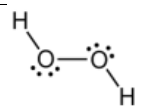
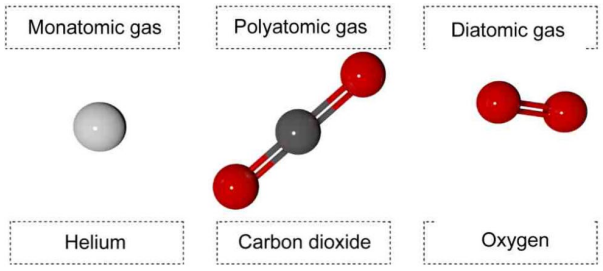
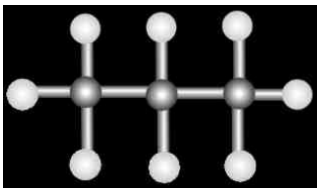
Question		Answers	Notes	Total	Crit
1	a	$CaCO_3$		1	A
	b	Group 1 Period 3		2	A
	c	2.7 ***or*** $1s^2\ 2s^2\ 2p^5$ ***or*** $K^2\ L^7$		1	A
	d	less energy to remove the electron ***or*** the electron is easier to remove (because) outermost electron is further away from nucleus ***or*** (because there is) less attraction from the nucleus (because there are) more electron shells/levels in sodium	*ORA* *WTTE accept larger size*	3	A

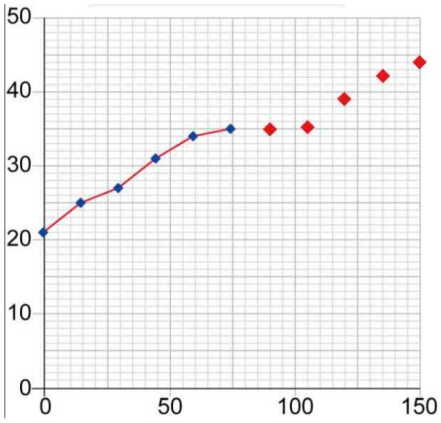
2	**a**	covalent		**1**	A
	b	 C		**1**	A
	c	**$2H_2O_2$ (aq) ⟶ $2H_2O$ (l) + O_2(g)** formulae of products correct with superscripts correct correctly balanced state symbols correct	*Accept any correctly balanced equivalent* *Accept aqueous or liquid for H_2O_2*	**3**	D
	d	 D		**1**	A
	e	more (hydrogen peroxide) particles are present at higher concentrations (hence) there are more successful collisions with stain particles (so) the teeth are being whitened more quickly ***or*** rate of reaction is faster	*WTTE* *ORA*	**3**	A

3	**a**	nitrogen ***and*** 78% oxygen ***and*** 20.9%	*Accept in either order*	**2**	C
	b	 Correct row above or below the model Correct pairing and correct structure All correct		**3**	A
	c	(noble gases are) unreactive ***or*** inert ***or*** have full outer shells (of electrons) ***or*** they don't share electrons with other atoms		**1**	A
	d	12 ***and*** 35.5 ***and*** 19 seen ***or*** correct method for calculation of RMM correctly calculated 187.5	*Ignore mass units if present, answer alone scores 2 marks*	**2**	A

	e	scent or deodorant (particles) move diffuse or move until equally spread out more quickly higher temperatures mean that the <u>particles</u> move faster ***or*** higher temperatures mean that the kinetic energy of the <u>particles</u> is greater	*ORA*	**3**	A
	f			**1**	A

4	**a**	28.1 (°C)		**1**	C
	b	29.7 (°C)		**1**	C
	c	Student B ***and*** measured T when all of gallium had melted ***or*** Student B ***and*** the change of state had occurred (and) the temperature was steady	*Do **not** accept ref to equipment, do **not** accept ref to more than one measurement*	**2**	C
	d	(as the % of zinc increases, the melting point) decreases	*ORA*	**1**	C
	e	(if) the percentage of zinc increases in an alloy (then) the density of that alloy will decrease (because) zinc has a lower density than copper		**3**	B
	f	1000 ± 10 °C		**2**	C
	g	Type A the melting point is 1066 (°C) so it will not melt ***or*** has a melting point that is above 1050 (°C)		**2**	**C**

5	**a**	Carbon dioxide ***or*** CO_2		**1**	A
	b	***Independent variable:*** (type of) solute ***Dependent variable:*** <u>freezing point</u> ***or*** <u>freezing temperature</u>	*WTTE* *Do **not** accept melting point*	**2**	B
	c	***Any two reasonable control variables, for example [max 2]:*** • volume / size of ice cube • amount/mass/concentration of solute • temperature of freezer • (shape /material of) container • starting temperature (of solution) • time		**2**	B
	d	how does the (IV from 5b) of solute affect the freezing point / temperature of the solution	*ECF from incorrect IV in 5b*	**2**	B

