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		$HCl + NaOH \rightarrow NaCl + H_2O$ Correct formula for NaCl ✓ 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	**6**	
2			$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ ✓ ✓	2 (2 x AO 2.1)	**Examiner's Comments** The '2' in front of the water tended to be well answered, but it seemed that many candidates may not have realised that the term 'complete combustion' automatically involves oxygen unless stated otherwise. While high scoring candidates realised that the reactant was oxygen, it was sometimes written as O rather than O_2. H_2O was also frequently suggested, as were CO, CO_2 and OH.
			Total	**2**	
3			C ✓	1 (AO 2.1)	**Examiner's Comments** Very few candidates could recognise which equation was balanced, and options such as B or D were chosen far more often than C.
			Total	**1**	
4	a	i	Na_2SO_4 ✓	1 (AO 2.1)	**ALLOW** SO_4Na_2 **DO NOT ALLOW** splitting of SO_4 **Examiner's Comments** Many incorrect responses for Na_2SO_4 included NaS, $NaSO_4$, NaSO, Na_2S, $NaCO_3$, Na_2CO_3 and H_2O. A large number omitted the question.
		ii	aqueous / dissolved in water ✓	1 (AO 1.1)	**ALLOW** solution **IGNORE** soluble in water **DO NOT ALLOW** liquid **Examiner's Comments** Aqueous was well known. Some candidates qualified this incorrectly with liquid. Aqua was a common non-creditworthy response. A significant number omitted the question.
		iii	Method for gas collection (such as gas syringe, displacement of water in upturned tube) ✓	2 (2 x AO 3.3a)	**Examiner's Comments** This proved to be very challenging for all but the most practised candidates.

			Clear illustration of ALL gas being directed into gas collection apparatus (bung on top of conical flask) / method will work successfully as drawn ✓		Common incorrect diagrams included: distillation apparatus, collecting the gas in an open beaker or conical flask or sealed test-tube or sealed measuring cylinder or only drawing a stopper in the conical flask. A large number omitted the question.
	b	i	Both points correctly plotted ✓	1 (AO 1.2)	± ½ small square
		ii	Curve of best fit accurately drawn ✓	1 (AO 2.2)	± small square of all of the points unless bii points are anomalous **DO NOT ALLOW** double lines / feathering / breaks in the line / drawn point to point with a ruler **Examiner's Comments** Drawing the curve proved challenging for many candidates. There were many feathery or multiple lines, lines which were too far away from the plotted points, lines which went point-to-point using a ruler and a small number of straight lines.
		iii	4.8 cm^3 ✓	1 (AO 2.2)	**ALLOW** +/- 0.1 cm^3 **ECF**
		iv	Use a larger conical flask ☐ Use less sodium carbonate ☐ Use less sulfuric acid ☐ Use more sulfuric acid ☑ ✓	1 (AO 3.3b)	**Examiner's Comments** The change to the experiment was well known. All responses were seen so no single misconception can be isolated from the incorrect responses.
			Total	**8**	
5			D ✓	1 (AO 2.2)	**Examiner's Comments** Candidates found balancing the equation challenging. C was the most popular incorrect response.
			Total	**1**	
6			B ✓	1 (AO 2.1)	**Examiner's Comments** Some candidates calculated the mass of chlorine required hence D was a popular response. C was also quite popular.

			Total	**1**	
7			**B**	1 (AO 2.1)	**Examiner's Comments** A was the most popular incorrect response.
			Total	**1**	
8			**A**	1 (AO 1.2)	
			Total	**1**	
9			**C**	1 (AO 2.2)	**Examiner's Comments** Some candidates divided by 10 instead of 100, and chose response D.
			Total	**1**	
10			**B**	1 (AO 2.1)	**Examiner's Comments** A was the most popular incorrect response.
			Total	**1**	
11		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** = $\frac{5.4}{7.6}$ × 100 ✓ = 71.05263 (%) ✓ To 1 decimal place = 71.1 (%) ✓	3 (2 × AO 2.2) (AO 1.2)	**ALLOW ECF** for wrong answer to correct numbers **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**	
12			$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ Formulae ✓ Balancing ✓	2 (2 × AO 2.2)	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' Balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae e.g., $C_3h_8 + 5O_2 \rightarrow 3Co_2 + 4H2O$ **Examiner's Comments** Many candidates gained the first mark by using the correct formulae, and the highest scoring candidates went on to balance the equation correctly. One of the more common formula mistakes was to use atomic oxygen.
			Total	**2**	
13			**C**	1 (AO 2.1)	**Examiner's Comments** High scoring candidates correctly chose option C, with B the second most popular choice.
			Total	**1**	
14			**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**	
15		i	Magnesium chloride ✓	1(AO2.1)	**ALLOW** $MgCl_2$ **DO NOT ALLOW** Magnesium chlorine **Examiner's Comments**

					More successful responses identified the salt from the reagents. Popular responses included: magnesium hydroxide, magnesium carbonate, magnesium oxide, the most popular being the common salt sodium chloride. **OCR support** To support teachers, we have our Making salts presentation and associated activities that can be used in the classroom to improve candidate knowledge and offer more chances to practice in context.
		ii	Idea that the mass stops changing or decreasing / there are no more bubbles (of carbon dioxide gas) formed ✓	1(AO1.2)	**ALLOW** mass stays constant **IGNORE** magnesium carbonate dissolves **Examiner's Comments** The most confident candidates evaluated the information and gave a correct observation. Popular incorrect responses included bubbling, mass decreases, solid dissolves and stopwatch stops.
		iii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 8.9 (g) award 2 marks** (mass at start of reaction – mass at 8 minutes) = 154.2 − 145.3 ✓ = 8.9 (g) ✓	2(2 × AO2.2)	**ALLOW** ECF for incorrect masses used in a subtraction of two numbers from the table **Examiner's Comments** Many candidates chose the correct values from the table and found the difference between them. A significant number either chose the value at 8 minutes, 145.3 or found the amount of carbon dioxide made over the whole 12 minutes. Showing working in multistep calculations is advised as working marks can often be given even when the final answer is incorrect.

					Assessment for learning Practical Activity Group In PAG 8, candidates are expected to use appropriate apparatus to make and record a range of measurements accurately, including mass, and measure the rate of a reaction when a gas is produced. Teachers should make sure candidates are exposed to a variety of practical methods that will help them to be successful in their exams.
			Total	**4**	
16			Al^{3+} ✓	1(AO2.1)	**ALLOW** Al^{+3} **Examiner's Comments** More successful responses used the formula to determine the charge on the aluminium ion. Common incorrect responses included: Al, Al^3, Al^+ and Al^{2+}.
			Total	**1**	
17			C ✓	1(AO2.1)	**Examiner's Comments** More successful responses balanced the charges to determine a formula. Many candidates used the charges as the balancing numbers and so D was the most popular response. **OCR support** Teachers may find our Writing Formulae resources useful in the classroom to improve this skill with candidates. There is also an activity and answer available.
			Total	**1**	
18			C ✓	1(AO1.1)	**Examiner's Comments** A was a popular incorrect response.

			Total	**1**	