

COMPONENT 1 – Concepts in Physics**FOUNDATION TIER****MARK SCHEME****GENERAL INSTRUCTIONS**Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response questions).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

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Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

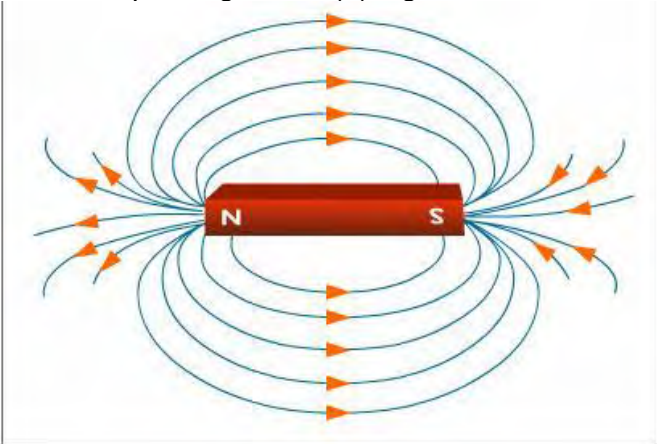
Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

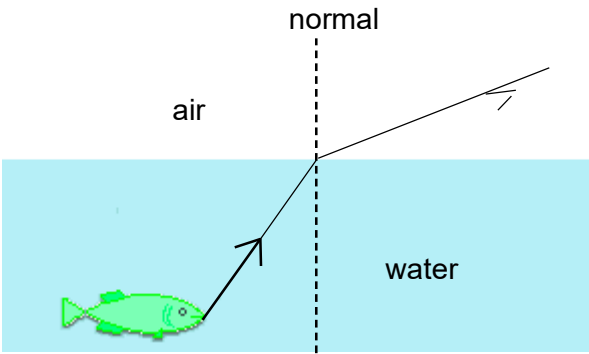
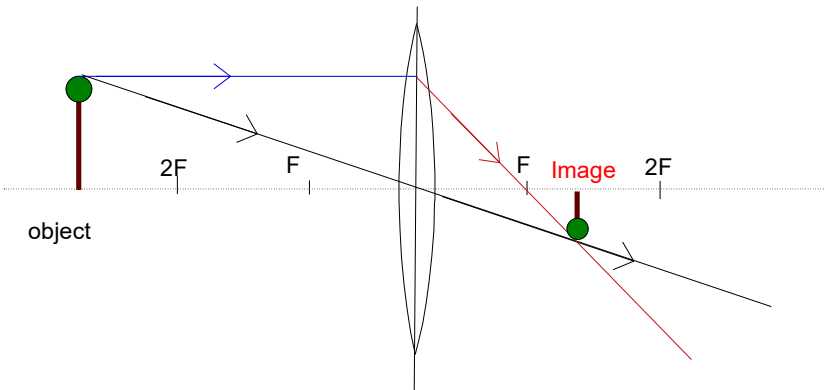
Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		Step-down transformer	1			1		
		(ii)		Ticks in boxes 2 (1) and 4 (1) i.e. It increases the voltage It reduces energy losses from the cables If ticks are placed in three boxes then the maximum mark if both boxes 2 and 4 are ticked is 1 mark	2			2		
	(b)			30%		1		1		
				Question 1 total	3	1	0	4	0	0

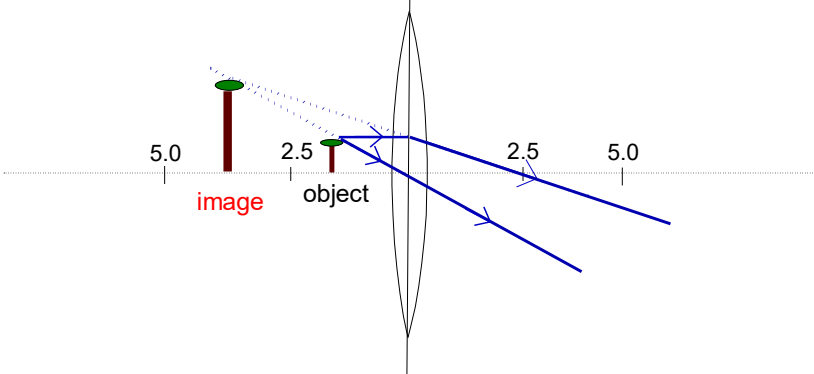
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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		<p>At least 2 field lines on each side (1) All arrows pointing N to S (1) e.g. as below</p> 	2			2		2
	(b)	(i)	<p>Induced magnet is temporary (1) When another magnet field is present (1)</p>	2			2		
		(ii)	<p>Ticks in boxes 2 (1) and 3 (1) i.e. The magnet induces a N pole at the nearest end of the bar The iron bar and magnet attract each other If ticks are placed in three boxes then the maximum mark if both boxes 2 and 3 are ticked is 1 mark</p>		2		2		2
	(c)		<p>Downward arrow in top compass (1) Upward arrow in bottom compass (1)</p>		2		2		2
			Question 2 total	4	4	0	8	0	6

