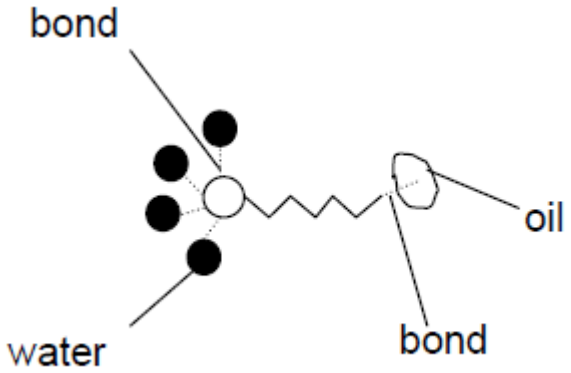
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>mass of water calculated (1)

prediction supported because as more copper hydroxide is used the mass of water increases (1)
but
prediction supported illustrated by examples showing the direct proportionality e.g. mass of $Cu(OH)_2$ doubles in expt 1 and expt 2 and so does the mass of water (2)</td><td>3</td><td>Maximum of two marks if no comment about whether data supports prediction

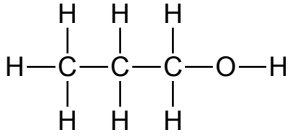
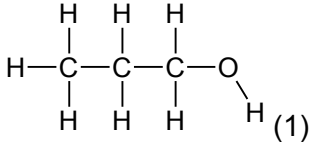
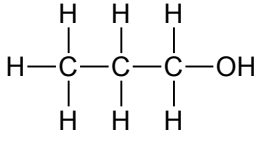
<table><tr><td>experiment number</td><td>Mass of water made in g</td></tr><tr><td>1</td><td>0.09</td></tr><tr><td>2</td><td>0.18</td></tr><tr><td>3</td><td>0.28</td></tr><tr><td>4</td><td>0.37</td></tr><tr><td>5</td><td>0.60</td></tr></table>
allow both explanation marks if answer based on mass of copper oxide rather than water

allow prediction not supported because the result for experiment 5 does not fit the pattern (2)</td></tr>
<tr><td></td><td>Total</td><td>3</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
2 a	**any one from:** fewer collisions (1) less crowded particles (1) fewer hydrogen ions / less concentrated H^+ (1)	1	**ignore** any extra qualification about collisions **but not** particles have more energy fewer ions / fewer particles is **not** sufficient **not** atoms or molecules as particles if particles are named **allow** weak acids do not fully ionise (but strong acids do) / weak acids do not completely dissociate (but strong acids do) / weak acids are less ionised **allow** ora if strong acid specified
b	correct measuring equipment to measure volume of gas in diagram e.g. gas syringe / displacement of water using measuring cylinder or upturned burette (1) equipment will work and it is gas tight (1)	2	The measuring apparatus does not have to be set up or part of a correct diagram
	Total	**3**	

Question	Answer	Marks	Guidance
3 a	**C** (1) it removes blood / food stains (1)	2	 **allow** it removes organic materials **not** any reference to removing paint **ignore** reference to grease
b	**any three from** detergent has a hydrophilic (head) (1) idea that detergent is bonded to water molecules (1) hydrophobic end bonds with grease (1) idea that hydrophobic or tail lifts off grease (1)	3	**USE TICKS FOR THIS QUESTION** **marks may be awarded for a labelled diagram** **allow** idea of hydrophilic end or hydrophilic part (1) **allow** hydrophilic (end) is bonded to water / hydrophilic (end) is attracted to water (molecules) (2) water surrounds the hydrophilic end is **not** sufficient **allow** hydrophobic (end) is attracted to grease (molecules) grease surrounds the hydrophobic end is **not** sufficient for MP2 and MP3 **allow** attached to, clings to, connected, stick on or stick to instead of bonded, but **do not allow** stick into or stick out 

Question	Answer	Marks	Guidance
c	test - add bromine (water) (1) result - idea that bromine water loses its colour (1) – this mark is dependent on the correct reagent or a near miss e.g. bromide	2	**allow** Br_2 (1) **allow** decolourised / loses its colour / goes colourless (1) **not** goes clear / discoloured **ignore** initial colour of bromine
	Total	**7**	

