

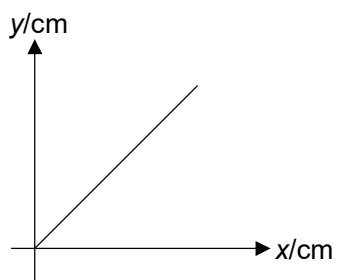
ADMIRALTY SECONDARY SCHOOL
4E PHYSICS MARKING SCHEME
PRELIMINARY EXAM 2024 / PAPER 3

SECTION A

Qn 1	Answer	Marks
(aii)	$(\Theta_T =) 31.5 \pm 0.5 \text{ }^{\circ}\text{C}$	1
(aiii)	100.0 g to 1 dp	1
(bii)	$(\Theta_H =)$ temperature expressed to nearest 0.5 $^{\circ}\text{C}$.	1
(biv)	$(\Theta_F =)$ temperature expressed to nearest 0.5 $^{\circ}\text{C}$.	1
(c)	$C_{\text{brass}} = 0.38 \text{ J/(g }^{\circ}\text{C)}$ correct calculation correct unit and precision to least sf (2sf)	1 1
(di)	Any two : - some energy is transferred to the internal store of the polystyrene cup (by conduction) - energy is transferred from the internal store of the exposed water surface to the internal store of the surroundings by heating - energy is transferred from the internal store of the cup to the internal store of the surroundings by heating	2
(dii)	Any two : - include the mass and specific heat capacity of the glass beaker in the calculation - lag the sides of the beaker to reduce energy transfer via conduction - cover the top of the polystyrene cup with a card to reduce energy transfer via convection	2

Qn 2	Answer	Marks
(aiii)	$31.4 \pm 0.2 \text{ cm}$ for accuracy (for precision of 0.1 cm and unit)	1 1
(biv)	$x = 7.0 \text{ cm}$ $y = 7.6 \text{ cm}$	1 1
(c)	13 g (follow least sf)	1
(d)	Constant variables: - Length and mass of the rule (same ruler), - same 10 g mass, - same position where the 10g mass was placed. - Set up the apparatus as shown in Fig. 2.4. - Place the pivot such that distance between S_1 and the pivot, x, is 5.0 cm. - Move the position of the 10 g mass until it balances horizontally. - Record y, the distance between the pivot and S_2, the centre of the 10g mass. - Record these values in a table.	

- 6) Keeping key variables constant, vary x for four further values of y . Record these values in the same table.
- 7) Plot a graph of y/cm against x/cm .
- 8) A straight line of best fit should be obtained, demonstrating that y and x are linearly related.
- 9) The gradient of the line of best fit is $\frac{M}{10}$. The mass of the ruler is $10 \times$ the gradient of the best fit line.



x/cm	y/cm
5.0	
7.0	
9.0	
11.0	
13.0	

- for 2 correct constant variables stated
- how to vary x as independent variable and measure y as dependent variable
- Plot a graph of y against x and correct sketch of best fit line
- correct table and heading with units with 5 rows with values of x .
- Correctly explain how the mass of the ruler is determined from graph

1

1

1

1

1

SECTION B

Qn 3	Answer	Marks
(a)	Ensure that the torch, lens and the screen all fall on the same parallel plane.	1
	Keep the lens vertically upright , such that the light from the torch will pass through the centre of the lens.	1
	Move the screen towards and away the lens along the rule until a sharp image is formed,	1
	where any change in X will cause an image that is less sharp.	1
(b)	Find average	1
	80.0 cm to 84.0 cm.	1
(ci)	15.0 cm to 19.0 cm.	1
(cii)	correct calculation of d with unit (allow ecf)	1
	correct calculation of y with unit (allow ecf)	1
(d)	Table • heading with units for for X, U_d, U_M, d and y with correct units AND results from (a)(ii) and (b)(i) included. at least 5 readings of M with approximately equal intervals ▪ all values of X, U_d, U_M recorded to 0.1 cm and X values in the range $60 \text{ cm} \leq X \leq 95 \text{ cm}$. ▪ at least 5 sets of data (X, U_d, U_M) with correct trend, as X increases, U_d increases and U_M decreases ▪ all values of d and y corrected calculated with correct number of significant figures (3sf)	1 1 1 1
(e)	Graph	
	▪ axes labelled & correct orientation, with quantity and unit (allow ecf from wrong unit in table)	1
	▪ appropriate scales (plots occupying at least $\frac{1}{2}$ grid)	1
	▪ plots all correct to $\frac{1}{2}$ small square and precise plots; check the two points furthest from the line	1
(f)	▪ best fit fine line and fine points or crosses	1
	Gradient	
	▪ triangle method seen on graph with points used for calculation of gradient sufficiently far apart (>50% of line) on the line AND correct working for calculation of gradient	1
		1
(fii)	f in the range $13 \text{ cm} \leq f \leq 17 \text{ cm}$	1

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REQUISITION LIST

SECTION A (PLACE IN ONE TABLE)

Q1

- a thermometer
- a 100 g slotted mass, made of brass, with a 50 cm string attached
- a polystyrene foam cup,
- a plastic stirrer,
- a plastic dropper,
- 250 cm³ glass beaker,
- 100 cm³ measuring cylinder,
- a piece of cloth, and
- *supply of boiling hot water boiled to 100 °C

*approximately 150 cm³ of hot water is needed per candidate. The boiling water that has just been boiled will be from two water urns placed in the front of the lab on each side and shared between several candidates.

Q2

- a 30 cm plastic ruler,
- a 10 g slotted mass,
- a pivot (knife-edge).

SECTION B (PLACE IN ANOTHER TABLE)

Q3

- a converging lens (focal length – 15 cm)
- a cross-wire object to be illuminated (circle-type),
- a lens holder
- a light source
- a stand, boss and clamp, with the boss and clamp adjusted to approximately 15.0 cm of height from bench
- a screen,
- a metre rule,
- a set square,
- blu-tack.