# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

*(A constituent of JKUAT)*

**Faculty of Applied and Health Sciences**

**DEPARTMENT OF PURE AND APPLIED SCIENCES**

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

## ACH 4317 : SURFACE AND COLLOID CHEMISTRY

SPECIAL/SUPPLEMENTARY EXAMINATION

FEBRUARY 2013 SERIES 2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions
Answer question **ONE** (compulsory) and any other **TWO** questions

**Question ONE**

a) Explain the following terms:

(i) Critical surface tension **(2marks)**

(ii) Contact angle hysteresis **(2marks)**

b) Air is introduced through a nozzle into a tank of water to form a stream of bubbles. If the bubbles are intended to have a diameter of 2mm. Assuming that the value of surface tension between air and water is 72.7 x $10^{-3}$N/m, Calculate how much in pressure of the air at the tip of the nozzle must exceed that of the surrounding water. **(3marks)**

c) Explain the following experiments:

i) Sedimentation equilibrium **(2marks)**

ii) Sedimentation velocity **(2marks)**

d) Outline any TWO properties of foam extinguisher. **(2marks)**

e) Describe melting in terms of contact angle. **(3marks)**

f) (i) State Boyle-Van't Hoff's Law. **(2marks)**

(ii) The osmotic pressure of a solution containing30g of a substance in 1 litre solution at 20˚C is 3.2 atmospheres.

Calculate the sedimentation coefficient S given the molecular mass of solute as 228.

**(3marks)**

g) Why is nickel termed as a good catalyst? **(3marks)**

h) Outline any THREE features of chemisorptions. **(3marks)**

i) A tank containing $18m^3$ of water at 30˚C was added 2,000Kg of powder made up of uniform cubes 2.0mm on a side with a particle density of $2,000Kg/m^3$. Each cube covered a square array of surface sites, each of which is 1.0nm from its neighbor. Calculate the;

(i) Specific surface area

(ii) Area per ride of surface site.

**Question TWO**

The adsorption of nitrogen on Zinc oxide powder was studied at 77K. The volume (V) of nitrogen adsorbed measured at 273K and 1 atm on 7.40g of Zinc oxide was determined as a function of pressure, P. The results are given below. (Po for $N_2$ at 77K = 76 Torr).

| **P(Torr)** | **$V(10^{-6}m^3)$** | **$V(Po/p)^{-1}$** | **$1/v((Po/p)^{-1})$** | **$1/v((Po/p)^{-1})$** | **Po/P** | **P/Po** |
|---|---|---|---|---|---|---|
| 56 | 5.9 | | | | | |
| 96 | 6.4 | | | | | |
| 145 | 7.24 | | | | | |
| 223 | 8.58 | | | | | |
| 288 | 9.86 | | | | | |

i) Complete the table **(9marks)**

ii) Plot these data according to the BET isothern equation

$$1/V[(Po/P)^{-1}] = \frac{C - 1}{VmC}(p/Po) + \frac{1}{VmC}$$

**(5marks)**

iii) Determine Vm, the monolayer volume per gram of ZnO. **(3marks)**

iv) If the area occupied by one $N_2$ molecule is $16.2 \times 10^{-20}m^2$, Calculate the surface area of 1g of the ZnO powder. **(3marks)**

**Question THREE**

a) Discuss any TWO factors that affects viscosity. **(6marks)**

b) Explain the classification of shear thinning & shear thickening fluids. **(10marks)**

c) Explain the application of theology in the preparation of concrete paste. **(4marks)**

**Question FOUR**

a) (i) Name TWO probes commonly used during the measurement of surfaces tension using force tensionetry. **(2marks)**

(ii) Outline any FOUR advantages of using force tensiometers in contact angle measurements. **(4marks)**

(iii) Explain, with the help of an equation(s), any two experimental parameters that can be derived directly from contact angle and surface tension. **(6marks)**

b) Explain how colloids are

(i) Prepared by electrical dispersion method **(2marks)**

(ii) Purified by dialysis. **(2marks)**

**Question FIVE**

a) Describe the cleansing action of soap. **(10marks)**

b) (i) Outline any THREE advantages and disadvantages of using detergents. **(6marks)**

(ii) Give any FOUR differences between soaps and detergents **(4marks)**