Reg. No. : B160478ME

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

DEPARTMENT OF CHEMISTRY

S1 B. Tech.

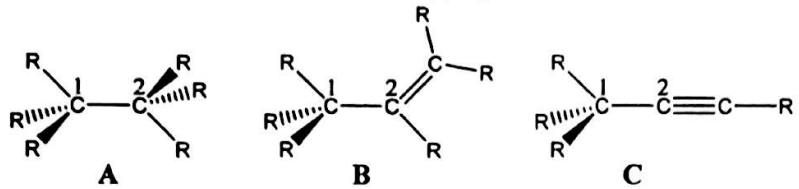
Monsoon Semester, Test I Examination, September 2016

CY1001 - Chemistry

Time: 1 hour **Max. Marks: 20**

Answer All Questions

1. The C1-C2 bond distances in the molecules A to C are given below. R indicates an alkyl group. Explain the variation of the C1-C2 bond distances with appropriate reason.



A **B** **C**

C1-C2 distance = (1.54 Å) (1.50 Å) (1.46 Å)

(2 Marks)

2. Explain the partial π-bond character of each C-C bond in allyl cation using valence bond theory.

(2 Marks)

3. How do you justify the sp^3 hybridization of carbon atom in CH_4 from the data given below? Consider that the formation of CH_2 does not require promotion of electron from the ground state of carbon atom.

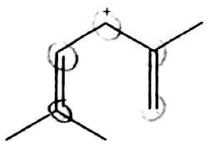
$C(1s^2 2s^2 2p_x^1 2p_y^1 2p_z^0) \longrightarrow C(1s^2 2s^1 2p_x^1 2p_y^1 2p_z^1)$ $\Delta E = +406$ kJ/mol

$CH_2 + 2\,H \longrightarrow CH_4$ $\Delta E = -895$ kJ/mol

(2 Marks)

4. Predict shape of the following molecules and suggest the bond angle in each case.
(i) SiF_4 (ii) SF_4 (iii) XeF_4 (3 Marks)

5. Sketch the π-molecular orbitals of the following cation in the increasing order of energy and assign HOMO and LUMO.



(3 Marks)

6. Depict the nature of different molecular orbitals formed by 2p orbitals of a homo-diatomic molecule by assuming molecular axis as z-axis. Assign the appropriate symmetry of the resulting molecular orbitals and arrange them in the increasing order of energy. (2 + 1 + 1 = 4 Marks)

7. NH is a highly reactive gas-phase species. The orbital energies of hydrogen and nitrogen atoms are, H(1s) = -13.6 eV, N(2s) = -25.6 eV and N(2p) = -13.2 eV.
   a) Draw a molecular orbital energy level diagram of NH without considering mixing of 2s- and 2p-orbitals of nitrogen.
   b) Calculate the bond order of NH.
   c) Comment on the ionization potential of NH as compared to those of nitrogen and hydrogen atoms.

(2 + 1 + 1 = 4 Marks)

---End---

Scanned by CamScanner