



Uva Wellassa University, Sri Lanka
End Semester Examination – March 2011
SCT 431-1 Surface and Colloidal Chemistry



Time: One (01) hour

Total three (03) questions
Answer two (02) questions only

Universal gas constant, $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$
Plank's constant, $h = 6.626 \times 10^{-34} \text{ m}^2 \text{ kg s}^{-1}$
Acceleration due to gravity = 9.81 m s^{-2}

Density of water = 1 g cm^{-3}
1 atm = 101.325 kPa

Molar volume of ideal gas at standard temperature and pressure = $22.414 \times 10^3 \text{ cm}^3 \text{ mol}^{-1}$

- 01) a. State Young–Laplace equation. Identify all the terms therein.
b. State an application of Young–Laplace equation.
c. If a capillary is lowered into a liquid, the liquid often rises in the capillary until a certain height is reached. State an expression for the height of the liquid column in the capillary, identify the terms therein.
d. Water in trees rises in capillaries which are called xylem. If they are completely wetted ($\theta=0^\circ$) what should be the radius of the xylem to raise water from root to tip of a leaf at 2.5 m height. Assume that capillary rise is the only mechanism to raise water from root to leaves. Surface tension of water is 0.072 N m^{-1}

(50 marks)

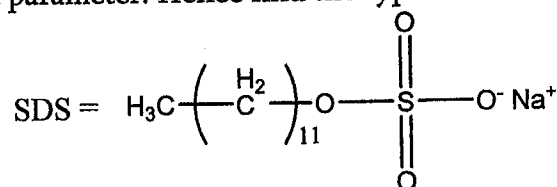
- 02) a. Define the following terms.
i. Adsorption
ii. Adsorption isotherm
b. Compare and contrast “physisorption” and “chemisorptions”.
c. State the Langmuir isotherm and identify the terms therein.
d. State the three main assumptions of Langmuir isotherm.
e. The following data have been obtained for the adsorption of H_2 on 1.00 g of copper surface at 0°C . The volume of H_2 below is the volume that the gas occupy at STP (0°C and 1 atm)

p / atm	0.050	0.100	0.150	0.200	0.250
V / cm^3	1.22	1.33	1.31	1.36	1.40

- i. Determine the volume of necessary to form a monolayer.
ii. Estimate the surface area of the copper sample. The density of liquid hydrogen is 0.708 g cm^{-3} .

(50 marks)

- 03) a. Define following terms
- i. Zeta potential
 - ii. Kraft temperature
 - iii. Critical micelle concentration.
 - iv. Amphiphilic molecule
- b. i. State an expression for the surfactant parameter and identify the terms therein.
 ii. The head group area of SDS in water (no additional background salt) is 0.62 nm^2 . Find the surfactant parameter. Hence find the type of the micelle formed.



- c. i. Compare and contrast "microemulsions" and "macroemulsions".
 ii. State an expression for the molar Gibbs energy of emulsification and identify the terms therein.
 iii. State two mechanisms of ageing of emulsions.
- d. Write short accounts on three of the following
- i. Colloids and nano particles
 - ii. Micelles
 - iii. Emulsions
 - iv. Surfactants

(50 marks)