6	**a**	 two data points plotted correctly all data point plotted correctly title links temperature change with time X axis label: time ***and*** s Y axis label: temperature ***and*** °C		**5**	C
	b	B because the graph shows a steady plateau at 35 °C this is the melting point/temperature of Form V		**2**	C

	c	evidence of a calculation of an average 36.6(6666…) 36.7	*Does not have to be correct answer for this first mark* *Award two marks if only 36.6 is shown* *Award three marks if only 36.7 is shown*	**3**	C
	d	43±0.5 °C		**2**	C
	e	***Any reasonable suggestion, for example [max 1]:*** • melting point not measured correctly • incorrect % of cocoa used • not all of the sample was melted • water bath was at incorrect temperature •		**1**	C
	f	investigate samples with intermediate % between 30 and 60		**1**	C

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<tr>
<td>7</td>
<td>a</td>
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<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1.V (Variables)</td><td>either independent or dependent variable is identified</td><td>independent and dependent variables are identified</td><td></td><td></td></tr>
<tr><td>2.CV (Control variables)</td><td>one control variable is stated</td><td>two control variables are stated</td><td></td><td></td></tr>
<tr><td>3.E (Equipment)</td><td>equipment to measure temperature or equipment to monitor one CV</td><td>equipment to measure temperature and equipment to monitor one CV</td><td></td><td></td></tr>
<tr><td>4. Meth (Method)</td><td>• put chocolate in boiling tube and measure melting temperature</td><td>• put chocolate in boiling tube and measure melting temperature
• all samples are measured</td><td>• put chocolate in boiling tube and measure melting temperature
• all samples are measured
• all samples are same size/mass</td><td>• put chocolate in boiling tube and measure melting temperature
• all samples are measured
• all samples are same size/mass
• heat until temperature is stable</td></tr>
<tr><td>5. D (Sufficient data)</td><td>at least three trials for one chocolate</td><td>at least three trials for all chocolates</td><td>at least three trials for all chocolates and plans to calculate average</td><td></td></tr>
<tr><td>6. S (Safety)</td><td>a safety precaution is mentioned</td><td>a safety precaution is mentioned linked to a specific named hazard</td><td></td><td></td></tr>
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<td>15</td>
<td>B</td>
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<tr><td rowspan="3">8</td><td>a</td><td>Li^{+}</td><td>Accept no superscript
Do not accept Li^{1+} or Li^{+1}</td><td>1</td><td>A</td></tr>
<tr><td>b</td><td>1714.28 (moles)

1714.3 (to 1 dp)</td><td>

Award 1 mark for 1.7</td><td>2</td><td>C

D</td></tr>
<tr><td>c</td><td colspan="3"><table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Env
(Environmental)</td><td>comment about lithium-ion batteries or crude oil</td><td>comment about lithium-ion batteries and crude oil</td><td>statement of advantage and disadvantage for lithium-ion or petrol

or

statement of advantage or disadvantage for lithium-ion and petrol</td><td>statement of advantage and disadvantage of lithium-ion and crude oil</td></tr>
<tr><td>Soc
(Social impacts)</td><td>a social impact of lithium-ion batteries or crude oil</td><td>a social impact of lithium-ion batteries and crude oil</td><td>a social impact of lithium-ion batteries and crude oil and an additional impact of either</td><td></td></tr>
<tr><td>App
(Appraisal)</td><td>a choice is stated</td><td>a choice is stated with further justification</td><td></td><td></td></tr>
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<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Economic aspects</td><td>a comment about an economic impact</td><td>a statement about an economic impact linked to the linear economy or the circular economy</td><td>a statement about an economic impact linked to the linear economy or the circular economy with justification</td><td>a statement about an economic impact linked to the linear economy and the circular economy with justification</td></tr>
<tr><td>Use of resources</td><td>a comment about use of resources</td><td>a statement about use of resources linked to the linear economy or the circular economy</td><td>a statement about use of resources linked to the linear economy or the circular economy with justification</td><td>a statement about use of resources linked to the linear economy and the circular economy with justification</td></tr>
<tr><td>Social impacts</td><td>a comment about a social impact</td><td>a statement about social impacts linked to the linear economy or the circular economy</td><td>a statement about social impacts linked to the linear economy and the circular economy</td><td></td></tr>
<tr><td>A concluding appraisal</td><td>a concluding appraisal is given</td><td></td><td></td><td></td></tr>
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<td>12</td>
<td>D</td>
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