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MAIN EXAMINATION

MAY – JULY 2016 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

SCHOOL FOCUSED PROGRAMME

CHEM 308: ANALYTICAL CHEMISTRY I

Date: JULY 2016	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions	

Q1. a) Statistical treatment of data is preferred as the last step in analysis. Define and state the purpose of the following statistical terms

i Median **(2 marks)**
ii Average deviation **(2 marks)**
iii Method error **(2 marks)**
iv Degree of freedom **(2 marks)**
v Confidence level **(2 marks)**

b) Analytical chemistry is a multidisciplinary field of study. Answer the following questions that relate to this field

i What are its TWO branches
ii State TWO roles of an analytical chemist
iii Explain random sampling in analytical chemistry
iv Describe how systematic errors can be identified in analytical chemistry.
v List TWO factors that would be considered in selecting methods of analysis. **(10 marks)**

c) The distribution co-efficient for a metal chalate partitioning between water and chloroform is 6.4. Calculate the fraction of chelate remaining when 25.0ML of 4.3×10^{-2}M of the metal chelate is shaken with

i One 10.0mL portion of chloroform **(5 marks)**
ii Two successive 5.0mL portions of chloroform **(5 marks)**

Q2. a) State for each of the following
i Ways of improving selectivity of a precipitating reagent
ii Personal errors
iii Properties of a good precipitate
iv Problem of trace analysis
v Ways of expressing accuracy

b) Define the following terms in chromatography
i Retention time **(2 marks)**
ii Resolution factor **(2 marks)**
iii Chromatography **(2 marks)**

c) Name TWO of each of the following in planar chromatography
i Steps involved **(2 marks)**
ii Modes of separation **(2 marks)**

Q3. a) List the steps involved in carrying out the following statistical test
i Student t-test when the true value is known **(3 marks)**
ii F-test **(3 marks)**
ii Q-test **(3 marks)**

b) Define the term masking **(1 mark)**

c) State an advantage of the following
i Metal chelate in solvent extraction
ii Digestion
iii Adding few drops of indicator during titration
iv Using specific container during sampling
v Classical techniques

Q4. The statistical data below was recorded after a chromatography experiment performed using two chromatographic techniques (TLC and PC)

	TLC	PC
Number of spots	5	6
Average distance of spots	4.1	3.3
Variance of distance of spots	0.02	0.04
Distance of standard spot	4.3	4.3

i State the degree of freedom for both techniques **(2 marks)**

ii Report the co-efficient of variation for TLC **(4 marks)**

iii Compare the variance for the distance of the spots **(5 marks)**

iv What are the absolute errors for both TLC and PC **(4 marks)**

v Evaluate the confidence limits of the average distance of the spots for PC. **(5 marks)**

Q5. a) State and explain the FOUR types of gravimetry. **(8 marks)**

b) Distinguish between the following

i Absorption and adsorption **(2 marks)**

ii Inclusion and occlusion **(2 marks)**

c) An ore containing magnetite Fe_3O_4 was analyzed by dissolving 1.5419g sample in concentrated HCl giving a mixture of Fe^{2+} and Fe^{3+}. After adding HNO_3 to oxidize any Fe^{2+} and Fe^{3+} the resulting solution was diluted with water and the Fe^{3+} precipitated as $Fe(OH)_3$ by adding NH_4OH. After rinsing the residue was ignited giving 0.8525g of pure Fe_2O_3. Calculate the % w/w Fe_3O_4 in the sample. **(8 marks)**

END