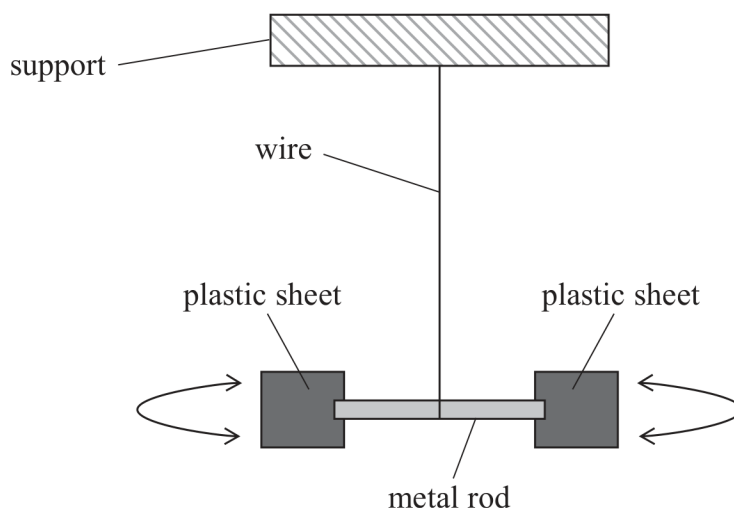


- 3 A student investigated the damping of a rotational pendulum using the apparatus shown.



When the metal rod is rotated through an angle and released, the rod performs angular oscillations about a vertical axis through the wire. The plastic sheets dampen the oscillations as they move through the air.

- (a) The relationship between the maximum displacement angle θ and number of oscillations n is given by

$$\theta = \theta_0 e^{-\lambda n}$$

where θ_0 is the initial displacement angle and λ is a constant.

Explain why a graph of $\ln \theta$ against n could be used to determine a value for λ .

(2)

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.....

(b) The student displaced the metal rod by a large angle.

He recorded the maximum displacement angle every 10 oscillations.

n	$\theta/^\circ$	
10	124	
20	82	
30	55	
40	37	
50	25	
60	16	

(i) Plot a graph of $\ln \theta$ against n on the grid opposite. Use the additional column for your processed data.

(5)

(ii) Determine the value of λ from the graph.

(3)

$\lambda =$

(iii) The student claimed that the initial displacement angle was greater than 180° .

Deduce whether this claim is correct.

(3)

