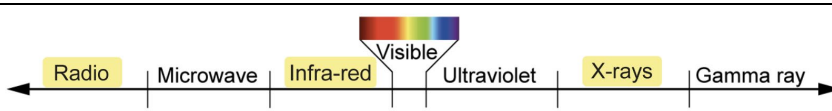


Question		Answers			Notes	Total	Criterion	Level													
1	a	<table border="1"> <thead> <tr> <th>Symbol</th> <th>Quantity</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>p</td> <td>momentum</td> <td>Ns or kg m s⁻¹</td> </tr> <tr> <td>m</td> <td>mass</td> <td>Kg</td> </tr> <tr> <td>v</td> <td>velocity</td> <td>m s⁻¹</td> </tr> </tbody> </table>			Symbol	Quantity	Unit	p	momentum	Ns or kg m s ⁻¹	m	mass	Kg	v	velocity	m s ⁻¹			2	Ai	1-2
		Symbol	Quantity	Unit																	
		p	momentum	Ns or kg m s ⁻¹																	
		m	mass	Kg																	
v	velocity	m s ⁻¹																			
	two correct all correct				1-2																
	b	the train has a greater mass or the train is heavier				1	Ai	1-2													
	c	<p>the ball has forward momentum</p> <p>a force is required to change (an object's) momentum</p> <p>as no force is available to change the momentum (the ball keeps moving)</p> <p>or</p> <p>(initially) the ball is moving forward and with the train (at 5 ms⁻¹)</p> <p>(Newton's first law states that) an object's velocity will stay the same unless a force acts on it or any correct reference to inertia</p> <p>there is no net force acting so the velocity will not change</p>			WTTE			5-6													
	d	<u>Friction</u> (creates a force that prevents the bag from moving)				1	Ai	3-4													

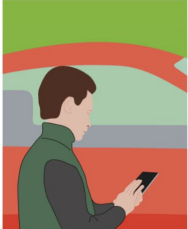
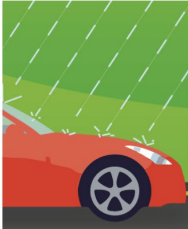
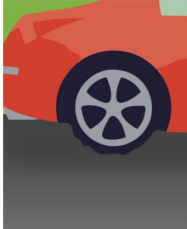



2	a	$P = IV$ or $I = P/V$ or $1100/220$ 5 A or amp(s) or ampere(s)	<i>Award 2 marks for answer with no calculation</i> <i>Award this unit mark independently</i>	3	Ai	3-4
	b	(electrons carry negative charge so) dust becomes negatively charged reference to attraction between opposite charges	<i>WTTE</i>		2	Aiii
	c	dust particles interfere with this field making it weaker or addition of negative charges to the positive plate reduces / neutralizes the overall (positive) charge (so) force of attraction is weaker	<i>WTTE</i>	2	Aii	3-4 3-4
3	a	 <p>Responses must be in the correct location either above or below the line</p>		1	Ai	1-2
	b	Any reasonable suggestion, for example [max 1] <ul style="list-style-type: none"> infrared does not pass through fur infrared could adversely affect health infrared could cause a heating effect infrared has higher energy than radio waves 	<i>ORA</i>	1	Aiii	3-4
	c	$v = f \lambda$ or 134000×2238 $299892000 \text{ (ms}^{-1}\text{)}$ 2.99892×10^8 or $3(.00) \times 10^8 \text{ (ms}^{-1}\text{)}$	<i>Award 2 marks for 29989200 with no calculation shown</i> <i>Award 1 mark for $3(.00) \times 10^8$ with no calculation</i> <i>Ignore incorrect units</i>	3	Aii Diii	3-4 3-4 3-4
	d	induction requires no internal power source alternative power source would lose power over time (requiring a replacement RFID or battery) or		2	Aiii	3-4 3-4

		an internal power source would be too large				
	e	(AC in the scanner coil produces an) <u>alternating</u> magnetic field / flux	<i>WTTE</i>			5-6
		the magnetic field passes through the cat to the RFID		3	Aii	5-6
		changing field in the RFID generates an emf in the RFID				7-8

