

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Tuesday 23 January 2024

Afternoon (Time: 1 hour 20 minutes)

Paper reference **WPH13/01**

Physics

International Advanced Subsidiary/Advanced Level

UNIT 3: Practical Skills in Physics I

You must have:
Scientific calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- **Show all your working out** in calculations and **include units** where appropriate.

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- The list of data, formulae and relationships is printed at the end of this booklet.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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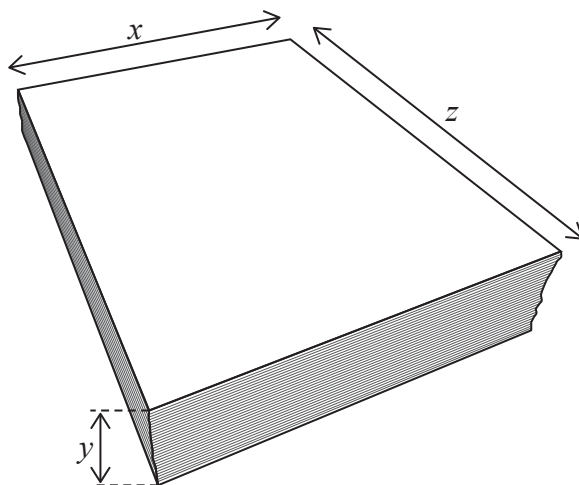
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Answer ALL questions.

- 1 A student had a stack of 500 sheets of paper. He measured the dimensions shown.



- (a) The student used a balance to determine the mass of the stack of paper. The reading is shown below.



- (i) State the resolution of the balance.

(1)

- (ii) Determine the percentage uncertainty in the mass of the stack of paper.

(2)

Percentage uncertainty =



- (b) The student used vernier calipers to measure the thickness y of the stack of paper.

Explain **one** technique he should use to determine an accurate value for y .

(2)

- (c) The student used the measurements from the stack of paper to determine the density of the paper.

- (i) Determine the density of the paper in g cm^{-3}

$$x = 210 \text{ mm}$$

$$y = 42.7 \text{ mm}$$

$$z = 297 \text{ mm}$$

(2)

$$\text{Density} = \dots\dots\dots \text{g cm}^{-3}$$

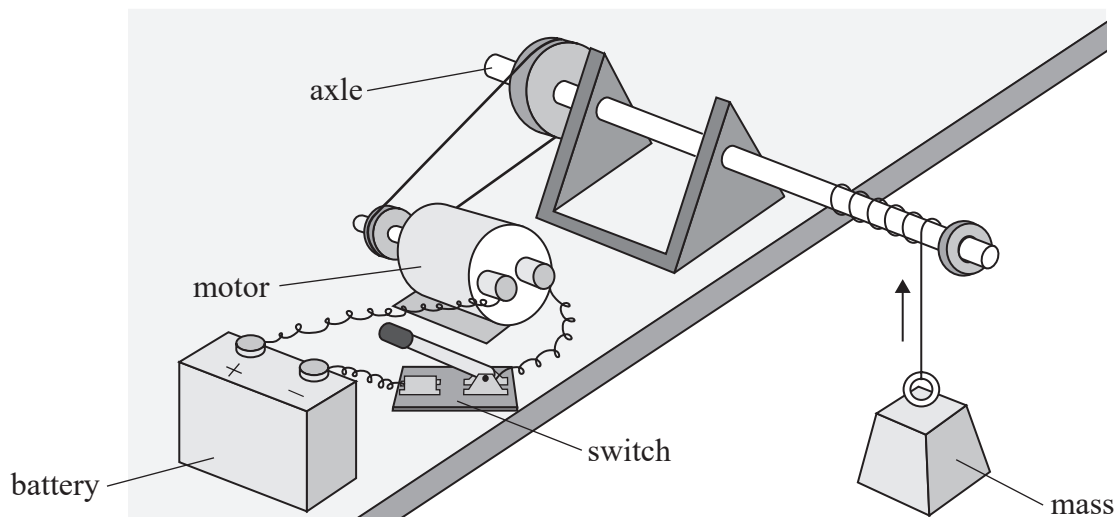
- (ii) Explain why making measurements on the whole stack of paper is better than making measurements on a single sheet of paper.

(2)

(Total for Question 1 = 9 marks)



- 2 A student investigated the efficiency of an electric motor, using the apparatus shown.

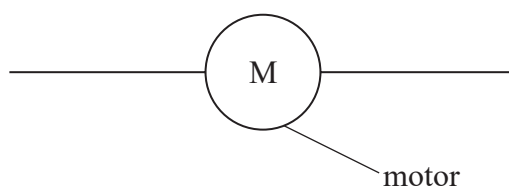


- (a) The motor was connected in a circuit including a battery and a switch.

The student connected additional components to determine the power of the motor.

Complete the circuit diagram for the circuit the student should use.

(2)



- (b) The student closed the switch in the circuit, and the motor lifted the mass from the floor.

She used a metre rule to measure the height gained by the 1 kg mass in 10 s.

- (i) Describe how she should measure a single value of the height gained as accurately as possible.

You should include the use of any additional apparatus needed.

