

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 8359

C

Roll No.....

Unique Paper Code : 217586

Name of the Paper : CHCT-501 : Chemistry – I

Name of the Course : B.Sc. (Prog.) Physical Sciences, Part III
(Concurrent Course)

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

SECTION A (Inorganic Chemistry)

Attempt any **three** questions.

Question No. **1** is compulsory.

1. (a) Why dipole moment of NH_3 is greater than NF_3 ? (2)
- (b) Write Schrödinger wave equation for single electron system. Define the various terms involved in the equation. (3)
- (c) Give the values of quantum number (n , l , m and s) for an electron in 4f energy state. (2)
- (d) Explain resonance in inorganic compounds.

OR

What is meant by normalization and orthogonality? (2)

- (e) Calculate the energy associated with the electron of a hydrogen atom in fourth orbit ($n = 4$). ($m = 9.1 \times 10^{-31}$ kg, $e = 1.602 \times 10^{-19}$ C, $h = 6.625 \times 10^{-34}$ Js). (2)

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- (f) Why ionic compounds have usually higher melting point while covalent compounds have low melting point ? (1.5)
2. (a) Discuss Born-Haber cycle for the determination of lattice energy with a suitable example. (4)
- (b) Give reason : N_2 molecule is diamagnetic whereas O_2 molecule is paramagnetic. (4)
- (c) What are the effects of the lone pair and electronegativity on the shapes of molecules ? (2.5)
- (d) Explain why 2d and 3f orbitals are not possible ? (2)
3. (a) Write brief notes with examples on : (2×5)
- (i) Hybridisation.
 - (ii) Solvation energy and lattice energy
 - (iii) Heisenberg Uncertainty Principle
 - (iv) Orbit and Orbitals
 - (v) Aufbau's Principle
- (b) Explain Radial Probability distribution curve. (2.5)
4. (a) Why σ bond is stronger than π bond ? (2)
- (b) Explain why He_2 molecule does not exist ? (2)
- (c) Using VSEPR theory, predict the shapes of (i) BCl_3 (ii) SF_4 (iii) H_2O (iv) ClF_3 . (4)
- (d) Write Born Lande's equation and define the terms in it. (2.5)
- (e) Explain why (2)
- $LiCl$ is insoluble in water but soluble in organic solvent

OR

XeF_2 is linear molecule but sp^3d hybridized.

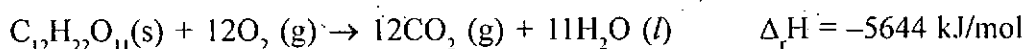
SECTION B (Physical Chemistry)

Attempt any three.

1. (a) Derive the following relation for the salt formed from a weak acid and a strong base

$$\text{pH} = \frac{1}{2} \text{pK}_w + \frac{1}{2} \text{pK}_a + \frac{1}{2} \log c \quad (6)$$

- (b) Calculate the enthalpy of formation of cane sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) using the following data :



Enthalpy of combustion of C(s) is -393 kJ/mol . (6.5)

2. (a) What do you understand by state function and path function? Classify the following as state function and path function: work, heat, entropy, enthalpy. (4)

- (b) Classify the following as strong and weak electrolyte: NaOH, NaCl, CH_3COOH , HCl, KNO_3 . (2.5)

- (c) Calculate the hydrolysis constant, degree of hydrolysis and pH of $10^{-2} \text{ mol dm}^{-3}$ solution of NH_4Cl . Given $K_b(\text{NH}_4\text{OH}) = 1.8 \times 10^{-5} \text{ mol dm}^{-3}$. (6)

3. (a) Explain Hess's law of constant heat of summation with example. (5)

- (b) Show that (any 3) (2.5 \times 3)

(i) $C_p - C_v = nR$

(ii) $\left(\frac{\partial S}{\partial p}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_p$

P.T.O.

$$(iii) P_1 V_1^\gamma = P_2 V_2^\gamma$$

$$(iv) \left(\frac{\partial S}{\partial V} \right)_T = \left(\frac{\partial p}{\partial T} \right)_V$$

4. Write short notes on (any five) :

(i) Buffer solution

(ii) Law of conservation of energy

(iii) Bond Energy

(iv) Carnot cycle for Ideal gas

(v) Common Ion effect

(vi) Solubility Product

(2.5×5)