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MEGA LECTURE

Topic 2 Exercise 6 – more complex calculations

1. Succinic acid has the formula $(CH_2)_n(COOH)_2$ and reacts with dilute sodium hydroxide as follows: $(CH_2)_n(COOH)_2 + 2NaOH \rightarrow (CH_2)_n(COONa)_2 + 2H_2O$
2.0 g of succinic acid were dissolved in water and the solution made up to 250 cm^3. This solution was placed in a burette and 18.4 cm^3 was required to neutralise 25 cm^3 of 0.1 $moldm^{-3}$ NaOH. Deduce the molecular formula of the acid and hence the value of n.

2. Sodium carbonate exists in hydrated form, $Na_2CO_3.xH_2O$, in the solid state. 3.5 g of a sodium carbonate sample was dissolved in water and the volume made up to 250 cm^3. 25.0 cm^3 of this solution was titrated against 0.1 $moldm^{-3}$ HCl and 24.5 cm^3 of the acid were required. Calculate the value of x given the equation:
$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$

3. 25 cm^3 of a sample of vinegar (CH_3COOH) was pipetted into a volumetric flask and the volume was made up to 250 cm^3. This solution was placed in a burette and 13.9 cm^3 were required to neutralise 25 cm^3 of 0.1 $moldm^{-3}$ NaOH. Calculate the molarity of the original vinegar solution and its concentration in gdm^{-3}, given that it reacts with NaOH in a 1:1 ratio.

4. 2.5 g of a sample of impure ethanedioic acid, $H_2C_2O_4.2H_2O$, was dissolved in water and the solution made up to 250 cm^3. This solution was placed in a burette and 21.3 cm^3 were required to neutralise 25 cm^3 of 0.1 $moldm^{-3}$ NaOH. Given that ethanedioic acid reacts with NaOH in a 1:2 ratio, calculate the percentage purity of the sample.

5. A toilet cleaner containing sodium hydrogensulphate, $NaHSO_4$ is believed to have been contaminated. 5.678 g of the sample were dissolved in water and the solution was made up to 250 cm^3. This solution was placed in a burette and 23.1 cm^3 of it were required to neutralise 25 cm^3 of 0.1 $moldm^{-3}$ sodium hydroxide. Calculate the percentage purity of the sample given that the species react in a 1:1 ratio.

6. When silicon tetrachloride is added to water, the following reaction occurs:
$SiCl_4(l) + 2H_2O(l) \rightarrow SiO_2(s) + 4HCl(aq)$
1.2 g of impure silicon tetrachloride was dissolved in excess water, and the resulting solution was made up to 250 cm^3. A 25 cm^3 portion of the solution was then titrated against 0.10 $moldm^{-3}$ sodium hydroxide, and 18.7 cm^3 of the alkali were required. What was the percentage purity of the silicon tetrachloride?

7. 13.2 g of a sample of zinc sulphate, $ZnSO_4.xH_2O$, was strongly heated until no further change in mass was recorded. On heating, all the water of crystallisation evaporated as follows: $ZnSO_4.xH_2O \rightarrow ZnSO_4 + xH_2O$.
Calculate the number of moles of water of crystallisation in the zinc sulphate sample given that 7.4 g of solid remained after strong heating.

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