

Uva Wellassa University of Sri Lanka
Faculty of Science & Technology
Science & Technology Degree Program

2nd Semester Examination – September/October 2013



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.	$[\text{MnO}_4^-]$ / mol dm ⁻³	$[\text{ClO}_3^-]$ / mol dm ⁻³	$[\text{H}^+]$ / 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.



(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)

- 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

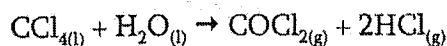
Bond dissociations energy of Cl₂ = 242 KJ mol⁻¹

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.



Heat of formation of CCl₄ = -135.4 KJ mol⁻¹

Heat of formation of H₂O = -285.8 KJ mol⁻¹

Heat of formation of COCl₂ = -218.8 KJ mol⁻¹

Heat of formation of HCl = -92.3 KJ mol⁻¹

(15 marks)