RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Science
Fourth Year – Semester II Examination – October/November 2014

CHE 4203- SURFACE AND COLLOIDAL CHEMISTRY

Answer **Only Four (4)** questions Time: Two hours

1. (a) Define sorption, sorbate, adsorption and ion exchange

[05 marks]

(b) Explain the following terms with suitable sketches (i) Substitutional solid solution (ii) Interstitial solid solution.

[05 marks]

(c) Discuss the importance of an interface and the characteristics of charged surfaces and surfaces as acid base reactants.

[10 marks]

(d) What is pH_{ZPC} describe the importance.

[05 marks]

2. (a) When a capillary tube is immersed in a liquid, the liquid will rise up the capillary or fall down. Explain this statement using figures.

[10 marks]

(b) The surface tension of mercury is 0.471N m^{-1} at 25^0C, while its density is 13.6 x 10^3 kg m^{-3}. To what depth will the mercury level be depressed inside a capillary of radius 1 mm when placed in a pool of mercury. (angle of contact $\theta=137^0$ and g=9.8m s^{-2}).

[05 marks]

(c) What pressure would be needed inside a bubble of water vapour of radius 0.1 mm in a medium of water at its standard boiling point to maintain equilibrium ?

[05 marks]

(d) Use the Clausius-Clapeyron equation to calculate the temperature that would be required to produce such a vapour pressure in order to sustain the bubble of water vapour. (Surface tension of water at the standard boiling point of 100^0C is 0.05885 Nm^{-1}, Enthalpy of vaporization of water at 100^0C = 40.67 k J mol^{-1}).

[05 marks]

3. (a) There are three types of colloidal systems describe with examples.

[05 marks]

(b) Deduce the Gibbs surface excess using relevant equations.

[10 marks]

(c) Starting from the derivative of Surface free energy derivde the Gibbs adsorption equation yielding for the interfacial phase.

[10 marks]

4. (a) Explain the types of Brunauer's classification of adsorption isotherms, using the relevant graphs showing the P^0 saturated vapour pressure.

[10 marks]

(b) Langmuir's isotherm describing the Adsorption of Adsorbate (A) onto the surface of the Adsorbant (S) needs three assumptions. Write the three assumptions and deduce the Langmuir absorption isotherm starting from a chemical reaction for monolayer adsorption.

[15 marks]

5. (a) Discuss the relationship between Zeta potential and surface potential for fresh water and saline water.

[10 marks]

(b) Explain the DLVO theory and the concept of double layer compression.

[05 marks]

(c) Distinguish between charge neutralization and charge reduction.

[05 marks]