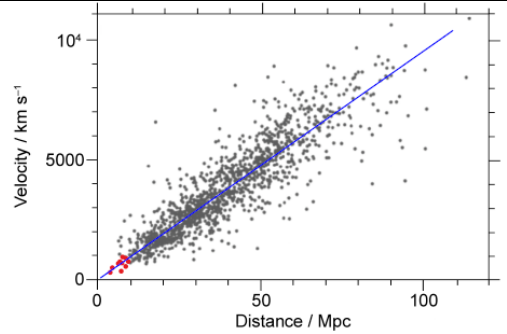


Question	Answers	Notes	Total	Crit									
1	<p>a</p> <p>Liquid ▾ Gas ▾ Solid ▾</p>		1	A									
	<p>b</p> <table border="1"> <thead> <tr> <th>Change of state</th> <th>Initial State</th> <th>Final State</th> </tr> </thead> <tbody> <tr> <td>Condensation</td> <td>Gas ▾</td> <td>Liquid ▾</td> </tr> <tr> <td>Vaporization</td> <td>Liquid ▾</td> <td>Gas ▾</td> </tr> </tbody> </table> <p>All correct</p>	Change of state	Initial State	Final State	Condensation	Gas ▾	Liquid ▾	Vaporization	Liquid ▾	Gas ▾		1	A
Change of state	Initial State	Final State											
Condensation	Gas ▾	Liquid ▾											
Vaporization	Liquid ▾	Gas ▾											
	<p>c</p> <p>the particles have greater (kinetic) energy or particles move faster</p> <p>the number of collisions per second is increased or particles collide with greater force</p> <p>(resulting in) greater pressure</p>	WTTE	3	A									
	<p>d</p> <p>air particles are moving (but are too small to be seen)</p> <p>(that) collide with (larger) smoke particles (that can be seen)</p>	WTTE	2	A									

2	a	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">E</td> <td style="text-align: center;">=</td> <td style="text-align: center;">m</td> <td style="text-align: center;">$(c)^2$</td> </tr> <tr> <td style="text-align: center;">joule</td> <td></td> <td style="text-align: center;">kilogram</td> <td style="text-align: center;">metre per second</td> </tr> </table> <p>all correct</p>	E	=	m	$(c)^2$	joule		kilogram	metre per second		1	A
	E	=	m	$(c)^2$									
	joule		kilogram	metre per second									
	b	Gravitational potential 80 J	<i>Award independently</i>	2	A								
c	KE=1/2mv ² correct answer: 7.26636... stated to 2 sig figs: 7.3 (ms ⁻¹)	<i>Seen or implied</i> <i>Award 3 marks for correct final answer</i>	3	D									
d	substitution into E=mc ² 1.6398 x 10 ⁻¹³ (J)	<i>Ignore incorrect substitution of one mass only (9.11 x 10⁻³¹) for first mark</i> <i>Award 1 mark for 8.199 x 10⁻¹⁴ (J)</i>	2	A									

3	a	Light is an example of a <input type="text" value="transverse electromagnetic"/> wave.		1	A
	b	<input type="text" value="B"/> the wavelength is stretched by the source moving away or the wavelength is increased as the source moves away	<i>WTTE Do not award second mark if incorrect wave is selected Accept correct reference to frequency</i>	2	A
	c	wavelength emitted from stars has increased (so) the stars appear more red (if they are moving away)		2	A
	d	 line passes through the origin line passes approximately through the centre of the data points	<i>judge by eye</i>	2	C
	e	As the distance (away from the Earth) increases, the velocity increases (there is a) proportional (relationship)		2	A
	f	suggests that there is an origin or everything was in the same place before (as) objects are moving away from each other or the universe is expanding		2	A
	g	the estimate is based on more data or the data we have is more reliable	<i>WTTE</i>	1	A

4	a	<table border="1"> <thead> <tr> <th colspan="2">Table Object</th> </tr> <tr> <th>Voltage/V</th> <th>Current/A</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td>0.20</td> </tr> <tr> <td>2.0</td> <td>0.41</td> </tr> <tr> <td>3.0</td> <td>0.60</td> </tr> <tr> <td>4.2</td> <td>0.81</td> </tr> <tr> <td>5.1</td> <td>1.01</td> </tr> </tbody> </table> <p>column headings voltage and current</p> <p>units of V and A in headers only</p> <p>all data complete and arranged in order of voltage or current</p> <p>all current readings rounded to 2d.p.</p> <p>correct conversion of 601 (mA) to 0.60(1) (A)</p> <p><u>0.41</u> (A)</p>	Table Object		Voltage/V	Current/A	1.0	0.20	2.0	0.41	3.0	0.60	4.2	0.81	5.1	1.01	<p><i>Accept data arranged in rows or columns</i></p> <p><i>Accept ascending or descending</i></p> <p><i>Ignore 601 mA for this marking point</i></p> <p><i>Value must be quoted to 2 dp</i></p>	6	C
Table Object																			
Voltage/V	Current/A																		
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b	doubling of voltage (approximately) doubles current <i>or</i> doubling of voltage does not exactly double current calculation of constant of proportionality, for at least two values <i>or</i> calculation of predicted current when voltage is doubled (so therefore) hypothesis is supported (within range of experimental precision) <i>or</i> hypothesis is rejected with correct reference to calculation	<i>Do not award third mark unless first or second mark is awarded.</i>	3	C
c	graph is not straight <i>or</i> gradient is not constant (so) it is a non-ohmic conductor	<i>Do not award second mark unless first is awarded</i>	2	C
d	easier to evaluate the visual representation of the relationship presented in a graph	WTTE	1	C
e	5.0 (Ω) 15 (Ω) Ω <i>or</i> ohm(s)	<i>Unit must be visible in one answer</i>	3	C D
f	<input type="text" value="C"/>		1	B

