

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

**THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF  
SCIENCE IN CHEMISTRY**

CHEM 361: RESEARCH METHODS

STREAMS: BSC Y3S2

TIME: 2 HOURS

DAY/DATE: THURSDAY 08/07/2021

5.00 P.M – 7.00 P.M

**INSTRUCTIONS:**

Answer question one and any other two questions

Use of calculators and statistical tables is allowed

Do not write anything on the question paper

**QUESTION ONE (30 MARKS)**

(a) Explain the following terms as used in research methods;

- |                          |          |
|--------------------------|----------|
| (i) Research             | [1 mark] |
| (ii) Null hypothesis     | [1 mark] |
| (iii) Experimental error | [1 mark] |
| (iv) Reliability         | [1 mark] |
| (v) Extraneous variable  | [1 mark] |

(b) (i) Outline the types of data measurements. [4 marks]

(ii) With an aid of a diagram, describe the process of identifying a research gap.

[5 marks]

(c) (i) Outline the four characteristics of the scientific method of inquiry. [4 marks]

(ii) Explain the characteristics of a good statement of the problem. [4 marks]

- (d) (i) Discuss two of the fundamental components that characterize every experimental design. [4 marks]
- (ii) Explain descriptive research design. [4 marks]

**QUESTION TWO (20 MARKS)**

- (a) Discuss four probability sampling techniques that a researcher may use during sampling. [8 marks]
- (b) In the determination of strontium in river water by flame emission spectrometry using the methods of standard additions, the following results were obtained:

Sr standard added ( $\mu\text{mL}^{-1}$ )	0.0	10.0	15.0	20.0	25.0	30.0
Emission signal	2.3	4.4	5.3	6.1	7.5	8.7

- (i) Fit a simple linear regression model [8 marks]
- (ii) Obtain a correlation coefficient [4 marks]

**QUESTION THREE (20 MARKS)**

Five laboratories (A, B, C, D and E) determine the concentration of Nickel naturally occurring in soils in mg/kg and obtained the following results:

Laboratories	Replicate 1	Replicate 2	Replicate 3	Replicate 4
A	12	12	8	7
B	19	8	11	10
C	7	8	9	13
D	6	9	8	8
E	20	15	14	17

Perform analyze of variance and test if the five laboratories yields significantly different results. Take  $\alpha = 0.05$  [20 marks]

**QUESTION FOUR (20 MARKS)**

- (a) Literature review is an important part of proposal writing . Discuss. [8 marks]
- (b) Discuss two characteristics of a good publication. [4 marks]
- (c) An analytical chemists claim that it is faster to test a water quality using analytical kit A than kit B. To test the claim, eight technician of proven ability were assigned each to the two kits and the time taken to carry out the analysis was recorded as follows: [8 marks]

Technician	1	2	3	4	5	6	7	8
Kit A	26	38	40	22	32	38	36	46
Kit B	34	44	44	28	28	42	34	48

At a 5% level of significance, determine if the analytical chemists' claim is valid. [8 marks]

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