Interpreting data

Question Paper 2

Level	International A Level
Subject	Physics
Exam Board	Edexcel
Topic	Lab Skills 2
Sub Topic	Interpreting data
Booklet	Question Paper 2

Time Allowed: **48 minutes**

Score: **/40**

Percentage: **/100**

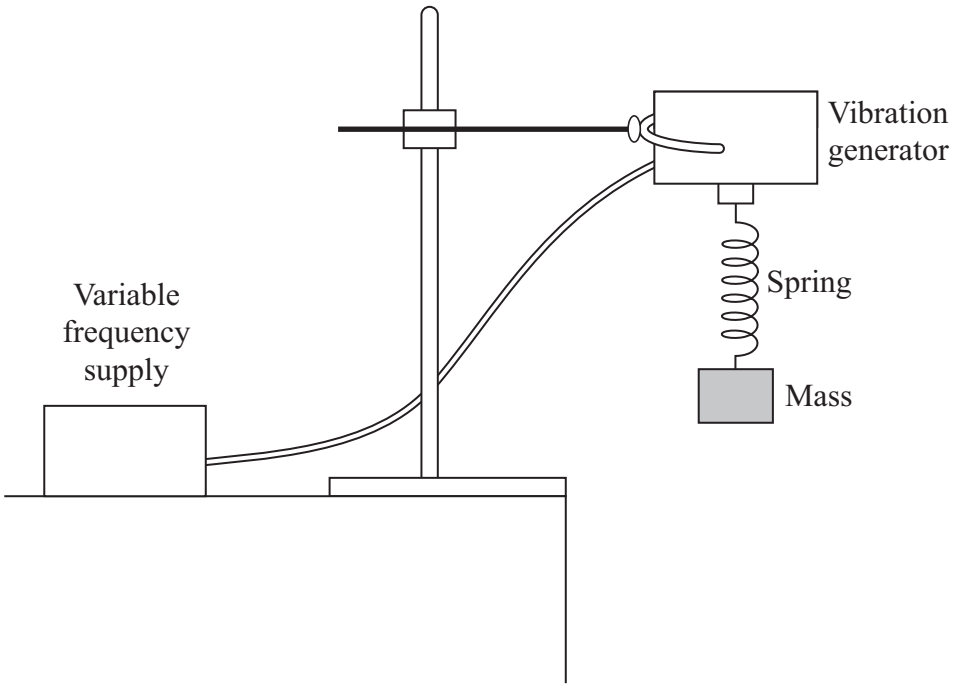
Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 A mass is hung on a spring as shown in the diagram. When the mass is pulled down and released, it oscillates at the natural frequency of the system.

When the top of the spring is forced to move up and down at this natural frequency, resonance occurs.

The system below is set up to observe what happens to the oscillations of the mass as the frequency f of the vibration generator is varied.



(a) State what you would observe as f gets close to the resonant frequency.

(1)

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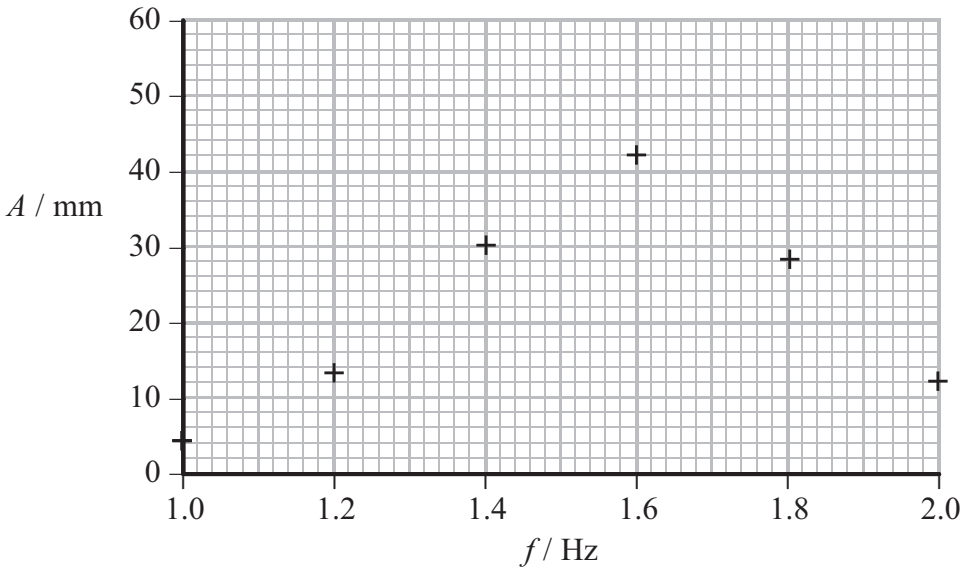
(b) As f is varied, the amplitude of oscillation A of the mass is recorded. The results are shown on the graph.



