

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(i)</b>	CuCl <sub>2</sub>		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(a)(ii)</b>	<p>An explanation linking the following points</p> <p><b>Either</b></p> <ul style="list-style-type: none"> <li>the amount of product calculated (1)</li> <li>using the equation (for the reaction) (1)</li> </ul> <p><b>Or</b></p> <ul style="list-style-type: none"> <li>the maximum amount of {product / copper chloride} (1)</li> <li>when all {reactant / copper} reacts (1)</li> </ul>	<p>using reacting masses</p> <p>amount of product when all {reactant / copper} reacts (2)</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(i)</b>	$2\text{Fe(s)} + 3\text{Br}_2\text{(g)} \rightarrow 2\text{FeBr}_3\text{(s)}$ <p>reactant formulae (1) balancing correct formulae (1) state symbols (1) s and g must be lower case</p>	<b>allow</b> state symbol mark even if other marks not awarded	<b>(3)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(ii)</b>	$56 + (3 \times 80)$ (1) $= 296$	give full marks for correct answer with no working	<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(iii)</b>	<p>ratio: <math>56/310</math> (1)</p> <p>% iron <math>56/310 \times 100</math> (%) (1)</p> <p>(= 18 (%))</p>	<p>any number/310 x 100 (%)</p> <p>18.06/18.1</p> <p>give full marks for correct answer with no working</p>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>1(b)(iv)</b>	HO	OH, O <sub>1</sub> H <sub>1</sub> , H <sub>1</sub> O <sub>1</sub>	<b>(1)</b>

Question number	Answer	Additional guidance	Mark
2(a)	An answer that combines the following points of understanding to provide a logical description: <ul style="list-style-type: none"> <li>• (hydrogen produced as a gas so) there would be {effervescence/fizzing/bubbles} (1)</li> <li>• and (calcium hydroxide produced as a solid so) the water would go {cloudy/a white precipitate would form} (1)</li> </ul>	Allow: calcium moves (around) (1) calcium decreases in size/disappears/dissolves (1)	(2)

Question number	Answer	Mark
2(b)	$\text{Mg} + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{H}_2$ <ul style="list-style-type: none"> <li>• LHS (1)</li> <li>• RHS (1)</li> </ul>	(2)

Question number	Answer	Additional guidance	Mark
2(c)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): <ul style="list-style-type: none"> <li>• In calcium the outermost electron(s) {are further away from nucleus /experience(s) greater shielding} (from the nucleus) (as shown by the electronic configuration) (1)</li> <li>• Therefore less attraction between nucleus and electron(s)/ the electron(s) is/are easier to remove (1)</li> </ul>	Allow answers in terms of why reactivity of magnesium is less than that of calcium	(2)

Question number	Answer	Additional guidance	Mark
2(d)	<ul style="list-style-type: none"> <li>• divides mass by relative atomic mass (1)</li> <li>• calculates simplest ratio (1)</li> <li>• expresses ratio correctly as empirical formula (1)</li> </ul>	<p><u>Example of calculation</u></p> <p>Ca : Br</p> $\frac{0.2}{40} : \frac{0.8}{80}$ $0.005 : 0.01$ $1 : 2$ <p>empirical formula <math>\text{CaBr}_2</math></p> <p>Formula alone scores max 1</p>	<b>(3)</b>

Question number	Answer	Additional guidance	Mark
3(a)(i)	<ul style="list-style-type: none"> <li>particles are same size when they should be different sizes (1)</li> <li>model is in 2D but crystal is 3D (1)</li> </ul>	Allow reverse statements giving correct information.	(2)

Question number	Answer	Mark
3(a)(ii)	<p>An explanation that combines identification – knowledge (1 mark) and reasoning/justification – understanding (2 marks):</p> <ul style="list-style-type: none"> <li>very strong bonds/ionically bonded (1)</li> <li>between 2+ cations and 2– anions (1)</li> <li>so requires lot of energy to separate magnesium and oxide ions to melt the solid (1)</li> </ul>	(3)

