RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. Honours in Chemistry
Fourth Year – Semester II Examination – July 2020

CHE 4203 – SURFACE AND COLLOIDAL CHEMISTRY

Time: Two (2) hours

$R = 8.314\ J\ K^{-1}mol^{-1}$ $c = 3.0 \times 10^{8}\ m\ s^{-1}$ Boltzmaan constant, $k = 1.381 \times 10^{-23}\ J\ K^{-1}$

Answer **only** four (04) questions.

1.

a) i. Describe the basic requirements, a molecule should possess to be a surfactant and give two known examples. (19 marks)

ii. Design three imaginary surfactant molecules, belongs to three different surfactant categories which suits above requirements (structures should be different molecules from the examples given in part i). (21 marks)

b) i. Explain the capillary action by means of a liquid that does not wet the surface. (20 marks)

ii. "Capillary action cannot be used to get a continues flow". Discuss. (20 marks)

iii. Design a model emphasizing the limitations, to obtain a continues flow using the capillary action. (20 marks)

2.

a) Account for the colloids. Include but not limited to method of preparation and purification in your answer. (30 marks)

b) There are two immiscible liquids in a vessel, water (5 mL) and oil (50 mL).

i. Explain how to make a permanent dispersion out of these liquids. (20 marks)
ii. Describe a technique to identify the type of the dispersion. (10 marks)
iii. What type of dye one has to use to colour the prepared dispersion. (10 marks)

c) Demonstrate the stabilization of an emulsion by means of a surfactant. (30 marks)

3.

a) Explain how to use Langmuir trough method to estimate the cross-sectional area of a surfactant molecule. (30 Marks)

b) It is found that 0.768 mg of palmitic acid covers a 950 cm^2 of water surface at the point surface pressure starts rapid increasing. Estimate the cross sectional area (in nm^2) of a molecule. Given that molar mass of palmitic acid is 256 g mol^{-1}.

(20 marks)

c) Argue which of the two molecules; $C_{12}H_{25}COO^-Na^+$ or $C_{17}H_{35}COO^-Na^+$, has higher critical micelles concentration. (20 marks)

d) Obtain Gibb's adsorption isotherm for two component system where the solute is nonionic. Given that Gibb's adsorption isotherm is $d\gamma = -RT\ \Sigma\ \Gamma_i d(\ln a_i)$.

(30 marks)

4.

a) i. Elaborate dialysis in the context of colloidal chemistry (15 marks)

ii. Illustrate the importance of electrodialysis. (15 Marks)

b) For a surface,

$dG = -SdT + Vdp + \gamma dA + \Sigma\mu_i dn_i$

Derive the Kelvin equation starting from above relationship where γ is the surface tension and μ_i is the chemical potential of a liquid. Identify all the terms in the final equation. (50 marks)

c) Elaborate the detergency of a surfactant (35 marks)

5.

a) Describe the structure of foam and illuminate on the stability. (20 marks)

b) Write a short note on electrical double layer of a colloid particle. (40 marks)

c) Compare and contrast chemisorption and physisorption. (40 marks)

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