(i) Use the graph to estimate the resonant frequency.

(1)

Resonant frequency = ... Hz

(ii) Describe how you would improve the experiment to obtain a more accurate value for the resonant frequency.

(2)

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(iii) Suggest why it would be better to use an ultrasound position sensor and data logger to record the position of the mass.

(1)

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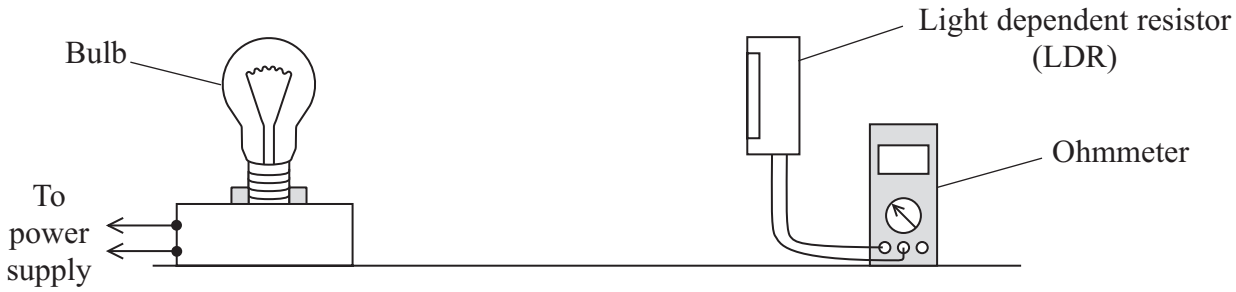
(Total for Question 1 = 5 marks)

2 A physicist investigates how light intensity varies with distance from a light bulb. He sets up the apparatus as shown.



(a) Mark on the diagram the exact distance d he should measure.

(1)

(b) State why the resistance R of the LDR will increase as it gets further away from the bulb.

(1)

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(c) State the most important quantity to control to ensure a fair test and explain how the physicist might control it.

(2)

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(d) The relationship between R and d is given by

$$R = k\,d^{p}$$

where k and p are constants.

Explain why a graph of ln R against ln d will give a straight line.

(2)

