

BINDURA UNIVERSITY OF SCIENCE EDUCATION

CHEMISTRY DEPARTMENT

COURSE: CH215: CHEMICAL RESEARCH METHODS & STATISTICS

2 HOURS

ANSWER QUESTION ONE AND FOUR OTHERS, TWO FROM EACH OF THE SECTIONS A AND B. EACH QUESTION CARRIES 20 MARKS

JUN 2023

1. (a) Define the following terms;
- (i) Certified reference material [1 marks]
 - (ii) Industrial standards [1 marks]
 - (iii) Method traceability [1 marks]
- In a laboratory accreditation test the following data were obtained.

Sample	ASTRA LAB	FSE LAB
1	129.5	132.3
2	89.6	91.0
3	76.6	73.6
4	52.2	58.2
5	110.8	104.2
6	50.4	49.9
7	72.4	82.1
8	141.4	154.1
9	75.0	73.4
10	34.1	38.1
11	60.3	60.1

Compute;

- (i) The mean [1 marks]
- (ii) The mode [2 marks]
- (iii) Standard deviation [2 marks]
- (iv) Relative standard deviation [2 marks]
- (v) Comment on the relative standard deviation you obtained in (iv) above. [2 marks]

- (vi) Is there a significant difference between the analysis of the two Laboratories. Show your working. **[8 marks]**

SECTION A: ANSWER ANY TWO QUESTIONS

2. (a) Discuss the purpose of a literature review study. **[12 marks]**
 (b) What are the contents of an abstract? **[6 marks]**
 (c) What is the purpose of blind and blank samples in research work? **[2 marks]**
3. (b) Design a quality assurance and quality control regime for HPLC analysis of a pesticide. **[4 marks]**
 (c) (i) What is calibration. **[4 marks]**
 (ii) Discuss the purpose for carrying out calibration in laboratory work. **[6 marks]**
 (d) Describe a quality assurance protocol for sampling water from a borehole for analysis of nitrates. **[6 marks]**
- 4 Describe a protocol for calibrating an HPLC UV VIS detector. **[20 marks]**

SECTION B: ANSWER ANY TWO QUESTIONS

5. In a research project a student obtained the following results;

Antibacterial activity by zone of inhibition (mm)

Extract A	Extract B	Extract C	Extract D	Cotrimoxazole
1.78	1.81	1.78	1.84	1.76
1.76	1.80	1.80	1.80	1.79
1.75	1.79	1.76	1.83	1.74
1.76	1.83	1.77	1.79	1.73
1.80	1.82	1.82	1.82	1.78

- (a) Is there a significant difference between antibacterial activity of the extracts and the standard drug cotrimoxazole? **[15 marks]**
 (b) Which extract(s) can be an alternative to cotrimoxazole? **[5 marks]**
6. The table below shows the observed pollution indexes of water samples from upstream **A** and downstream **B** of a gold mine.

Area A		Area B	
2.92	4.69	1.84	3.44
1.88	4.86	0.95	3.69
5.35	5.81	4.26	4.95
3.81	5.55	3.18	4.47

Is there enough evidence to suggest that the mine is polluting the stream? [20 marks]

- 7 A student analyzed the amount of arsenic in borehole water around the Chipadze area and obtained the following results in ppm;

1.25 1.26 1.29 1.56 1.46 1.23 1.49 1.27 1.31 1.43

The WHO maximum permissible limit is given as 1.30 ppm. Is the borehole water safe for drinking.

END OF PAPER