



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

**UNIVERSITY EXAMINATION FOR:**

**BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY:**

**BTAC 2014/S-FT AND BTAC 2015/S-PT**

**ACH 4313: SURFACE AND COLLOIDS CHEMISTRY**

**SPECIAL/SUPPLEMENTARY EXAMINATION**

**SERIES: JUNE 2017**

**TIME: 2 HOURS**

**DATE:** Pick Date Select Month Pick Year

## **Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of five questions. Answer question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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## **Question ONE**

(a) i. Define the following terms as used in surface and colloid chemistry.

- I. Surfactants (2 marks)
- II. Contact angle (2 marks)
- III. Surface free energy (2 marks)
- IV. Adsorption (2 marks)

ii. Distinguish between lyophilic sols and lyophobic sols. (4 marks)

(b) i. Write down a mathematical expression described by B.E.T adsorption isotherm and define all variables. (4 marks)

ii. Differentiate between emulsions and foams. (4 marks)

- iii.** Give any TWO general rules that have been developed to explain the biodegradation of most surfactant types. (2 marks)
- (c) i.** 2 g of nitrogen is adsorbed on 1.5 g of metal powder at 300 K and 0.7 atm. Express the mass, number of moles and volume of nitrogen at 300K and 0.7 atm and S.T.P respectively, adsorbed per gram of the adsorbent. (4 marks)
- ii.** In a coagulation experiment, 5 ml of  $As_2S_3$  sol is mixed with distilled water and 0.1 M solution of NaCl so that the total volume is 10 ml. It has been observed that all tubes containing more than 4.7 ml of sodium chloride coagulate within 5 minutes. Determine the flocculation value of NaCl for  $As_2S_3$  sol. (3 marks)
- iii.** State TWO general types of emulsions. (2 marks)

### Question TWO

- (a) i.** Define the term *electro-osmotic flow [EOF]* and write down a mathematical expression used to determine EOF. (6 marks)
- ii.** Outline the FOUR general groups of surfactants giving ONE example in each case. (6 marks)
- (b) i.** A gold sol contains 0.193 g of gold per  $dm^{-3}$ . The particles are spherical in shape with radius of 120 nm. If the density of gold is  $19.3 g cm^{-3}$ . Determine:
- I. The number of particles present in  $10^{-14}$  of the sol. (3 marks)
  - II. The interfacial area of the gold particle in  $1 m^3$  of the sol. (3 marks)
- ii.** State any THREE applications of each of the following:
- I. Surfactants in *Industry* (3 marks)
  - II. Surfactants in *Consumer* products (3 marks)

### Question THREE

- (a) i.** Define the term *coagulation*. (2 marks)
- ii.** Discuss briefly any TWO applications of colloids under the following classes.
- I. Natural applications (6 marks)
  - II. Technical applications (6 marks)
- (b) i.** The osmotic pressure of nitrocellulose has been measured at various concentrations, at  $27^{\circ}C$  and the graph drawn between  $\pi/c$  and  $c$  gives a straight line that has an intercept at  $c = 0$  and is equal to  $0.355 \text{ torr/g}^{-1}$ . Determine molecular weight of the nitrocellulose samples.  $[R = 0.082 \text{ L atm K}^{-1}\text{mol}^{-1}]$  (2 marks)

ii. State any FOUR characteristics of chemisorption. (4 marks)

#### Question FOUR

(a) i. Describe briefly purification of colloidal sols by *Ultrafiltration* method. (4 marks)

ii. Explain briefly the *Adsorption theory* of catalysis and what is meant by the term *shape selective catalysis*. (5 marks)

(b) i. 1 g of water of a water-insoluble substance of density  $0.8 \text{ g cm}^{-3}$  is dispersed in 2 liters of water, leading to the formation of a colloidal sol containing  $10^{13}$  particles of spherical shape per  $\text{mm}^3$ . Determine the radius of the particle. (6 marks)

ii. Draw a chemical structure illustrating cross-section of soap micelle in water. (5 marks)

#### Question FIVE

(a) i. State THREE methods used to stabilize foams. (3 marks)

ii. Electrophoresis has been applied to a variety of analytical separation problems. List FIVE such separation areas. (5 marks)

(b) i. State any FOUR factors affecting adsorption of gases on solids. (4 marks)

ii. Draw sketch curves represented by each of the following adsorption isotherms.  
I. BET isotherm  
II. Langmuir isotherm (6 marks)

ii. State any TWO applications of adsorption. (2 marks)