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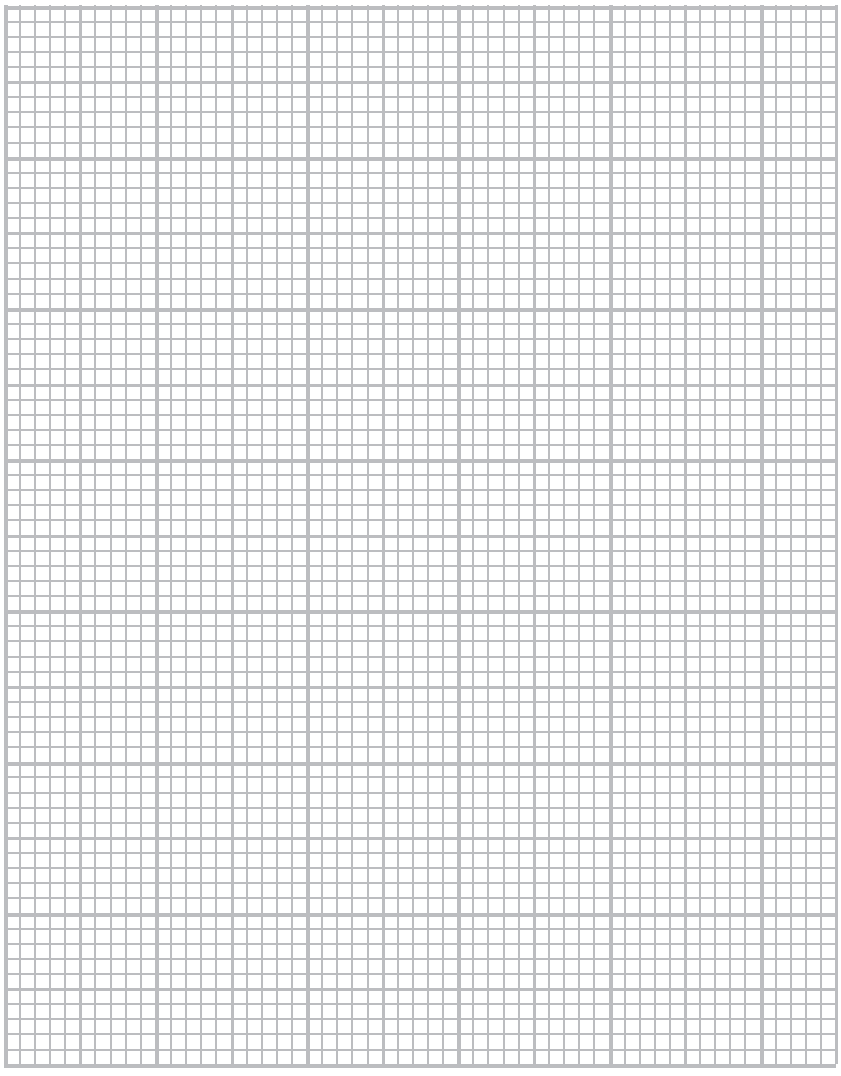
(e) He measures R for different values of d and records the following results.

d/m	R/kΩ		
1.00	1.79		
1.20	2.24		
1.60	3.32		
2.00	4.04		
2.20	4.70		
2.60	5.50		

Plot a graph of ln R against ln d. Use the column(s) provided to show any processed data.

(5)



(f) (i) Use your graph to find a value for p.

(2)

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.....

p = ...

(ii) Use your graph to find a value for *k*.

(2)

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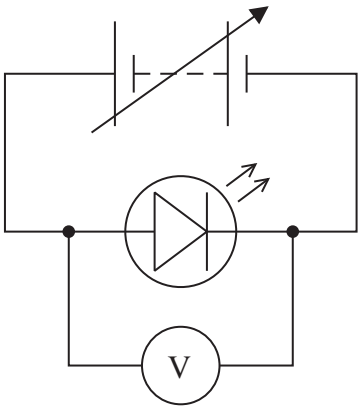
k = ...

(Total for Question 2 = 15 marks)

3 A student used light emitting diodes (LEDs) to determine a value for Planck's constant. He set up the circuit shown.



He increased the potential difference V from zero and recorded the value at which the LED just began to emit light. He repeated this for LEDs that emitted light of different, known frequencies f.

His results are shown in the table.

f/Hz × 10^{14}	V/V
6.38	2.23
5.28	1.69
5.10	1.57
4.69	1.40

(a) Criticise these results.

(1)

