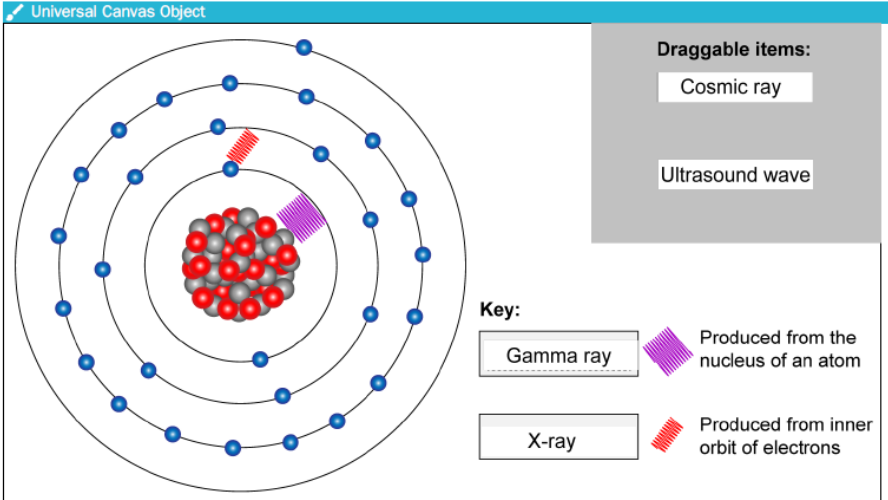


Question	Answers	Notes	Total	Crit									
1 a	Use of speed = distance/time  4(kmh <sup>-1</sup> )	<i>Seen or implied</i>	2	A									
	<input checked="" type="radio"/> C. energy transformed = power × time		1	A									
c	<table border="1" data-bbox="293 587 1012 740"> <thead> <tr> <th data-bbox="293 587 533 662">Horse</th> <th data-bbox="533 587 772 662">Mass of horse/kg</th> <th data-bbox="772 587 1012 662">Weight/N</th> </tr> </thead> <tbody> <tr> <td data-bbox="293 662 533 703">A</td> <td data-bbox="533 662 772 703">350</td> <td data-bbox="772 662 1012 703"><b>3500</b></td> </tr> <tr> <td data-bbox="293 703 533 740">B</td> <td data-bbox="533 703 772 740"><b>510</b></td> <td data-bbox="772 703 1012 740">5100</td> </tr> </tbody> </table>	Horse	Mass of horse/kg	Weight/N	A	350	<b>3500</b>	B	<b>510</b>	5100		2	A
Horse	Mass of horse/kg	Weight/N											
A	350	<b>3500</b>											
B	<b>510</b>	5100											
d	<div style="border: 1px solid black; padding: 10px; display: inline-block;"> <table style="border-collapse: collapse;"> <tr> <td style="border: 1px dashed black; padding: 5px; text-align: center;">Chemical potential energy</td> <td style="padding: 0 10px;">→</td> <td style="padding: 0 10px;"><b>Kinetic energy</b></td> <td style="padding: 0 10px;">→</td> <td style="border: 1px dashed black; padding: 5px; text-align: center;">Gravitational potential energy</td> </tr> </table> </div>	Chemical potential energy	→	<b>Kinetic energy</b>	→	Gravitational potential energy		1	A				
Chemical potential energy	→	<b>Kinetic energy</b>	→	Gravitational potential energy									
e	Calculate work done 61200 (J)  Calculate power 11127  11.127 (kW)	<i>Award 3 marks for 11.127 expressed to 2 or more sig figs ECF</i>	3	A									
f	$I = P/V$  $I = 6.48695..$ or 6.5 (A)	<i>Seen or implied</i>  <i>Accept answer stated to 2 or more sig figs</i>	2	A									

