

CHUKA



UNIVERSITY

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

CHEM 361: RESEARCH METHODS

STREAMS: BSC Y3S2

TIME: 2 HOURS

DAY/DATE: TUESDAY 16/04/2019

11.30 A.M. – 1.30 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, giving their possible sources:
- (i) Experimental error. (3 marks)
 - (ii) Sampling error. (3 marks)
- (b) (i) Outline the types of data measurements. (4 marks)
- (ii) Describe the steps in hypothesis testing. (4 marks)
- (c) With an aid of a diagram, describe the process of identifying a research problem. (8 marks)
- (d) (i) Outline the four characteristics of the scientific method of inquiry. (4 marks)
- (ii) Explain the following terms as used in experimental designs:
- (a) Randomisation. (2 marks)
 - (b) Replication. (2 marks)

QUESTION TWO (20 MARKS)

Five laboratories (A, B, C, D and E) determined the concentration of lead naturally occurring in soils in mg/kg and obtained the following results as shown in the table below.

Laboratories	Replicate 1	Replicate 2	Replicate 3	Replicate 4
A	22	22	18	17
B	29	18	21	20
C	17	18	19	23
D	16	19	18	18
E	30	25	24	27

Perform analyse of variance and test if the five laboratories yields significantly different results.

Take $\alpha = 0.05$ (20 marks)

QUESTION THREE (20 MARKS)

- (a) Literature review is an important part of proposal writing. Discuss. (10 marks)
- (b) The following set of measurements was taken from a soil sample on determination on nitrates ion in ppm: 63, 45, 67, 52, 39, 68, 48, 78, 66, 56, 35, 89, 46, 34, 61, 75 and 63. Construct a 95% and 99% confidence interval for the population mean. (10 marks)

QUESTION FOUR (20 MARKS)

- (a) An analytical chemist claims that it is faster to test 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:

Technician	1	2	3	4	5	6	7	8
Kit A	21	33	35	17	27	33	31	41
Kit B	29	39	39	23	23	37	29	43

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

- (b) Using the following data:
- (i) Fit a regression model. (8 marks)
- (ii) Obtain a correlation coefficient. (4 marks)

x	1	2	3	4	5	6	7
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y	7	11	16	21	28	33	36
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