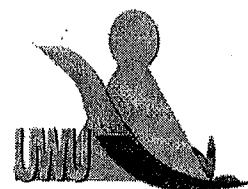


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Uva Wellassa University, Sri Lanka
End Semester Examination – August 2011
SCT 132-1 Chemistry II



Time: One (01) hour

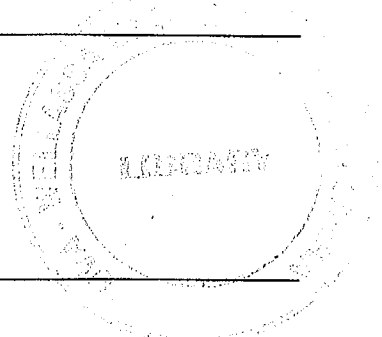
Total three (03) questions.

Question No 1 is compulsory.

Answer only for two (02) questions.

Use of standalone scientific calculators is allowed.

All symbols carry standard meanings.



1. a. Define following terms
 - i. Sublimation energy (ΔH_s)
 - ii. Ionization energy (ΔH_E)
 - iii. Dissociation energy (ΔH_d)
 - iv. Electron affinity (ΔH_a)
 - v. Lattice energy (ΔH_u)

(15 marks)
- b. Write the balance equation for formation of $MgF_2(s)$

(02 marks)
- c. Draw the Bohn-Haber cycle for formation of $MgF_2(s)$ from $Mg(s)$ and $F_2(g)$

(10 marks)
- d. Derive an equation for heat of formation (ΔH_f) of $MgF_2(s)$ in terms of ΔH_s , ΔH_E , ΔH_d , ΔH_a and ΔH_u

(08 marks)
- e. Calculate the lattice energy (ΔH_u) of formation of $MgF_2(s)$ from following data and by using the equation derive in section (d)
Sublimation energy of $Mg = 146.4 \text{ kJ mol}^{-1}$, First ionization energy of $Mg = 737 \text{ kJ mol}^{-1}$, second ionization energy = 1449 kJ mol^{-1} , Dissociation energy of $F_2 = 158.8 \text{ kJ mol}^{-1}$, Electron affinity = -328 kJ mol^{-1} and Formation energy = $-1096.5 \text{ kJ mol}^{-1}$ (ΔH_a)

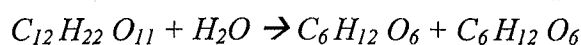
(07 marks)
- f. Calculate the distance between Na^+ and Cl^- ions in $NaCl$ lattice, if crystallization energy of $NaCl$ is -788 kJ mol^{-1} . Use following equation.

$$\Delta E_{\text{crystallization}} = -\frac{N}{4\pi\epsilon_0 r} Z^2 e^2 M \left(1 - \frac{1}{n}\right)$$

Avogadro number = $6.022 \times 10^{23} \text{ mol}^{-1}$, number of charges of the ions in NaCl = 1, charge of electron = $1.6022 \times 10^{-19} \text{ C}$, Madelung constant = 1.747558, permeability of space = $8.854 \times 10^{-12} \text{ C}^2 \text{ m}^{-1}$, $n = 9.1$.

(08 marks)

2. a. Differentiate between the following: first order and pseudo-first order reactions. Explain why the H_2O in the following reaction does not affect the rate of the reaction, and reaction is pseudo-first order with respect to $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ activity.



(15 marks)

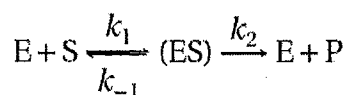
- b. For a certain reaction, the value of the rate constant is $5.0 \times 10^{-3} \text{ dm}^3 \cdot \text{mol}^{-1} \cdot \text{sec}^{-1}$. Find the value of rate constant in $\text{cm}^3 \cdot \text{molecule}^{-1} \cdot \text{sec}^{-1}$

(15 marks)

- c. State the Arrhenius equation of a given reaction. Define all terms stated therein. The values of the rate constants for a reaction $\text{H}_2 + \text{I}_2 = 2\text{HI}$ were observed as $3.0 \times 10^{-5} \text{ dm}^3 \cdot \text{mol}^{-1} \cdot \text{sec}^{-1}$ and $2.5 \times 10^{-3} \text{ dm}^3 \cdot \text{mol}^{-1} \cdot \text{sec}^{-1}$ at 357°C and 447°C respectively. Calculate the activation energy, E_a for forward and reversed reaction of $\Delta H = 15.5 \text{ kJ} \cdot \text{mol}^{-1}$.

(20 marks)

3. a. What is meant by pseudo-steady state approximation (PSSA)?



For enzyme catalyzed reaction Prove that $\frac{d[\text{P}]}{dt} = \frac{k_2[\text{E}]_0[\text{S}]}{K_m + [\text{S}]}$ assuming PSSA.

Where

$$K_M = \frac{k_{-1} + k_2}{k_1} \text{ and } [\text{E}]_0 \text{ initial concentration of the enzyme.}$$

(30 marks)

- b. Deduce that at high substrate concentration, $[\text{S}] \gg K_M$, the reaction rate, $\frac{d[\text{P}]}{dt}$ is 0^{th} order

(20 marks)