CALCULATIONS (D)

Succinic acid is a diprotic acid. 1.282 g of the acid was dissolved in deionised water and made up to 250 cm^3 solution in a volumetric flask. 25.0 cm^3 samples of this solution was titrated against 0.102 mol dm^{-3} sodium hydroxide solution, requiring a mean volume of 21.30 cm^3 for neutralisation.

a Why should the burette be rinsed with sodium hydroxide solution before filling rather than water?

so that the concentration of the sodium hydroxide is not diluted by water

b Concordant titres are achieved. What are concordant titres?

titres within ±0.1 cm^3 of each other

c Calculate the relative formula mass of the succinic acid. Give your answer to the appropriate number of significant figures.

moles NaOH = $0.102 \times \frac{21.30}{1000}$ = 0.002173

moles succinic acid in each titration = $0.002173 \times \frac{1}{2}$ = 0.001086

moles succinic acid in whole sample = 10×0.001086 = 0.01086

M_r succinic acid = $\frac{1.282}{0.01086}$ = 118 (3sf)

d The pipette used to measure out the acid into the conical flask had an uncertainty of ±0.1 cm^3. Calculate the percentage uncertainty.

% uncertainity = $100 \times \frac{0.1}{25}$ = 0.40%

e The balance used to measure out the acid had an uncertainty of ±0.001 g. Calculate the percentage uncertainty for weighing out this 1.282 g.

% uncertainity = $2 \times 100 \times \frac{0.001}{1.282}$ = 0.16%

f If the volumetric flask had been overfilled with water, how would this have affected the titre value and the relative formula mass of the succinic acid. Explain your answer.

less acid in 25 cm^3 samples and so titre would be lower

would lead to higher M_r in calculation