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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8755395305

PHYSICS **9702/52**

Paper 5 Planning, Analysis and Evaluation **October/November 2025**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 30.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **8** pages.

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1 Fig. 1.1 shows a model wind turbine with blades, each of length *L*, placed in moving air.

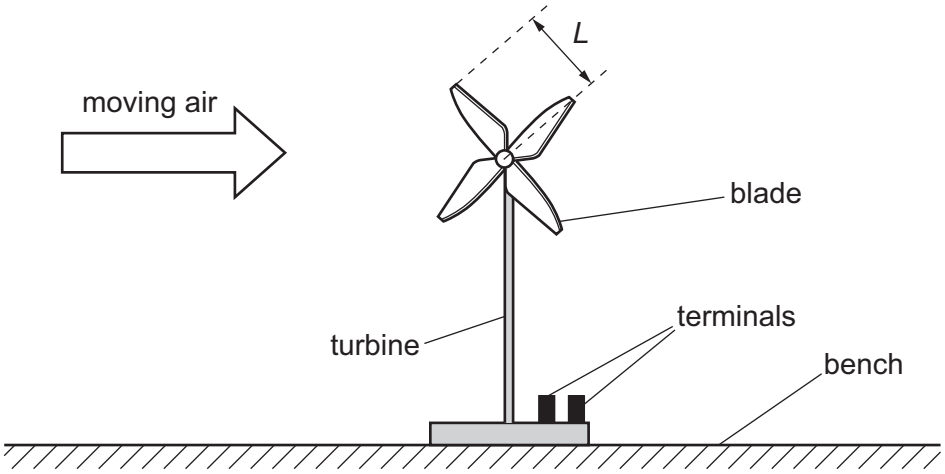

Fig. 1.1

The area of the circle swept by the blades of the turbine is *A*.

The output of the turbine has two terminals. The turbine is connected to a resistor of resistance *R*. At a speed *v* of the moving air, the current in the resistor is *I*.

The atmospheric pressure is *P* and the thermodynamic temperature of the air is *T*.

It is suggested that *I* is related to *v* by the relationship

$$\frac{I^2R}{Q} = \frac{APv^3}{2T}$$

where *Q* is a constant.

Plan a laboratory experiment to test the relationship between *I* and *v*.

Draw a diagram showing the arrangement of your equipment.

Explain how the results could be used to determine a value for *Q*.

In your plan you should include:

- the procedure to be followed
- the measurements to be taken
- the control of variables
- the analysis of the data
- any safety precautions to be taken.

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Diagram

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2 A student observes the orbits of some of the moons around the planet Saturn, as shown in Fig. 2.1.

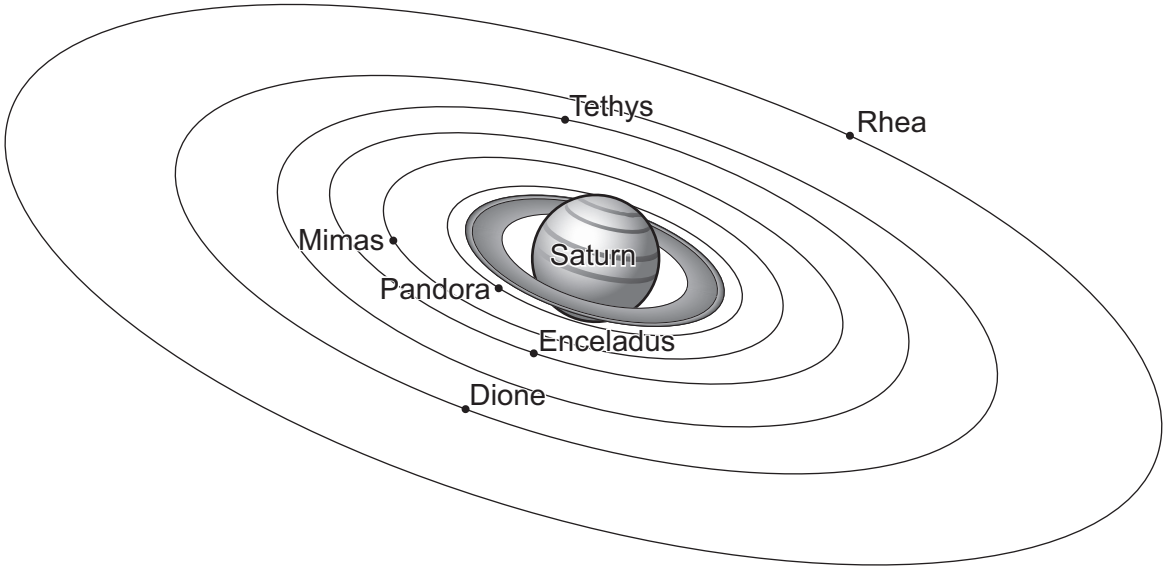

Fig. 2.1 (not to scale)

For the moon Pandora, the period of the orbit and the mean distance from the centre of Saturn are determined.

The measurements of period T and mean distance r are repeated for other moons.

It is suggested that T and r are related by the equation

$$T = \frac{2\pi r^n}{k}$$

where n and k are constants.

(a) A graph is plotted of lg T on the y-axis against lg r on the x-axis.

Determine expressions for the gradient and y-intercept.

gradient = ...

y-intercept = ...
[1]

(b) Values of r and T are given for different moons in Table 2.1.