5	a	$\frac{\rho}{A}$		1	C
	b	evidence of gradient calculation answer in the range 0.043 to 0.047 $\Omega \text{ m}^{-1}$	<i>Award 2 marks for correct value alone</i> <i>Award unit mark separately. Accept Ω/m. Do not accept caret for exponent</i>	3	C
	c	length of zero should have a resistance of zero (and) graph doesn't intercept origin		2	C
	d	all values shifted by the same amount because the errors cancel out in gradient calculation (so therefore) statement is invalid	<i>award one mark for saying gradient calculation is not accurate because data are not accurate</i>	3	C
	e	Accept any reasonable response, for example [max 1] <ul style="list-style-type: none"> • zero error • calibration error • additional resistance from other components in the circuit 		1	C
	f	if the area of the wire increases, the resistance would decrease relationship is inversely proportional <u>electrons</u> are moving fewer pathways if the area is smaller	ORA ORA, WTTE	4	B

6	a	two bulbs in series ammeter connected to measure current through bulbs correct circuit with no additional components in series with the bulbs			3	B	
	b				15	B	
			1 mark	2 marks			3 marks
	Research question	Research question links IV and DV					
Hypothesis	A simple prediction that is incomplete or incorrect	Predicts that the current will decrease as the number of bulbs in series increases	Predicts that the current will decrease as the number of bulbs in series increases because resistance increases				
IV and DV	Independent variable identified number of bulbs or dependent variable identified as current	Independent variable identified as number of bulbs and dependent variable identified as current					
CV	supply voltage is the same	supply voltage is the same as increased supply voltage would increase the current flow					
Data	Method implies a range of values	Method includes at least 5 values of IV					
Method	Attempt at a method but detail is insufficient to follow	Method described and could easily be followed by another student					
Equipment	some equipment is listed	power supply, bulbs	power supply, wires, bulbs and ammeter to measure DV				
c	Accept any reasonable additional IV, for example [max 1] <ul style="list-style-type: none"> • bulbs in parallel • material of wires • colour / type of light bulb • different supply voltage 		<i>Do not accept length of wire, cross-sectional area of wire, resistors</i>		1	C	
d	any reasonable research question linked to IV in part c and current				1	B	

7	a	<table border="1"> <tr> <td style="background-color: #fce4d6;">Wood burning biomass</td> <td style="background-color: #e2efda;">Geothermal power</td> <td style="background-color: #e1eef6;">Tidal power</td> </tr> <tr> <td>Disadvantage Needs a large amount of space for fuel production. There is also a time delay between planning the power plant and production beginning.</td> <td>Disadvantage Needs to be built in geologically suitable areas and the start-up costs are high.</td> <td>Disadvantage Needs to be built in coastal areas on land and may disrupt the ecosystem.</td> </tr> </table> <p>one disadvantage correct two disadvantages correct all disadvantages correct</p>	Wood burning biomass	Geothermal power	Tidal power	Disadvantage Needs a large amount of space for fuel production. There is also a time delay between planning the power plant and production beginning.	Disadvantage Needs to be built in geologically suitable areas and the start-up costs are high.	Disadvantage Needs to be built in coastal areas on land and may disrupt the ecosystem.		3	D	
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b	<p>correct energy forms selected in the correct order</p>	<i>Ignore order for this first mark</i>	2	D								
c	<table border="1"> <thead> <tr> <th></th> <th>1 mark</th> <th>2 marks</th> </tr> </thead> <tbody> <tr> <td>Advantages</td> <td>A statement of an advantage implicitly linked to a country</td> <td>A statement of an advantage implicitly linked to a country with explanation</td> </tr> <tr> <td>Disadvantages</td> <td>A statement of a disadvantage implicitly linked to a country</td> <td>A statement of two or more disadvantages implicitly linked to a country with explanation for each</td> </tr> </tbody> </table>		1 mark	2 marks	Advantages	A statement of an advantage implicitly linked to a country	A statement of an advantage implicitly linked to a country with explanation	Disadvantages	A statement of a disadvantage implicitly linked to a country	A statement of two or more disadvantages implicitly linked to a country with explanation for each	4	D
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