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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2020/2021 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: CHE 112**

**COURSE TITLE: ANALYTICAL CHEMISTRY I**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 10/10/2021 TIME: 3.00-5.00 PM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of FOUR (4) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Arsenic in multiple samples was determined using a standard method and a new developed method. seven different samples were analysed using the two procedures giving the following results in ppm

|  |  |  |
| --- | --- | --- |
| Sample  | Standard method | New Method |
| 1 | 10.5 | 10.3 |
| 2 | 10.4 | 10.7 |
| 3 | 12.7 | 11.9 |
| 4 | 8.6 | 8.7 |
| 5 | 11.5 | 11.3 |
| 6 | 12.1 | 13.1 |
| 7 | 15.2 | 13.1 |

1. Find the standard deviation of the difference. (4 marks)
2. If the two methods have comparable precisions, find whether there is any significant difference between the results of the two methods at the 95% confidence level. The tabulated t value for six degrees of freedom at 95% confidence level is 2.447. (4 marks)
3. Define the following Analytical Chemistry terms (8 marks)
4. Precision and Accuracy
5. Retention (Tr)and Adjusted Retention Time (Tr’)
6. Determinate and indeterminate errors
7. Back titration
8. Describe the following terms and state their acceptable values in a set of analytical analysis data? (3 marks)
9. LOD
10. LOQ
11. Describe the basic steps to be followed in a chemical analysis in Analytical Chemistry (3 marks)
12. State any three 2 Classical analytical techniques? (2 marks)
13. How many milliliters of 0.100M KI are needed to react with 40.00 ml of 0.0400 M Hg2(NO3) if the reaction is: Hg22+ + 2I- Hg2I2(s)? (6 marks)

**QUESTION TWO (2)-(20 marks)**

1. Describe in detail 3 application of Analytical chemistry in Real life experiences (6 marks)
2. Differentiate between (4 marks)
3. Qualitative analysis
4. Quantitative analysis
5. Which technique can be used to separate a soluble solid from the liquid that is dissolved in it? (2 marks)
6. State four desirable properties of standard solutions for Chemical Analysis (4 marks)
7. State the three types of chromatography and give their main features. (4 marks)

**QUESTION THREE (3)-(20 marks)**

1. Define the following chromatographic terms (4 marks)
2. Chromatogram
3. Peak resolution (R)
4. Number of theoretical plates (N)
5. Height of a theoretical plate (H)
6. Differentiate between grab and composite sampling (3 marks)
7. Name two extraction techniques of liquid- liquid mixtures (2 marks)
8. In the lab a student got the following 4 numbers for the concentration of chloride in a Sample: 0.1015, 0.0991, 0.1016, and 0.1017. Calculate the following using the above data;
9. The mean (2 marks)
10. The standard deviation (3 marks)
11. Check whether any point should be excluded at the 95% confidence level. Tabulated Q 95% = 0.829 for 4 observations (6 marks)arks

**QUESTION FOUR (4)** **- (20 marks)**

1. The amount of iron in a meteorite was determined by a redox titration using KMnO4 as the titrant. A 0.4185-g sample was dissolved in acid and the liberated Fe3+ quantitatively reduced to Fe2+, using a reductor column. Titrating with 0.02500 M KMnO4 requires 41.27 mL to reach the end point. Determine the %w/w Fe2O3 in the sample of meteorite. (15 marks)
2. In a chromatographic analysis, a sample gives a peak with a retention time of 6.68 min and a baseline width of 0.19 min. what are the Number of theoretical plates involved in this separation? Given that the column used in this analysis 3,0 meters long, what is the height of a theoretical plate? (5 marks)

**QUESTION FIVE (5)-(20 marks)**

1. What is a precipitate digestion and why is it important step in gravimetric analysis?

 (3 marks)

1. 0.8 g sample contains sulfur S (aw = 32) has been dissolved. The sulfur is precipitated as BaSO4 (mw = 233). If the weight of the precipitate is 0.3 g calculate the percentage of sulfur in the sample (3 marks)
2. Two students titrated a 100.00 mL sample of HCl with an unknown concentration with a standardized 0.1339 M NaOH sample.



The students obtained the following results:

|  |  |  |
| --- | --- | --- |
| NO.  | Student A (mL) | Student B(mL) |
|  | 23.17 | 25.25 |
|  | 22.69 | 25.19 |
|  | 23.25 | 25.23 |
|  | 22.97 | 25.23 |

1. Determine the average (mean) and standard deviation for each student’s data set

 (5 marks)

1. Which student was more precise? Explain (2 marks)
2. If the unknown HCl sample has a concentration of 0.0030 M, which student is more accurate? (2 marks)
3. Are the results (titration volumes) obtained by the two students significantly different at the 95% confidence level (Given: Spooled = 0.18)? (3 marks)
4. Using the Q test, decide if the second measurement (22.69 mL) for student A should be discarded? Q(tab) at 95% CL= 0.829 (2 marks)