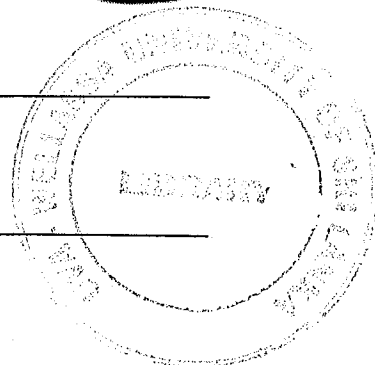


Uva Wellassa University, Sri Lanka
End Semester Examination – January 2010
CHE 241-2 Inorganic Chemistry (Repeat)



Time: Two (02) hours

Total five (05) questions
Answer four (04) questions only



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

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

Rydberg constant, $R_H = 1.097 \times 10^7 \text{ m}^{-1}$

Velocity of light = $2.998 \times 10^8 \text{ m s}^{-1}$

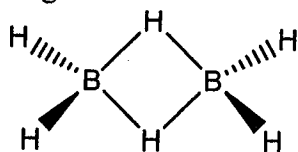
Mass of electron = $9.109 \times 10^{-31} \text{ kg}$

Charge of electron = $1.602 \times 10^{-19} \text{ C}$

Permittivity of vacuum, $\epsilon_0 = 8.8542 \times 10^{-12} \text{ kg}^{-1} \text{ m}^{-3} \text{ A}^2$

- 01) a. State the Bohr model for a hydrogen atom. State two drawbacks of the model. (07 marks)
- b. In 1885 Balmer showed that the wave number, $\bar{\nu}$ of any line in the visible spectrum of atomic hydrogen could be given by a simple empirical formula. State the formula, identify all terms therein. (05 marks)
- c. The wave number of the first line of Balmer series of hydrogen is 15200 cm^{-1} . Calculate the wave number of the first Balmer line of Li^{2+} ion. (05 marks)
- d. State the values of the four quantum numbers possible for an electron in a 4p orbital. (08 marks)
- 02) a. Define the term "electronegativity". (05 marks)
- b. State the Fajan's rules. (05 marks)
- c. Predict the type of bonds formed in HCl and CsCl. (08 marks)
- d. Briefly explain the significance of the large increase in the third ionization energy of Ca and the fifth ionization energy of Si. (07 marks)

- 03) a. i. Draw the structure of borazine. (05 marks)
- ii. Explain why borazine is called as "inorganic benzene". (05 marks)
- b. i. Draw the structure of boron nitride. (05 marks)
- ii. What is the compound called as "inorganic graphite". Explain why is it called so. (05 marks)
- c. Diborane has the following structure



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

(05 marks)

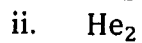
- 04) a. For the ion $[\text{Co}(\text{en})_2\text{NH}_3\text{CN}]^{2+}$, answer the following questions;
- i. Write the IUPAC name.
- ii. What is the oxidation state of the central atom?
- iii. What is the coordination number of the central atom? (07 marks)
- b. The compound $\text{Co}(\text{NH}_3)_5\text{SO}_4\text{Br}$, exists in two forms: red and violet. Each form dissociates in water forming two ions. A solution of the red compound forms a precipitate of AgBr on the addition of AgNO_3 solution, but no precipitate of BaSO_4 upon the addition of BaCl_2 solution. For the violet compound, just the reverse occurs. From these evidences, write the formula of complex ions in each case (label them as "red" or "violet"). Write the IUPAC name of each compound. (10 marks)
- c. Using molecular orbital diagrams briefly explain the following:
 " $[\text{Ru}(\text{H}_2\text{O})_6]^{2+}$ is found to be paramagnetic whereas $[\text{Ru}(\text{CN})_6]^{4-}$ is diamagnetic."

(08 marks)

05
a. Sketch examples of σ bonding, π bonding and non bonding orbital overlaps that could occur between two p atomic orbitals.

(06 marks)

b. Which of the following ions, is most stable? Justify your answer using appropriate molecular orbital diagrams.



(12 marks)

c. Name the three types of hybrid orbital that may be formed by an atom with only s and p orbitals in its valence shell. Draw the shapes of the hybrid orbitals mention above.

(07 marks)