<b>2</b>	<b>a</b>	D. Dispersion		<b>1</b>	<b>A</b>
	<b>b</b>	Red light has the longest wavelength <b>or</b> the lowest frequency  Red is <u>refracted</u> the least (of the colours)  Red light is the fastest (in the prism) <b>or</b> Red light has the lowest refractive index <b>or</b> Red light is slowed down the least (by the glass)		<b>3</b>	<b>A</b>
	<b>c</b>	IR has longer wavelength <b>or</b> IR has lower frequency <b>or</b> IR is detectable as heat	<i>WTTE</i>	<b>1</b>	<b>A</b>
	<b>d</b>	$f = \frac{v}{\lambda}$ seen or implied  4(.00) x 10 <sup>14</sup> (Hz)		<b>2</b>	<b>A</b>

3	a	Atomic number= 6 Mass number=14		2	A
	b	<p><b>Accept any similarity from the list [max 1]</b></p> <ul style="list-style-type: none"> <li>• same number of protons</li> <li>• same charge on the nucleus</li> </ul> <p><b>Accept any difference from the list [max 1]</b></p> <ul style="list-style-type: none"> <li>• different number of neutrons</li> <li>• different number of nucleons</li> <li>• C-14 nucleus is unstable but C-12 nucleus is stable</li> </ul>	<p><i>Do not accept same atomic number or both are carbon nuclei</i></p> <p><i>Do not accept different mass number</i></p>	2	A
	c	 <p>Gamma ray in correct location</p> <p>X-ray in correct location</p>		2	A
	d	${}_{92}^{238}\text{U} \rightarrow {}_{90}^{232}\text{Th} + {}_2^4\alpha$ ${}_{90}^{232}\text{Th} \rightarrow {}_{91}^{234}\text{Pa} + {}_{-1}^0\beta$		2	A
	e	A <u>neutron</u> is absorbed by the <u>nucleus</u> of uranium-238	WTTE	1	A

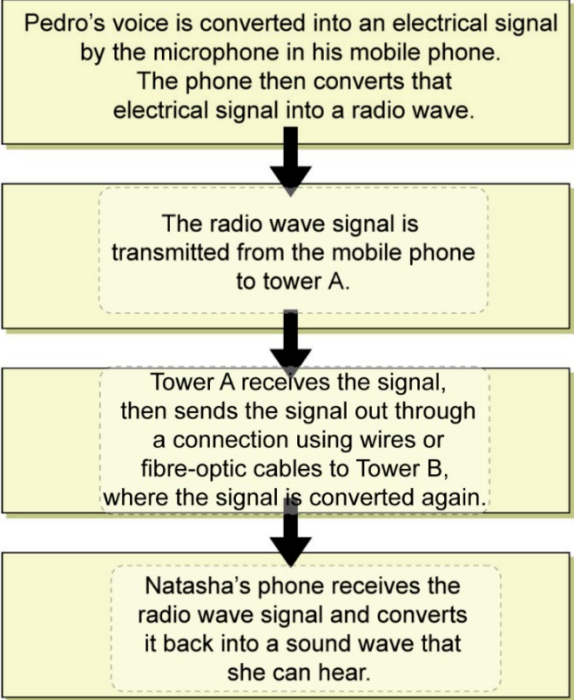
<b>4</b>	<b>a</b>	A RQ linking mass <b>or</b> force <b>or</b> weight <b>or</b> pressure <b>and</b> volume		<b>1</b>	<b>B</b>
	<b>b</b>	Mass as only IV Volume of air as only DV		<b>2</b>	<b>B</b>
	<b>c</b>	Increase		<b>1</b>	<b>B</b>
	<b>d</b>	Correct use of (m x g) Increase in pressure = $1.51898 \times 10^5$ or 151899 (Pa or $\text{Nm}^{-2}$ ) Total pressure = $2.5 \times 10^5$ (Pa or $\text{Nm}^{-2}$ ) or 251899 (Pa or $\text{Nm}^{-2}$ )	<i>Seen or implied</i>  <i>Correct to at least 2 sig figs, no ECF</i>  <i>Award 3 marks for correct total pressure value stated to at least 2 sig figs</i>	<b>3</b>	<b>C</b>
	<b>e</b>	As the pressure increases, the volume decreases  <b>Second mark, accept any further description [max 1]</b> <ul style="list-style-type: none"> <li>• in an inverse relationship</li> <li>• pressure is proportional to 1/volume</li> <li>• pressure is inversely proportional to volume</li> <li>• when pressure doubles, volume halves</li> </ul>		<b>2</b>	<b>C</b>
	<b>f</b>	<b>Reference to the graph, for example [max 1]</b> <ul style="list-style-type: none"> <li>• the line is horizontal <b>or</b> flat <b>or</b> the same value (of 11000) is found for every pressure</li> <li>• There is a slight slope to the line</li> <li>• The value at 300kPa is not constant</li> </ul> <b>Justification [max 1]</b> <ul style="list-style-type: none"> <li>• (so) the graph supports Boyle's Law (within experimental error)</li> <li>• (so) the graph does not support Boyle's Law</li> </ul>	<i>Reference to the graph must be made for the first marking point</i>          <i>Do not award the second marking point without the first marking point being awarded</i>	<b>2</b>	<b>C</b>
	<b>g</b>	Answer in range 145-155  cm <sup>3</sup>	<i>Award unit mark independently</i>	<b>2</b>	<b>C</b>

