

physmMOEENGTZ0XXXX



Markscheme

November 2024

Physics

On-screen examination








15 pages










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The following are the annotations available to use when marking responses.

Annotation	Explanation
	Correct point, place at the point in the response where it is clear that the candidate deserves the mark. For use in analytically marked questions only.
	Omission, incomplete
CON	Contradiction
	Valid part (to be used when more than one element is required to gain the mark)
	Error carried forward
	Dynamic annotation, it can be expanded to surround work
	Underline tool that can be expanded
	Highlight tool that can be expanded to mark an area of a response

Annotation	Explanation
	Not good enough
	The candidate has given a response but it is not worthy of any marks
	Text box used for additional marking comments
	Seen; must be stamped on all blank response areas and on duplicate pages of concatenated responses
	Vertical wavy line that can be expanded
	Words to that effect
	Award 1, 2, 3, 4 marks. For use in holistically marked questions only

Markscheme instructions

- 1 Mark positively. Give candidates credit for what they have achieved and what is correct. Do not deduct marks for incorrect responses. Do not deduct marks for spelling errors.
- 2 Follow the markscheme provided and award only whole marks.
- 3 Each marking point appears on a separate line.
- 4 The maximum mark for each subpart is indicated in the "Total" column.
- 5 Where a mark is awarded a tick should be placed in the text at the precise point where it is clear the candidate deserves the mark.
- 6 Each marking point in a question part should be awarded separately unless there is an instruction to the contrary in the Notes column.
- 7 A question subpart may have more marking points than the total allows. This will be indicated by the word "**max**" in the Answer column. Further guidance may be given in the Notes column.
- 8 Additional instructions on how to interpret the markscheme are in bold italic text in the Answer column.
- 9 Alternative wording may be indicated in the Answer column by a slash (/). Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.
- 10 Alternative answers are indicated in the Answer column by "**or**". Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.
- 11 If two related points are required to award a mark, this is indicated by "**and**" in the answer column.
- 12 Words in brackets () in the Answer column are not necessary to gain the mark.
- 13 Words that are underlined are essential for the mark.
- 14 In some questions a reverse argument is also acceptable. This is indicated by the abbreviation *ORA (or reverse argument)* in the Notes column. Candidates should not be rewarded for reverse arguments unless *ORA* is given in the Notes column.
- 15 If the candidate's response has the same meaning or is clearly equivalent to the expected answer the mark should be awarded. In some questions this is emphasized by the abbreviation *WTTE (or words to that effect)* in the Notes column.
- 16 When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add ECF (error carried forward) to the candidate response.
- 17 The order of marking points does not have to be the same as in the Answer column unless stated otherwise.
- 18 Marks should not be awarded where there is a contradiction in an answer. Add CON to the candidate response at the point where the contradiction is made.
- 19 Do not penalize candidates for errors in units or significant figures unless there is specific guidance in the Notes column.
- 20 Questions with higher mark allocations will generally be assessed using a level response method using task specific clarifications developed with reference to the criteria level descriptors. A candidate's work should be reviewed to determine holistically the mark for each row of the holistic grid and a mark awarded for each row.

Question		Answers				Notes	Total	
1	a	C					1	A
	b		Kinetic energy	Potential energy	Speed		2	A
		Position A	minimum	maximum	minimum			
Position B		maximum	minimum	maximum				
Position C		minimum	maximum	minimum				
		First mark: One row correct Second mark: All correct						
	c	1 period has a time of 1.71(s) Use to calculate value $g=9.788(26 \text{ ms}^{-2})$ Correct value stated to 3 sig figs. $9.79 \text{ (ms}^{-2})$				<i>Seen or implied</i> <i>Award 2 marks max if length in cm and period 17.1s is used</i>	3	A
	d	Accept any reasonable suggestion, for example [max 1] <ul style="list-style-type: none"> the laboratory might not be at sea level the measurement of T might have been inaccurate the measurement of l might have been inaccurate 				<i>Do not accept mass of local geographical features</i>	1	A
	e	Loss of PE = gain of KE seen or implied Evidence of change in height 8m (so) KE =156.96 (kJ) 160 (kJ rounded to 2 sf)					4	A
	f	Frictional forces (bearings, air) or wasted as heat					1	A

2	a	hot air or smoke (particles) rises As it is less dense (than the air around it)		2	A
	b	Accept any two properties from the list [max 2] <ul style="list-style-type: none"> • alpha particles have high ionizing power • an alpha particle is a helium nucleus, or an alpha particle is made of 2 protons and 2 neutrons • low penetrating power or stopped by a sheet of paper • they are positively charged • gets affected in electric and magnetic fields 		2	A
	c	A		1	A
	d	B Proton/atomic number is not the same (as Americium)		2	A
	e	420±10 (years)		1	C
	f	1680±40 (years)	<i>ECF from part (e)</i>	1	C
	g	As beta and gamma are less ionizing There would be no current Alarm will sound all the time or Beta and gamma are more penetrating The radiation would go through the smoke Smoke would not be detected	<i>Only award mp3 if the other 2 marking points have been awarded</i>	3	A