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	2 A		1		1		
		(ii)	Manipulation: resistance = $\frac{\text{voltage}}{\text{current}}$ or by implication i.e. $\frac{4}{2}$ (1) Resistance = 2 [Ω] (1)		2		2	1	
	(b)	(i)	Decrease (1) Stay the same (1)		2		2		
		(ii)	Increase		1		1		
	(c)	(i)	Variable resistor / rheostat (1) Change current going through the circuit (1)	2			2		1
		(ii)	Change ammeter so that it is reading over a smaller range			1	1		1
	(d)	(i)	Component C			1	1		1
		(ii)	Both components B and D selected (and no others) as obeying Ohm's law (1) If mixture of correct/ incorrect components selected as obeying Ohm's law (0) Explanation: These are straight line graphs which show that voltage is directly proportional to current as required in Ohm's law (1)	1		1	2		2
			Question 3 total	3	6	3	12	1	5

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)		<p>Light ray is clearly refracted</p> 	1			1		
	(b)		<p>Light ray through focal point (1) Position of image at intersection of rays (1)</p> 	2			2		

(c)			<p>Path of light ray shown through focal point and extended back (1 m) Position of light at intersection of rays (1 m)</p> <p style="text-align: center;">magnifying glass</p> 	2			2		
			<p>Question 4 total</p>	5	0	0	5	0	0

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		4	1			1		
		(ii)		Wavelength = $\frac{10}{4} = 2.5$ [m]		1		1	1	
		(iii)		$\frac{1.9 - 1.5}{2}$ (1) Amplitude = 0.2 [m] (1)		2		2	1	
	(b)	(i)		Substitution: 0.3×2.5 (1) ecf Wave speed = 0.75 [m/s] (1)	1	1		2	2	
		(ii)		[Wavelength] decreases	1			1		
				Question 5 total	3	4	0	7	4	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		In descending order R S P Q All correct (2) Two correct (1) 0 or 1 correct (0)			2	2		
	(b)		An expanding (1) red (1) away from us (1)	3			3		
			Question 6 total	3	0	2	5	0	0

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			Mass number = 60 (1) Proton number = 28 (1) Numbers must be in the correct places		2		2		
	(b)	(i)		400 - 1		1		1		
		(ii)	I	0.93 pm = 0.93×10^{-3} nm (1) 0.93×10^{-3} nm is less than 10^{-3} nm therefore this is in the gamma range (1)			2	2	2	
			II	Substitution: $\frac{300\,000\,000}{0.93 \times 10^{-12}}$ (1) Frequency = 3.2×10^{20} [Hz] (1)	1			2	2	
			III	Treatment cancer/tumours	1			1		
				Question 7 total	2	4	2	8	4	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		Background radiation	1			1		
		(ii)		Beta (1) Alpha (1)			2	2		
		(iii)		Paper drops count rate so alpha present (1) Aluminium drops count rate more so beta present too (1)			2	2		
	(b)			30 cpm / background (1) Lead can't stop any more radiation than aluminium (1)	1		1	2		
				Question 8 total	2	0	5	7	0	0

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Turning (1)	1			1		
		(ii)		$W = mg$ (stated or implied) (1) $28 \times 10 = 280$ [N] (1)	1	1		2		
		(iii)		Substitution: $1.5 \times 280 = d \times 400$ (1) allow ecf on F Manipulation $d = \frac{1.5 \times 200}{400}$ (1) $d = 0.75$ m (1)	1	1 1		3	3	
	(b)			Bottle opener A because it is longer and therefore gives a greater moment (than bottle opener B) (1)			1	1		
				Question 9 total	3	3	1	7	3	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
10	(a)		All 4 points plotted correctly $\pm \frac{1}{2}$ small square division award 2 marks 3 points plotted correctly $\pm \frac{1}{2}$ small square division award 1 mark Good curve of best fit consistent with the data (1)		3		3	3	3
	(b)	(i)	Manipulation: $p = \frac{F}{A}$ (1) Substitution: $F = (0.25 \times 10^6) \times (0.002)$ (1) Force = 500 [N] (1)	1	1		3	3	3
		(ii)	Force is large enough to break the glass tube (1) Place a [perspex] screen in front of the glass tube (1)			2	2		2
	(c)		Constant = $10 \times 0.4 \times 10^6$ (selection equation & substitution) (any column of data may be used) (1) Constant = 4×10^6 (1) $P = \frac{4 \times 10^6}{80}$ (manipulation & substitution) allow ecf (1)p $P = 5 \times 10^4 \text{ Pa} / 0.05 \times 10^6 \text{ Pa} / 0.05 \text{ MPa}$ (1)	1	1 1 1		4	3	3
			Question 10 total	2	8	2	12	9	11

