



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
(SCIENCES)
1ST YEAR SECOND SEMESTER 2023/2024 ACADEMIC YEAR
MAIN REGULAR

COURSE CODE: SPB 9112

COURSE TITLE: BASIC ANALYTICAL CHEMISTRY

EXAM VENUE:

DATE:

TIME:

EXAM SESSION:

STREAM:

INSTRUCTIONS:

- 1. Answer question 1 (Compulsory) in section A and ANY other 2 questions in Section B.**
 - 2. Candidates are advised not to write on the question paper.**
 - 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**
-

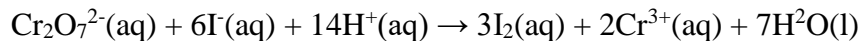
Question (30 marks)

- Describe the various steps in analytical analysis (6 marks)
- Describe the various types of sampling methods (10 marks)
- Describe the categories of separation methods alongside the principle behind each separation method (7 marks)
- Outline the steps in gravimetric analysis (7 marks)
- Explain the following terms; (2 marks)
 - Precision and accuracy
 - spectroscopy

SECTION B

Question 2

- Calculate the mass in grams of Na^+ (22.99 g/mol) in 25.0 g of Na_2SO_4 (142.0 g/mol) (5 marks)
- Describe the preparation of 500 mL of 0.0740 M Cl^- solution from solid $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ (244.3 g/mol) (5 marks)
- By titration you find that 15.0 cm^3 of hydrochloric acid neutralise 25.0 cm^3 of a 0.100 mol dm^{-3} solution of sodium hydroxide. What is the concentration of hydrochloric acid? (5 marks)
- A standard solution is prepared by dissolving 1.185g of potassium dichromate(VI) and making up to 250 cm^3 of solution. This solution is used to find the concentration of a sodium thiosulphate solution. A 25 cm^3 portion of the oxidant was acidified and added to an excess of potassium iodide to liberate iodine:



When the solution was titrated against sodium thiosulphate solution, 17.5 cm^3 of 'thio' was required. Find the concentration of the thiosulphate solution. (5 marks)

Question 5

- Solute A has a $K = 3$ for an extraction between water (phase 1) and benzene (phase 2).
If 100 mL of a 0.01M solution of A in water is extracted one time with 500 mL benzene, what fraction will be extracted? (5 marks)
- The retention volume of a solute is 76.2 mL for a column with $V_m = 16.6$ mL and $V_s = 12.7$ mL. Calculate the capacity factor and the partition coefficient for this solute. (5 marks)

- c. Two compounds with partition coefficients of 15 and 18 are to be separated on a column with $V_m/V_s = 3.0$ and $t_m = 1.0$ min. Calculate the number of theoretical plates needed to produce a resolution of 1.5. (5 marks)
- d. What mass of Ag_2CO_3 275.7 g/mol is formed when 25.0 mL of 0.2 M AgNO_3 are mixed with 50.0 mL of 0.0800 M Na_2CO_3 ? (5 marks)

Question 5

- a. What will be the molar analytical concentration of Na_2CO_3 in the solution produced when 25.0 mL of 0.200 M AgNO_3 is mixed with 50.0 mL of 0.08 M Na_2CO_3 (5 marks)
- b. In a sample with an absorbance of 1 at a specific wavelength, what is the relative amount of light that was absorbed by the sample (5 marks)?
- c. Guanosine has a maximum absorbance of 275 nm, $\epsilon_{275} = 8400 \text{ M}^{-1} \text{ cm}^{-1}$ and the pathlength is 1. Using a spectrophotometer, you find the that $A_{275} = 0.70$. What is the concentration of guanosine (5 marks)?
- d. There is a substance in a solution (4 g/liter). The length of cuvette is 2 cm and only 50% of the certain light beam is transmitted. What is the extinction coefficient (5 marks)?

Question 5

- a. The absorption coefficient of a glycogen-iodine complex is 0.20 at light of 450 nm. What is the concentration when the transmission is 40 % in a cuvette of 2 cm (5 marks)?
- b. The following results were obtained in the replicate determination of the lead content of a blood sample: 0.752, 0.756, 0.752, 0.751, and 0.760 ppm Pb. Find the mean and the standard deviation of this set of data. (5 marks)
- c. An iron ore was analyzed by dissolving a 1.1324g sample in concentrated HCl. The resulting solution was diluted with water and the iron(III) was precipitated as the hydrous oxide $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ by the addition of NH_3 . After filtration and washing, the residue was ignited at a high temperature to give 0.5394g of pure Fe_2O_3 (159.69 g/mol). Calculate;
 - i. The % Fe (55.847 g/mol) (5 marks)
 - ii. The % Fe_3O_4 (231.54 g/mol) (5 marks)