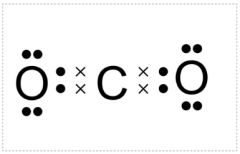
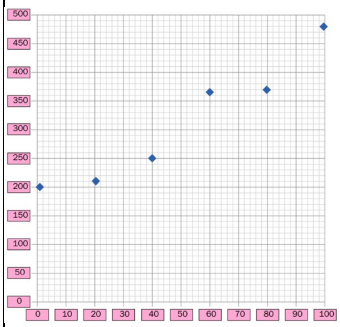
Question		Answers	Notes	Total	Crit
1	a	(The molecule) contains two atoms of oxygen		1	A
	b	CO_2	*2 must be a subscript*	1	A
	c	 Carbon in the centre with oxygen either side Both double bonds correct (dots and crosses) Correct arrangement of lone pairs (dots) around each oxygen atom		3	A
	d	$CO_2(aq) \rightleftharpoons CO_2(g)$ both states correct correct equilibrium arrow	*Accept either direction for equilibrium*	2	D
	e	The cola is less fizzy Is no longer at equilibrium or (because) some of the CO_2 escapes The solubility of CO_2 decreases with the temperature ***or*** Diffusion increases ***or*** The concentration of dissolved CO_2 decreases ***or*** is lower		3	A

2	**a**	98 g mol^{-1}	 *Accept g/mol*	**2**	A
	b	0.113(93514) (moles) 0.114 (moles)	 *Award 2 marks if only 0.114 is seen*	**2**	A
	c	($C_5H_{12}O_5$) Correct number of each type of atoms Correct formula Correctly expressed	 *Elements must be in the correct order for 3 marks*	**3**	A
	d	Text/MCQ/Mini-Cl Carboxylic acid Text/MCQ/Mini-Cl Ester		**2**	A

3	**a**	2.8.3 ***or*** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$		**1**	A
	b	***Accept any two properties, for example, [max 2]*** • Aluminium can is less reactive • Aluminium can is less dense or lighter • Aluminium is more readily available ***Accept any two correctly linked explanations, for example [max 2]*** • Less likely to react with food • Cheaper to transport • (as) it can be recycled		**4**	A

<table>
<tr><td>4</td><td>a</td><td>Table Object
<table><tr><td>Temperature of water (°C)</td><td>Mass of sugar (g)</td></tr><tr><td>0</td><td>200</td></tr><tr><td>20</td><td>210</td></tr><tr><td>40</td><td>250</td></tr><tr><td>60</td><td>365</td></tr><tr><td>80</td><td>370</td></tr><tr><td>100</td><td>480</td></tr></table>Columns labelled as Temperature and mass

Units in column header

Data arranged in increasing order</td><td>Do not accept units with data</td><td>3</td><td>C</td></tr>
<tr><td></td><td>b</td><td> 

X Axis labelled Temperature

Y axis labelled mass of sugar

Units included with both axis labels

Three data points plotted correctly

All data points plotted correctly and using the majority of the graph grid</td><td></td><td>5</td><td>C</td></tr>
</table>

	c	C		1	C
	d	Correct point identified 60 ℃ Mass = 290±10 (g)	*Accept 4th point*	**2**	C
	e	Text Object Sugar inside the spinning container Text/MCQ/Mini-Cloze Object State of sugar: liquid Text Object Sugar in the collection bowl Text/MCQ/Mini-Cloze Object State of sugar: solid Text/MCQ/Mini-Cloze Object Sugar inside the spinning container: Takes the shape of the container Sugar in the collection bowl: No change of shape when changing container	*Award ECF from first marking point for second mark for each pair*	**4**	C

5	**a**	***IV:*** Time ***or*** duration ***DV:*** How cooked or solid or white ***Accept any two reasonable CV, for example [max 2]*** • Size of egg • Type of egg • Temperature of water • Volume of water • Colour of shell	*Accept ref to any change in appearance*	**4**	B
	b	***If:*** the egg is heated ***or*** cooked for a longer time ***Then:*** The more solid ***or*** white the egg will become ***Because:*** there is a greater amount of chemical change	*WTTE*	**3**	B
	c	Sugar and protein react With heat Maillard reaction causes brown colour		**3**	A
	d	The colour would be less brown (as) lower temperature gives fewer changes due to Maillard reaction	*WTTE, accept rate is slower*	**2**	B

