



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied and Health Sciences

Department of Pure & Applied Sciences

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4313: SURFACE AND COLLOID CHEMISTRY

ORDINARY EXAMINATION

SERIES: December 2024

TIME: 2 HOURS

DATE: Pick Date December 2024

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) Define the term adsorption **(2marks)**
- b) Distinguish between colloidal system and micro-heterogeneous systems **(4marks)**
- c) Describe the following colloidal systems in terms of the dispersed phase and dispersion media giving relevant examples in each case.
 - (i) Solid foams **(2marks)**
 - (ii) Emulsions **(2marks)**
 - (iii) Gel **(2marks)**
- d) Explain how the following affect the colloidal solute size distribution **(4marks)**
 - (i) Adhesive forces
 - (ii) Repulsive forces
- e) State and explain **THREE** colloidal purification methods **(6marks)**
- f) Define fractional coverage **(2marks)**

QUESTION TWO

- a) Distinguish between foams and emulsions **(2marks)**
- b) What are the key features of water-in-oil and oil-in-water emulsions **(4marks)**
- c) Dilute foams are metastable and are more likely to be resistant to drainage. List **FOUR** factors that are likely to improve their drainage **(4marks)**
- d) A sample of charcoal weighing 6.00 g was brought into contact with a gas contained in a vessel of one litre at a temperature of 27 °C. The pressure of the gas was found to drop from 700 mmHg to 400

mmHg. Calculate the volume of the gas that is adsorbed per weight (in grams) of the adsorbent under the conditions of the experiment. The density of charcoal was 1.5 g cm^{-3}

(10marks)

QUESTION THREE

- a) Define desorption **(1mark)**
- b) Explain how the following methods can be used to determine the extent of gas adsorption
- (i) Pressure drop method **(3marks)**
 - (ii) Thermal Adsorption **(3marks)**
 - (iii) Radioactive Tracer Technique **(3marks)**
- c) Explain the following observations with respect to colloids
- (i) They aggregate easily **(2marks)**
 - (ii) They can be purified through dialysis with ease **(2marks)**
 - (iii) They have very low osmotic pressure **(2marks)**
- d) Distinguish between uni-molecular and multi-layer adsorption isotherms **(4marks)**

QUESTION FOUR

- a) The following data was obtained from the chemisorption of carbon monoxide gas on 3.022 g of charcoal at 0°C and 760 mmHg.

P(mmHg)	100	200	300	400	500	600
$V_a \text{ (cm}^3\text{)}$	10.2	18.6	25.5	31.4	36.9	41.6

- (i) Show that the data fit the Langmuir adsorption isotherm. $\theta = KP_a / (1 + KP_a)$ **(8marks)**
- (ii) Determine the value of the constant K and the volume corresponding to complete coverage (V_a^0) of the charcoal surface. **(5marks)**
- b) State the relationship between surface tension and temperature **(3marks)**
- c) State any **FOUR** applications of adsorption **(4marks)**

QUESTION FIVE

- a) Define surface tension **(1mark)**
- b) List **THREE** factors that affect critical micelle concentration **(3marks)**
- c) Describe the two stages of obtaining colloidal systems by condensation method **(8marks)**
- d) Explain how the following factors affect adsorption
- (i) Nature of the gas **(2marks)**
 - (ii) Temperature **(2marks)**
 - (iii) Pressure **(2marks)**
 - (iv) Nature of the adsorbent material **(2marks)**