SL HL Paper 3 Section A Experimental work (2)

The following experiment was used to determine the number of moles of water of crystallisation in washing soda crystals, $Na_2CO_3.xH_2O$.

5.35 g of washing soda crystals were placed in a conical flask and exactly 50.0 cm^3 of 1.00 mol dm^{-3} hydrochloric acid solution was added. A cotton wool plug was placed in the mouth of the flask and left in place until the reaction was completely finished. All the contents of the flask were then transferred to a 100 cm^3 volumetric flask with washings and the total volume made up to the graduated mark with distilled water. A 10.0 cm^3 sample of this new solution was pipetted into a new conical flask and titrated with 0.100 mol dm^{-3} sodium hydroxide solution using phenolphthalein as the indicator. 12.60 cm^3 of the 0.100 mol dm^{-3} sodium hydroxide solution was required to reach the end point.

(a) State the equation for the reaction of sodium carbonate with hydrochloric acid. *[1]*

(b) Explain why a piece of cotton wool was placed in the mouth of the conical flask while the reaction was taking place. *[1]*

(c) Describe how you can determine practically that the end point of the titration has been reached. *[1]*

(d) Calculate the amount (in mol) of hydrochloric acid remaining after the reaction with the washing soda crystals. *[1]*

(e) Calculate the amount (in mol) of washing soda crystals initially placed in the conical flask. *[1]*

(f) Determine the number of moles of water of crystallisation (*x*) in washing soda crystals. *[1]*