<table>
<tr><td>6</td><td>a</td><td>The force needed to break cooked meat is higher

(so) the hypothesis is not supported</td><td>ORA

Do not award the second mark unless the first is awarded</td><td>2</td><td>C</td></tr>
<tr><td></td><td>b</td><td>Lime and lemon and lemon and lime (could be eaten)

The samples had breaking forces of greater than 280 N</td><td></td><td>2</td><td>C</td></tr>
<tr><td></td><td>c</td><td>As a control or for direct comparison or as a baseline</td><td></td><td>1</td><td>C</td></tr>
<tr><td></td><td>d</td><td>Repeat the experiment

Calculate an average</td><td></td><td>2</td><td>C</td></tr>
<tr><td></td><td>e</td><td>What is the effect of pH on (breaking force)?</td><td>WTTE</td><td>1</td><td>B</td></tr>
<tr><td></td><td>f</td><td colspan="2"><table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Variables</td><td>Either IV (pH) or DV (force) is identified</td><td>IV (pH) and DV (force) is identified</td><td></td><td></td></tr>
<tr><td>CV</td><td>One CV is stated</td><td>Two CV are stated</td><td></td><td></td></tr>
<tr><td>Equipment</td><td>Equipment to measure DV (Force meter) or equipment to monitor one CV</td><td>Equipment to measure DV (Force meter) and one CV</td><td>Equipment to measure DV (Force meter) and stopwatch and equipment to monitor one further CV</td><td></td></tr>
<tr><td>Method</td><td>A method is attempted</td><td>Force measured
and
at least 15 mins or same size of sample or sample is submerged in acid</td><td>Force measured
and
at least 15 mins
and
Same size of sample
or sample is submerged in acid</td><td>Force measured
and
at least 15 mins
and
Same size samples
and
sample is submerged in acid</td></tr>
<tr><td>Data</td><td>Measurement for one pH</td><td>3 trials for one pH
or
One trial for at least five pH</td><td>3 trials for at least 5 pH</td><td>3 trials for at least 5 pH and plans to calculate average</td></tr>
<tr><td>Safety</td><td>A safety precaution is mentioned</td><td>A safety precaution explicitly linked to acidity of solutions or use of force meter</td><td></td><td></td></tr>
</table></td><td>17</td><td>B</td></tr>
</table>

<table>
<tr><td>7</td><td>a</td><td>2000-950 or 2000-900

Accept answers in the range 1050 to 1100</td><td>Award 2 marks for correct answer with no working</td><td>2</td><td>C</td></tr>
<tr><td></td><td>b</td><td colspan="2"><table>
<tr><td></td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>Advantages/disadvantages (AD)</td><td>One production advantage or disadvantage of plant-based protein is implied</td><td>More than one production advantage or disadvantage of plant-based protein is stated</td><td>More than one production advantage or disadvantage of plant-based protein is stated with further supporting evidence for at least one</td></tr>
<tr><td>Nutritional Data (D)</td><td>One category of nutritional data is stated for both burgers</td><td>More than one category of nutritional data is compared for both burgers</td><td></td></tr>
<tr><td>Conclusion (C)</td><td>A concluding appraisal</td><td>A concluding appraisal with justification</td><td></td></tr>
</table></td><td>7</td><td>D</td></tr>
<tr><td>8</td><td></td><td colspan="2"><table>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Environmental impact</td><td>An environmental impact is implied</td><td>An environmental impact is stated</td><td>More than one environment impact is stated</td><td>More than one environment impact is stated with scientific justification for at least one</td></tr>
<tr><td>Ethical</td><td>An ethical issue is implied</td><td>An ethical issue is stated</td><td>An ethical issue is stated with further discussion</td><td></td></tr>
<tr><td>Socio-economic</td><td>A social or economic issue is implied</td><td>A social or an economic issue is stated</td><td>A social issue and an economic are stated</td><td>A social issue and an economic are stated with justification for at least one</td></tr>
<tr><td>Potential for affecting health</td><td>Attempt to describe a potential health effect</td><td>A potential effect on health is clearly stated</td><td></td><td></td></tr>
<tr><td>Concluding appraisal</td><td>An attempt at an appraisal</td><td>An appraisal with justification</td><td></td><td></td></tr>
</table></td><td>15</td><td>D</td></tr>
</table>