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

END OF SEMESTER 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 "physical (van der Waals') adsorption" and "chemisorption". (2 marks)

(ii) Explain the difference in the volumes in the physical adsorption of the following gases by 1 gram of charcoal at 25°C and 1 atm. pressure.

Gas	Volume adsorbed (cm3)
Carbon dioxide	50
Sulphur dioxide	400

(7 marks)

(b) (i) Explain the difference between a "true solution" and a "colloidal dispersion' (2 marks)

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

(c) (i) Explain the meaning of the term "**salting out**" as applied to lyophilic sols. (3 marks)

(ii) Briefly explain how the effect in (iii) above can be solved. (3 marks)

(d) The Gibb's equation for adsorption from solution is expressed as:

$S = -\frac{c}{RT}.\frac{d\gamma}{dc}$ for a dilute solution.

(i) Explain the meaning of the terms in the expression. (4 marks)

(ii) For a 0.05M solution of phenol in water at 20°C, the rate at which the surface tension varies with concentration, $-d\gamma/dc$, is 165 $erg.cm^2.mol^{-1}L$. Determine the amount of phenol adsorbed at the surface of the solution in $moles/cm^2$.

{$R = 8.314 \times 10^7$ $ergs.deg^{-1}mole^{-1}$} (4 marks)

(iii) Briefly explain the effect of phenol on the interfacial tension between the two liquids in view of the result in (ii) above. (2 marks)

Question TWO

(a) (i) Define the terms "tyndal effect" and "tyndal beam". (2 marks)

(ii) Draw a schematic diagram of an ultramicroscope and briefly explain how it works. (7 marks)

(iii) Give TWO applications of the tyndal beam. (2 marks)

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

(ii) A film containing 6.25×10^{-5} gram of octadecanoic acid ($C_{17}H_{35}COOH$) spread on water was compressed into a unimolecular film occupying an area of 16 x 18 cm. Calculate the cross-sectional area of one molecule.

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

Question THREE

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

(ii) State the TWO factors that influence the coagulation of lyophobic sols by electrolytes. (2 marks)

(iii) Differentiate between "electrical double layer" and "electrokinetic potential". (2 marks)

(iv) Explain how the electrical charge on colloidal particles contributes to the stability of lyophobic sols. (3 marks)

(b) (i) Define the term "adsorption isotherm". (1 mark)

(ii) Sketch a general adsorption isotherm of a gas by a solid at two different temperatures and explain the salient features of the plot. (7 marks)

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

(ii) Briefly describe ONE chemical and TWO physical methods of demulsification. (3 marks)

Question FOUR

(a) (i) Define the term "lyotropic series". (1 mark)

(ii) Explain the trend in the following part of the lyotropic series: $Li^+ > Na^+ > K^+$. (5 marks)

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

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

(ii) Using a sketch, explain the formation of "micelles" by detergent solutions. (6 marks)

(d) Explain the difference between "intrinsic" and "extrinsic" colloids, giving ONE example of each type. (3 marks)

Question FIVE

(a) (i) Define the term "colligative property". (1 mark)

(ii) Explain why the molecular mass determined by the osmotic pressure method is often referred to as the "**number average molecular mass**", (2 marks)

(iii) Explain why in the osmotic pressure method for macromolecular mass determination, the data are normally extrapolated to infinite dilution. (3 marks)

(b) (i) Define the term "electrophoretic mobility". (1 mark)

(ii) Calculate the velocity of a protein molecule of radius 2.0 nm and average charge of +5 in the direction of an applied potential gradient of 100 Vcm^{-1}.

{Mobility u $= \frac{eZ(Vm-1)}{6\pi r\eta}$; e = 1.602 x 10^{-19} C;

viscosity of water @ 20°C = 1.005 x 10^{-3} $Kgm^{-2}s^{-1}$} (6 marks)

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

(ii) Give two types of aerosol, briefly explaining their phase constitution. (2 marks)

(d) (i) State the TWO types of emulsion. (1 mark)

(ii) Describe a simple method which can be used to distinguish the TWO types of emulsion in (i) above. (3 marks)