CRAWFORD UNIVERSITY
COLLEGE OF NATURAL AND APPLIED SCIENCES
DEPARTMENT OF PHYSICAL AND EARTH SCIENCES
(INDUSTRIAL CHEMISTRY UNIT)
HARMATTAN SEMESTER EXAMINATIONS 2013/2014 SESSION

COURSE CODE: ICH 443
COURSE TITLE: SURFACE CHEMISTRY **UNITS: 2**
TIME ALLOWED: 2 HOURS
DATE: MARCH. 2014

INSTRUCTION: ATTEMPT ONLY THREE QUESTIONS

1. (a) Define the following terms as used in the surface and colloidal phenomena:
   (i) Adsorbate
   (ii) Adsorbent
   (iii) Dispersed phase
   (iv) Dispersion medium
   (v) Desorption.
   (b) Explain the phenomenon of surface tension.
   (c) (i) Mention two methods used for the determination of surface tension.
   (ii) Briefly describe one of the methods mentioned in question (c) (i) above.
   (d) Determine the excess pressure of a droplet of water with radius 10^{-2} m for which γ is 0.0065 $N.m^{-1}$.

2. (a) Explain Langmuir isotherm.
   (b) The surface tension at 20 °C for several alcohols is $\gamma(CH_3OH)$ = 22.6 $dyne.cm^{-1}$, $\gamma(C_2H_5OH)$ = 2.28 x 10^{-2} $N.m^{-1}$, and $\gamma(n\text{-}C_3H_7OH)$ = 23.8 $mJ.m^{-2}$. Which of these alcohols has the greatest surface tension?
   (c) Differentiate between surface and interface.
   (d) (i) State the condition under which it is possible to obtain an ultra clean surface of a metal.
   (ii) Mention all the possible intermolecular forces of attraction involved in the interactions between water-oil phases.
   (iii) Write an the interfacial tension equation for all the forces of attraction mentioned in question (d) (ii) above.

3. (a) Mention five factors that affect the nature of a colloidal system.

(b) Briefly explain the following:
(i) Colloidal dispersion
(ii) True solutions of macromolecular
(c) State at least five differences between lyophilic and lyophobic.
(d) Explain adsorption isotherm and state the three phenomena that may be involved in physical adsorption.

4. (a) (i) How much work is needed to break up a mole of water into tiny droplets, each in the form of a sphere with a radius of 10^{-3} cm if the surface tension, γ of water is 0.0928 $N.m^{-1}$?
(ii) State the assumption made in your calculation in question (a) (i) above.
(b) (i) State two general methods of preparing sols or colloidal solutions.
(ii) Explain one of the methods of preparing sols mentioned in question (b) (i) above.
(c) Mention five applications of a colloidal system.

5. (a) (i) Derive the Kelvin Equation and state its application.
(ii) What is the ratio of the vapour pressure of water in droplet with radius, r = 1.0 μm compared to that for bulk water at 25 °C? For H_2O at 25 °C, $\gamma = 71.97 \times 10^{-3}$ $N.m^{-1}$ and $\rho = 0.997$ $g.cm^{-3}$.
(b) State at least five differences between physiosorption and chemosorption.
(c) Explain the two methods of purifying sols or colloidal solutions.