[This question paper contains 4 printed pages.]

Sr. No. of Question Paper	:	5944	D	Your Roll No
Unique Paper Code	:	217151		
Name of the Course	:	B.Sc. (H) Microbiol	ogy/l	Botany/Zoology/Bio-chemistry
Name of the Paper	:	CHCT-301 : Chem	istry	√ — I
Semester	:	Ι		
Duration : 3 Hours				Maximum Marks : 75

## **Instructions for Candidates**

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

Use separate answer-sheets for Section A and Section B. 2.

## **SECTION – A**

Attempt Three questions in all. Q. No. 1 is compulsory.

## 1. Answer the following briefly :

(a)	What do you mean by normalization and orthogonality of a function?	wave (2)
(b)	Write the possible values of quantum number for an electron in 3d orbital.	and 5f (2)
(c)	State the number of nodes in $R_{(r)}$ plots of 3s orbital, where $R_{(r)}$ star Radial wave function.	nds for (2)
(d)	State the number of high probability zones in 2s and 5f orbitals.	(2)
(e)	The melting point of BaO is high. Why?	(1½)
(f)	Which is more covalent AgCl or AgI ?	(2)
(g)	BeF, is linear but SF, angular. Why ?	(2)

Maximum Marks : 75

- (a) Write the Schrodinger equation in Cartesian and polar co-ordinates, giving the significance of the terms involved in it. (4)
  - (b) Calculate the percentage ionic character of HF if electro negativities of H and F are 2.1 and 4.0 respectively. (4)
  - (c) Define resonance. Draw resonating structure for  $SO_4^{-2}$ ,  $N_3^{-}$  and NO. (4)
- 3. (a) Write the electronic configuration for Cr (Atomic No. 24) and Cu (Atomic No. 29). Explain why half-filled and fulfilled orbitals have extra stability. (4)
  - (b) Calculate the heat of formation  $(\Delta H_f)$  of MgF<sub>2</sub> from its elements using Born-Haber cycle.

Given Sublimation energy of M	g = 146.4  KJ/mole	
Dissociation energy of $F_2$	= 158.9 KJ/mole	
Ionization energy of Mg (g)	= 2184.0 KJ/mole	
Electron affinity for F to F-	= -334.7 KJ/mole	
Lattice energy of MgF <sub>2</sub>	= -2922.5 KJ/mole	(4)

- (c) Define the lattice energy. What is its importance ? State Born-Lande equation for calculation of lattice energy. Give the significance of each term. What is the value of  $Z^2$  for a crystal of TiCl<sub>4</sub>. (4)
- 4. (a) Define VESPER theory. Predict the shape of the following molecules on the basis of VESPER theory

(i)  $OF_2$  (ii)  $CIF_3$  (iii)  $ICl_2^-$  (5)

- (b) What are the ordinates for radial distribution function?
  (c) What are Eigen Values?
  (d) LiI is soluble in ethanol while LiF is insoluble.
  (2)
- (e) Predict the shape of  $XeO_2F_2$  on the basis of hybridization. (2)

## **SECTION - B**

Scientific calculator is allowed. Attempt three questions in all. Question No. 1 is compulsory.

- 1. Explain (Answer any five) :
  - (a) What are intensive properties ? State which of the following properties are intensive :

Density, volume, molar heat capacity and temperature.

- (b) Why the efficiency of a Carnot engine can never be unity?
- (c) The solution of sodium acetate is basic in nature. Why?
- (d) What is meant by Ionic product of water ? What is its value at 298K ?
- (e) What is the indicator used for the titration of strong acid and strong base ? Also give reason.
- (f) Explain Kirchhoff's law and its importance in thermo-chemistry.
- 2. (a) Show that pH of solution of a salt of strong acid and weak base is given by  $pH = \frac{1}{2}(pk_w - pk_b - \log_{10}C)$  (3<sup>1</sup>/<sub>2</sub>)
  - (b) Derive Henderson equation for pH of an acidic buffer solution. (3)
  - (c) Define solubility product of sparingly soluble salt. Calculate molar solubility of PbI<sub>2</sub>
    - (i) In water
    - (ii) In 0.20 sodium iodide

Given 
$$\{K_{sp}(PbI_2) = 7.9 \times 10^{-9}\}$$
 (3×2)

- 3. (a) Derive (any three):
  - (i)  $C_p C_v = nR$
  - (ii)  $(\partial P/\partial S)_{T} = -(\partial T/\partial V)_{P}$

P.T.O.

 $(2\frac{1}{2}\times5)$ 

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(iii)  $\Delta G = \Delta A$  for an isothermal expansion of an ideal gas

(iv)  $PV^{\gamma} = constant$ 

All the symbols have their usual meanings 
$$(3\times 2)$$

(b) What is meant by enthalpy of formation ? Calculate enthalpy of formation of acetylene from the fact that its enthalpy change for combustion is  $-1299.6 \text{ kJ mol}^{-1}$ .

 $\Delta H_{f}^{o}(H_{2}O, 1) = -285.8 \text{ kJmol}^{-1}$  $\Delta H_{f}^{o}(CO_{2}, g) = -393.5 \text{ kJmol}^{-1}$ (3<sup>1</sup>/<sub>2</sub>)

- (c) Derive the expression of work done during reversible isothermal expansion for one mole of ideal gas. (3)
- 4. (a) Write short note :- (any three)
  - (i) Common-ion effect.
  - (ii) Integral heat of solution and differential heat of solution
  - (iii) Theory of acid base indicator
  - (iv) Third law of thermodynamics
  - (v) Salt hydrolysis  $(3\times 3)$
  - (b) Calculate the entropy change when one mole of ideal gas expands reversibly from an initial volume of 1.0 dm<sup>3</sup> to a final volume of 10.0 dm<sup>3</sup> at constant temperature of 298 K. (3<sup>1</sup>/<sub>2</sub>)

(1200)