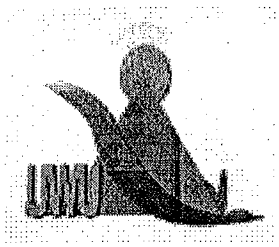


Uva Wellassa University, Sri Lanka
Btech. Science and Technology
End Semester Examination- Semester 1
December –2008

SCT 231-1 Inorganic Chemistry

Answer Four (04) questions only. All questions carry equal marks.

Scientific Calculators are allowed.

Time: One (01) hour

Universal gas Constant, $R = 8.314\ J\,K^{-1}\,mol^{-1}$
Planck's Constant, $h = 6.6262 \times 10^{-34}\ Js$
Rydberg Constant, $R_H = 1.0967 \times 10^{7}\ m^{-1}$
Velocity of light $= 2.99 \times 10^{8}\ m\,s^{-1}$
Mass of electron, $m = 9.1091 \times 10^{-31}\ kg$
Charge on electron, $e = 1.6021 \times 10^{-19}\ C$
Permittivity of Vacuum, $\varepsilon_0 = 8.854185 \times 10^{-12}\ kg^{-1}\,m^{-3}\,A^2$

1 a. State the Bohr model of the Hydrogen atom. Discuss the drawbacks of this model?

(06 Marks)

b. Name first three series of lines that occur in the atomic spectrum of hydrogen. Give a general equation for the wavenumber applicable to all series.

(10 Marks)

c. The Balmer series of (absorption) spectral lines for hydrogen appear in the visible region. What is the lowest energy level that these electronic transitions start from?

(02 Marks)

d. What transition corresponds to the spectral line at 486 nm in the Balmer series?

(07 Marks)

2 a. Draw molecular orbital diagram for the following compounds

i. B_2

ii. He_2

(10 Marks)

b. Use the VSEPR theory to deduce the structure of the following compounds.

i. PCl_5

ii. I_3^-

iii. BF_3

(15 Marks)

3. a. Borazine is sometimes called as '*Inorganic benzene*', briefly explain.

(04 Marks)

b. Graphite is soft but diamond is hard, explain.

(08Marks)

c.

	F_2	Cl_2	Br_2
Bond energy/ kJ mol^{-1}	159	243	193

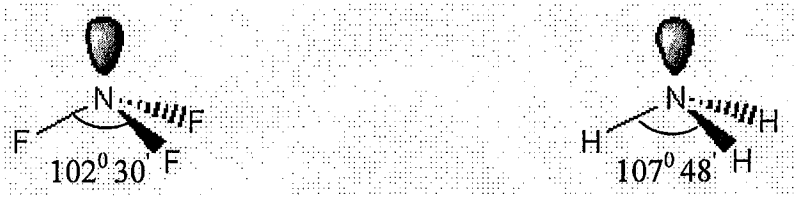
Write an account for the variation of bond energies of F_2, Cl_2 and Br_2 given above.

(08 Marks)

d What is 'Inert pair effect'? Support your answer with two examples

(05 Marks)

4. a.



Bond angle of NH_3 is greater than that of NF_3, briefly explain.

(05 Marks)

b. Chemical properties of Li are more similar to Mg than the rest of the elements in the group 1. Discuss this statement by giving three examples.

(08 Marks)

c. The bond length of Se - O is shorter than a normal single bond, explain.

(05 Marks)

d. Nitrogen and phosphorous both are in the same group. However, PCl_5 is common however, NCl_5 is unknown, explain.

(07 Marks)

5. a. Draw structures of the following

i. Boron nitride

ii. Borazine

iii. Aluminum chloride

iv. Boron hydride

(10 Marks)

b. What are 'Interhalogen compounds'? How many types of Interhalogen compounds are known? Give an example for each type.

(15 Marks)

6. a Write an account on the fact that there is a decrease in first ionization energy from Be to B and Mg to Al.

(06 Marks)

b. i. What are Fajan's rules?

(05 Marks)

ii. Predict the types of bond in HCl and KCl using Fajan's rules.

(06 marks)

c. Born-Lande equation for lattice energy is given below. Define terms.

$$U = \frac{N_0 A Z^+ Z^- e^2}{4\pi \varepsilon_0 r_0}\left[1 - \frac{1}{n}\right]$$

Use this equation to explain following lattice energies.

LiF	-1004 kJ mol^{-1}
MgO	-3933 kJ mol^{-1}

(08 marks)