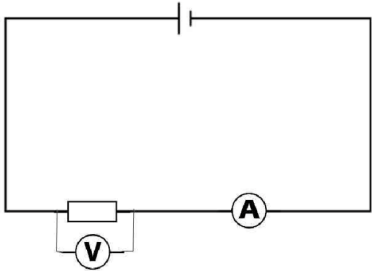
3	a	<p>If, then: The diameter increases then the resistance will decrease</p> <p>Because: There are more paths for the <u>electrons</u> to follow or There are more <u>electrons</u> to carry to electricity</p>	<p><i>WTTE</i> <i>Do not accept there is more space or volume</i></p>	2	B												
	b	<p>At least three of one material only, no other material included</p> <p>At least three of one length only</p> <p>5 diameters of one length only</p>	<p><i>Award 3 marks for 5 diameters of material C only</i></p>	3	B												
	c	<p>IV is diameter or Material C is the only material with five different diameters</p> <p>Material and length should be controlled</p>		2	B												
	d	<table border="1"> <thead> <tr> <th>Diameter/ mm</th> <th>Resistance/Ohms</th> </tr> </thead> <tbody> <tr> <td>12</td> <td>56</td> </tr> <tr> <td>17</td> <td>27</td> </tr> <tr> <td>20</td> <td>20</td> </tr> <tr> <td>23</td> <td>16</td> </tr> <tr> <td>27</td> <td>12</td> </tr> </tbody> </table> <p>Headers diameter and resistance</p> <p>Units for headers correct and in headers only</p> <p>Complete, correct data arranged in order</p> <p>56.2 correctly rounded to 56</p>	Diameter/ mm	Resistance/Ohms	12	56	17	27	20	20	23	16	27	12		4	C
Diameter/ mm	Resistance/Ohms																
12	56																
17	27																
20	20																
23	16																
27	12																

e	<p>Accept any two reasonable suggestions, for example [max 2]</p> <ul style="list-style-type: none"> • average could be calculated • (so) random errors are eliminated • to increase reliability 		2	C
f	D		1	C
g	<p>Research question What is the relationship between the length of a cylinder and resistance? or What is the relationship between the material of a cylinder and resistance?</p> <p>Independent variable: consistent with RQ Control variable: consistent with RQ</p>	<p><i>Do not accept "What is the relationship between diameter and resistance?"</i></p> <p><i>Allow RQ without a question mark as long as it is phrased as a question</i></p>	3	C

4	a	What is the relationship between distance from a light source and resistance of an LDR?	Accept intensity in place of distance	1	B
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4	b			13	B
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	1 mark	2 marks	3 marks	4 marks	Notes
1.V	distance as independent variable or resistance as dependent variable	distance as independent variable and resistance as dependent variable			Only requirement is to state using the terminology of IV and DV. No need to explain further. Do not accept calculated values as DV unless explicitly shown how calculated from measured values.
2.C V	one control variable stated	one control variable stated and justified or and two control variables stated	two control variables are stated and one justified	two control variables are stated and both justified	Do not accept "keeping equipment the same" as a CV. CV: background light, temperature, same angle of LDR with respect to the light, brightness or power of the light Accept intensity for brightness
3.E	ruler to measure distance				Equipment needs to be correct for the given situation and stated CVs. Accept tape measure, metre rule Do not accept equipment that is mentioned in the question / instructions.
4.M	method is linked to distance or resistance	method linked to distance and resistance	method linked to resistance and distance and can be followed		A method that does not include how to vary the IV is incomplete. Limited information about CVs mean that data is unlikely to be relevant
5.D	any reference made to different variations of distance	at least five variations of distance or at least three trials	at least five values of distance and at least three trials		The values of the five or more variations should be explicitly stated for 3 marks

5	a	42 (°C)		1	C																							
	b	 <p>Resistor connected to battery in complete circuit</p> <p>Ammeter in series</p> <p>Voltmeter in parallel with no other components added</p>	<i>Allow addition of a switch only</i>	3	B																							
	c	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Variable</th> <th style="text-align: center;">Independent</th> <th style="text-align: center;">Dependent</th> <th style="text-align: center;">Control</th> </tr> </thead> <tbody> <tr> <td>Temperature of the resistor</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Length of the resistor</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td>Current in the circuit</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Diameter of the resistor</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td>Voltage across the resistor</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </tbody> </table> <p>Temperature of resistor as only IV</p> <p>Current as DV only</p> <p>CVs as length and diameter and voltage across</p>	Variable	Independent	Dependent	Control	Temperature of the resistor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Length of the resistor	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Current in the circuit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Diameter of the resistor	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Voltage across the resistor	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		3
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d	High temperature of beads <i>or</i> Electrical hazards		1	B
e	Two data points correctly stated To show that the relationship is not inverse proportion (so) prediction is not supported	<i>Do not award the second or third mark unless the first mark is awarded</i>	3	C
f	83(.565...) 84 (Ω)	<i>Award two marks if 84 is seen</i>	2	C
g	Data point correctly plotted (50, 84 \pm 1) Line of best fit appropriately models the data	<i>Judge by eye</i>	2	C
h	60 \pm 2 (Ω)	<i>Accept an intercept consistent with the LoBF in part g</i>	1	C
i	Accept any value in the range 0.43-0.55 Ω °C ⁻¹	<i>Accept Ω /°C</i>	2	C
j	Accept any reasonable comment, for example [max 1] <ul style="list-style-type: none"> • it is not appropriate to extrapolate far beyond the data set • there might not be a linear relationship over this large temperature range • the resistor would be damaged or would melt at this high temperature 		1	C

