



CRAWFORD UNIVERSITY  
COLLEGE OF NATURAL AND APPLIED SCIENCES  
DEPARTMENT OF PHYSICAL AND EARTH SCIENCES  
INDUSTRIAL CHEMISTRY PROGRAMME

HARMATTAN SEMESTER EXAMINATION 2016/2017 SESSION

**COURSE CODE:** ICH 321

**COURSE TITLE:** APPLIED CHEMICAL THERMODYNAMICS UNIT 3

**TIME ALLOWED:** 3 HOURS

**DATE:** February, 2017. Instruction: Attempt any four (4) Questions

- (a) Differentiate between Potential and Kinetic energies.

(b) Show that the activation energy  $E_a$  of a reacting specie is influenced by a 10K rise in temperature to the extent that:  $E_a = \ln 2(RT_1T_2)/(T_2-T_1)$ .
- (a) Differentiate the order of a reaction from its molecularity.

(b) Methyl benzene (toluene) is immiscible with water. If boiled together under atmospheric pressure of 755 torr at 85°C, what is the ratio of toluene to water in the distillate. (Assume the vapour pressure of pure toluene and water at 85°C to be 322 torr and 400.6 torr respectively).
- (a) Derive the equation for a first order reaction.

(b) Show that the kinetics of a complex reaction can be described by Arrhenius equation thus:  $\ln K = -E_a/RT + \ln A$
- (a) Describe the distillation of immiscible liquids with respect to the vapour pressures of the pure liquids.

(b) Determine the mass percentage of carbon tetra chloride  $CCl_4$  ( $P_1^\circ = 114.5$  torr) in the vapour phase at equilibrium in a 1:1 mole ideal solution with trichloromethane  $CHCl_3$  ( $P_2^\circ = 199.1$  torr) at 25°C.
- (a) Show that the change in energy  $E_a$  is related to the enthalpy change at constant volume by the equation  $\Delta E = q_v$

(b) Differentiate the terms "Energy", "Work" and "Heat"
- (a) Define the terms "Heat Capacity" and "Specific Heat Capacity"

(b) 2.45 KJ of heat was expended to raise a mass of water from 35.7°C to 86.5°C. if the heat capacity of water is given as 4200J/gK-1, what was the volume of the water used?