Roll No. .....

(011/17-I)

5168

B. Sc. EXAMINATION

(First Semester)

CHEMISTRY

First Paper (CH-101)

Time : Three Hours *Maximum Marks : 27*

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory.

1. (a) Name the various orbitals associated with (i) $n = 3$, $l = 1$, (ii) $n = 3$, $l = 0$. 1

   (b) Write the electronic configuration of (i) Pd (Z = 46) (ii) Cu^{2+} (Z = 29). 1

   (c) Define Electronegativity. 1

   (d) Which element has higher value of electron affinity : F or Cl ? 1

(e) What is the geometry of ICl_2^- ion according to VSEPR theory ? 1

(f) Give the hybridization and shapes of PF_3 and SO_4^{2-}. 1

(g) What is the coordination number of Na^+ in NaCl and Cs^+ in CsCl ? 1

Section A

2. (a) Define with example :

(i) Pauli exclusion principle

(ii) Degenerate orbitals. 2

(b) Find the shielding constant and effective nuclear charge of 3d electron in Zn (Z = 30). 1½

(c) Explain the azimuthal quantum number and magnetic quantum number. 1½

3. (a) Calculate de-Broglie wavelength of an electron (mass = 9.1×10^{-31} kg) moving at 1% speed of light (h = 6.63×10^{-34} kg $m^2 s^{-1}$). 2

(b) State and explain Heisenberg's uncertainty principal. 1½

(c) What are isoelectronic ions ? Account for the decrease in size of the following isoelectronic ions $O^{2-} > F^{-} > Na^{+} > Mg^{2+}$. 1½

4. (a) Explain any *one* method of determination or evaluation of electronegativity. 2

(b) Differentiate between Covalent and van der Waals' radii. 1½

(c) What do you understand by successive electron gain enthalpy of an element ? What makes the second electron gain enthalpy of oxygen positive while its first electron gain enthalpy was negative ? 1½

Section B

5. (a) Using VSEPR theory, how will you show that : 3

(i) ICl_4^- is square planar.

(ii) ClF_3 is T-shaped

(iii) SF_4 is see-saw shaped.

(b) Draw MO energy level diagram for NO molecule. Calculate its bond order. 2

6. (a) Calculate the percentage ionic character of HCl molecule from the following data :

Electronegativities of H and Cl are 2.1 and 3.0, respectively. 2

(b) Calculate the limiting radius ratio r^+/r^- for a tetrahedral site. 1½

(c) Discuss Schottky defect. 1½

7. (a) When a mole of crystalline NaCl is prepared from 1 gram atom of sodium and 0.5 mole of chlorine gas, 410 kJ of heat is produced. The heat of sublimation of Na metal is 108.8 kJ. The heat of dissociation of chlorine gas into atoms is 242.7 kJ, the ionization energy of Na is 493.7 kJ and the electron affinity of chlorine is 368.2 kJ. Calculate the lattice energy of NaCl. 2

(b) Draw neat and labelled diagram of the unit cell of fluorite structure. 1½

(c) Explain polarization and polarizing power. 1½