



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY I

SCH 1206

Supplementary Examination Paper

August 2015

This examination paper consists of 3 printed pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr Audacity Maringa

INSTRUCTIONS

1. Answer any **FOUR** questions in this question paper.
2. Each question carries 25 marks.

MATERIAL NEEDED: Periodic Table

MARK ALLOCATION

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

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SCH 1206

1. (a). Explain the difference between:
- (i) Homogeneous and heterogeneous material
 - (ii) Specific and selectivity in a chemical analysis
 - (iii) Laboratory sample and replicate sample [6 marks]
- (b). What is the difference between a real sample and a standard sample? Give examples. [7 marks]
- (c). What are the factors that complicate a typical analysis? [3 marks]
- (d). Systematic errors can occur due to:
- (i) Instrumentation
 - (ii) Method
 - (iii) Human factors

Describe each of these, giving an example and state how these errors can be avoided. [9 marks]

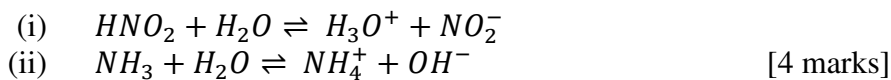
2. (a) Define the following:
- (i) Absolute errors
 - (ii) Mean
 - (iii) Median [6 marks]
- (b) Explain the differences between precision and accuracy. [4 marks]
- (c) Consider the following set of replicate measurements:
- A: 9.5, 8.5, 9.1, 9.3, 9.1
- B: 0.972, 0.943, 0.986, 0.937, 0.954
- Calculate:
- (i) Mean
 - (ii) Median
 - (iii) Range
 - (iv) Standard deviation
 - (v) Co-efficient of variation [15 marks]

3. (a) Define autoprotolysis. [2 marks]
- (b) Explain the common ion effect. [2 marks]

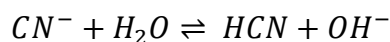
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(c) State the Le-Chatelier's principle and give an example. [4 marks]

(d) Write down the dissociation constant expression for the following equations:



(e) What is K_b for the equilibrium reaction?



$K_a = 6.2 \times 10^{-10}$ for HCN [4 marks]

(f) Calculate the solubility of $Ba(IO_3)_2$ in a solution prepared by mixing 200 mL of 0.0100 M $Ba(NO_3)_2$ with 100 mL of 0.100 M $NaIO_3$. The solubility-product constant for $Ba(IO_3)_2$ is 1.57×10^{-9} . [9 marks]

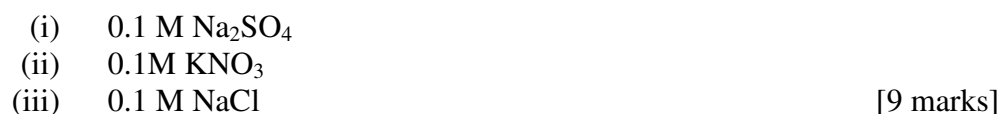
4. (a) Explain briefly the salt effect. [3 marks]

(b) Define the terms ionic strength, activity and activity coefficient. [6 marks]

(c) State the properties of activity coefficient. [5 marks]

(d) Explain why the solubility of an ionic compound increases as the ionic strength of a solution increases. [2 marks]

(e) Calculate the ionic strength of:



5. (a) Briefly explain back titration. [3 marks]

(b) What is a secondary standard? [2 marks]

(c) Describe the factors that are ideal for a standard solution. [8 marks]

(d) A 100 mL sample of brackish water was ammoniacal and the sulphide it contained was titrated with 16.47 mL of 0.0231 M $AgNO_3$. The analytical reaction is: $2Ag^- + S^{2-} \rightarrow Ag_2S$

Calculate the concentration of H_2S in water in parts per million. [12 marks]

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