THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

132/3A

CHEMISTRY 3A
ALTERNATIVE A PRACTICAL
(For Both School and Private Candidates)

Time:* 3 Hours** ***Wednesday, 10th February 2010 a.m.

INSTRUCTIONS

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **one (1)** carries 20 marks and the other **two**, 15 marks each.
4. Non-programmable calculators may be used.
5. Cellular phones are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet.
7. You may use the following constants:
   Atomic masses:
   H = 1, O = 16, S = 32, Cl = 35.5, K = 39, I = 53

This paper consists of 5 printed pages.

1. You are provided with the following:

Q_1: A solution made by dissolving 7 g of iron (II) sulphate crystals ($FeSO_4.xH_2O$) in 1000 mls of boiled and cooled dilute sulphuric acid.

Q_2: 0.02M $KMnO_4$ solution.

Q_3: Dilute sulphuric acid.

Procedure:

(i) Pipette 20 cm^3 or 25 cm^3 of Q_1 into a conical flask, add 20 cm^3 of Q_3.

(ii) Titrate the mixture containing Q_1 and Q_3 using Q_2 until purple colour appears. Record the results of your titrations as shown in the following table:

The volume of pipette used was_____cm^3.

Burette readings:

Titration no.	Pilot	1	2	3
Final volume (cm^3)				
Initial volume (cm^3)				
Titre value (cm^3)				

Summary:

_____cm^3 of the mixture of Q_1 and Q_3 required _____cm^3 of Q_2 to complete reaction.

Questions:

(a) Write the ionic equation of half reaction taking place in this experiment.

(b) Write the overall ionic reaction equation.

(c) Calculate the molarity of the iron (II) sulphate crystals in solution.

(d) Calculate the value of x, the number of water of crystallization in the sample.

(e) Why do we heat the dilute sulphuric acid during the preparation of the solution for this experiment? **(20 marks)**

2. You are provided with the following:

Y_1: Solution of 0.02M iodine dissolved in 0.2M KI

Y_2: 0.25M acetone solution

Y_3: 0.50M sodium hydrogen carbonate solution

Y_4: 0.01M sodium thiosulphate solution

Y_5: 1.00M sulphuric acid

T: Starch solution.

Theory:

Acid catalysed iodination of acetone in aqueous solution may be represented by the following reaction equation:

$$I_{2(aq)} + CH_3\text{-}\underset{\underset{O}{\|}}{C}\text{-}CH_{3(aq)} \xrightarrow{H^+} ICH_2\text{-}\underset{\underset{O}{\|}}{C}\text{-}CH_{3(aq)} + HI_{(aq)} \quad \ldots\ldots\ldots\ldots(1)$$

This reaction proceeds at a fairly slow rate. The reaction between sodium thiosulphate and iodine can be represented as follows:

$2S_2O_3^{2-} + I_2(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}$ .....(2)

The rate of reaction in number (1) depends on the concentration of acetone and iodine. When a large excess of acetone is used such that its concentration is virtually unchanged throughout the reaction, the dependence of the reaction (1) on the concentration of iodine may be studied. The reaction in number (1) may be carried out by titrating small portions of the reaction mixture with sodium thiosulphate using starch indicator.

Procedure:

(i) Using a measuring cylinder, put 80 cm^3 of Y_1 into a conical flask; into a second flask put 40 cm^3 of Y_2 and 40 cm^3 of Y_5. In the third conical flask put 15 cm^3 of Y_3. At a convenient time, pour the contents of the first flask (Y_1) into the second flask. Immediately start the stop clock and shake well the mixture for at least one minute to ensure thorough mixing. Put Y_4 solution into a burette ready for titration.

(ii) After about 5 minutes, pipette a 10 cm^3 portion of the reaction mixture into the third flask containing Y_3. Note the exact time when you do this. Shake the flask. When the effervescence has ceased, titrate the residual iodine in the flask with the sodium thiosulphate solution Y_4, using starch indicator. The indicator is only used towards the end point of the titration.

(iii) Repeat procedure (ii) at intervals of time such as 10, 15, 20, 25, 30 and 35 minutes. Tabulate your results as shown in the following table:

Results:

Time in minutes	Volume of Y_4 used in cm^3	Concentration of iodine (M)	1/Conc. of iodine
5			
10			
15			
20			
25			
30			
35			

Questions:

(a) Use your results to fill the blank columns in the table.

(b) Using your results, draw the following graphs:

(i) Concentration of iodine against time

(ii) 1/Conc. of I_2 against time.

(c) Comment on the shapes of each of the graphs drawn.

(d) What is the order of reaction with respect to iodine? Give reasons.

(15 marks)

3. You are provided with the following:

P: Iso-butanol

Q: 1M sodium hydroxide solution (NaOH)

R: 0.1M sodium hydroxide solution (NaOH)

S: Glacial acetic acid (CH_3COOH)

TT: Distilled water

U: Phenolphthalein (P.O.P) indicator.

Procedure:

(i) Put Q in a burette.

(ii) Measure 2 cm^3 of S and put it into 20 cm^3 of each of TT and P in a separating funnel and shake for three minutes.

(iii) Allow it to settle and run off the lower layer of TT, discarding the boundary layer near the point of separation between TT and P.

(iv) Titrate 10 cm^3 of TT layer with Q in the burette using U as indicator. Record the results.

(v) Titrate 10 cm^3 of P layer with R in burette. Using U as indicator.

(vi) Repeat the experiment by using 3 cm^3 of S.

NB: Allow plenty of time when titrating against the iso-butanol solution and shake between each addition. Record your results as follows:

Results:

Volume of S (cm^3)	**Volume of R for 10 cm^3 of P layer (cm^3)**	**Volume of Q for 10 cm^3 of TT layer (cm^3)**	**$\frac{10 \times \text{volume of S in TT}}{\text{Volume of S in P}}$**	**$\frac{10 \times \text{volume of S in TT}}{\sqrt{\text{Volume of S in P}}}$**
2				
3				

Questions:

(a) Complete the table above.

(b) What can you say about the two partition coefficients in the last two columns?

(c) Name three conditions needed for the partition of a given solute between two immiscible solvents to be constant.

(d) What can you then conclude from the above experiment? **(15 marks)**