Question number	Answer	Accept	Reject	Marks
1 (a) (i)	13(.0)			1
(ii)	1.4			1
(iii)	25(.0)			1
(b)	indigo			1
	red			1
(c)	$NaOH + HCl \rightarrow NaCl + H_2O$ IGNORE state symbols even if incorrect	$H^+ + OH^- \rightarrow H_2O$		1

(Total marks for Question 1 = 6 marks)

Question number	Answer	Accept	Reject	Marks
2 (a) (i)	**M1** – M_r (NaOH) = 40			1
	M2 – 10(.0) ÷ M1			1
	M3 – 0.25 (mol) Correct answer with no working scores 3			1
(ii)	**M1** – 0.25 x 1000 ÷ 250			1
	M2 – 1(.0) (mol/dm^3) Correct answer with no working scores 2 Mark csq throughout	M3 from (a)(i) ÷ 250 / 0.001 for 1 mark		1

(b)	(i)	**M1** – (reading at end) 25.20 **M2** – (reading at start) 1.65 **M3** – (volume added) 23.55 Award 1 mark for correct end and start readings in reverse order Mark **M3** csq on **M1** and **M2** Penalise lack of two decimal places once only in a correct answer			1 1 1
	(ii)	**M1 –** (colour at start) yellow **M2** – orange/pink	red		1 1
	(iii)	different volumes can be measured /continuously graduated / addition (of acid) can be controlled / volume required is not known IGNORE references to precision or accuracy	pipette measures one volume only		1
(c)	(i)	**M1** – 2(.00) x 200 ÷ 1000 **M2** – 0.4(0) (mol) Correct final answer with no working scores 2 marks	400 for 1 mark		1 1
	(ii)	**M1** – $n(CO_2)$ = 0.2(0) / ½ of **M2** from (c)(i) (mol) **M2** – mass(CO_2) = 8.8(0) (g) / **M1** x 44 Correct final answer with no working scores 2 marks			1 1

(Total marks for Question 2 = 15 marks)

Question number	Answer	Notes	Marks
3 (a) i	beaker	Ignore qualifiers such as measuring / graduated / 250 cm^3	1
ii	Pipette	Ignore qualifiers such as measuring / graduated / 25 cm^3	1
iii	colour change is gradual /not sharp/not defined OR end point not sharp/defined/accurate	Ignore reference to many colours	1
	methyl orange / phenolphthalein / litmus	Accept other correct indicators Ignore reference to pH meter Reject litmus paper Ignore named colours and colour changes	1
iv	(measures) only one volume / fixed volume / 25 cm^3 has only one graduation mark OR cannot deliver (measured) variable volume OR volume required is not known OR cannot be controlled / hard to control	Ignore reference to accuracy / size Accept reverse arguments based on suitability of burette, eg burette can deliver/measure any volume	1

Question number	Answer	Notes	Marks
3 (b)	(after) 22.60		1
	(before) 2.75		1
	(added)	CQ on before and after readings Award 1 for before and after values both correct but in wrong order All values must be to 2 dp Penalise answers to other than 2 dp once only	1

Question number	Answer	Notes	Marks
3 (c) i	ticks in columns 3 and 4		1
ii	$\frac{23.35 + 23.45}{2}$	CQ on ticked results If no results ticked, award M1 if only columns 3 and 4 averaged If only 1 result ticked, then no marks can be awarded in (c)	1
	23.4(0)	CQ on results averaged Answer should be to 2 dp, except that trailing zero not needed Correct final answer without working scores 2	1

Question number	Answer	Notes	Marks
3 (d) i	divide/÷ by 1000 (not by 100) OR convert volume/cm^3 to dm^3 OR use 1000 instead of 100	Accept $\frac{0.0500 \times 23.60}{1000}$ (= 0.00118 mol) Accept divide (final) answer by 10	1
ii	multiply/× (amount of H_2SO_4) by 2 (not divide by 2)	Accept 0.(0)0118 × 2 (= 0.0(0)236 mol) Accept any other number in place of 0.0(0)118 Accept multiply (final) answer by 4	1
iii	divide by 25.0 (not by 23.60) OR divide by volume of KOH (not by volume of H_2SO_4) OR use 25.0/volume of KOH instead of 23.60/volume of H_2SO_4	Accept $\frac{0.00590 \times 1000}{25.0}$ (= 0.236 mol) Accept any other number in place of 0.00590 Must be positive statement about correction needed, e.g. in iii, ignore statement about volume of H_2SO_4 should not have been used	1
		Total	**14**

Question number	Answer	Notes	Marks
4 a i	pipette		1
ii	pink	Ignore purple Accept red	1
	colourless	Ignore clear Ignore white Award 1 mark for both colours correct in wrong order	1
b	(after) 23.15 (before) 1.40 (added) 21.75	CQ on before and after readings Award 1 mark for both readings correct but in wrong order All values must be to 2 dp Penalise answers to other than 2 dp once only	1 1 1
c i	ticks in columns 3 and 4		1
ii	$\frac{21.10 + 21.20}{2}$	CQ on any combination of ticked results If no results ticked, award M1 if only columns 3 and 4 averaged If only 1 result ticked, then no marks can be awarded in (c)	1
	21.15	CQ on results averaged - see separate table Answer should be to 2 dp, except that trailing zero not needed Correct final answer without working scores 2	1

Question number	Answer	Notes	Marks
4 d i	$0.300 \times \frac{200}{1000}$		1
	0.06(00) (mol)	Correct final answer scores 2 marks 60 scores 1 mark in di No marks for answers such as 0.6 / 6 / 600	1
clip ii	di ÷ 2 / 0.03(00) (mol)		1
clip iii	M_r = 98	Award 1 mark for 98 anywhere in iii	1
	2.94 (g)	ECF from incorrect M_r Moles CQ on ii Must be 2 or more sig figs	1
			Total 14 marks