

#### DEPARTMENT OF CHEMISTRY FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA SECOND SEMESTER EXAMINATION 2018/2019 SESSION

**COURSE CODE: CHM 324** 

**UNITS: 3** 

COURSE TITLE: ANALYTICAL CHEMISTRY TIME ALLOWED: 2 HOURS

INSTRUCTION: ANSWER ONE QUESTION ONLY FROM EACH SECTION

#### **SECTION A**

- **1.** (a) (i) Define the term *t-test*.
  - (ii) State three applications of t-test

### [5 Marks]

- (b) In a repeated analysis, the concentrations (mg/kg) of arsenic obtained from a sample of an industrial wastewater were; 2.24, 2.14, 2.18, 2.21 and 2.22.
- (i) Find the mean and the standard deviation of the values.
- (ii) Using student t-test, compare your mean in b (i) with expected value of 2.15, stating if there exists any significant difference. (t-tab = 1.11, at 95% Confidence Interval) [8 Marks]
- (c) When is a method of chemical analysis said to be rugged? [2 Marks]
  - 2. (a) The following data refer to the cyanide concentrations ( $\mu/g$ ) in a sample of foreign soft drink in replicate determinations: 14.17, 14.15, 14.24, 14.27, 14.01. Determine whether the value 14.27 should be accepted or not. ( $Q_{tab} = 0.54$ , at 95 % confidence interval). [3 Marks]
  - (b) (i) Define the term accuracy.
  - (ii) When is a result said to be highly accurate? [4 Marks]
  - (c) (i) Differentiate between systematic and random error. [4 Marks]
  - (ii) State two examples of systematic error. [2 Marks]
    - (iii) What are the ways in which systematic error could be eliminated? [2 Marks]

# **SECTION B**

- 3. (a) Highlight any four (4) operational steps in gravimetric analysis. [4 Marks]
- (b) Give the chemical structures and two ions the following organic compound precipitate.
  - i. 1- Nitroso-2- naphthol
  - ii. Dimethylglyoxime

[8]

#### Marks]

- (c) In the analysis of nickel content of steel us DMG as precipitating agent, what is the percentage of Nickel if 0.6472g of steel gives 0.1188g of Ni(DMG)<sub>2</sub> precipitate. [Molar masses: Ni = 58.69, Ni(DMG)<sub>2</sub> =288.91] [3 Marks]
- **4.** (a) Describe any four (4) methods in gravimetric analysis.

### [6 Marks]

(b) Distinguish between inclusion and occlusion adsorbed impurities with examples.

#### [3 Marks]

(c) Explain three ways to minimize precipitate impurities in gravimetric analysis.

# [3 Marks]

(d) A limestone sample weighing 1.5g was dissolved and the calcium content was precipitated with ethanedioic acid. The precipitate was ignited and weighed as CaO. Determine the percentage of  $CaCO_3$  in the sample if the CaO weighed 0.8g. [Molar masses:  $CaCO_3 = 100.09$ , CaO = 56.08]

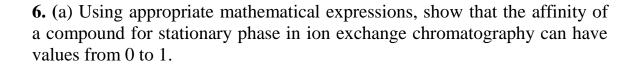
# [3 Marks]

# **SECTION C**

**5.** (a) Explaining all the terms used, show that the percentage extraction of a solute in a solvent extraction technique is given by the expression:

% Etraction (E) = 
$$\frac{100D}{D + V_{aq}/V_{org}}$$

(b) Discuss how a mixture of two solutes in an aqueous medium can be analysed using solvent extraction technique. [7 Marks]



#### [4 Marks]

- (b) Briefly explain the following terms as used in ion exchange chromatography.
- (i) Retention factor (ii) The basic principles [4 Marks]

### **SECTION D**

- 7. a) Define the term "Titrimetric analysis". [2 marks]
- b) Outline the quality of specific requirements a primary standard substance must meet.

# [3 marks]

- c) For the titration of 25.00cm<sup>3</sup> of 0.050 00 moldm<sup>-3</sup> NaOH with 0.250 00 moldm<sup>-3</sup>HCl, calculate the pH when the titre value is (i) 0.30Ve (ii) 1.10Ve **[10 marks]** 
  - 8. a) What is the;
- i) mass of CsOH required to prepare 250cm<sup>3</sup> of 0.020 00 moldm<sup>-3</sup> CsOH solution?

[Cs = 132.9; O = 16.0; H = 1.0]

- ii) pH of 0.020 00moldm<sup>-3</sup> CsOH solution? [3 marks]
- b) Derive an expression for acid dissociation constant. [3 marks]
- c) Briefly describe the four groups of titrimetric methods based on the type of reactions involved. [6 marks]