BINDURA UNIVERSITY OF SCIENCE EDUCATION

CHEMISTRY DEPARTMENT

JUN 2025

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

1. (a) When do you validate a method? **[10 marks]**

   (b) In a research project to determine the antidiabetic activity of zumbani plant flavonoids, a student obtained the following blood glucose levels in mg/dL in alloxan diabetes induced rats.

Sample	Standard drug	Zumbani flavonoids
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 **[2 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]**

SECTION A: ANSWER ANY TWO QUESTIONS

2. (a) Discuss the purpose of writing an abstract in a thesis. **[7 marks]**

   (b) What are the important aspects that should be included in a research background section? **[10 marks]**

   (c) What is the purpose of field blank samples in sampling? **[3 marks]**

3. (a) Design a quality assurance and quality control protocol for HPLC analysis of a pesticide. **[6 marks]**

   (b) (i) What is calibration? **[4 marks]**

   (ii) Discuss the purpose for carrying out calibration in laboratory work. **[6 marks]**

   (c) What are the disadvantages of case studies? **[4 marks]**

4 (a) Describe a protocol for sampling soil for heavy metal analysis. **[8 marks]**

(b) (i) What is the importance of a literature review? **[4 marks]**

(ii) List down method performance parameters? **[8 marks]**

SECTION B: ANSWER ANY TWO QUESTIONS

5. The table below shows the observed pollution indexes of samples along a stream passing a gold mine.

Area sampled	Pollution Index
Storm drain 1	2.92
10 m away from discharge point 1	1.84
Discharge point 1	1.88
Upper middle river position 1	0.95
1 m away from discharge point 1	5.35
Discharge point 2	3.81
Storm drain 2	4.69
Upper middle river sampling point 2	4.26
20 m away from discharge point 2	3.18
Discharge point 3	4.86
30 m away from discharge point 3	3.44
Upper stream from all effluent points	3.69
Downstream of all discharge points	5.84
Storm drain 3	5.55
Middle position of discharge point 2 and 3	4.95
20 m in stream from the stream banks	4.47

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

6. 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]**

7 An HPLC ES MS-MS method for analysis of the antioxidant TBHQ in cooking oil produced the results shown below;

Sample 1 212 mg/kg
Sample 2 210 mg/kg
Sample 3 198 mg/kg
Sample 4 138 mg/kg
Sample 5 220 mg/kg
Sample 6 250 mg/kg

What advice will you give to the consumers? **[20 marks]**
The maximum permissible limit is 200 mg/kg.

END OF PAPER