<b>5</b>	<b>a</b>	<p>As temperature increases, the kinetic energy <b>or</b> speed increases</p> <p>The number of collisions between the gas particles and the wall of the balloon increases <b>or</b> The force of the collisions between the gas particles and the wall of the balloon increases <b>or</b> The kinetic energy of the particles is transferred to elastic potential energy</p> <p>So the balloon expands because the balloon is elastic <b>or</b> The balloon expands because its wall is pushed out by the pressure of the gas</p>	<i>WTTE</i>	<b>3</b>	<b>B</b>
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<b>b</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>14</b>	<b>B</b>
	RQ	an RQ correctly linking temperature and volume or circumference					
	V (Variables)	temperature as independent variable <b>or</b> circumference implied as dependent variable	independent variable of temperature <b>and</b> dependent variable of circumference stated	independent variable of temperature <b>and</b> dependent variable of circumference stated <b>and</b> one control variable stated			
	E (Equip)	equipment to measure temperature <b>or</b> circumference	equipment to measure temperature <b>and</b> circumference				
	M (Method)	attempt at a method linked to circumference <b>or</b> temperature	method is described with measurements of circumference <b>and</b> temperature but not detailed enough to be followed by another student	complete method is realistic and described with measurements of circumference <b>and</b> temperature <b>and</b> could easily be followed by another student			
	D (Data)	a reference to different temperatures	at least five increments of temperature	at least five increments of temperature <b>and</b> repeated measurements of circumference	at least five increments of temperature <b>and</b> repeated measurements of circumference <b>and</b> plans to calculate average		
S (Safety)	mentions a relevant safety precaution for example: working at elevated temperature or making sure the balloon is not inflated too much at the start						

