Uva Wellassa University of Sri Lanka
Faculty of Science & Technology
Science & Technology Degree Program
2nd Semester Examination – September/October 2013

Uva Wellassa University

SCT 132-1 Chemistry II

No. of questions: two (02)
Answer all questions
Time allocation: one (01) hour
Total marks allocated: 100 marks

1. Given below are initial rate data for a chemical reaction between MnO_4^- and ClO_3^- ions.

Exp. No.	$[MnO_4^-]$ / mol dm^{-3}	$[ClO_3^-]$ / mol dm^{-3}	$[H^+]$ / mol dm^{-3}	Initial Rate / mol dm^{-3} s^{-1}
1	0.10	0.10	0.10	5.2×10^{-3}
2	0.25	0.10	0.10	3.3×10^{-2}
3	0.10	0.30	0.10	1.6×10^{-2}
4	0.10	0.10	0.20	7.4×10^{-3}

a. Determine the rate law and rate constant for the following reaction.

$$2\,MnO_4^- + 5\,ClO_3^- + 6\,H^+ \longrightarrow 2\,Mn^{2+} + 5\,ClO_4^- + 3\,H_2O$$

(15 marks)

b. What is the half-life of a zero order reaction? Give necessary calculations.

(05 marks)

c. The Arrhenius equation is a description of the relationship between the rate constant, the activation energy of the reaction and the temperature. Write the Arrhenius equation and label the all components in it.

(05 marks)

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d. The rate constant of a chemical reaction is measured at several temperatures as given in the table below.

Temperature / K	600	700	800	900	1000
Rate constant /s^{-1}	0.00034	0.0031	0.029	0.10	0.38

i. Is this a first order or second order reaction?

ii. Assuming that the data follows the Arrhenius equation, calculate the activation energy and the Arrhenius constant of the reaction.

(25 marks)

2.

a. Define following terms.

i. Atomization energy

ii. Sublimation energy

iii. First ionization energy

iv. Crystallization energy (16 marks)

b. Write the balance equation for formation of $NaCl_{(S)}$ (04 marks)

c. Calculate the lattice energy of NaCl from following data.

Atomization energy of Sodium = 107 KJ mol^{-1}

First ionization energy of Sodium = 496 KJ mol^{-1}

Bond dissociations energy of Cl_2 = 242 KJ mol^{-1}

Electron affinity of Chlorine = -364 KJ mol^{-1}

Formation energy of NaCl = -411 KJ mol^{-1} (15 marks)

d. Calculate the free energy for the following reaction by using given data.

$$CCl_{4(l)} + H_2O_{(l)} \rightarrow COCl_{2(g)} + 2HCl_{(g)}$$

Heat of formation of CCl_4 = -135.4 KJ mol^{-1}

Heat of formation of H_2O = -285.8 KJ mol^{-1}

Heat of formation of $COCl_2$ = -218.8 KJ mol^{-1}

Heat of formation of HCl = -92.3 KJ mol^{-1} (15 marks)