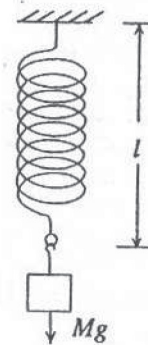
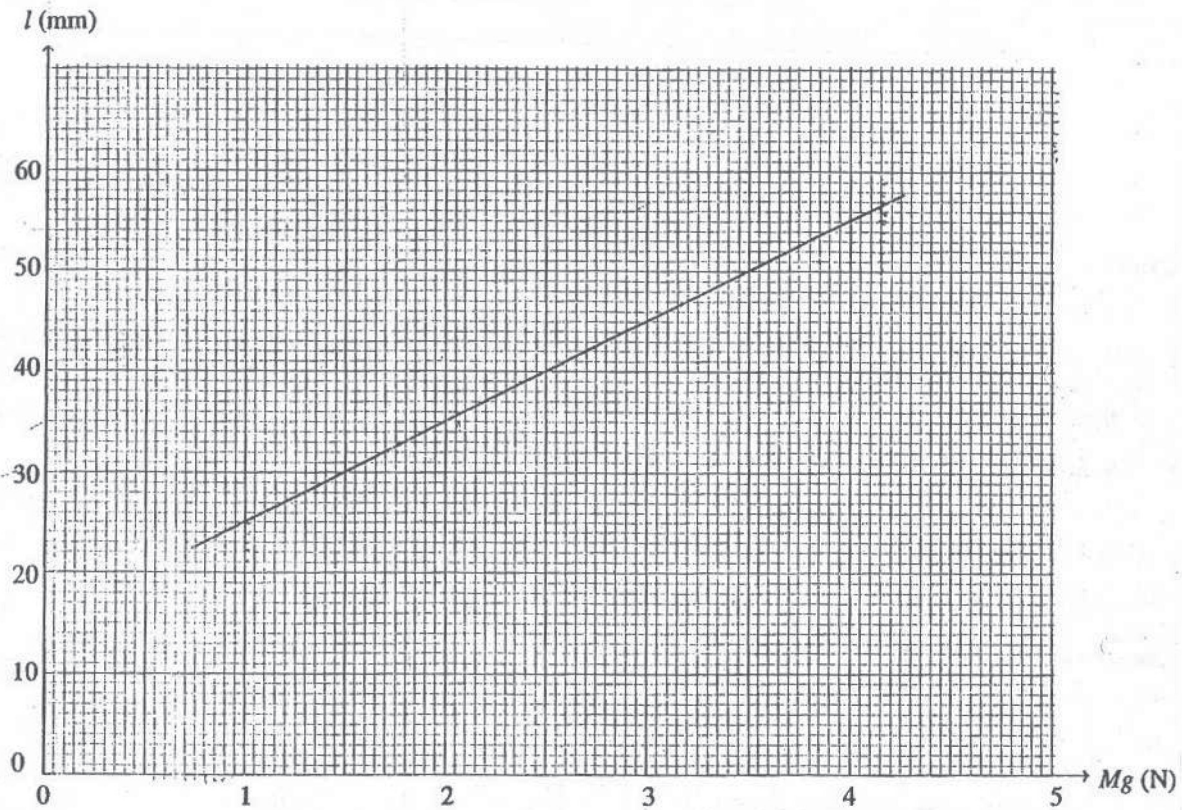


2001 A/L Structured Essay Question No (01)

1. To determine the coefficient of static friction ( $\mu$ ) between two surfaces, you are given a uniform rectangular block of wood with a hook attached to one of its sides, a light spring, a metre ruler and five weights of mass ( $M$ ) 0.1 kg, 0.2 kg, 0.3 kg, 0.4 kg and 0.5 kg. In order to calibrate the spring to measure forces, one end of the spring is attached to a fixed point and the other end is loaded with given weights as shown in the figure.

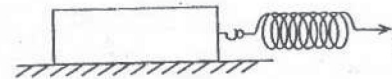


The force ( $Mg$ ) applied on the spring and the corresponding length ( $l$ ) of the spring are plotted as follows.



- (a) When the block is hung from the spring the length of the spring was found to be 30 mm. Determine the mass of the block, using the above calibration graph.
- .....

- (b) Now the block is placed on a horizontal table and the spring is connected to the hook as shown in the figure. Then the spring is stretched horizontally until the block just starts to slide. When this occurs the length ( $l$ ) of the spring is measured.



Write down the expression which relates the limiting frictional force  $F$ , with the normal reaction force  $R$  between the surfaces and  $\mu$ .

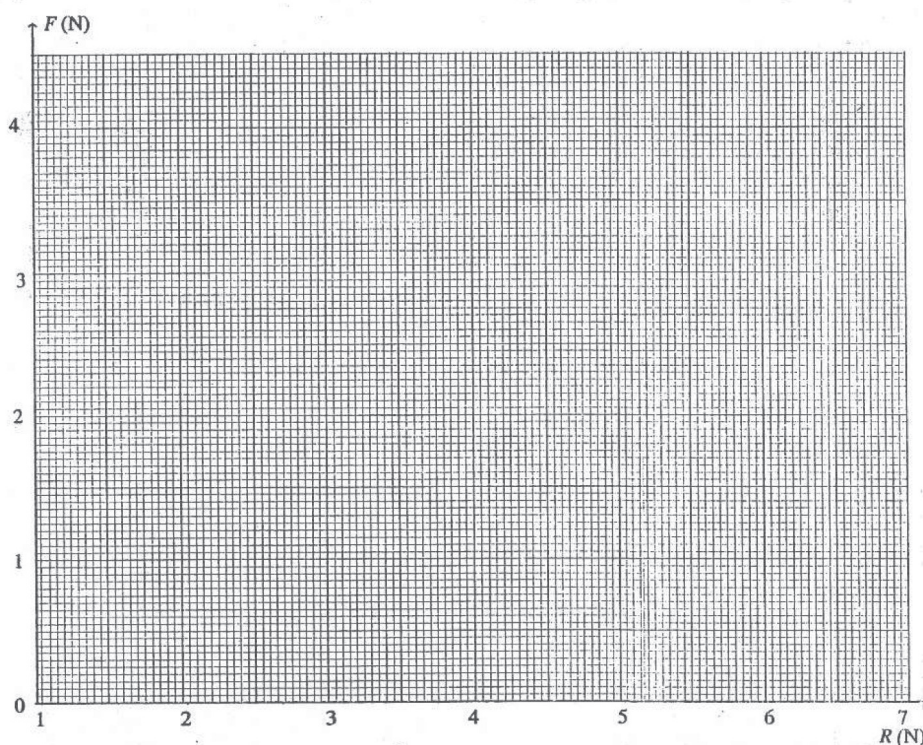
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(c) The above experimental procedure in (b) is repeated by placing each weight on top of the block. The corresponding  $l$  values thus obtained are given in the following table.

	$R$ (N)	$l$ (mm)	$F$ (N)
block without any weight		25	
block + 0.1 kg weight		30	
block + 0.2 kg weight		35	
block + 0.3 kg weight		41	
block + 0.4 kg weight		48	
block + 0.5 kg weight		55	

(i) Complete the above table by calculating  $R$  values and obtaining corresponding  $F$  values.

(ii) Mark the above  $F$  and  $R$  pairs on the grid given below using crosses (x).



(iii) Draw the best straight line that passes through the above points.

(iv) Find the gradient of the graph, and hence determine a value for  $\mu$ .

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(d) What would be the best procedure to measure  $l$  in (b) using the metre ruler?

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