SARDAR PATEL UNIVERSITY
B.Sc. Semester-1 Examination
US01CCHE02- Inorganic Chemistry

Date: 27th November, 2013
Day: Wednesday

Q.1 Answer the following Multiple Choice Questions. (10)

1. Electrons residing between the nucleus and outermost shell are called:
   (a) intervening electron (b) valence shell electron
   (c) excited electron (d) outermost shell electron

2. What is the value of shielding constant for 1s electron in oxygen?
   (a) 0.35 (b) 0.85 (c) 0.30 (d) 1.0

3. Hamiltonian operator (\(\hat{H}\)) do not contain energy part.
   (a) rotational (b) potential (c) kinetic (d) none of these

4. What is the percentage of \(p\) character in \(sp^3\) hybridized orbital?
   (a) 25% (b) 33.33% (c) 50% (d) 75%

5. Which elements are not accommodate in the main body of the periodic table?
   (a) Transition (b) Inner transition (c) Metallic (d) only Lanthanides

6. Which repulsion between electron-pairs is strongest one?
   (a) lone pair-bond pair (b) lone pair-lone pair
   (c) bond pair-bond pair (d) lone pair & atom

7. Which pair follows isoelectronic principle?
   (a) B\(_4\) & CH\(_4\) (b) BF\(_4\) & NH\(_4\)\(^+\) (c) NO\(_3\) & NO\(_2\)\(^+\) (d) none of these

8. What is the geometrical arrangement of \(sp^3\) hybridization?
   (a) linear (b) trigonal (c) trigonal planar (d) tetrahedral

9. A \(\pi\)-bond is formed by the overlap of:
   (a) s-s orbital (b) s-p orbital
   (c) p-p overlap sidewise manner (d) P-P overlap end-to-end fashion

10. Molecular species has unpaired electron.
    (a) N\(_2\) (b) F\(_2\) (c) O\(_2\) (d) O\(_2\)\(^-\)

Q.2 Answer the following short questions. (Any Ten) (20)

(i) Define electro-negativity and shielding effect.
(ii) Write the mathematical expression for Hamiltonian operator.
(iii) Give the details obtained from the plots of \(R_{e\text{-atom}}\) vs \(r\).
(iv) Ionization energy of B (Z=5) is lower than that of Be (Z=4). Explain.
(v) Explain the term ‘electron affinity.’
(vi) List the factor affecting the magnitude of electro negativity.
(vii) What are isoelectronic species?
(viii) Why any hybrid orbital can form strong bond than atomic orbital?
(ix) Give the shape of CH\(_4\), CO\(_3\)\(^2-\), N\(_3\) and PCl\(_5\).
(x) Explain: s-s linear combination of atomic orbital.
(xi) Be\(_2\) does not exist. Explain.
(xii) Give the note for linear combination of atomic orbital.

(P.T.O)
Q.3 Answer the following.
(A) Derive de-Broglie’s wave equation. Discuss its significance.
(B) Explain the factors affecting shielding constant and effective nuclear charge.

OR

Q.3 Answer the following.
(A) Derive the relation between Cartesian co-ordinates and spherical polar co-ordinates.
(B) Calculate $\sigma$ and $Z_{eff}$ for 3d electron in Mn ($Z=25$) and Cu ($Z=29$).

Q.4 Answer the following.
(A) Define electron affinity. Discuss the factors affecting the magnitude of electron affinity.
(B) Explain variation of ionization energy in III-A group.

OR

Q.4 Answer the following.
(A) Give the merits of long form of periodic table.
(B) Calculate the electro-negativity of lead (Pb) following Allred-Rochow method.
   (Given Covalent radius of Pb=1.53 Å and atomic number of Pb=82.)

Q.5 Answer the following.
(A) Explain octet rule in detail with suitable illustration and exception.
(B) The shape of molecule is distorted in presence of lone pair and by difference in electro-negativity. Explain.

OR

Q.5 Answer the following.
(A) Define hybridization. Discuss the $sp$ hybridization in BeF$_2$ molecule.
(B) Chlorine trifluoride(ClF$_3$) has distorted trigonal bipyramidal shape while triiodide ion(I$_3^-$) has linear shape. Explain by VSEPR theory.

Q.6 $O_2$ molecule is paramagnetic whereas $O_2^-$ (peroxide ion) is diamagnetic. Explain giving diagram on the basis of molecular orbital theory.

OR

Q.6 Describe molecular orbital treatment of $B_2$ molecule and $F_2$ molecule.