Question	Answer	Marks	Guidance
4 a i	any value between 12 and 13 (cm^3) (1)	1	
ii	44^oC (1) idea of highest point on the curve / where most carbon dioxide is made (1)	2	**allow** 42-45 (^oC) (1) **second mark is dependent on the correct temperature** **allow** optimum temperature (1)
b	$C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH$ formulae (1) balancing – dependent on correct formulae (1)	2	**allow** C_2H_6O as formula for ethanol **allow** any correct multiple e.g. $2C_6H_{12}O_6 \rightarrow 4CO_2 + 4C_2H_5OH$ **allow** = or ⇆ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with minor errors of case, subscript or superscript e.g. $C^6H^{12}O^6 \rightarrow 2Co_2 + 2C_2H_5OH$
c i	C_3H_7OH / C_3H_8O (1)	1	
ii	 (1)	1	**allow**  (1) **allow**  (1) **allow** displayed formula for propan-2-ol
	Total	**7**	

Question			Answer	Marks	Guidance
5	(a)	(i)	68 (cm^3) (1)	1	
		(ii)	37–39 (seconds) (1)	1	
		(iii)	line needs to level off at same height and be steeper initially (1)	1	By eye the line should go through the origin Line drawn to left of original and must not go above 79 cm^3 at any point but must end at 78 cm^3
	(b)		reactant not in excess / that is all used up (at the end of the reaction (1)	1	**allow** reactant that determines the volume of hydrogen given off (1) **allow** substance that causes the reaction to stop **allow** reagent that runs out (first)
			Total	**4**	

Question			Answer	Marks	Guidance
6	(a)		$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ formulae (1) balancing (1)	2	**allow** any correct multiple, including fractions **allow** = / ⇌ instead of → **not** and / & / '+ energy' balancing mark is dependent on the correct formulae but **allow** 1 mark for a balanced equation with a minor error in subscripts / formulae eg CaCO3 + 2HCl → CaCl2 + CO2 + H_2O
	(b)	(i)	any value within range 5½ - 6 (minutes) (1)	1	
		(ii)	15 / 15.0 (1) cm^3/min or cm^3/minute (1)	2	 **allow** 0.25 (1) cm^3/s (1) **not** cm^3/m
		(iii)	rate of reaction for first 2 minutes is greater than between 2 and 4 minutes / ora (1)	1	it is faster / it goes slower are not sufficient answer must be **comparative** **allow** rate is 15 for first 2 minutes and 8 for second 2 minutes **allow** reaction starts to slow down

Question			Answer	Marks	Guidance
6	(c)		**[Level 3]** Answer applies understanding of the reacting particle model to comprehensively explain **both** ways of increasing the rate of reaction. Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** Answer applies understanding of the reacting particle model to comprehensively explain **one** way of increasing the rate of reaction. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** Answer shows appreciation that the rate of reaction is increased by having more collisions in one of the two contexts **or** explains concentration using particles **or** uses surface area to explain crushed tablet. Quality of written communication impedes communication of the science at this level (1 – 2 marks) **[Level 0]** Quality of written communication impedes communication of the science at this level (0 marks)	6	**This question is targeted at grades up to A.** **allow** 'tablet' for calcium carbonate **ignore** faster collisions / quicker collisions **ignore** reference to 'more particles' **ignore** successful in terms of collisions but particles have more energy or move faster is not correct **not** atoms colliding **Indicative scientific points at level 2 and 3 can include:** **concentration of hydrochloric acid** • idea of increased collision frequency between acid particles and calcium carbonate / more collisions per second between acid particles and calcium carbonate **crushed tablet** • idea of increased collision frequency between acid particles and calcium carbonate / more collisions per second between acid particles and calcium carbonate **Indicative scientific points at level 1 can include:** **concentration of hydrochloric acid** • idea of more crowded acid particles / more acid particles in the same volume / more H^+ ions in the same volume / acid particles closer together • idea of more collisions between acid particles and particles of the tablet **crushed tablet** • idea of increased surface area of calcium carbonate or tablet / more calcium carbonate or tablet particles exposed to the acid
			Total	**12**	

Question			Answer	Marks	Guidance
7	(a)		**one** correct property (1) **but** **two** correct properties (2)	2	If three answers then if 2 correct award 1 mark if only 1 is correct award 0 marks. If four or five answers given award 0 marks graphite has a low melting point graphite conducts electricity when solid ✓ graphite is colourless graphite is insoluble in water ✓ graphite is extremely hard
	(b)		diamond (1)	1	
			Total	**3**	