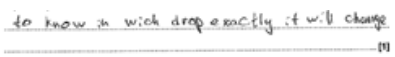
Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		**First check the answer on the answer line** **If answer = 11.6 (g) award 4 marks** M_r of H_2SO_4 = 98.1 **AND** K_2SO_4 = 174.3 ✓ Substitution into Mass of $K_2SO_4 = 6.54 \times \frac{174.3}{98.1}$ ✓ = 11.62 ✓ To 3 significant figures = 11.6 (g) ✓	4 (3 x AO 2.2) (1 x AO 1.2)	**ALLOW** ECF from incorrect M_r **ALLOW** ECF on answer **ALLOW** ECF for sig fig mark from calculations involving identifiable multiplication or division **Examiner's Comments** Many candidates scored at least partial credit by showing their working and had a basic idea of what sort of calculation should be performed. Values were often inserted into the wrong places, but examiners were able to award error carried forward marks for those who had attempted the correct type of calculation, and for those who had then adjusted their calculation answer to three significant figures. Again, a significant number of candidates left this question blank.
	b		Burette ✓	1 (AO 1.2)	**ALLOW** range of spelling **Examiner's Comments** The highest achieving candidates were clearly familiar with this piece of apparatus, though in this case a range of highly idiosyncratic spellings had to be allowed. Many others made an educated guess and called it a titration tube.
	c		Idea of making it easier to see precisely when the indicator changes colour ✓	1 (AO 1.2)	Must have idea of colour and idea of change **ALLOW** to know when it turns clear **IGNORE** idea of improving measuring volumes of solution

					Examiner's Comments Candidates who were familiar with titrations discussed being able to see the colour of the indicator, even if they didn't discuss the need to see the *change* in colour. Those with little experience made suggestions along the lines of preventing damage to the bench.
	d		Idea of (more) accurate/precise end point / Idea of speed of change / Easier to stop excess alkali being added (when the indicator changes colour) ✓	1 (AO 1.2)	**ALLOW** to make it more accurate **ALLOW** to see at what point the colour changed **IGNORE** So they can calculate how many drops added to make it change **ALLOW** If too much added, titration ruined **Examiner's Comments** Candidates with first-hand experience of titrations discussed the rapidity of the change, others realised in more general terms that it would make the determination of the end point more accurate. Exemplar 2  This candidate response shows clear familiarity with titration procedures. This response received 1 mark.
	e		HC*l* + NaOH → NaC*l* + H_2O Correct formula for NaC*l* ✓ Rest of equation correct ✓	2 (2 x AO 2.1)	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' Equation mark is dependent on a correct NaCl **Examiner's Comments** High attaining candidates recognised that the salt would be sodium chloride, even if they wrote it as $NaCl_2$. Others seemed unfamiliar with the term 'salt' and gave a wide variety of possible

					products. A significant number of candidates left this blank.
			Total	**9**	
2			A ✓	1 (AO 2.1)	**Examiner's Comments** Higher scoring candidates answered this well.
			Total	**1**	
3		i	Neutralisation ✓	1 (AO 1.2)	
		ii	**First check the answer on answer line** If answer = 76 / 76.47 / 76.5 (%) award 3 marks M_r of NaCl = 58.5 and H2O = 18.0 ✓**OR** 58.5 and 76.5 atom economy = $\frac{58.5}{76.5} \times 100$ ✓ = 76.47 / 76.5 (%) ✓	3 (3 × AO 2.2)	**ALLOW ECF** from incorrect M_r **ALLOW** atom economy = $\frac{M_r \text{ of desired products}}{\text{sum of } M_r \text{ of all products}} \times 100$ ✓ **Examiner's Comments** Most candidates seemed uncertain how to approach this calculation. Examiners were often able to award credit for working out suitable relative molar masses even if the rest of the calculation was flawed.
			Total	**4**	
4		i	$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$ ✓	1 (AO 2.1)	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' **Examiner's Comments** This part was answered well, with both high scoring and medium scoring candidates understanding how to write a simple equation.
		ii	**First check the answer on answer line** **If answer = 71.1(%) award 3 marks** % yield = (am ÷ pm) × 100 **OR** = $\frac{5.4}{7.6} \times$ 100 ✓	3 (2 × AO 2.2) (AO 1.2)	**ALLOW ECF** for wrong answer to correct numbers

			= 71.05263 (%) ✓ To 1 decimal place = 71.1 (%) ✓		**ALLOW** decimal place mark if an incorrect answer **Examiner's Comments** Answers to this question showed an unusual distribution. Candidates either scored all 3 marks, or appeared to get totally confused over what to do, though still picked up 1 mark for the number of decimal places in their answer.
			Total	**4**	
5			(B) F C A G D (E) ✓✓✓✓	4 (4 × AO 1.2)	All 5 in correct order = 4 marks correct sequence of 4 letters = 3 marks correct sequence of 3 letters = 2 marks correct sequence of 2 letters = 1 mark Look for a run of letters, in sequence, even if something missing, e.g., D F C A G has 4 letters in sequence = 3 A F C G D has 4 letters in sequence with a gap = 3 F C A D G has 3 letters in sequence = 2 F C D A G has 2 letters in sequence = 1 **Examiner's Comments** High scoring candidates were able to sequence all five stages correctly, and many got three in a correct sequence. One of the main stumbling blocks came at stage A, when to add the indicator.
			Total	**4**	
6			**First check the answer on answer line** **If answer = 0.003 (g) award 3 marks** M_r of H_2 = 2.0 ✓ Mass of $H_2 = \frac{2.0}{65.4} \times 0.1$ ✓ = 0.003 (g) ✓	3 (3 × AO 2.2)	**Examiner's Comments** This question proved to be tricky for many, though most candidates were prepared to show their working and so examiners could give them credit for

					at least calculating the relative molar mass of hydrogen.
			Total	**3**	
7			**A**	1 (AO 2.2)	**Examiner's Comments** Most candidates showed clear appreciation of conservation of matter and scored well on this question.
			Total	**1**	