Table 2.1

moon	$r/10^8\,\text{m}$	$T/10^3\,\text{s}$	$\lg(r/10^8\,\text{m})$	$\lg(T/10^3\,\text{s})$
Pandora	1.42	52 ± 5		
Mimas	1.86	81 ± 5		
Enceladus	2.38	120 ± 10		
Tethys	2.95	170 ± 10		
Dione	3.77	240 ± 20		
Rhea	5.28	390 ± 30		

Calculate and record values of $\lg(r/10^8\,\text{m})$ and $\lg(T/10^3\,\text{s})$ in Table 2.1. Include the absolute uncertainties in $\lg(T/10^3\,\text{s})$. [2]

(c) **(i)** Plot a graph of $\lg(T/10^3\,\text{s})$ against $\lg(r/10^8\,\text{m})$. Include error bars for $\lg(T/10^3\,\text{s})$. [2]

(ii) Draw the straight line of best fit and a worst acceptable straight line on your graph. Label both lines. [2]

(iii) Determine the gradient of the line of best fit. Include the absolute uncertainty in your answer.

gradient = ... [2]

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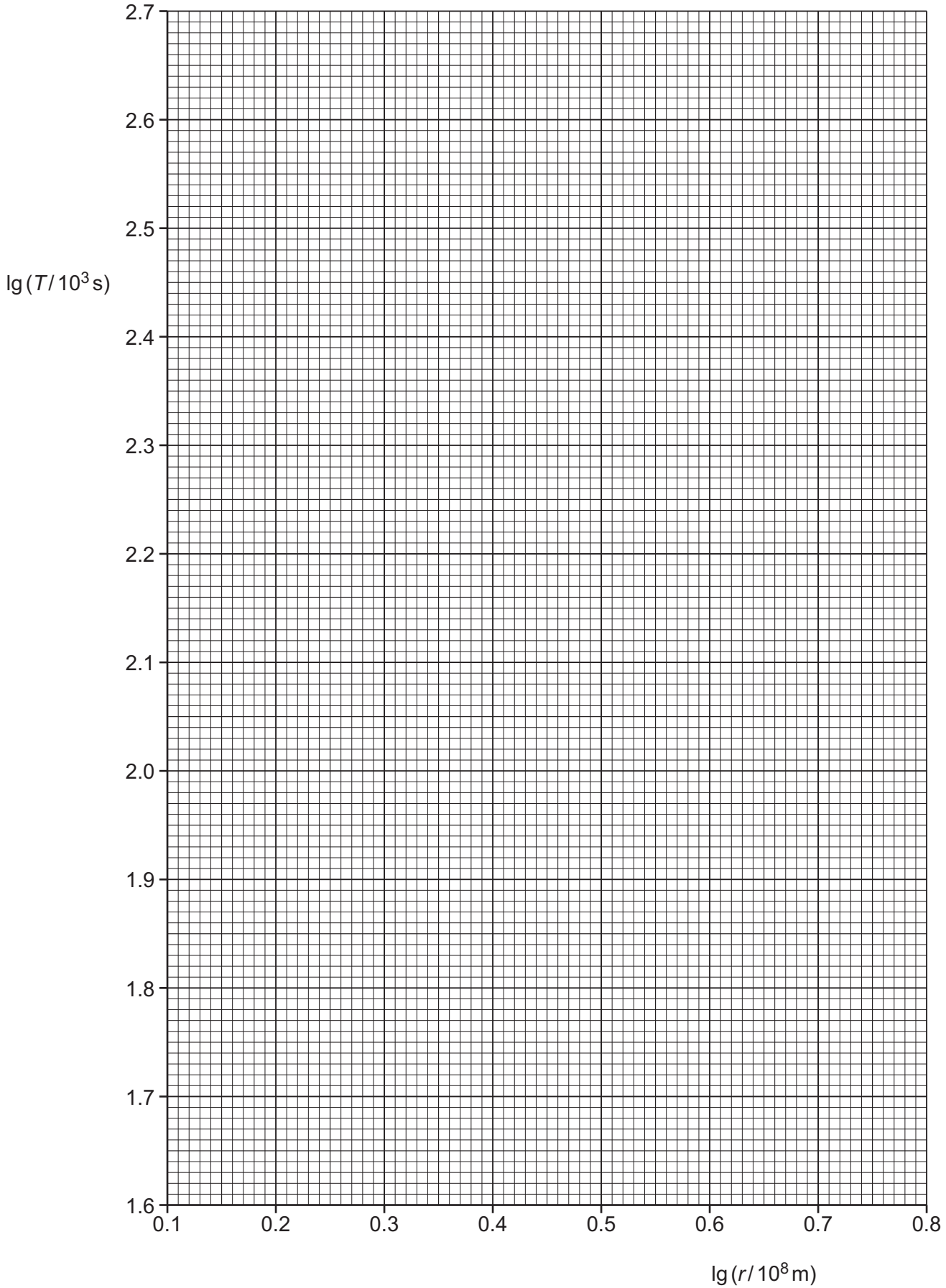

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(iv) Determine the *y*-intercept of the line of best fit. Include the absolute uncertainty in your answer.

y-intercept = ... [2]

(d) Using your answers to **(a)**, **(c)(iii)** and **(c)(iv)**, determine the values of *n* and *k*. Include the absolute uncertainties in *n* and *k*. You need not be concerned with units.

n = ...

k = ...
[3]

(e) Titan is another moon of Saturn. The orbit of Titan has a period of 1.38×10^6 s.

Determine the value of *r* for Titan.

r = ... m [1]

[Total: 15]

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