Give the balanced chemical equation for the preparation of XeO_3 . A compound (X) is formed when XeO_3 is added to strong alkaline solution ($\text{pH} > 10.4$). Name the compound with its structure and OS of Xe. 1+2=3
8. (a) How can nitrogen sesquioxide (N_2O_3) be prepared? Draw and comment on the symmetrical and asymmetrical forms of N_2O_3 . What will happen when it reacts with concentrated acid? 1+2+1=4

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(Continued)

- (b) Show the disproportionation reaction of hydroxylamine in acidic and alkaline solutions. Give an example of NH_2OH use in organic reaction. 2+1=3

UNIT—V

9. (a) What is cement? Write the average compositions of various types of Portland cements. 1+1=2
- (b) Write a short note on setting of cements. 3
- (c) Give the composition and use of ammonium sulphate nitrate (ASN) fertilizer. 1+1=2
10. (a) Why calcium cyanamide (nitrolim) is known as a good fertilizer? Describe the preparation of nitrolim. 1+2=3
- (b) Write the chemical formula and phosphate content of triple superphosphate (TSP). Describe the basic chemical reaction in the manufacture process of TSP and its usage as fertilizer. 1+3=4
