TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED CHEMISRTY

(ANALYTICAL AND INDUSTRIAL OPTIONS)

ACH 4313 : SURFACE AND COLLOID CHEMISTRY

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: APRIL 2016

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. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

(a) (i) Differentiate between "adsorption" and "absorption". (2 marks)

(ii) Briefly explain how variations in temperature and pressure influence the adsorption of a gas on a solid. (2 marks)

(iii) The Freundlich adsorption isotherm is represented by the empirical equation

$a = kp^n$. Explain the meaning of the terms in the equation. (2 marks)

(b) (i) State the major characteristic of a colloidal state. (1 marks)

(ii) Define the terms "disperse phase" and "dispersion medium" as applied to colloidal systems. (2 marks)

(iii) Explain the basic principles of the "condensation" and "dispersion" methods for the preparation of colloidal dispersions. (4 marks)

(c) (i) Define the terms "surface tension" and "interfacial tension". (2 marks)

(ii) Explain how the interfacial tension between the emulsifier and water or oil influences the stability of oil/water emulsions. (6 marks)

(d) (i) Define the term "sol". (1 mark)

(ii) Explain the basic principle of the ultracentrifuge method for macromolecular weight determination. (1 mark)

(iii) Explain why the macromolecular weights determined by the ultracentrifuge method are referred to as "**weight average molecular weight**" (M_w). (2 marks)

(iv) The rotor speed in an equilibrium ultracentrifuge study of a protein sol was found to be 1.65 x 10^4 rotations.min^{-1}. Calculate the angular velocity of the sol in rad.sec^{-1}. (5 marks)

Question TWO

(a) (i) State the basic principle of a chromatographic analysis. (1 mark)

(ii) Briefly explain how a separation of a mixture of compounds in solution can be accomplished by column chromatography. (5 marks)

(b) (i) Define the term "monomolecular film". (1 mark)

(ii) Using a sketch explain how a monolayer of a long-chain fatty acid sample is formed on the surface of water. (5 marks)

(c) Explain the difference between the following pairs of terms:

(i) "Electroosmosis" and "streaming potential". (2 marks)

(ii) "Ampholytes" and "zwitterions". (2 marks)

(iii) "Monodisperse" amd "polydisperse" sols. (2 marks)

(iv) "Adsorbent" and "adsorbate". (2 marks)

Question THREE

(a) (i) Explain the difference between "lyophilic" and "lyophobic" sols, giving TWO examples of each type. (4 marks)

(ii) State TWO factors which determine the stability of lyophilic sols. (2 marks)

(b) Explain why most solutes are generally more easily adsorbed from aqueous than from ethanolic solution. (4 marks)

(c) (i) Define the terms "foam" and "anti-foaming agent". (2 marks)

(ii) State TWO factors that influence liquid foam stability. (2 marks)

(iii) Briefly explain the conditions which necessitate the use of anti-foaming agents. (1 mark)

(iv) Explain the difference between "open-cell" and "closed-cell" solid foams. (2 marks)

(v) Give ONE application of liquid and TWO applications of solid foams. (3 marks)

Question FOUR

(a) (i) Define the term "amphiphile". (1 mark)

(ii) Briefly explain how an emulsifier enhances the stabilization of an oil-in-water emulsion. (3 marks)

(iii) Briefly discuss the stabilization of emulsions by solid emulsifiers. (4 marks)

(b) Explain the formation of a positively charged silver iodide sol. (4 marks)

(c) (i) Define the term "peptization". (1 mark)

(ii) Briefly explain how water peptizes a gelatin (lyophilic) sol. (3 marks)

(d) The interfacial tension between toluene and water at 25°C is 44.09 dynes.cm^{-1}, while the surface tension of water, at the same temperature, is 71.82 dynes.cm^{-1}. Determine the surface tension of toluene at 25°C. (4 marks)

Question FIVE

(a) Briefly describe the operation of the following methods for preparation of colloidal dispersions.

(i) Colloid mill. (3 marks)

(ii) Electrical disintegration. (3 marks)

(b) (i) State the TWO methods which can be used for the purification of colloidal dispersions, and . explain the basic principle on which EACH operates. (3 marks)

(ii) Briefly describe the operation of ultrafiltration method for the purification of colloidal dispersions. 3 marks)

(c) A monomolecular film containing 5.19×10^{-5} gram of hexadecanoic acid ($C_{15}H_{31}COOH$) spread on water occupied an area of 265 cm^2. Calculate the area occupied by one molecule.

{Avogadro's constant, $N_A = 6.023 \times 10^{23}$ mole^{-1}} (8 marks)