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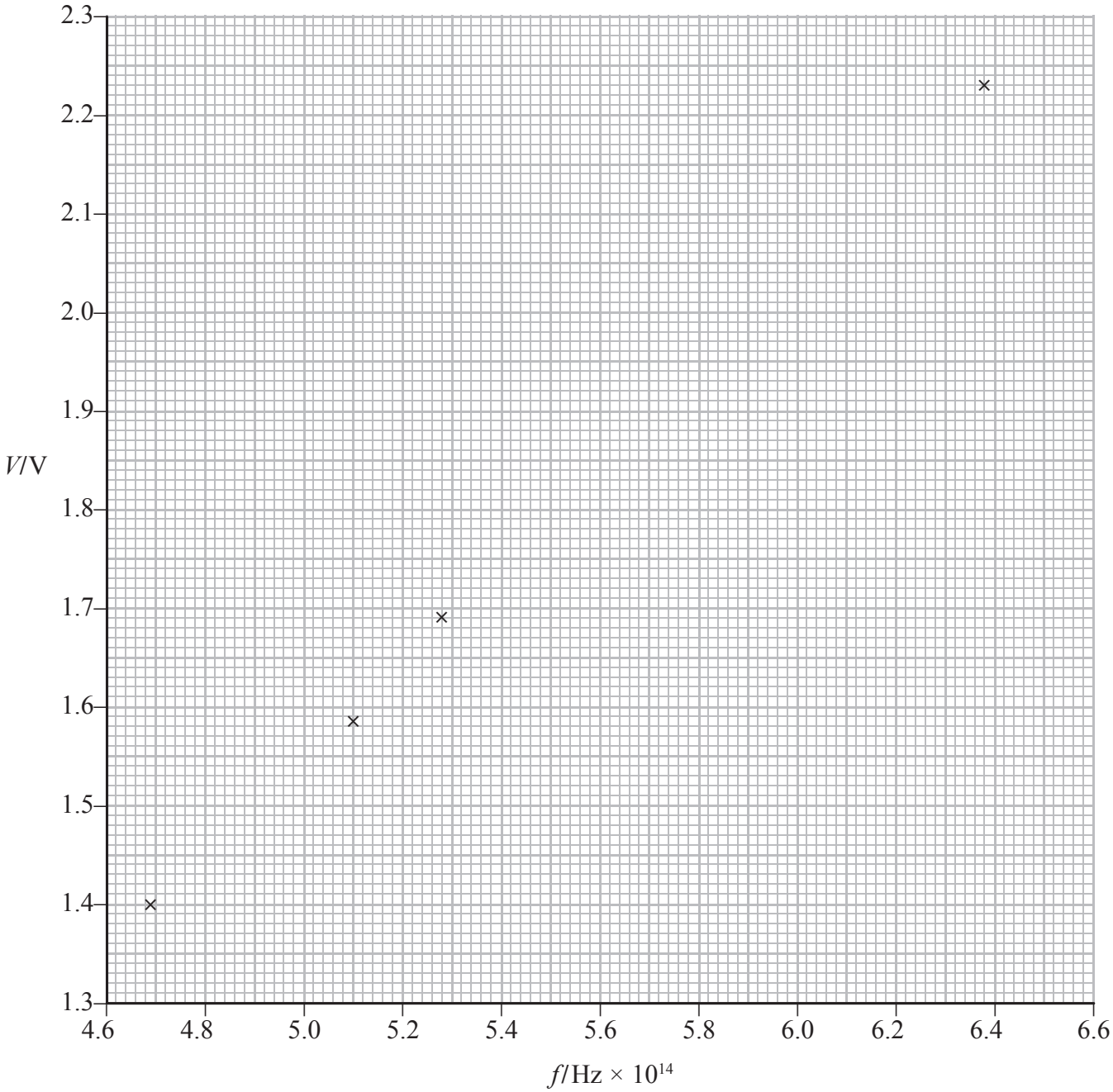
(b) V and f are related by

$$eV = hf - b$$

where e is the electron charge, h is Planck's constant and b is also a constant.

The student plotted a graph of V against f.



(i) Draw a straight line of best fit on the graph.

(1)

(ii) Use the gradient of your line to determine a value for Planck's constant.

(4)

Planck's constant = ...

(iii) Determine the percentage difference between your value and the accepted value of Planck's constant.

(1)

(Total for Question 3 = 7 marks)

4 The intensity of light emitted by a light bulb varies with the electrical power supplied.

(a) Draw a circuit diagram of the circuit you would use to vary and determine the electrical power supplied to a bulb.

(2)

(b) In an experiment, a second circuit containing a Light Dependent Resistor (LDR) is used to determine the intensity of the light emitted by the bulb as the power supplied is varied. The LDR is placed a certain distance away from the bulb.

(i) State what happens to the resistance of an LDR as the light intensity falling on it increases.

(1)

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(ii) State why the distance between the LDR and the bulb should remain constant throughout the experiment.

(1)

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(c) Values of power P and the corresponding light intensity I are shown in the table below.

I/W m^{-2}	P/W		
1900	20.47		
740	13.09		
425	11.09		
220	8.29		
123	6.37		
76	5.45		

It is suggested that I and P are related by

$$I = kP^x$$

where k and x are constants.

