



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

ADVANCED SAMPLING AND SAMPLING METHODS

SCH 5104

End of Semester Examination Paper

DECEMBER 2024

This examination paper consists of 5 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

Examiner's Name: Dr P. Ncube

External Examiner: Dr. G. Mehlana

INSTRUCTIONS

1. Answer Any four (4) questions from the five (5) provided
2. Each question comprises various sub questions
3. Each question carries 25 marks
4. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
5.	25
TOTAL ATTAINABLE MARKS	100

QUESTION ONE

- 1.(a) The following two methods are used to collect information about the population. Define each term.
- (i) Census [2]
 - (ii) Sampling. [2]
- (b) List four advantages of sampling. [4]
- (c) Despite the advantages listed in question (b), sampling has some disadvantages. Name two such disadvantages and briefly explain each disadvantage. [2 x 2]
- (d) In sampling for analytical chemistry analysis, which method(s) of sampling is/are often preferred? Give relevant examples to justify your answer. [13]

QUESTION TWO

- 2 (a) State each of the following principles of sampling:
- (i) Principle of Statistical Regularity [2]
 - (ii) Principle of Validity [2]
 - (iii) Principle of Optimization [2]
- (b) What safety precautions need to be taken when sampling? List **FOUR** such precautions. [4]
- (c) When carrying out a sample survey, sampling errors may arise due to the fact that only a portion of the population has been used to estimate the parameters and draw inferences about the population. Discuss any **THREE** reasons that may result in sampling errors. [3 x 5]

QUESTION THREE

3. Copy and complete the table below to state **SAMPLE CONTAINER MATERIAL** used to collect samples of the different analytes (Use P for plastic, G for glass), state the **METHOD OF PRESERVATION** and **THE TIME TO KEEP SAMPLES BEFORE ANALYSIS**. Complete the information in the respective columns using the completed examples. [25]

TABLE 1: METHODS OF PRESERVATION FOR DIFFERENT DETERMINANTS FOR WATER SAMPLES

Analyte/Determinant	Sample container material	Method of preservation	Time between sampling and analysis
Alkalinity	P or G	Refrigerator at 4°C	24 hours
BOD	G		
Colour			
Phosphorus total			
Organic carbon			
Metals: Total			
Mercury			
Cyanide			
Sulfide		1 mol / litre Zn(OAc) ₂ , 2 ml per litre of sample, then 1 mol/ litre NaOH, 2 ml per litre of sample	
Dissolved Oxygen			

QUESTION FOUR

4 (a) State each of the following principles of sampling:

- (i) Principle of Statistical Regularity [2]
- (ii) Principle of Validity [2]
- (iii) Principle of Optimization [2]

(b) What safety precautions need to be taken when sampling? List **FOUR** such precautions. [4]

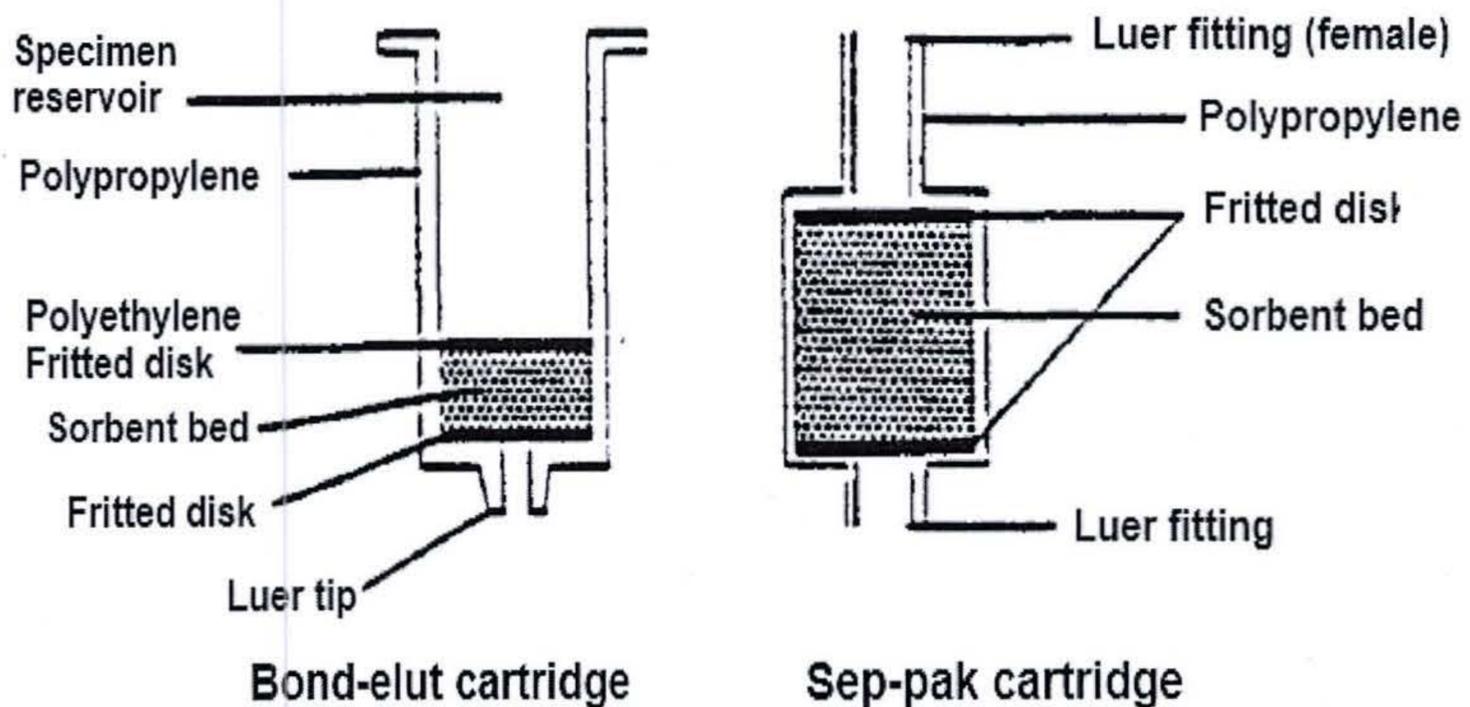
(c) When carrying out a sample survey, sampling errors may arise due to the fact that only a portion of the population has been used to estimate the parameters and draw inferences about the population. Discuss any **THREE** reasons that may result in sampling errors. [3 x 5]

QUESTION FIVE

5 (a) Define each of the following types of samples

- (i) Grab/catch samples [2]
- (ii) Composite samples [2]
- (iii) Integrated samples [2]

(b) The Figure below shows two different types of disposable cartridges used in solid phase extraction (SPE).



(b) (i) Name the common type of material used as the sorbent in SPE. [2]

(ii) Outline the five steps of extraction using SPE. [10]

(iii) Explain the difference in use of the above types of cartridges. [2]

(c) Solid phase microextraction (SPME) has experienced rapid development and growth in number of application areas since its inception over 20 years ago. It has had a major impact on sampling and sample preparation practices in chemical analysis, bioanalysis, food and environmental sciences.

Give a brief description of the principle of SPME, highlighting some applications of the extraction technique. [5]

*****END OF QUESTION PAPER*****