Question number	Answer	Additional guidance	Mark
3(b)(i)	$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ <ul style="list-style-type: none"> <li>all formulae on correct side (2)</li> <li>balancing (1)</li> </ul>	Allow 3/4 formulae (1)	(3)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	<p>relative formula mass copper carbonate  <math>= 63.5 + 12.0 + (3 \times 16.0)</math>  <math>= 123.5</math>            relative formula mass copper oxide  <math>= 63.5 + 16.0</math>  <math>= 79.5</math> (1)</p> <p>mass copper oxide  <math>= \frac{15.0 \times 79.5}{123.5} = 9.7 \text{ g to 2 s.f.}</math> (1)            Answer must be to two significant figures</p> <p>OR</p> <p>moles of copper carbonate  <math>= \frac{15.0}{123.5} = 0.12145</math> (1)            mass of copper oxide  <math>= \text{moles CuCO}_3 \times 79.5</math>  <math>= 9.7 \text{ g to 2sf}</math> (1)            Answer must be to two significant figures</p>	Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Additional guidance	Mark
<b>3(c)</b>	<p>2.4/24 moles Mg = 0.1 mol (1)</p> <p>and 0.2 moles H<sub>2</sub>O has mass 0.2 × formula mass H<sub>2</sub>O = 3.6 g (1)</p> <p>total mass reactants = 2.4 + 3.6 = 6.0 g is the same as total mass products = 5.8 + 0.2 = 6.0 g (1)</p>	Award full marks for correct numerical answer without working.	<b>(3)</b>

Question Number	Answers	Acceptable Answers	Mark
<b>4(a)(i)</b>	A displacement		<b>(1)</b>

Question Number	Answers	Acceptable Answers	Mark
<b>4(a)(ii)</b>	orange	Any colour or combination of colours from brown, red, orange and yellow Ignore shade of colours  Reject other colours combined with these e.g. yellow-green	<b>(1)</b>

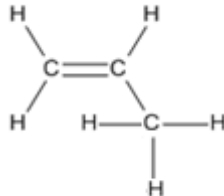
Question Number	Answers	Acceptable Answers	Mark
<b>4(b)</b>	<b>C</b>		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(c)</b>	$(\text{H}_2 + \text{Br}_2 \rightarrow) 2\text{HBr}$  <ul style="list-style-type: none"> <li>• correct formula for HBr <b>(1)</b></li> <li>• balancing of correct formulae <b>(1)</b></li> </ul>	Ignore state symbols  Allow BrH <b>(1)</b>	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(d)</b>	$[24 + 2 \times 35.5]$ <b>(1)</b> (= 95)	95 with no working  $[24 + 2 \times 35.5]$ with no answer or an incorrect answer scores <b>(1)</b>	<b>(1)</b>

Question Number	Answers	Acceptable Answers	Mark
<b>4(e)</b>	<ul style="list-style-type: none"> <li>• relative formula mass = <math>[23 + 19]</math> <b>(1)</b> (= 42)</li> <li>• <math>[(19/\text{their relative formula mass}) \times 100]</math> <b>(1)</b> (= 45.2(%)) <b>consequential</b> on their relative formula mass</li> </ul>	$(19/42) \times 100$ <b>(2)</b> (= 45.2 (%)) $(19/[19+23]) \times 100$ <b>(2)</b> (= 45.2 (%))  45/45.2 (%) with no working <b>(2)</b> Ignore additional significant figures  Allow 42 seen in working <b>(1)</b> Allow $(19/23) \times 100 = \{82.6\% / 83\%$ <b>(1)</b>	<b>(2)</b>

Question number	Answer	Mark
5(a)	C	(1)

Question number	Answer	Additional guidance	Mark
5(b)	<ul style="list-style-type: none"> <li>molecular formula – C<sub>5</sub>H<sub>10</sub> (1)</li> <li>structure (1)</li> </ul> 		(2)

Question number	Answer	Additional guidance	Mark
5(c)(i)	<ul style="list-style-type: none"> <li>calculates relative molecular mass of C<sub>4</sub>H<sub>9</sub>OH (1)</li> <li>calculates mass of C<sub>4</sub>H<sub>9</sub>OH produced (1)</li> <li>final answer = 1.9 (kg) (1)</li> </ul>	<p><u>Example of calculation</u></p> <p>Relative molecular mass of C<sub>4</sub>H<sub>9</sub>OH = (4 × 12) + (9 × 1) + 16 + 1 = 74</p> <p>Mass of C<sub>4</sub>H<sub>9</sub>OH produced = (74 ÷ 56) × 1.4</p> <p>Accept 1.85 (kg)</p> <p>Award full marks for use of moles/correct numerical answer without working</p>	(3)

Question number	Answer	Mark
5(c)(ii)	A	(1)

Question number	Answer	Mark
5(d)	<ul style="list-style-type: none"> <li>X and Y are both unsaturated/contain {multiple/double} bonds/alkenes (1)</li> <li>Z is saturated/contains no {multiple/double} bonds/alkane (1)</li> </ul>	(2)