(i) Show that a graph of $\ln I$ against $\ln P$ should be a straight line.

(2)

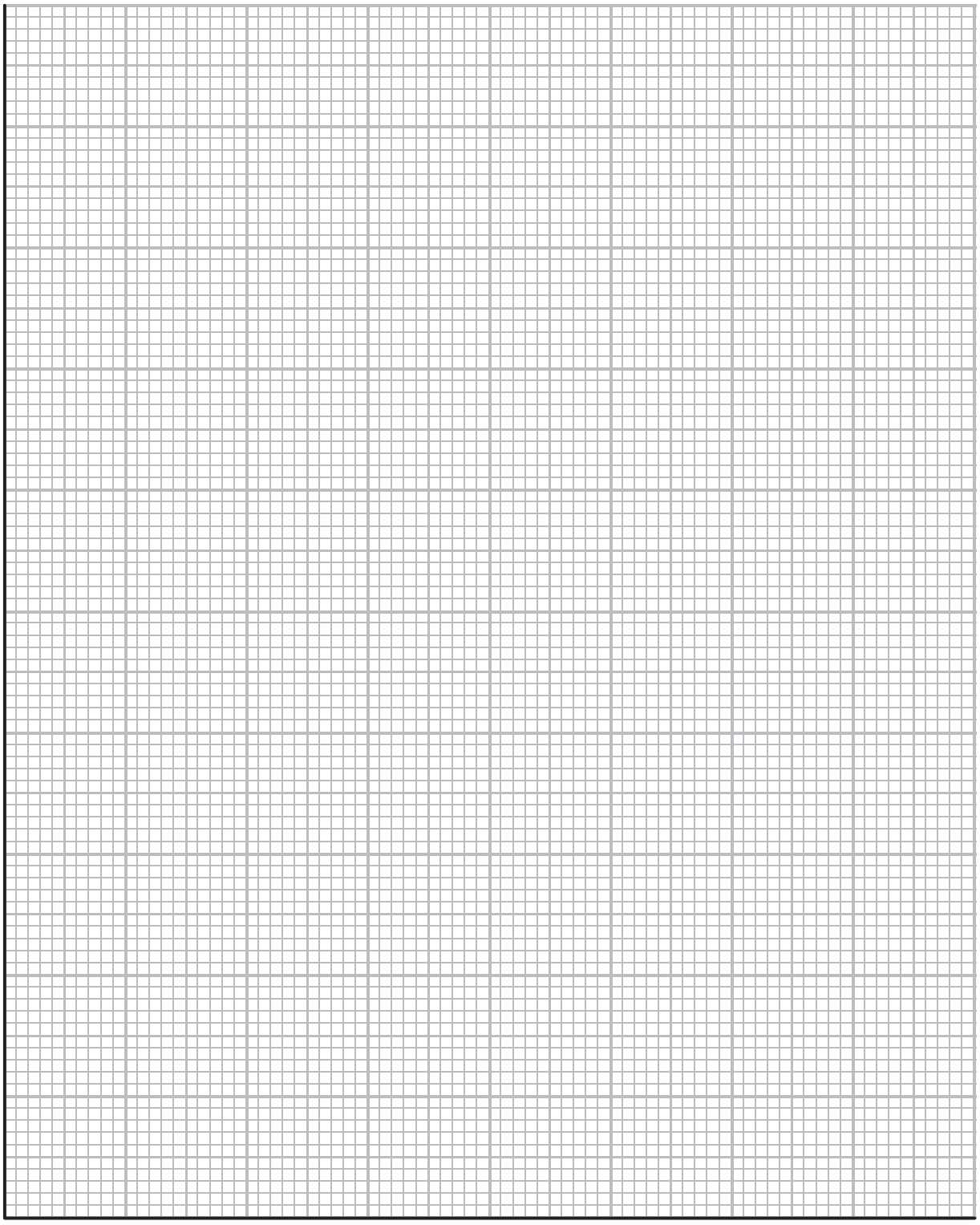
(ii) Use the grid opposite to plot a graph of $\ln I$ against $\ln P$. Use the column(s) in the table for your processed data.

(5)

(iii) Use your graph to determine a value for x.

(2)

x = ...



(Total for Question 4 = 13 marks)