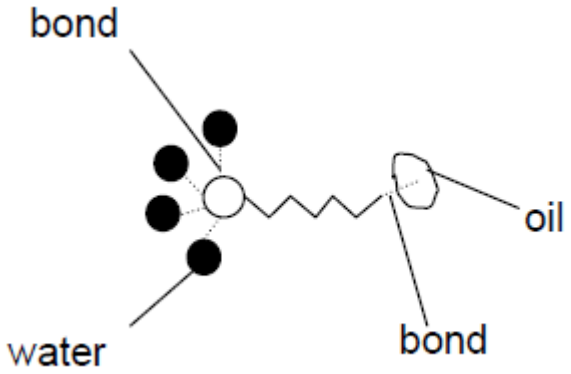
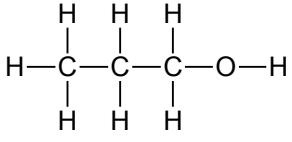
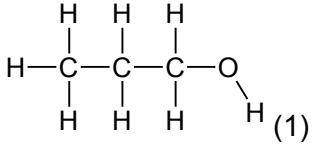
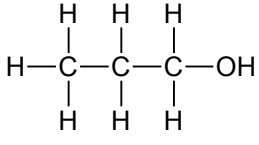
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>mass of water calculated (1)<br><br>prediction supported because as more copper hydroxide is used the mass of water increases (1)<br>but<br>prediction supported illustrated by examples showing the direct 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<br><br><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><br>allow both explanation marks if answer based on mass of copper oxide rather than water<br><br>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:**<br>fewer collisions (1)<br>less crowded particles (1)<br><br>fewer hydrogen ions / less concentrated $H^+$ (1) | 1 | **ignore** any extra qualification about collisions **but not** particles have more energy<br><br>fewer ions / fewer particles is **not** sufficient<br>**not** atoms or molecules as particles if particles are named<br><br>**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<br><br>**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)<br><br>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)<br><br>it removes blood / food stains (1) | 2 | <br><br>**allow** it removes organic materials<br>**not** any reference to removing paint<br><br>**ignore** reference to grease |
| b | **any three from**<br><br>detergent has a hydrophilic (head) (1)<br><br>idea that detergent is bonded to water molecules (1)<br><br>hydrophobic end bonds with grease (1)<br><br>idea that hydrophobic or tail lifts off grease (1) | 3 | **USE TICKS FOR THIS QUESTION**<br>**marks may be awarded for a labelled diagram**<br><br>**allow** idea of hydrophilic end or hydrophilic part (1)<br><br>**allow** hydrophilic (end) is bonded to water / hydrophilic (end) is attracted to water (molecules) (2)<br>water surrounds the hydrophilic end is **not** sufficient<br><br>**allow** hydrophobic (end) is attracted to grease (molecules)<br>grease surrounds the hydrophobic end is **not** sufficient<br><br>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<br><br> |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| **c** | test - add bromine (water) (1)<br><br>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)<br><br>**allow** decolourised / loses its colour / goes colourless (1)<br>**not** goes clear / discoloured<br>**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)<br><br>idea of highest point on the curve / where most carbon dioxide is made (1) | 2 | **allow** 42-45 ($^oC$) (1)<br><br>**second mark is dependent on the correct temperature**<br><br>**allow** optimum temperature (1) |
| **b** | $C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH$<br><br>formulae (1)<br>balancing – dependent on correct formulae (1) | 2 | **allow** $C_2H_6O$ as formula for ethanol<br>**allow** any correct multiple e.g. $2C_6H_{12}O_6 \rightarrow 4CO_2 + 4C_2H_5OH$<br>**allow** = or ⇆ for arrow<br>**not** 'and' or & for +<br>**allow** one mark for correct balanced equation with minor errors of case, subscript or superscript<br>e.g. $C^6H^{12}O^6 \rightarrow 2Co_2 + 2C_2H_5OH$ |
| **c i** | $C_3H_7OH$ / $C_3H_8O$ (1) | 1 | |
| **ii** | <br>(1) | 1 | **allow**<br> (1)<br><br>**allow**<br> (1)<br>**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<br><br>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)<br><br>**allow** substance that causes the reaction to stop<br><br>**allow** reagent that runs out (first) |
| | | | **Total** | **4** | |

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

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| 6 | (c) | | **[Level 3]**<br>Answer applies understanding of the reacting particle model to comprehensively explain **both** ways of increasing the rate of reaction.<br>Quality of written communication does not impede communication of the science at this level<br>(5 – 6 marks)<br><br>**[Level 2]**<br>Answer applies understanding of the reacting particle model to comprehensively explain **one** way of increasing the rate of reaction.<br>Quality of written communication partly impedes communication of the science at this level<br>(3 – 4 marks)<br><br>**[Level 1]**<br>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.<br>Quality of written communication impedes communication of the science at this level<br>(1 – 2 marks)<br><br>**[Level 0]**<br>Quality of written communication impedes communication of the science at this level<br>(0 marks) | 6 | **This question is targeted at grades up to A.**<br><br>**allow** 'tablet' for calcium carbonate<br>**ignore** faster collisions / quicker collisions<br>**ignore** reference to 'more particles'<br>**ignore** successful in terms of collisions but particles have more energy or move faster is not correct<br>**not** atoms colliding<br><br>**Indicative scientific points at level 2 and 3 can include:**<br><br>**concentration of hydrochloric acid**<br>• idea of increased collision frequency between acid particles and calcium carbonate / more collisions per second between acid particles and calcium carbonate<br><br>**crushed tablet**<br>• idea of increased collision frequency between acid particles and calcium carbonate / more collisions per second between acid particles and calcium carbonate<br><br>**Indicative scientific points at level 1 can include:**<br><br>**concentration of hydrochloric acid**<br>• idea of more crowded acid particles / more acid particles in the same volume / more $H^+$ ions in the same volume / acid particles closer together<br>• idea of more collisions between acid particles and particles of the tablet<br><br>**crushed tablet**<br>• 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)<br><br>**but**<br><br>**two** correct properties (2) | 2 | If three answers then if 2 correct award 1 mark if only 1 is correct award 0 marks.<br><br>If four or five answers given award 0 marks<br><br>graphite has a low melting point<br>graphite conducts electricity when solid ✓<br>graphite is colourless<br>graphite is insoluble in water ✓<br>graphite is extremely hard |
| | (b) | | diamond (1) | 1 | |
| | | | **Total** | **3** | |