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

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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.

i. Mean
ii. Median
iii. Range
iv. Standard Deviation
v. Relative Standard Deviation

If the accepted value or true value is 0.00450 calculate:

vi. absolute error of the mean
vii. relative error of the mean. [17]

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

0.624, 0.613, 0.596, 0.607, 0.582

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

2. (a). $Fe(OH)_2$ has a Ksp of 7.9×10^{-16} . What is the molar concentration of Fe^{2+} and OH^- in a saturated solution of $Fe(OH)_2$. What is the pH of this solution? What is the solubility of $Fe(OH)_2$ 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;
   i. 0.00
   ii. 15.00
   iii. 50.00
   iv. 55.00
   v. 60.00 mL of titrant.

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

   (b). 2 mols of O_2 and 2 mols of SO_2 are placed in a $1dm^3$ container and allowed to come to equilibrium:

   $$2SO_2 + O_2 \longleftrightarrow 2SO_3 \qquad \text{(all gases)}$$

   The total pressure is 10 atm. If the number of mols of O_2 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 dm^3 where the following equilibrium is eventually established:

   $$2HI(g) \longleftrightarrow H_2(g) + I_2(g)$$

   At equilibrium it is found that the l_2 reacts with 37.0 cm^3 of 0.20 M sodium thiosulphate according to the equation:

   $$I_2 + 2S_2O_3^{2-} \longleftrightarrow S_4O_6^{2-} + 2I^-$$

   Calculate K_c. [5]

4. (a). Define the following terms;
   i. Buffer
   ii. Buffer capacity
   iii. Sampling
   iv. Le Charteliers principle
   v. Common ion effect [10]

   (b). What is the difference between:
   i. a primary standard and a secondary standard
   ii. an endpoint and an equivalence point
   iii. formal concentration and molar concentration
   iv. a Fajans titration and a Volhard titration
   v. 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 CH_3CH_2COOH ($K_a = 1.3 \times 10^{-5}$) 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 HCI and 0.02 M base ($K_b = 8.1 \times 10^{-8}$) should be mixed to make 100 cm^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!!!!!!!!!!