(4)

- (ii) Explain why repeat measurements are appropriate for this measurement.

(2)



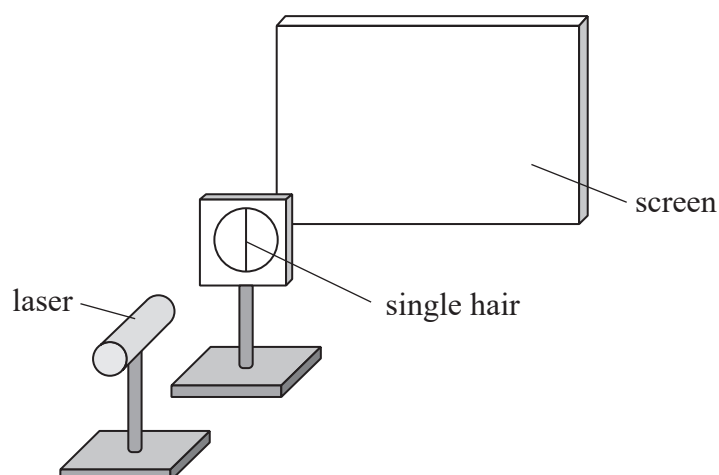
- (c) Explain how the measurements made by the student should be used to determine the efficiency of the motor as it lifts the mass.

(3)

(Total for Question 2 = 11 marks)



- 3 A student used a laser and screen to determine the diameter of a hair. The apparatus was arranged as shown.



- (a) Identify a health and safety issue caused by using a laser and how this issue may be dealt with.

(2)

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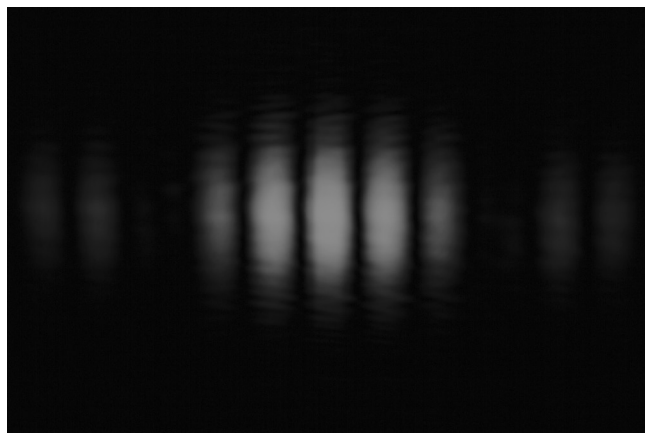
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- (b) The student placed the screen 2 m from the hair.

He switched on the laser. A diffraction pattern was produced on the screen, as shown.



(Source: © GIPHOTOSTOCK/SCIENCE PHOTO LIBRARY)

- (i) The student used a metre rule to measure the distance between adjacent minima.

Describe how the student should determine an accurate value for the distance between adjacent minima.

(2)

- (ii) Explain how the student could modify the arrangement of the apparatus to reduce the percentage uncertainty in this value.

(2)



- (c) The student repeated the procedure using three different lasers. Each laser produced a different wavelength of light.

The student calculated the diameter d of the hair using each laser. He recorded the values as shown.

	$d / \mu\text{m}$
Laser 1	76.0
Laser 2	84.4
Laser 3	77.1

- (i) Determine the mean value of d .

(2)

Mean value of $d =$

- (ii) Determine the percentage uncertainty in the mean value of d .

(2)

Percentage uncertainty =



- (d) In a different experiment, the student applied force to stretch the hair. He determined the average breaking stress for hair as 181 MPa with a percentage uncertainty of 6%.

The student suggested that the breaking stress for hair is the same as the breaking stress for copper wire.

Deduce whether the suggestion is correct.

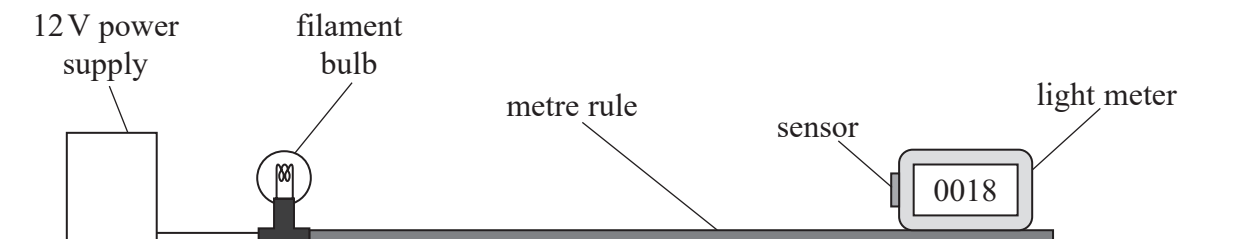
breaking stress for copper wire = 210 MPa

(2)

(Total for Question 3 = 12 marks)



- 4 A student investigated the inverse square law for light, using the apparatus shown.



The student used a metre rule to measure the distance d between the filament of the bulb and the sensor on the light meter.

The reading on the light meter is the intensity I of the light.

- (a) Explain how **two** sources of error can be reduced in this investigation.

