MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
SECOND YEAR FIRST SEMESTER
SCHOOL OF PURE APPLIED AND HEALTH SCIENCES
BACHELOR OF SCIENCE IN CHEMISTRY

COURSE CODE: CHE 2110-1

COURSE TITLE: ANALYTICAL CHEMISTRY II

DATE: 6TH APRIL, 2022   TIME: 1100-1300 HRS

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **TWO** questions.
2. All Examination Rules Apply.

Question One (30mks)

a) The table below shows results for albumen levels in men obtained by two methods

Method 1	27	29	27	32	29	35	29	32
Method 2	31	33	37	37	35	29	30	34

Is there a significant difference between the two methods   **(8mks)**

b) State four factors to be considered when choosing a method for analysis
.   **(4mks)**

c) The essential metal ion content of urine specimen was determined using the ion selective electrode. The results obtained were; 102, 97, 99, 101 and 106. What is the 99% confidence limit of the ion concentration
.   **(4mks)**

d) An analyte eluded from a 12.2 m column in 400s. The width of the base of the peak was measured to be 13s. Calculate the number of plates and the plate heights   **(4mks)**

e) Two methods of analysis gave the following data;

Quantity	New method	Standard method
Sample mean	99.35	99.53
S^2	0.185	0.152
N	3	3

Are the two methods significantly different   **(4mks)**

f) The retention time for methane (t_M) which doesn't interact with stationary phase in a chromatography experiment is 42s and the retention times for benzene(t_R(B) and toluene (t_R(T) are 251s and 333s respectively. Calculate the capacity factors of benzene and toluene and the selectivity factor for the separation.   **(6mks)**

QUESTION TWO (20mks)

a) The following data were obtained in calibrating a turbidimeter for the determination of sulphate ions in natural water.

Mg SO_4^{2-}/L	0.00	5.0	10.0	15.0	20.0
Turbidimeter Reading	0.06	1.48	2.28	3.98	4.61

   i)   Calculate the means of the concentrations of sulphate ions and the instrument readings.   **(2mks)**
   ii) Calculate the slope (b) and intercept on y (a) and derive an equation of the best line of fit through the points.   **(5mks)**
   iii) From the equation of the best line of fit calculate the concentration of sulphate ions in water sample whose turbidimeter reading is 3.0.   **(1mk)**

iv) Using the product moment correlation coefficient (r) determine whether there exists a linear relationship between the readings.
. **(6mks)**

b) Explain the term retardation factor as used in chromatography **(2mks)**

c) State four factors that result to deviation from Beer's law in the absorption behaviour of solutions **(4mks)**

QUESTION THREE (20mks)

a) The following table shows the albumen concentration in g/Litre in the blood sera of 8 men and 8 women.

MEN	37	39	37	42	39	45	39	42
WOMEN	41	43	47	47	45	39	40	44

i) Calculate the standard deviations for the albumen levels in men and women. Do they differ significantly at 95% confidence level? .
. **(6mks)**

ii) Calculate the pooled standard deviation for the two sets of data and decide whether their means differ significantly at 95% confidence level. **(5mks)**

b) Describe the basic principle underlying the type of chromatographic equilibration processes. **(4mks)**

c) Briefly explain the steps you will follow in the separation and quantification of a mixture of organic compounds using thin layer chromatography (TLC) on a pre-coated plate. **(5mks)**

QUESTION FOUR (20mks)

a) Explain the need for separation of mixtures and state the two main categories of separation methods **(3mks)**

b) State any three non-chromatographic techniques. **(3mks)**

c) i) Describe ion exchange method of separation of mixtures **(2mks)**
Ii) Explain the two classifications of ion exchange resins **(2mks)**

d) A 2.8×10^{-4} M solution of potassium permanganate has an absorbance of 0.510 when measured in a 1.00 cm cell at 520 nm. Calculate the concentration in

i) Moles per litre **(3mks)**

ii) Parts per million of potassium permanganate ions in a solution that has absorbance of 0.697 when measured in a 5.00 cm cell at 520 nm
. **(3mks)**

e) Explain any two sources of band broadening in column chromatography **(4mks)**

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