

Uva Wellassa University, Sri Lanka
End Semester Examination – June 2009
SCT 131-1 Inorganic Chemistry



Time: One (01) hour

Total 05 Question

Answer four (04) questions only

Universal gas Constant, $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$

Planck's Constant, $h = 6.6262 \times 10^{-34} \text{ J s}$

Rydberg Constant, $R_H = 1.0967 \times 10^7 \text{ m}^{-1}$

Velocity of light $= 2.99 \times 10^8 \text{ m s}^{-1}$

Mass of electron, $m = 9.1091 \times 10^{-31} \text{ kg}$

Charge on electron, $e = 1.6021 \times 10^{-19} \text{ C}$

1 electron volt, $1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$

Permittivity of Vacuum, $\epsilon_0 = 8.854185 \times 10^{-12} \text{ kg}^{-1} \text{ m}^{-3} \text{ A}^2$

- 01) I. State the Bohr model of the Hydrogen atom. List two drawbacks in this model? (09 marks)
- II. What is the difference between a continuous spectrum and a line spectrum? (02 marks)
- III. What is the major difference between an absorption spectrum and an emission spectrum? (02 marks)
- IV. Doubly ionized lithium, Li^{2+} ($Z=3$) and triply ionized beryllium, Be^{3+} ($Z=4$) each emit a line spectrum. For a certain series of lines in the lithium spectrum, the shortest wavelength is 40.5 nm, for the same series of lines in the beryllium spectrum, what is the shortest wavelength?

Note:

Bohr's formula applies for energies of stationary energy level, n , for hydrogen or hydrogen like atoms given by;

$$E_n = -13.6 \frac{Z^2}{n^2} \text{ (in electron volts)}$$

(12 marks)

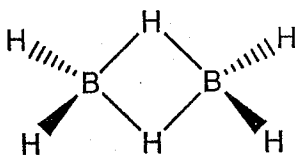
- 02) I. Sketch examples of σ bonding, π bonding and non bonding orbital overlaps that could occur between two p atomic orbitals. (06 marks)
- II. Draw the valence molecular orbital diagram of (valence shell s orbital and p orbital only) of tin molecule, Sn_2 (label atomic and molecular orbital). Determine the bond order for Sn_2 molecule. (07 marks)
- III. Which of the following ions, is most stable? Justify your answer using appropriate molecular orbital diagrams.
- a. Be_2^+
- b. He_2

- 03) I. State the valence bond theory. (12 marks)
- II. For the following molecules and ions, (05 marks)
- predict the correct idealized VSEPR geometry.
 - determine the hybridisation of the central atom
 - determine the oxidation state of the central atom.
- a. BBr_3
- b. XeF_4
- c. SF_6
- d. I_3^-

(20 marks)

- 04) I. a. Draw the structure of borazine. (05 marks)
- b. Borazine is sometimes called as “inorganic benzen”, briefly explain. (08 marks)
- II. a. Draw the structure of boron nitride. (05 marks)
- b. What is the compound called as “inorganic graphite”. Why is it called so? (07 marks)

- 05) I. a. What is “inert pair effect”? (05 marks)
- b. Thallium, Tl belongs to Group 13, however, thallic (Tl^+) compounds are more stable than thallic (Tl^{3+}) compounds. Briefly explain. (05 marks)
- II. Nitrogen and phosphorus both belongs to group 15. PCl_5 is common but not NCl_5 . Briefly explain. (07 marks)
- III. Diborane has the following structure



Briefly explain the nature of bonding in hydrogen bridges in diborane.

(08 marks)