<b>6</b>	<b>a</b>	<p>Acceleration is due to an unbalanced force  <b>or</b>  Newton's second law says the greater the force, the greater the acceleration  <b>or</b>  <math>F=ma</math></p> <p>Expulsion of gas and thrust are paired forces  <b>or</b>  Forces are an action-reaction pair of forces</p> <p>(this is an example of) Newton's third law</p>		<b>3</b>	<b>C</b>													
	<b>b</b>	An RQ correctly linking circumference <b>or</b> volume with distance travelled		<b>1</b>	<b>B</b>													
	<b>c</b>	38.2 <b>and</b> cm	<i>Unit <b>and</b> value required for the point. Accept 0.382 m.</i>	<b>1</b>	<b>C</b>													
	<b>d</b>	<table border="1" data-bbox="304 884 1335 1137"> <thead> <tr> <th>Circumference / cm</th> <th>Distance travelled / m</th> </tr> </thead> <tbody> <tr><td>35.8</td><td>1.07</td></tr> <tr><td>38.2</td><td>1.30</td></tr> <tr><td>41.0</td><td>1.97</td></tr> <tr><td>50.3</td><td>3.10</td></tr> <tr><td>54.9</td><td>3.99</td></tr> <tr><td>58.2</td><td>5.06</td></tr> </tbody> </table> <p>Table with circumference and distance travelled <b>and</b> units in headers only</p> <p>Data in ascending or descending order</p> <p>Data to consistent dp</p> <p>Numbers correctly converted to consistent units</p>	Circumference / cm	Distance travelled / m	35.8	1.07	38.2	1.30	41.0	1.97	50.3	3.10	54.9	3.99	58.2	5.06	<p><i>Accept data arranged in either vertical columns or horizontal rows</i></p> <p><i>Accept either metres or centimetres for each column</i></p>	<b>4</b>
Circumference / cm	Distance travelled / m																	
35.8	1.07																	
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	<b>e</b>	The graphs show that as the circumference increases, the distance travelled will increase		<b>3</b>	<b>C</b>													



7	a	<p>Accept period in the range 1.6-1.8</p> <p>Accept frequency in the range 0.56-0.63</p> <p>Hz <i>or</i> s<sup>-1</sup></p>	<p><i>Seen or implied</i></p> <p><i>Must be expressed as 2 sig figs</i></p> <p><i>Award the unit mark independently</i></p>	3	C  D
	b	C		1	A
	c	 <p>Pedro's voice is converted into an electrical signal by the microphone in his mobile phone. The phone then converts that electrical signal into a radio wave.</p> <p>The radio wave signal is transmitted from the mobile phone to tower A.</p> <p>Tower A receives the signal, then sends the signal out through a connection using wires or fibre-optic cables to Tower B, where the signal is converted again.</p> <p>Natasha's phone receives the radio wave signal and converts it back into a sound wave that she can hear.</p> <p>All correct</p>		1	D

<b>d</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>13</b>	<b>D</b>
	<b>Advantages and disadvantages</b> (location-tracking tech)	a statement of one advantage <b>or</b> disadvantage for an individual	a statement of one advantage <b>and</b> one disadvantage for an individual <b>or</b> a statement of one advantage for an individual <b>or</b> disadvantage for an individual with support	a statement of more than one advantage for an individual <b>and</b> more than one disadvantage for an individual	a statement of at least two advantages for an individual with support for one <b>and</b> at least two disadvantages for an individual with support for one		
	<b>Economic (Economic benefits)</b>	an economic benefit for a company	more than one economic benefit for a company <b>or</b> one benefit with support	more than one economic benefit for a company with support for at least two			
	<b>Security (Security implications)</b>	a positive <b>or</b> a negative security implication for a country	a positive <b>and</b> a negative security implication for a country	a positive <b>and</b> a negative security implication for a country with support for <b>one</b>	a positive <b>and</b> a negative security implication for a country with support for <b>both</b>		
	<b>Con (Concluding appraisal)</b>	a concluding opinion is given	a concluding appraisal linking to previous arguments				

8						
		<b>1</b>	<b>2</b>	<b>3</b>		
	<b>Benefits of controlling</b>	a statement of a benefit	a statement of two or more benefits <i>or</i> a statement of one benefit with an explanation	a statement of two or more benefits with at least one explained		
	<b>Limitations of controlling</b>	a statement of a limitation	a statement of two or more limitations <i>or</i> a statement of one limitation with an explanation	a statement of two or more limitations with at least one explained		
<b>Con (Conclusion)</b>	a simple conclusion	a conclusion with a detailed appraisal of the issues raised				
					8	D