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
11	(a)		Braking distance	1			1		
	(b)	(i)	Increase it	1			1		
		(ii)	Steeper line shown		1		1	1	
	(c)	(i)	B (1) Steepest line / largest gradient (1)			2	2	1	
		(ii)	Correct because it has the smallest area under the graph			1	1	1	
	(d)		Selection of $v = u + at$ (1) $a = \frac{13 - 0}{5.2}$ substitution and manipulation (1) $a = 2.5 \text{ [m/s}^2\text{]} (1)$	1	1 1		3	2	
			Question 11 total	3	3	3	9	5	0

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
12	<p>Indicative content:</p> <p>The spring constant k can be found using $F = kx$</p> $k = \frac{F}{x} = \frac{60}{0.5} = 120 \text{ N/m}$ <p>Stored energy, $E = \frac{1}{2} kx^2$ so for the bow</p> $E = 0.5 \times 120 \times 0.5^2 = 15 \text{ J.}$ <p>% of energy transferred to the arrow = $7.2 \times 100/15 = 48\%$</p> <p>52% of the energy is not transferred to the arrow but is dissipated in some way.</p> <p>The evidence does not support the hypothesis since it claims most of the energy is transferred to the arrow.</p> <p>Allocation of AOs</p> <p>AO1 Selection and substitution of relevant data into $F = kx$ and $E = \frac{1}{2} kx^2$ (2)</p> <p>AO2 Calculations to give spring constant and the stored energy of bow (2)</p> <p>AO3 Analysis of data to show most energy is not transferred and the hypothesis is not supported (2)</p> <p>5 – 6 marks</p> <p>Relevant data and equations are selected. Calculations are laid out clearly and logically, can be followed easily and are completed correctly. Detailed and clear explanation that the data does not support the hypothesis.</p> <p><i>There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant to the argument.</i></p>	2	2	2	6	2	6

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			<p>3 – 4 marks Relevant data and equations are selected. Most steps of the calculations are carried out correctly but there may be occasional errors. The candidate's methodology can be followed and any errors easily identified. An attempt is made at commenting on the hypothesis which is consistent with the candidate's data analysis. <i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument.</i></p> <p>1-2 marks Candidates will select an appropriate equation. Few calculations are correctly attempted or completed. Where calculations are attempted it may be difficult to check for sources of error due to the way in which the calculation is presented. Analysis of the hypothesis will either not be attempted or be based upon a significant misunderstanding of the data. <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument.</i></p> <p>0 marks No attempt made or no response worthy of credit.</p>						
			Question 12 total	2	2	2	6	2	6

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
13	(a)		Alternating / oscillating (1) since it is marked with a frequency of 50 Hz (1)	2			2		
	(b)	(i)	Manipulation of $P = VI$ (1) Current = 11.3 A (1) Fuse choice = 13 A (1) Should be used as others would constantly melt (1)		1 1	1 1	4	2	
		(ii)	Prevents fire (1) By melting if too high a current flows (1)	2			2		
		(iii)	In case of a fault provides low resistance path to earth (1) Preventing electric shocks (1)	2			2		
	(c)	(i)	Selection of $\Delta Q = mc\Delta\theta$ (1) Substitution $\Delta Q = 1.5 \times 4200 \times 80$ (1) Energy = 504 000 [J] (1)	1 1	1		3	2	
		(ii)	For every 1 J of energy transferred to the kettle only 0.92 J is transferred to the water (1) Remaining energy is transferred to other things e.g. body of kettle / surroundings (1)		2		2		
	(d)		Less efficient since more energy lost to surroundings (1) Therefore there greater CO ₂ emissions / more mining / more transport of fuel involved (1)			2	2		
			Question 13 total	8	5	4	17	4	0

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
14	(a)		Friction between moisture and ice (1) Exchange of electrons (1) So ice becomes negatively charged / moisture becomes positively charged (1)	1 1	1		3		
	(b)	(i)	Electrons repelled (1) To Earth through lightning conductor (1)		2		2		
		(ii)	Positive ions attracted to bottom of cloud (1) Which combine with negative charge / help to neutralise bottom of cloud (1)		2		2		
		(iii)	Reduces size of charge on cloud (1) Lightning travels through conductor (1)		2		2		
	(c)		Recall of $Q=It$ (1) Substitution of 3000×0.005 (1) Answer = 15 (1) Unit = C or Coulomb (1)	1 1 1	1		4	2	
			Question 14 total	5	8	0	13	2	0