

## Paper 4

**Questions are applicable for both core and extended candidates  
unless indicated in the question**

- 1 (c) A student determines the concentration of a solution of dilute sulfuric acid,  $\text{H}_2\text{SO}_4$ , by titration with aqueous sodium hydroxide,  $\text{NaOH}$ .

**step 1** 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup>  $\text{NaOH}$  is transferred into a conical flask.

**step 2** Three drops of methyl orange indicator are added to the conical flask.

**step 3** A burette is filled with  $\text{H}_2\text{SO}_4$ .

**step 4** The acid in the burette is added to the conical flask until the indicator changes colour. The volume of acid is recorded. This process is known as titration.

**step 5** The titration is repeated several times until a suitable number of results is obtained.

- (i) Name the piece of apparatus used to measure exactly 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup>  $\text{NaOH}$  in **step 1**.

..... [1]

- (ii) State the colour change of the methyl orange indicator in **step 4**.

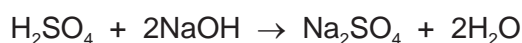
from ..... to ..... [1]

- (iii) State how the student decides that a suitable number of results have been obtained.

.....  
..... [1]

- (iv) 20.0 cm<sup>3</sup> of  $\text{H}_2\text{SO}_4$  reacts with 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup>  $\text{NaOH}$ .

The equation for the reaction is shown.



Calculate the concentration of  $\text{H}_2\text{SO}_4$  using the following steps.

- Calculate the number of moles in 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup>  $\text{NaOH}$ .

..... mol

- Determine the number of moles of  $\text{H}_2\text{SO}_4$  that react with the  $\text{NaOH}$ .

..... mol

- Calculate the concentration of  $\text{H}_2\text{SO}_4$ .

..... mol/dm<sup>3</sup>  
[3]