MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL AND BIOLOGICAL SCIENCES

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

SECOND YEAR **SECOND** SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY

ACH 208 – QUANTITATIVE ANALYSIS

DURATION: 2 HOURS

DATE: 16th April 2019

TIME: 9:00-11:00 am

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.
4. Statistical tables are attached on the back pages.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) List four factors of good quality control. (4 marks)

b) State three sampling techniques and briefly explain each of them (6 marks)

c) The replicate results in an analysis were 1.80, 1.58 and 1.64 ppm. Find the interval for which 50 chances out of 100 the mean would fall assuming s is a good approximation of δ. (4 marks)

d) Consider the following sample date consisting of five observations 0.142, 0.153, 0.135, 0.002 and 0.175. The fourth value appear anomalous. Test whether it should be rejected or retained using Q test at 95% confidence level. (3 marks)

e) Give three types of errors in an experimental data and briefly describe each of them. (6 marks)

f) The calcium in a 200ml sample of natural water from a spring was determined by precipitating the calcium as CaC_2O_4. The precipitate was filtered, washed and ignited in a crucible with an empty mass of 26.6002g. The mass of the crucible plus CaO was 26.7134g. Calculate the concentration of Ca in water in grams per 100ml of the water. (Ca=40, C=12.001, O=15.999) (4 marks)

g) Calculate the pH of 0.2mol dm^{-3} solution of methanoic acid, given that methanoic acid has Ka of 1.6×10^{-4} mol dm^{-3}. (3 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) A new procedure in determination of iron in kales was tested on a sample known from its method of preparation to contain 0.123% Fe. The results were in % Fe=0.112, 0.118, 0.115 and 0.119. Is the analyte accurate at 99% confidence level? (5 marks)

b) Given the following sample data from a chemist in analysis of a certain drug from same tables in milligrams, 0.3221, 0.3231, 0.3218, 0.3561 check whether the last value should be rejected using $4\bar{d}$ test. (4 marks)

c) (i) List four methods of data collection (4 marks)

(ii) State the method you would use in (i) above to study the effect of mercury in human beings with reasons. (2 marks)

d) A 0.2356g sample containing only NaCl and $BaCl_2$ yielded 0.4637g of dried AgCl. Calculate the percent of each halogen compound in the sample. (Na=23, Cl=35.54, Ba=137.3, Ag=107.9). (5 marks)

QUESTION THREE (20 MARKS)

a) $25cm^{-3}$ of a solution of sodium ethanediaote of concentration 0.1mol dm^{-3} were added into a titration flask. A burette was filled with potassium manganate (VII) solution of concentration 0.038 mol dm^{-3}. What volume of the potassium manganate (VII) solution is needed to give the endpoint in the titration? The equation for the reaction is;

$$5C_2O_4^{2-}{}_{(aq)} + 2MnO_4^{-}{}_{(aq)} + 8H^+ \rightarrow 10CO_{2(g)} + 2\,Mn^{2+}{}_{(aq)} + H_2O_{(l)}$$

(4 marks)

b) The analysis of Calcite sample yielded CaO % OF 55.95, 56.00, 56.04, 56.08 and 56.23. The last value appears to deviate from the lest. Use Tn test to determine whether it be rejected or retained. (4 marks)

c) Calculate the 90% confidence for 1.90 ppm measurement assuming s is good approximation of δ , to be 0.1ppm. State the interval the μ lies. (3 marks)

d) Describe two types of control chart in quality control. (4 marks)

e) Define:

i. A chelate

ii. A bidentate ligand (2 marks)

f) What will be the PH of a buffer solution made from a mixture of 0.2Moldm^{-3} aqueous ammonia and 0.1dm^{-3} ammonium chloride? Given pK_b for ammonia is 4.75. (3 marks)

QUESTION FOUR (20 MARKS)

a) Describe steps in designing a statistical study. (6 marks)

b) State three properties of a normal curve error. (3 marks)

c) A 0.8102 sample of impure $Al_2(CO_3)_3$ was decomposed with HCl; the liberated CO_2 was collected on calcium oxide and found to weigh 0.0515g. Calculate the percentage of aluminum in the sample (Al=26.98, C=12.01, O=15.999, Cl=35.54, H=1.008). (3 marks)

d) What are buffer solutions? (1 mark)

e) A chemist obtained the following data for the alcohol content of a sample of blood %: 0.084, 0.089, and 0.079. Calculate the 95% confidence limits of the mean. (4 marks)

f) A sample of blood was tested for zinc and the following results were obtained in ppm; 0.0132, 0.0135, 0.0131, 0.0145. Use the 3s test to determine whether the last value should be rejected. (3 marks)