

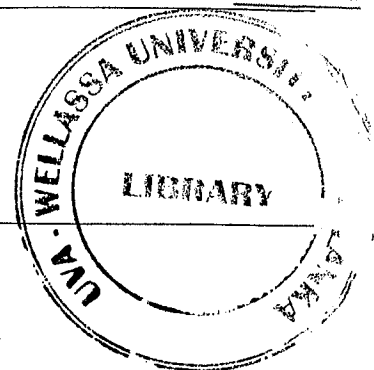
Instructions to candidates

Duration: One (01) hour

Number of questions: Two (02)

Answer all questions

Total mark allocation: 200 marks



1. a. 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}

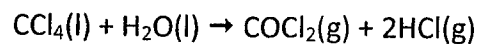
Bond dissociations energy of Cl_2 = 242 KJ mol^{-1}

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

Formation energy of NaCl = -411 KJ mol^{-1}

(40 Marks)

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



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

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

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

Heat of formation of HCl = $-92.3 \text{ KJ mol}^{-1}$

(60 Marks)

2. In aqueous medium HgCl_2 reacts with $\text{K}_2\text{C}_2\text{O}_4$ yielding KCl , CO_2 and Hg_2Cl_2

a. Write the balanced equation for the above reaction.

b. Following data are obtained for three different sets of experiments.

Experiment No	Initial Concentration / mol L^{-1}		Initial Rate of Reaction / $\text{mol L}^{-1} \text{min}^{-1}$
	HgCl_2	$\text{K}_2\text{C}_2\text{O}_4$	
1	0.105	0.15	1.775×10^{-5}
2	0.105	0.30	7.100×10^{-5}
3	0.052	0.30	3.500×10^{-5}

i. Write the equation for the rate (R) of total reaction using initial concentration of HgCl_2 and initial concentration of $\text{K}_2\text{C}_2\text{O}_4$. Define all the constants.

ii. Calculate the order of the reaction with respect to HgCl_2 .

iii. Calculate the order of the reaction with respect to $\text{K}_2\text{C}_2\text{O}_4$.

iv. Calculate total order of the reaction.

v. Calculate the rate constant of the reaction.

vi. If concentration of HgCl_2 is twice that of $\text{K}_2\text{C}_2\text{O}_4$, calculate the time it takes for the concentration of HgCl_2 to change from 0.105 mol L^{-1} to 0.075 mol L^{-1} .

(100 Marks)