CRAWFORD UNIVERSITY
COLLEGE OF NATURAL AND APPLIED SCIENCES
DEPARTMENT OF PHYSICAL AND EARTH SCIENCES
(INDUSTRIAL CHEMISTRY UNIT)
HARMATTAN SEMESTER EXAMINATIONS 2016/2017 SESSION

COURSE CODE: ICH 443
COURSE TITLE: SURFACE CHEMISTRY **UNITS: 2**
TIME ALLOWED: 2 HOURS
DATE: MARCH, 2017

INSTRUCTION: ATTEMPT ONLY THREE QUESTIONS

1. (a) Explain the phenomenon of surface tension.
   (b) Write short note on the effect of temperature on the surface tension. Support your answer with a named equation.
   (c) Define the following terms as used in the surface and colloidal phenomena:
   (i) Adsorbate
   (ii) Adsorbent
   (iii) Desorption
   (iv) Dispersion medium
   (v). Dispersed phase

2. (a) Show that according to the capillary rise method used in the determination of surface tension,

$$h = \frac{2\gamma\cos\phi}{\rho g r}$$

   (b) A capillary tube with an inside diameter of 0.03 cm is dipped vertically into a beaker of distilled water at 20 °C. The water rises 29.3 mm in the tube with a constant angle of 0 °C. If the density of water at 20 °C is 998.2 kgm^{-3}, what is the surface tension of the water?
   (c) Differentiate between physiosorption and chemosorptions.

3. (a) (i) Derive the Kelvin Equation and state its application.
   (ii) Calculate the ratio of the vapour pressure of water in droplet with radius, r = 1.5 μm compared to that for bulk water at 25 °C. For water at 25 °C, $\gamma = 71.98 \times 10^{-3}$ $N.m^{-1}$ and $\rho = 0.998$ $g.cm^{-3}$.
   (b) Explain the two methods of purifying sols or colloidal solutions.

4. (a) State at least five differences between lyophilic and lyophobic.
   (b) Explain adsorption isotherm and list the three phenomena that may be involved in physical adsorption.
   (c) Mention five factors that affect the nature of a colloidal system.
   (d) Briefly explain the true solutions of macromolecular

5. (a) Differentiate between surface and interface.
   (b) (i) Explain briefly liquid-liquid interface.
   (ii) Write an expression for the interfacial tension for hydrocarbon oil and water interface.
   (c) Write short note on the following:
   (i) Wetting
   (i) Wetting agent
   (ii) Wetting on solid surface
   (d) Suppose a movable wire frame filled with thick soap film is 20 cm and has surface tension of 0.0927 Nm^{-1}. How much work would be done to move the wire through a distance of 4 cm?