



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
BACHELOR OF SCIENCE HONOURS DEGREE
END OF SECOND SEMESTER EXAMINATIONS – APRIL 2014
ANALYTICAL CHEMISTRY I – SCH 1206
TIME: (3) THREE HOURS

MATERIAL
Periodic Table

INSTRUCTIONS TO STUDENTS
Answer any FOUR questions in this question paper.
Each question carries 25 marks.
TOTAL MARKS-100

1. (a). Consider the following set of data and answer the questions that follow:

Trial Number	Value	Trail Number	Value
1	0.00452	4	0.00447
2	0.00463	5	0.00448
3	0.00453	6	0.00458

Calculate the following. Show all work including equations.

- Mean
- Median
- Range
- Standard Deviation
- Relative Standard Deviation

If the accepted value or true value is 0.00450 calculate:

- absolute error of the mean
- relative error of the mean. [17]

- (b). Consider the following set of replicate measurements:

0.624, 0.613, 0.596, 0.607, 0.582

- Calculate the 95% confidence limit. What does it mean? [8]

2. (a). $\text{Fe}(\text{OH})_2$ has a K_{sp} of 7.9×10^{-16} . What is the molar concentration of Fe^{2+} and OH^- in a saturated solution of $\text{Fe}(\text{OH})_2$. What is the pH of this solution? What is the solubility of $\text{Fe}(\text{OH})_2$ in g/l? [10]

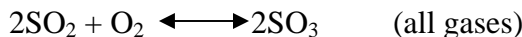
- (b). What is the pH of a 0.05M solution of benzylamine? (The K_a of benzylamine is 4.5×10^{-10}). [10]

- (c). Calculate the solubility product constant for a 4.7×10^{-6} M Ag_3PO_4 solution. [5]

3. (a). A 50.00 mL aliquot of 0.100 M of ammonia is titrated with 0.100 M HCl.
Calculate the pH after addition of;
- 0.00
 - 15.00
 - 50.00
 - 55.00
 - 60.00 mL of titrant.

Plot the titration curve and with a reason suggest a suitable indicator. [15]

- (b). 2 mols of O₂ and 2 mols of SO₂ are placed in a 1 dm³ container and allowed to come to equilibrium:

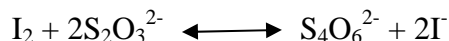


The total pressure is 10 atm. If the number of mols of O₂ at equilibrium is 1.5, calculate K_p at the same temperature. [5]

- (c). Iodine is used as a disinfectant for superficial wounds. The gaseous form is produced from hydrogen iodide. 3.20 g of hydrogen iodide is pumped into an empty container of volume 1 dm³ where the following equilibrium is eventually established:



At equilibrium it is found that the I₂ reacts with 37.0 cm³ of 0.20 M sodium thiosulphate according to the equation:



Calculate K_c. [5]

4. (a). Define the following terms;
- Buffer
 - Buffer capacity
 - Sampling
 - Le Chateliers principle
 - Common ion effect
- [10]

- (b). What is the difference between:
- a primary standard and a secondary standard
 - an endpoint and an equivalence point
 - formal concentration and molar concentration
 - a Fajans titration and a Volhard titration
 - a Lewis base and a Bronsted-Lowry Base
- [10]

- (c). List at least five desirable properties of a primary standard. [5]

5. (a). A sample of propanoic acid $\text{CH}_3\text{CH}_2\text{COOH}$ ($K_a = 1.3 \times 10^{-5}$) of mass 0.400g was dissolved in water to give a solution of total volume 50.00cm^3 . This solution was then titrated with 0.15 M NaOH. Calculate the pH of the solution at the end point. [8]
- (b). Calculate the volumes of 0.02 M HCl and 0.02 M base ($K_b = 8.1 \times 10^{-8}$) should be mixed to make 100cm^3 of buffer solution of pH 7.00. [assume that the acid and base react in a ratio of 1:1]. [4]
- (c) What are argentometric methods of analysis? [2]
- (d) Briefly describe two different types of chemical indicator methods used in argentometric titrimetry. [6]
- (e). Describe the direct titration procedures used in complexometric titrations using EDTA [5]

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