



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY I

SCH 1206

Second Semester Examination Paper

May 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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1. (a). Distinguish between the following:
- i. A gross sample and a laboratory sample [2 marks]
 - ii. A real sample and a standard sample [4 marks]
- (b). Explain the following terms:
- i. Quantitative analysis [1 mark]
 - ii. Qualitative analysis [1 mark]
- (c). What are the steps taken in a chemical analysis? [6 marks]
- (d). In a chemical analysis, what is the function of a calibration curve? [3 marks]
- (e). Analytical methods are classified according to the nature of final measurements. Explain what each of the following methods is all about:
- i. Gravimetric methods [2 marks]
 - ii. Volumetric methods [2 marks]
 - iii. Electroanalytical methods [2 marks]
 - iv. Spectroscopic methods [2 marks]
2. (a). Define the following terms:
- i. Accuracy [2 marks]
 - ii. Precision [2 marks]
 - iii. Median [2 marks]
 - iv. Mean [2 marks]
- (b). What is the difference between systematic errors and random errors? [8 marks]
- (c). Find the mean, median, and standard deviation of the following data set:
39.83, 39.61, 39.25 and 39.68 [9 marks]
3. (a). Explain the term common ion effect. [3 marks]
- (b). What is solubility product? [2 marks]
- (c). Generate the solubility product constant expression for:
- i. CuBr [2 marks]
 - ii. HgCl [2 marks]
 - iii. PbCl₂ [2 marks]

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- (d). Calculate the solubility-product constant for each of the following substances, given that the molar concentration of their saturated solutions are as indicated:
- RaSO_4 ($6.6 \times 10^{-6} \text{ M}$) [3 marks]
 - $\text{Ce}(\text{IO}_3)_3$ ($1.9 \times 10^{-3} \text{ M}$) [3 marks]
- (e). The solubility product for $\text{Ce}(\text{IO}_3)_3$ is 3.2×10^{-10} . What is the Ce^{3+} concentration in a solution prepared by mixing 50 mL of 0.045 M Ce^{3+} with 50 mL of:
- Water [2 marks]
 - 0.045 M IO_3^- [2 marks]
 - 0.25 M IO_3^- [2 marks]
 - 0.05 M IO_3^- [2 marks]
4. (a). What is a buffer solution and what are its properties? [3 marks]
- (b). Define buffer capacity. [2 marks]
- (c). Write down the equilibrium reaction of acetic acid and water. [2 marks]
- (d). Calculate the pH of a buffer prepared by adding 10 mL of 0.1 M acetic acid to 20 mL of 0.1 M sodium acetate. $K_a = 1.75 \times 10^{-5}$ NB: State the assumption that you have used. [10 marks]
- (e). Calculate the pH of a solution prepared by adding 25 mL of 0.1 M sodium hydroxide to 30 mL of 0.2 M acetic acid. $K_a = 1.75 \times 10^{-5}$ [8 marks]
5. (a). Define the following terms:
- Millimole [2 marks]
 - End point [2 marks]
 - Stoichiometric ratio [2 marks]
 - Titration error [2 marks]
- (b). What variables can change the pH range of an indicator to shift? [2 marks]
- (c). Calculate the pH during titration of 50 mL of 0.05 M NaOH with 0.1 M HCl at room temperature after the addition of the following volumes of reagent:
- 24.50 mL [5 marks]
 - 25.00 mL [5 marks]
 - 25.25 mL [5 marks]

End of paper!!!!!!!!!!!!

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