W1-2-60-1-6

**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2014/2015**

**FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE**

**DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY/**

**INDUSTRY CHEMISTRY/ANALYTICAL CHEMISTRY**

**SCH 2304: ANALYTICAL CHEMISTRY I**

**DATE: APRIL 2015 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**

USE THE FOLLOWING INFORMATION WHERE APPROPRIATE

Qtab (n = 8) = 0.524 at 95% confidence level

ttab (df = 14) = 2.1418 at 95% confidence level

ttab (df = 7) = 2.3646 at 95% confidence level

Ftab (F7, 7) = 4.995 at 95% confidence level

ttab (df = 8) = 2.3060 at 95% confidence level

Qtab (n = 4) = 0.831 at 95% confidence level

**QUESTION ONE (30 MARKS)**

1. Distinguish between the following terms as used in fluorescence:
2. Pre-filter and post filter effect [2 marks]
3. Static and dynamic quenching [2 marks]
4. Internal and external conversion [2 marks]
5. Fluorescence and phosphorescence [2 marks]
6. i) Explain the principle of differential scanning calorimetry. [3 marks]

ii) Explain one application of thermal analysis. [1 mark]

1. Explain the characteristics of a sample that can be determined by:
2. UV/visible spectrophotometry [2 marks]
3. Photoluminescence methods [2 marks]
4. Infra-red spectroscopy [2 marks]
5. Distinguish between the following statistical terms:
6. Accuracy and precision [2 marks]
7. Histogram and bar chart [2 marks]
8. The concentration level of a lead in a sample of water was determined

by two methods (A and B). The following tabulated results were obtained.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Method A | Concentration of Lead in a sample of water (ppm) | | | | |
| 4.52 | 6.20 | 5.52 | 5.80 | 4.82 |
| Method B | 3.30 | 4.20 | 3.50 | 3.80 | 4.10 |

Using suitable parametric method, determine whether there is any significant

Difference in the results obtained by the two methods (A and B) at the 95%

confidence level. [8 marks]

**QUESTION TWO (20 MARKS)**

1. Three students (Anne, John and Tom) determined the level of iron in a food

supplement and obtained the following tabulated results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Anne | Fe (ppm) | | | |
| 4.52 | 3.85 | 5.20 | 3.75 |
| John | 3.30 | 3.85 | 3.50 | 4.10 |
| Tom | 4.85 | 4.70 | 4.75 | 4.70 |

Given that the actual Fe level in the food supplement is 4.0 ppm:

1. Provide
2. Ascending order of precision [2 marks]
3. Descending order of accuracy [2 marks]
4. Among the three students whose results are affected:
5. Most by random errors [1 mark]
6. Least by systematic error [1 mark]
7. Convert the data obtained by Anne to logarithm to the base 10.

Determine whether the largest value after this conversion is an outlier

at the 95% confidence level. [3 marks]

1. i) Explain the principle of atomic emission spectroscopy. [3 marks]

ii) Draw a block diagram of an atomic absorption spectrometer. [1 mark]

iii) Discuss each of the components of this instrument:

1. The most commonly used light source for this instrument [3 marks]
2. Nebuliser [1 mark]
3. Atomiser [1 mark]
4. Detector [2 marks]

**QUESTION THREE (20 MARKS)**

1. Draw a block diagram of a spectro-fluorimeter and discuss briefly the

various components of this instrument. [7 marks]

1. Explain the merits and demerits of photoluminescence methods compared

to absorption methods of analysis for molecular species. [3 marks]

1. Explain the following interference effects in atomic spectroscopy and how

each of these can be tackled:

1. Self absorption [2 marks]
2. Flame emission [2 marks]
3. Ionisation [2 marks]
4. Explain how you would quantitatively determine ascorbic acid (vitamin C)

in an orange juice sample using any suitable instrumental method of analysis

of your choice. [4 marks]

**QUESTION FOUR (20 MARKS)**

1. Distinguish between polarography and voltammetry. [2 marks]
2. Explain how lead in water sample can be quantitatively determined by

anodic stripping voltammetry. [4 marks]

1. The samples of honey were determined for fructose content using two

analytical methods (Method A and Method B). The following results

were obtained.

|  |  |  |
| --- | --- | --- |
| Sample | % Fructose | |
| Method A | Method B |
| 1 | 36.5 | 37.5 |
| 2 | 38.2 | 36.8 |
| 3 | 39.9 | 39.5 |
| 4 | 40.5 | 38.5 |
| 5 | 38.3 | 39.5 |
| 6 | 41.3 | 40.8 |
| 7 | 40.5 | 39.1 |
| 8 | 37.5 | 37.1 |

1. Using suitable parameter method, determine whether there was

significant difference in the results obtained by the two methods

at the 95% confidence level. [4 marks]

1. Establish whether there is any significant difference in the results

obtained by the two methods at the 95% confidence level, using any

suitable non-parametric methods. [3 marks]

1. Is the smallest value obtained using Method A an outlier at the

95% confidence. [3 marks]

1. Explain the advantages and disadvantages of using method of standard

addition compared to standard methods for calibration strategies. [4 marks]