Chemistry TAS Report

1. Experiment Number : 2
2. Date : 21/9/07
3. Title : An acid-base titration

4. Aims/Objective :
   To determine the concentration of the sodium hydroxide solution.

5. Introduction :
   A titration between sodium hydroxide and ethanedioic acid is carried out so that
   the concentration of the sodium hydroxide solution can be determined.
   The acid used in this experiment is dibasic so two mole of hydrogen ions per mole
   of it is produced.
   An indicator called phenolphthalein is added. At the end point, solution changes
   from colourless to pink that the just complete reaction can be shown.

6. Relevant Equations/Chemical Reactions Involved :

7. Chemicals :
   approximately 0.1M sodium hydroxide solution
   0.1M standard ethanedioic acid solution $\quad\quad\quad$ 25 cm^3
   phenolphthalein indicator solution
   wash-bottle of distilled water

8. Apparatus and equipment :

100 cm^3 beaker	x 2	pipette filler	x 1
25 cm^3 pipette	x 1	white tile	x 1
250 cm^3 conical flask	x 4	filter funnel	x 1
50 cm^3 burette	x 1	safety spectacle	x 1

9. Procedure :
   1. Funnel was used that the burette and also its tip were rinsed with the sodium
      hydroxide solution and then filled with this solution.
   2. The initial burette reading was recorded to the nearest 0.05 cm^3.

3. Pipette filler was used that the pipette was rinsed with ethanedioic acid solution and 25.0 cm^3 of the solution was transferred to a clean 250 cm^3 conical flask.
4. 2-3 drops of the phenolphthalein indicator solution were added.
5. Sodium hydroxide solution was run from the burette into the flask that ethanedioic acid was titrated. The solution was being stirred during the titration. And the alkali was added drop by drop if pink colour was about to be turned.
6. The final burette reading was recorded.
7. Steps 1-6 were repeated three more times. But the pipette and burette were not necessary to be rinsed again.

10. Observations :

The solution turned into pink at the end point.

11. Data, Calculation and Results :

a. Results Table

	Trial	1	2	3
Final burette reading (cm^3)	32.65	31.70	32.10	31.50
Initial burette reading (cm^3)	5.50	4.20	4.80	4.30
Volume of titrant added (cm^3)	27.15	27.50	27.30	27.20

Mean titre = (27.50+27.30+27.20)/3 = 27.33 cm^3

b. Accuracy

(1) The burette readings should be recorded to the nearest 0.05 cm^3.

(2) Consecutive titrations should agree to within 0.10 cm^3 and the titration should be repeated until it is achieved. But it may not be done due to the limit of time or materials. Technique can be improved by practice so that it is not necessary to do many times.

(3) Calculate the mean of the two or three closest consecutive readings and the results should be quoted to the nearest 0.05 cm^3 too.

12. Conclusion :

No. of mole of NaOH = 2 x No. of mole of H$_2$C$_2$O$_4$

$$= 2 \text{ x } (0.1 \text{ x } 25 \text{ x } 10^{-3})$$

$$= 5 \text{ x } 10^{-3} \text{ mol}$$

Concentration of NaOH = $(5 \text{ x } 10^{-3}) / (27.33 \text{ x } 10^{-3})$

$$= 0.183 \text{ M}$$

The concentration of NaOH was found to be 0.183 M.

13. Answer to questions :

1. (a) The concentration of solution of sodium hydroxide will be higher if the burette is not rinsed with the sodium hydroxide solution.
   (b) The concentration of solution of sodium hydroxide will be smaller if the pipette is not rinsed with the ethanedioic acid solution.
   (c) The concentration of solution of sodium hydroxide will be smaller if the tip of the burette is not filled before titration begins.
   (d) There is no effect on the concentration of solution of sodium hydroxide if the conical flask contains some distilled water before the addition of ethanedioic acid.
2. Phenolphthalein produces a sharp colour change from acidic condition to alkaline condition so we choose this as an indicator.
3. We need to remove sodium hydroxide from the burette as soon as possible after the titration since it will change to solid state which is more difficult to remove.