

This question paper contains 3 printed pages.]

2

Your Roll No. ....

1314

A

**B.Sc. (Hons.)/Geology/Sem. II**  
**Paper—CHHT—101—Chemistry—I**  
**(Admissions of 2010 and onwards)**

Time : 3 Hours

Maximum Marks : 75

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

*Attempt six questions in all including  
Q. No. 1 which is compulsory and carries 15 marks.  
All other questions carry equal marks.*

1. Explain :

- (a) The ionic radii of  $\text{Na}^+$  and  $\text{Cu}^+$  ions are almost the same.
- (b) Spherical symmetry of  $s$ -orbitals
- (c) Sanderson's electron density ratio
- (d)  $4s$  subshell is filled before  $3d$ , while  $2p$  subshell is filled before  $3p$ .
- (e) What is the mathematical expression for the condition of a Normalized Wave function ?

3, 3, 3, 3, 3

[P.T.O.]

2. (a) Derive Schrödinger wave equation for an electron in H-atom and explain the physical significance of  $\psi$  and  $\psi^2$ .
- (b) Draw the radial probability distribution curve for  $3s$ ,  $3p$  and  $3d$  orbitals. What conclusion can be derived from these curves ?  
6, 6
3. (a)  $\psi$  and  $\psi^2$  angular wave function plots for  $p_z$  orbital are different. Explain.
- (b) The electronic configuration  $3d^5 4s^1$  has higher exchange energy than  $3d^4 4s^2$ .
- (c) The atomic radii of transition elements do not undergo much variation as we move from left to right in the periodic table why ?  
4, 4, 4
4. (a) Explain the term octahedral and tetrahedral covalent radii. 6
- (b) Name the three quantum numbers which are obtained by solving the Schrödinger wave equation. What is the significance of each one ? State the values which can be assigned to each of these. 6
5. (a) Justify the statement that  $\psi$  has no physical significance of its own. 6
- (b) What are the differences between an orbit and orbital ? 6

6. (a) Write the definition and scale of electronegativity given by Pauling, Mulliken and Allred-Rochow. 6
- (b) Calculate the value of univalent radii of  $\text{Na}^+$  and  $\text{F}^-$  ions, if the inter nuclear distance between  $\text{Na}^+$  and  $\text{F}^-$  ions in  $\text{Na}^+\text{F}^-$  ionic crystal is 231 pm ( $\text{Na}$ ,  $Z = 11$ ;  $\text{F}$ ,  $Z = 9$ ) 6
7. (a) Calculate  $Z^*$  (effective nuclear charge) for the  $3d$  and  $4s$  electrons in  $\text{Cu}$  ( $Z = 29$ ). 6
- (b) Calculate the electronegativity of Carbon from the following data 6

$$E_{\text{H-H}} = 104.2 \text{ Kcal/mol}$$

$$E_{\text{C-C}} = 83.1 \text{ Kcal/mol}$$

$$E_{\text{C-H}} = 98 \text{ Kcal/mol}$$

$$\text{and } X_{\text{H}} = 2.1$$