4	a	how does the <u>angle</u> between 2 (plane) mirrors affect the number of images?	WTTE <i>Accept responses phrased as questions only</i>	1	Bi	1-2																																
	b	<table border="1"> <thead> <tr> <th colspan="4">Table Object</th> </tr> <tr> <th></th> <th>Independent variable</th> <th>Dependent variable</th> <th>Control variable</th> </tr> </thead> <tbody> <tr> <td>The object used</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>The position of the object</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>The number of images observed</td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>The size of the mirrors used</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>The angle between the mirrors</td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>The shape of the mirrors used</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> </tbody> </table> <p>IV – the angle between the mirrors only</p> <p>DV – the number of images observed only</p> <p>CV – the position of the object and the object used and the size of the mirrors used and the shape of the mirrors used only</p>	Table Object					Independent variable	Dependent variable	Control variable	The object used	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The position of the object	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The number of images observed	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The size of the mirrors used	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The angle between the mirrors	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The shape of the mirrors used	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		3	Biii	1-2 1-2 1-2
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c	protractor		1	Biv	3-4																																	
d	92 ± 2 (°)		1	Cii	1-2																																	
e	<p>as angle increases number of images decreases</p> <p>conditions of inverse proportion clearly stated or implied in calculation $N = k/\text{Angle}$ or if angle is doubled, the number of images is not halved</p> <p>data from the graph correctly used to show that relationship is not inversely proportional</p>	<p><i>Award separately and ignore any further incorrect comment linked to inversely proportional relationship</i></p> <p><i>Award three marks if the first marking point is implied in the last marking point</i></p>	3	Ciii	1-2 7-8 7-8																																	
f	<p>Any reasonable explanatory points, for example [max 2]</p> <ul style="list-style-type: none"> DV is not continuous only integer values of numbers of images are allowed comparison between angles is easier 	<i>Accept discrete variable</i>	2	Ci	5-6 7-8																																	
g	<p>(the second student because) there are more data points or (the second student because) data are taken at regular intervals</p> <p>increased number of measurements over the range shows the pattern more clearly</p>	WTTE	2	Civ	3-4 3-4																																	

5	a	distance noted as being 220m evidence of use of speed equation (distance/time) rounded correctly to 2sf 280 m s ⁻¹	<i>Award third marking point if an incorrect value is rounded correctly to 2sf</i>	3	Cii Diii	5-6 3-4 7-8
	b	increase the number of time measurements at this distance (because this will) improve reliability by minimising the effect of random errors in timing increase the overall time for the sound to travel by increasing the distance to the wall (because) small timing errors (due to human reactions) become less significant if the overall time is longer	<i>WTTE</i> <i>Do not award marks if additional equipment is used</i>	4	Cv	5-6 7-8 5-6 7-8
	c	2.65±0.03 and 0.90±0.03 (2.65– 0.90 =) 1.75 ± 0.06 (s)	<i>Award 2 marks for the correct value</i>	2	Cii	3-4 3-4
	d	Column Headers: Distance (travelled) and time results in order Units in column heading only: m and s data rounded to 2 dp and recorded correctly including their value from part c	<i>Accept tables presented in rows</i> <i>ecf from part (c)</i>	4	Ci	1-2 5-6 3-4 5-6

	e	correct gradient of LOBF speed = 330 to 355 (m s ⁻¹)	<i>seen or implied</i> <i>Ignore rounding</i>	2	Cii	5-6 5-6
	f	identification of data point at 400m or 1s time is too low – should be greater to follow the trend and be closer to the LOBF	<i>WTTE</i>	2	Cii	1-2 3-4
	g	sound faster at higher temp temp linked to kinetic energy <i>or</i> speed of particles time between collisions is reduced <i>or</i> faster rate of energy transfer		3	Cii	1-2 7-8 7-8

7	a	$v^2 = u^2 + 2as$ or $u^2/2a = s$ $400/(2*2) = s$ $s = 100$ m	Accept use of $s = ut + 1/2at^2$ Award the unit mark separately	4	Aii	3-4 5-6 5-6 5-6
	b	<div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="width: 30%; text-align: center;">  <p>Using a cell phone</p> <input type="text" value="driver factor"/> </div> <div style="width: 30%; text-align: center;">  <p>Heavy rain</p> <input type="text" value="environmental factor"/> </div> <div style="width: 30%; text-align: center;">  <p>Worn out tyre tread</p> <input type="text" value="car factor"/> </div> <div style="width: 30%; text-align: center;">  <p>Faulty brakes</p> <input type="text" value="car factor"/> </div> <div style="width: 30%; text-align: center;">  <p>Drinking alcohol</p> <input type="text" value="driver factor"/> </div> <div style="width: 30%; text-align: center;">  <p>Poor road surface</p> <input type="text" value="environmental factor"/> </div> </div> <p>2 correct 1 mark all correct 2 marks</p>		2	Di	1-2 1-2

	c	<p>Alcohol: increases time taken (for the brain) to respond or delayed reactions</p> <p>so stopping distance or thinking distance increases</p> <p>Poor road surface: <u>friction</u> is lower on a poor road surface</p> <p>so stopping distance or braking distance increases</p>	WTTE	4	Dii	<p>3-4</p> <p>3-4</p> <p>3-4</p> <p>3-4</p>
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8								
			1	2	3	4		
	Driverless technology	an incomplete statement about a feature of DT	a statement of one feature of DT related to safety	description of one feature of DT or statements about two features of DT related to safety	description of more than one feature related to safety			
	Society	an incomplete statement of societal implications	one advantage or one disadvantage about society	one advantage and one disadvantage about society clearly stated	more than one advantage and more than one disadvantage about society clearly stated			
	Economic	an incomplete statement about economic implications	one advantage or one disadvantage about economic implications	one advantage and one disadvantage about economic implications	more than one advantage and more than one disadvantage about economic implications			
Concluding appraisal	a brief concluding appraisal	a concluding appraisal linking all arguments						
						14	Dii	4x1-2 4x3-4 3x5-6 3x7-8