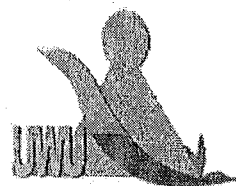




Uva Wellassa University, Sri Lanka
End Semester Examination – March 2011
SCT 131-1 Chemistry I



Time: One (01) hour

Total four (04) questions
Answer all questions

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

Plank's constant, $h = 6.626 \times 10^{-34} \text{ m}^2 \text{ kg s}^{-1}$

Rydberg constant, $R_H = 1.096 \times 10^7 \text{ m}^{-1}$

Electron mass = $9.1095 \times 10^{-28} \text{ g}$

Proton mass = $1.67252 \times 10^{-24} \text{ g}$

Neutron mass = $1.67495 \times 10^{-24} \text{ g}$

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

Avogadro constant, $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

01. a. State the Bohr model for a hydrogen atom.

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(05 marks)

- b. State two drawbacks of the model.

1.

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2.

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(04 marks)

- c. Why do corresponding lines in the atomic spectra of hydrogen and deuterium appear at slightly different wavelengths?

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(04 marks)

- d. 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 and identify all terms therein.

(05 marks)

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

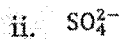


(06 marks)

- f. Calculate the wave length of the $n=4$ to $n=2$ transition in the deuterium spectrum?

(06 marks)

02. a. Predict the shape of the following molecules using VSEPR theory.



(10 marks)

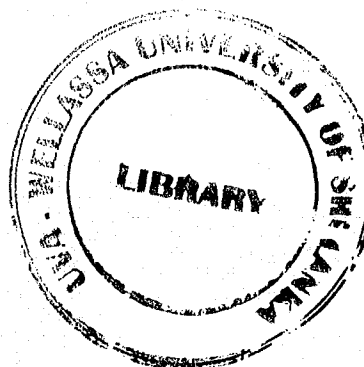
b. Draw an orbital interaction diagram (molecular orbital diagram) for any one of the following molecules.



(05 marks)

c. Draw the shapes of the molecular orbitals for the direct overlap of two p atomic orbitals. Show the nodal planes clearly.

(05 marks)



03. a. Clearly indicating the stereochemistry draw the structures of following compounds:

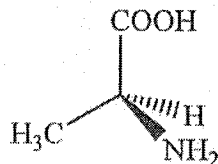
i. (*R*)-2-chlorobutanoic acid

ii. (*Z*)-3,5-dibromohex-2-en-1-ol

iii. N-Methylcyclohexylamine

(15 marks)

b. Structure given bellow is L-alanine, a simple amino acid.



i. Draw corresponding Fisher projection.

ii. Using R or S designations specify the configuration at the chiral center.

(10 marks)

04. a. Draw the Newman projections of the following conformations of butane.
- | | |
|------------------------------|--------------------------------|
| i. Most stable conformation. | ii. Least stable conformation. |
|------------------------------|--------------------------------|

(10 marks)

- b. Staged conformations are more stable than eclipsed conformations. Briefly explain.

(05 marks)

- c. i. Draw *trans*-1-ethyl-3-methylcyclohexane in its most stable chair conformation.

(05 marks)

- ii. Explain whether *trans*-1-ethyl-3-methylcyclohexane chiral or achiral.

(05 marks)