6	a	use of density equation to calculate mass 12600000kg or 1.26×10^7 kg Use of $E=mgh$ or $W=Fd$ or $6.4275... \times 10^9$ Correctly rounded to 6.4×10^9 (J)	<i>Use of equation seen or implied</i> <i>Use of equation seen or implied</i>	3	A A D
	b	Accept any reasonable suggestion, for example [max 1] <ul style="list-style-type: none"> time is spent which could be used for education, work, caring for family, generating income energy needed to collect water in areas where food supply may be low risk of injury when walking across high terrain stress on body of carrying heavy loads water quality is unknown water could be contaminated during transit 		1	D

6	c			9	D
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1. H (The benefits to health that are associated with access to clean, drinkable water)		
Mark	Descriptor	Notes
1	One health benefit is stated	Statements <ul style="list-style-type: none"> Clean drinking water is required to live Clean water is required for sanitation or hygiene Clean water is needed for preparing food safely
2	One health benefit is stated with justification or Two health benefits are stated	Justifications <ul style="list-style-type: none"> Fewer infections Longer life expectancy Prevents spread of waterborne diseases
3	Two health benefits are stated with a justification for both	

2.E (The ethical advantages or disadvantages of asking the villagers to pay a small fee to access the clean water)		
Mark	Descriptor	Notes
1	An ethical advantage <i>or</i> disadvantage is stated	Advantages The pump can be repaired with the money made New pumps can be financed from the money made Creates work opportunities to maintain pumps
2	One ethical advantage <i>and</i> disadvantage is stated <i>or</i> Two advantages or disadvantages are stated	Disadvantages Might not have the money to pay to access the clean water Can introduce social differences
3	One ethical advantage <i>and</i> one disadvantage are stated with further discussion for one	Discussion points Is it right to ask for payment given water is a basic human need The money can be redistributed The money can be used to train people to repair the pumps
4	One ethical advantage <i>and</i> one disadvantage are stated with further discussion for both	The money would be retained in the community through job creation

3. C (A concluding appraisal giving your opinion about how the charity should ensure a long-term solution to water access for the village)		
Mark	Descriptor	Notes
1	A concluding opinion	
2	A concluding appraisal with justification	

7	a	(Region) 2		1	A
	b	High energy <i>or</i> high frequency		1	A

7	c			11	D
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1. C (The suitability of the climate in this location)		
Mark	Descriptor	Notes
1	A statement related to climate	Statement <ul style="list-style-type: none"> • Lots of rainfall • Lots of sun • Reference to cloudy days during the rainy season
2	A statement related to climate with justification <i>or</i> Two statements related to climate	Justification <ul style="list-style-type: none"> • (so) they can make provision for water all year round • Suitable hours of sun in all seasons (suitable for SODIS) • There may be times when there is not enough sunlight (for SODIS to be effective)
3	More than one statement related to climate with justification for at least one	

2.H (The impact on the health of the population)		
Mark	Descriptor	Notes
1	A statement related to health	Statement <ul style="list-style-type: none"> • There will be safe water for all the population
2	A statement related to health with justification	Justification <ul style="list-style-type: none"> • Bacterial infections will fall • Reduced number of deaths or infant mortality • Increased life expectancy • Less money is required for medical treatment

3.1 (Challenges in implementing the SODIS procedure successfully)		
Mark	Descriptor	Notes
1	A statement related to implementation	<p>Statement</p> <ul style="list-style-type: none"> • Need to train people • Lack of information or education or low ability to read • Lots of plastic bottles are needed • Plastic bottles must be cleaned before use • Need space to lay out the bottles in sunlight <p>Justification</p> <ul style="list-style-type: none"> • SODIS is only safe when carried out correctly • Plastic bottles are a source of pollution (if not reused) • May not have access to plastic bottles • Contaminated bottles may cause infection • SODIS will not work if bottles are not correctly laid out in sunlight
2	A statement related to implementation with justification or Two statements related to implementation	
3	More than one statement related to implementation with justification for at least one	
4	More than one statement related to implementation with justification for both	
4.C (Concluding appraisal)		
Mark	Descriptor	Notes
1	A concluding opinion	<ul style="list-style-type: none"> •
2	A concluding appraisal with justification	