Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that makes reference to the following points: • (from) yellow **(1)** • (to) orange **(1)**	Do not award ‘red / pink’ From orange to yellow scores (1)	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that makes reference to the following: • 23.40 (cm^3)	Allow 23.4 (cm^3)	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(c)	A description that makes reference to the following points:		**(3)**
	• add the acid (quickly) until just short of the rough end-point **(1)**	Accept within 1– 4 cm^3 (any value in this range) before the rough titre Allow to a value in the range 19.4 – 22.4 cm^3 Allow 'until close to the rough value' Ignore 'carbonate added' Do not award 'until the rough value is reached'	**Clip with (b)**
	• add the acid drop-by-drop **(1)**	Standalone mark (award even if M1 not given) Allow 'dropwise' Allow 'a few drops at a time' Ignore 'add very slowly'	
	• with swirling **and** until the indicator colour (just) changes **(1)**	Allow any indication of mixing Allow shaking Allow stirring Allow until the end-point Allow any stated final colour Ignore references to filling the burette, use of the pipette, white tiles	

Question Number	Answer	Additional Guidance	Mark
4(d)	• calculation of moles of sodium carbonate **(1)** • use of 2:1 ratio to gives moles of HCl in 22.65 cm^3 **(1)** • concentration of hydrochloric acid in mol dm^{-3} **(1)**	Example of calculation mol Na_2CO_3 = 25.0 × 0.105 ÷ 1000 = 2.625 × 10^{-3} / 0.002625 2 × 2.625 × 10^{-3} = 5.25 × 10^{-3} 5.25 × 10^{-3}× 1000 ÷ 22.65 = 0.23179 / 2.3179 × 10^{-1} (mol dm^{-3}) The reacting volumes transposed gives the final concentration of hydrochloric acid = 0.19026 (mol dm^{-3}). This scores (2) The same volume used twice will give the final concentration of hydrochloric acid = 0.2100 (mol dm^{-3}). These score (2) TE at each stage Ignore SF except 1 SF Allow any correct method Correct answer with some working scores (3) Comment If working shows factor of 1000 omitted twice in the step by step calculation max (2)	**(3)**

(Total for Question 4 = 9 marks)
(Total for Paper = 50 marks)

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