Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Science and Technology Degree Programme
Fourth year First Semester Examination – July/August 2016
SCT 431-1 Surface and Colloidal Chemistry

Uva Wellassa University

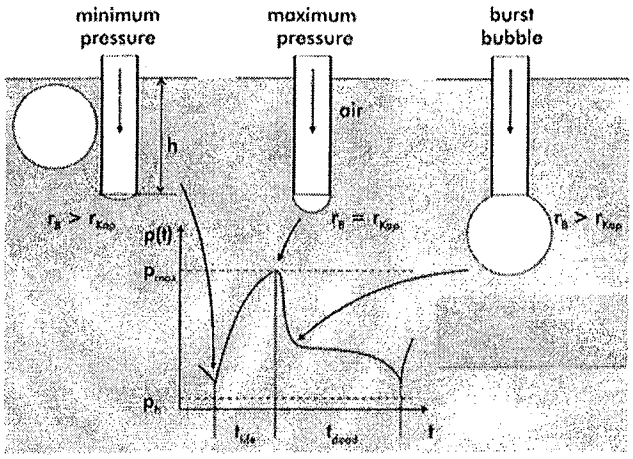
No. of Questions: Two (02)
Answer both questions
Time allocated: One (01) hour
Total Marks Allocated: One Hundred (100)

1. a. Define following terms related to surfaces. Use diagrams where necessary.
   i. Surface tension ii. Surface energy iii. Contact angle
   iv. Capillary rise v. Surfactant (10 marks)

b. In industrial processes measurement of surface tension is important. The maximum bubble pressure analysis is a technique used in many instruments (tensiometers) to measure surface tension.

i. State the Young- Laplace equation for a spherical surface and define the terms (5 marks)

ii. In the maximum bubble pressure method, bubbles are formed by air blowing through a capillary tube which is immersed in the liquid in which surface tension needs to be measured.



Derive the flowing relationship to measure surface tension of the liquid starting from Young-Laplace equation.

$$\gamma = \left(\frac{R_{kap}}{2}\right)(P_{max} - h\rho g)$$

where, γ is surface tension, R_{kap} is radius of the capillary tube, h is depth of tube immersed in liquid, ρ is density of the liquid. P_{max} is the pressure applied at maximum bubble pressure. (10 marks)

iii. Calculate the surface tension of the liquid if a capillary tube with 0.08 cm was dipped in 5 cm of liquid(density of 1.26 g/mL) when the maximum pressure is 1.15 atm. (1 atm = 1 x 10^5 Pa). (g = 10 ms^{-2}) (15 marks)

iv. List advantages and disadvantages of using this method to measure surface tension of a liquid. What could be possible correction factors that can be introduced increased the accuracy of the measurement? (6 marks)

v. List four other experimental methods that can be used to measure surface tension of a liquid. (4 marks)

2. a. State two phases present in following colloidal systems. Give one example for each type.

i. aerosols ii. sol

iii. emulsion iv. solid foam (10 marks)

b. Explain the difference between a true solution, suspension, and colloidal solution (10 marks)

c. What are the forces present in a colloidal system? Explain in terms of forces, what should be the condition to obtain a stable colloidal system? (10 marks)

d. The critical coagulation concentration (C_{cc}) of an electrolyte in a colloidal system is given in the following expression.

$$C_{cc} = \frac{8.7 \times 10^{-39}}{Z^6 A^2}$$

Use this expression to explain properties of an electrolyte which will facilitate coagulation. (10 marks)

e. Explain the following observation on flocculation when the electrolyte concentration is increased. (10 marks)

Electrolyte (M^{n+})content / moles	**Velocity (charge of system)**	**Observation**
0	3 (-)	Highly stable colloidal system
20×10^{-6}	2 (-)	Flocculation started after 4 hrs
30×10^{-6}	0 (0)	Flocculation is fast
40×10^{-6}	0.2 (+)	Flocculation started after 5 hrs
70×10^{-6}	1 (+)	Highly stable colloidal system