

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
END OF SEMESTER EXAMINATIONS – DECEMBER 2002
ANALYTICAL CHEMISTRY III – SCH 4206
TIME – 3 HRS

INSTRUCTIONS TO CANDIDATES

Answer **Any Four** questions.
Each question carries 25 marks.

1. Following the death of numerous deer near a pond in Hwange National Park, a park ranger consulted a chemist in the veterinary laboratory to help identify the cause of the problem so as to prevent further killings. A search carried out in the pond's surroundings (approx. 2 acres) revealed that the grass was wilted and discoloured. These observations lead to the speculation that a herbicide had been sprayed on the grass. A common ingredient of herbicides is arsenic. By employing the steps used in an analytical investigation, describe how the chemist would confirm the presence of arsenic and determine its concentrations in the sample. [25]
2. (a) What is a masking agent and how does it function? Give examples. [4]
(b) The average particle diameter of an ore sample is 2.0 mm. It is estimated that the stibnite content ($d_{Sb_2S_3} = 4.5 \text{ g cm}^{-3}$, 71.7 % Sb) is approximately 2.0%; the remainder has a density of 3.0 g cm^{-3} and contains about 1% Sb.
(i) How many particles of the ore should be taken if the relative standard deviation due to sampling is to be 1% or less?
(ii) What should the weight of the gross sample be?
(iii) To what diameter must the particles be ground in order to yield a sample for analysis that weighs 0.750g and has the same number of particles as the gross sample? [15]
(c) Discuss the sources of error in decomposition and dissolution of samples. [6]

3. (a) Discuss the advantages that microwave digestion has over the conventional flame methods. What are its disadvantages? [15]
- (b) With the aid of diagrams describe the vessels used for moderate pressure and high pressure microwave digestions. [10]

4. (a) The silver concentration in a sample of photographic waste was determined by atomic-absorption spectroscopy with the method of standard additions. The following results were obtained.

Added Ag: μg added per ml of original sample solution	0	5	10	15	20	25	30
Absorbance	0.32	0.41	0.52	0.60	0.70	0.77	0.89

Determine the concentration of silver in the sample, and obtain 95% confidence limits for this concentration. [15]

- (b) A method for the analysis of codeine in the prescription drugs yielded the following results when applied to a codeine free blank: 0.1, -0.2, 0.3, 0.2, 0.0, -0.1 mg codeine. Calculate the detection limit (in terms of milligrams or codeine) at the 99% confidence limit based upon the mean of (i) two analyses, (ii) four analyses and (iii) six analyses. [10]

5. (a) Describe the types of errors that may occur in a quantitative analysis. [10]

- (b) Discuss in detail, two quality control methods that you could apply to determine the quality of your analytical measurements. [15]

6. (a) Describe three extractions procedures? [10]

- (b) With the aid of relevant equations show how the pH and concentration of the reagent affects distribution ratios. [15]

END OF QUESTION PAPER!!!