



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied and Health Sciences

Department of Pure & Applied Sciences

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN ANALYTICAL CHEMISTRY

ACH 4306 : DRUG ANALYSIS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: APRIL 2025

TIME: 2 HOURS

DATE: Pick Date Apr 2025

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.

Question ONE

- (a) Using appropriate equations, explain how acetic acid in perchloric acid – acetic acid mixture behaves as a base. (4 marks)
- (b) 23.5 ml of perchloric acid (HClO_4) was titrated against 0.5 g of potassium hydrogen phthalate ($\text{C}_8\text{H}_5\text{O}_4\text{K}$) dissolved in 25 ml of glacial acetic acid. Calculate the concentration of perchloric acid. (Atomic masses: H = 1.008, C = 12.01, O = 16.00, Cl = 35.45, K = 39.10) (4 marks)
- (c) Explain the importance of pK_a values in drug administration. (6 marks)
- (d) Highlight tablet friability and its importance. (4 marks)
- (e) Provide any TWO factors affecting the stability of a complex with reference to the ligand. (4 marks)
- (f) Highlight the significance of a dissolution test in pharmaceuticals. (4 marks)
- (g) Describe the typical mobile and stationary phase for each of the following chromatography methods,

(i) Gas chromatography, GC, open tubular column (2 marks)

(ii) High performance liquid chromatography, HPLC. (2 marks)

Question TWO

(a) Describe Rate-Zonal Centrifugation separations. (10 marks)

(b) A drug has a partition coefficient of 9 between chloroform and water. Calculate the % of the drug that would be extracted from 10 ml of water with

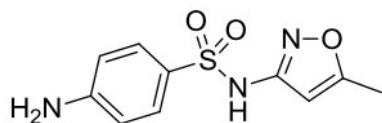
(i) 30 ml of chloroform (2 marks)

(ii) 3 x 10 ml of chloroform. (8 marks)

Question THREE

(a) Briefly describe how eluting conditions can be changed to improve separations in High Performance Liquid Chromatography (HPLC). (4 marks)

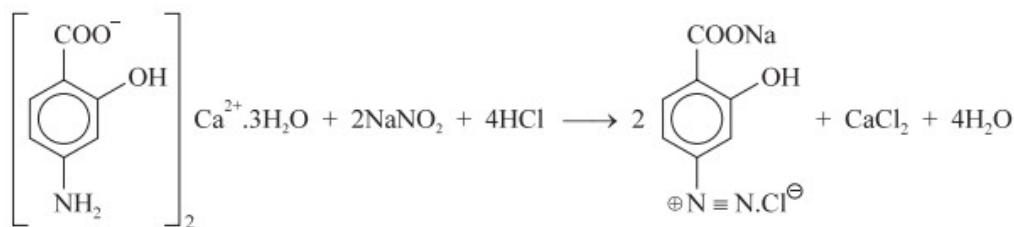
(b) Explain why the antibacterial agent Sulfamethoxazole ($pK_a = 4.6$) is a weak base, given the structure below.



Sulfamethoxazole
Antibacterial agent

(8 marks)

(c) In a diazotization titration, 27.4 ml of 0.1 M sodium nitrite in acid medium was used to titrate 0.5 g of calcium aminosalicylate (MW 344.38 g). Calculate the % purity of the calcium aminosalicylate sample.



(8 marks)

Question FOUR

(a) Outline the determination of water hardness by complex formation with EDTA. (14 marks)

(b) A 0.54 g sample of iron ore is dissolved in perchloric acid (HClO_4). The solution is filtered to remove solid matrix materials and made basic with addition of ammonium hydroxide. The iron precipitates as the $\text{Fe}(\text{OH})_3 \cdot x\text{H}_2\text{O}$ gel. The precipitate is ignited and 0.25 g Fe_2O_3 produced. Given the overall reaction: $2\text{Fe}^{3+} + 3\text{OH}^- \rightarrow \text{Fe}_2\text{O}_3 + 3/2 \text{H}_2$.

(i) Calculate the Gravimetric factor of Fe in the precipitate. (2 marks)

(ii) Calculate the weight of Fe in the precipitate. (2 marks)

(iii) Determine the wt. % of iron in the iron ore sample. (2 marks)

(Atomic masses: O = 16.0, Fe = 55.85)

Question FIVE

(a) Outline the Kjeldahl method for determination of total nitrogen in organic substances. (9 marks)

(b) Highlight the application of enzyme multiplied immunoassay technique (EMIT). (6 marks)

(c) Highlight the advantages of Fluorescence Polarization Immunoassay (FPIA). (5 marks)