(4)

- (b) The relationship between I and d is given by

$$I = \frac{k}{d^2}$$

where k is a constant.

- (i) Explain why a graph of I against $\frac{1}{d^2}$ should be a straight line through the origin.

(2)

- (ii) The student varied d and recorded corresponding values of I . She recorded the results in the table as shown.

d / m	$I / \text{W m}^{-2}$	
0.125	996	
0.175	510	
0.250	276	
0.375	109	
0.500	48	
0.750	18	

Complete the table with corresponding values of $\frac{1}{d^2}$

Use the additional column to record your processed data.

(2)

- (iii) Plot a graph of I on the y -axis against $\frac{1}{d^2}$ on the x -axis on the grid opposite.

(5)

- (iv) Determine the value of k from the graph.

(3)

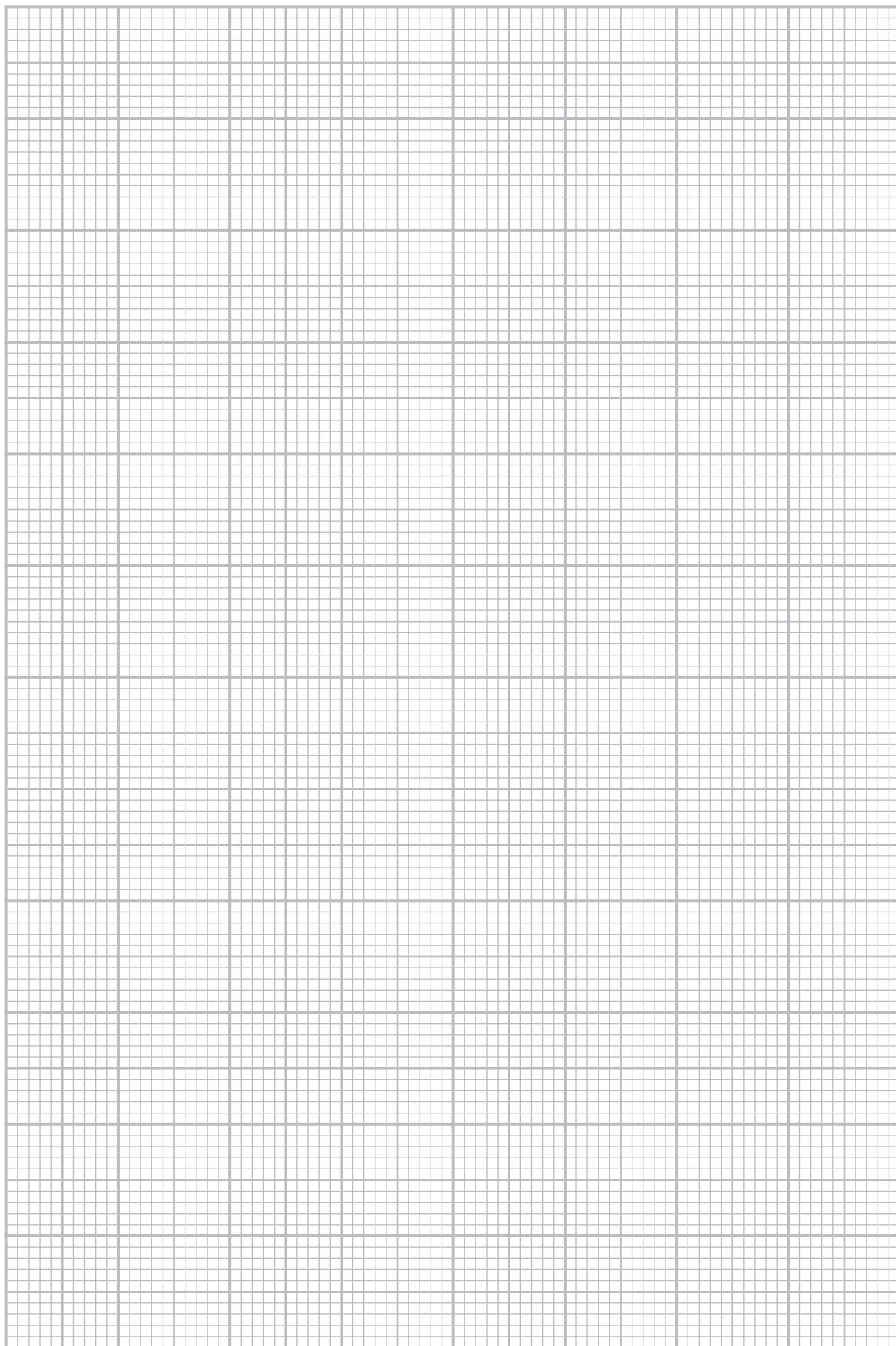
$k =$



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- (v) The student switched off the filament bulb. She recorded the intensity of the background light as 4 W m^{-2} .

The student then switched on the filament bulb. She moved the light meter to change d , until the reading on the light meter was 8 W m^{-2} .

Determine the distance between the light meter and the filament bulb.

(2)

Distance =

(Total for Question 4 = 18 marks)

TOTAL FOR PAPER = 50 MARKS

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