

[This question paper contains 6 printed pages.]

1902

Your Roll No.

B.Sc. (Prog.) / I

E

CH-103 - CHEMISTRY

(Admissions of 2008 and onwards)

Time : 3 Hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*(Use separate answer sheets for
Sections A, B and C each.)*

SECTION - A

(Inorganic Chemistry)

Attempt any two questions.

1. (i) Write time independent Schrodinger's wave equation and explain the terms involved in it. (2)
- (ii) Calculate and interpret with the help of MO theory, the bond order for the following molecules O_2 , O_2^+ , O_2^- and N_2 . (4)
- (iii) Despite the fact that the central atoms in NH_3 and H_2O are Sp^3 hybridized, the HNH bond angle is 107° where as HOH bond angle 104.5° . Explain ? (2½)

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- (iv) Calculate the heat of formation (ΔH_f) of MgF_2 using Born-Haber cycle. Given (4)

Sublimation Energy of $\text{Mg(S)} = 146.4 \text{ KJ/mole}$

Ionization Energy of $\text{Mg, I (Mg}^{++}) = 2184.0 \text{ KJ/mole}$

Dissociation Energy of $\text{F}_2(\text{D}) = 158.6 \text{ KJ/mole}$

Electron affinity of $\text{F EA (F}^-) = -334.7 \text{ KJ/mole}$

Lattice Energy of $\text{MgF}_2 (U_0) = -2922.5 \text{ KJ/mole}$

2. (i) Sketch the radial probability distribution curve for 3s, 3p and 3d orbitals on the same set of axis. (3)
- (ii) Why S-orbitals are spherically symmetrical. (2½)
- (iii) Calculate the kinetic energy of moving electron which has a wavelength of 4.8 pm (mass of electron = $9.11 \times 10^{-31} \text{ kg h} = 6.63 \times 10^{-34} \text{ s}$). (2½)
- (iv) Plot the radial wave function and radial distribution curve for
- (a) $n=2, l=1$
- (b) $n=2, l=0$ (2)
- (v) State giving a reason in each case, which cation will exert a greater polarizing power in the following cases

(a) Na^+ or Mg^{2+}

(b) Cu^{2+} or Ca^{2+} (2½)

3. Write short note of any **three** : (4×3)

(i) Quantum Number

(ii) Concept of exchange energy and stability of half filled orbitals

(iii) Aufbau's rule and its limitations

(iv) Orthogonal and normalized wave function

SECTION - B
(Organic Chemistry)

Attempt any two questions.

4. Explain why ?

(i) Benzylamine is a stronger base than Aniline.

(ii) 2-chloropropanoic acid is a stronger acid than 3-chloropropanoic acid.

(iii) m-Nitrophenol is a weaker acid than p-nitrophenol.

- (iv) Benzoic acid is a stronger acid than acetic acid.
- (v) o-Nitrobenzoic acid is a stronger acid than p-nitrobenzoic acid. (2½×5)
5. (i) Give the order of basicity of methylamines in aqueous solution.
- (ii) Give decreasing order of volatility of $\text{CH}_3\text{CH}_2\text{OH}$, CH_3COOH and CH_3CHO .
- (iii) Explain Hyperconjugation.
- (iv) What is the difference between meso-compound and racemic mixtures ?
- (v) Give one method of resolution. (2½×5)
6. (i) Explain the difference between relative and absolute configurations. (3)
- (ii) Draw the conformations of cyclohexane and give their relative stability. (4)
- (iii) What is the difference between D and d ? (2½)
- (iv) Draw the geometrical isomers of 1-chloropropene and assign them E & Z notations. (3)

SECTION – C
(Physical Chemistry)

Attempt any two questions.

7. (a) Derive Gibbs Helmholtz equation. (6)
- (b) What is the physical significance of Entropy? (2)
- (c) State and explain the third law of Thermodynamics. (2)
- (d) Define Work Function(A). (2.5)
8. (a) 10 moles of an ideal gas expands reversibly from a volume of 10 dm^3 to 100 dm^3 at a temperature of 27°C . Calculate the change in entropy. (4)
- (b) Differentiate between Integral enthalpy of dilution and Differential enthalpies of solution. (3)
- (c) Calculate q , w , ΔU and ΔH for the reversible isothermal expansion of 10 moles of an ideal gas at 27°C from a volume of 10 dm^3 to a volume of 100 dm^3 . (5.5)
9. (a) Illustrate the mechanism of action of acid-base indicators by taking suitable examples. (4)

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- (b) Explain why a solution of a weak acid and its salt behaves as a buffer. (2.5)
- (c) Calculate the degree of dissociation and the pH in 0.001M aqueous solution of acetic acid at 25°C.
Given $K_a = 1.8 \times 10^{-5}$. (6)