

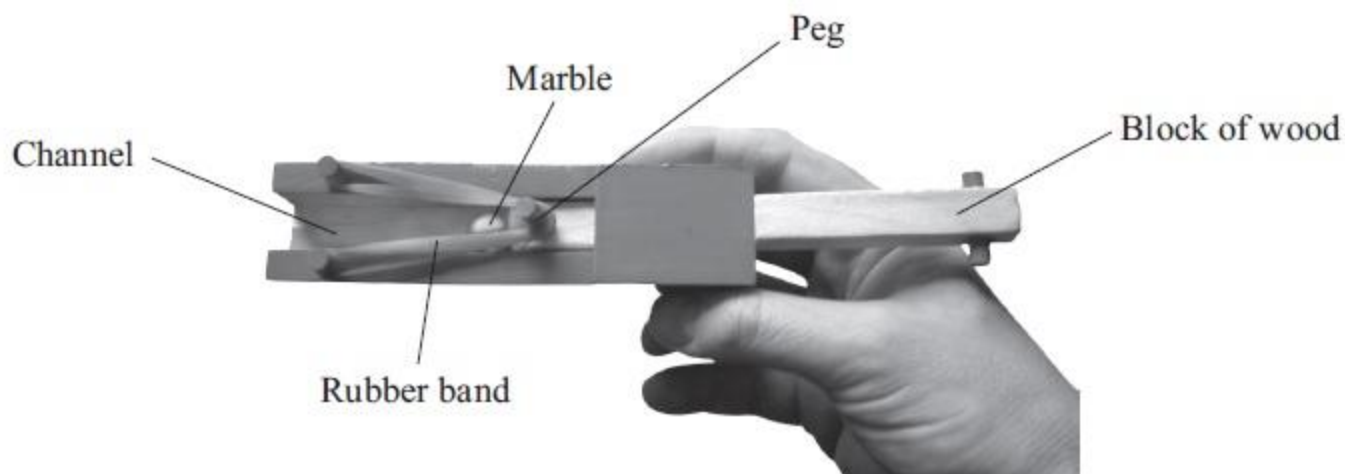
Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

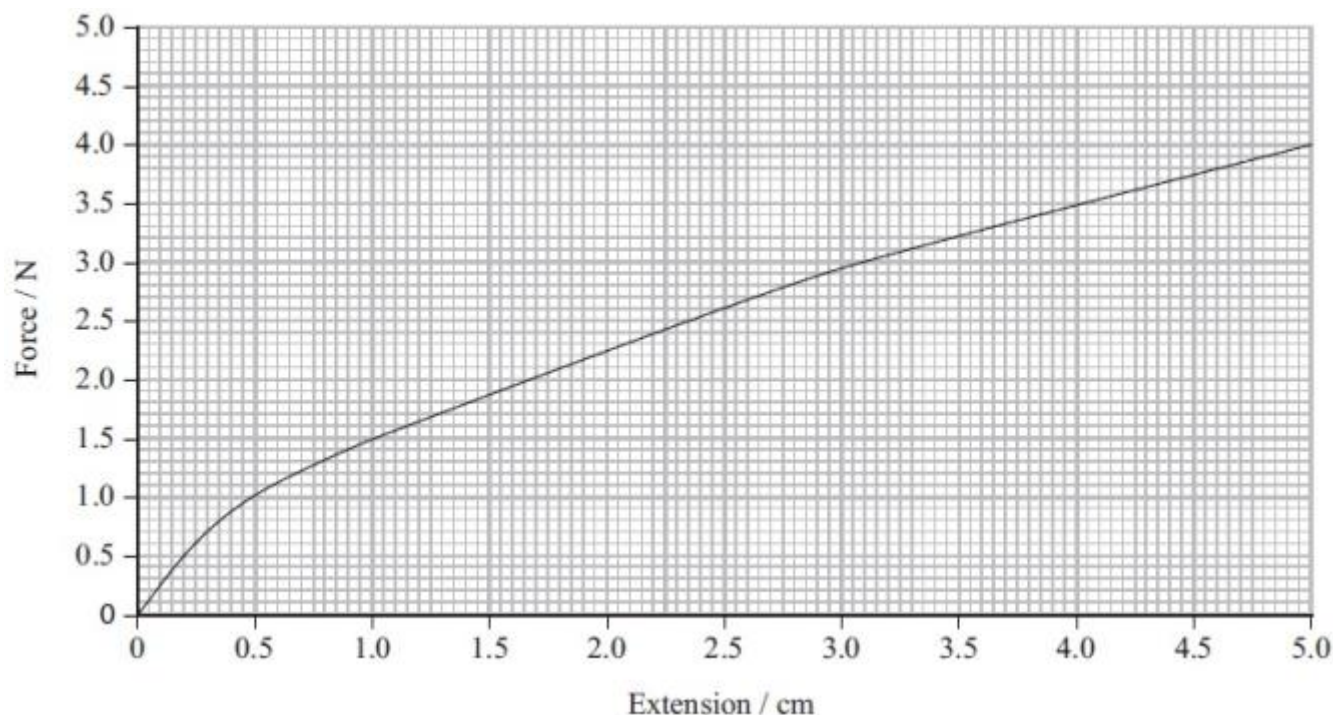
Q1.

The photograph shows a marble launcher.

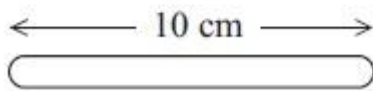


To load: pull the block of wood backwards, stretching the rubber band, place a marble into the channel.
To launch: release the block so it is pulled forward by the rubber band, pushing the marble through the channel.

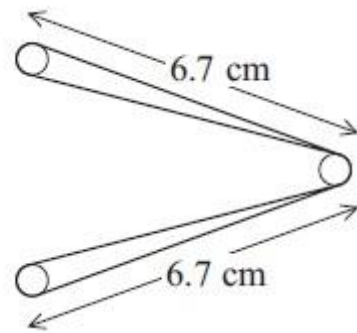
(a) The graph shows the results of an experiment to investigate the properties of the rubber band.



(i) The diagram shows the arrangement of the rubber band when it is stretched ready to launch a marble. The unstretched length of the rubber band is 10 cm.



Unstretched rubber band



Stretched rubber band

Use the graph to show that the tension is about 3 N.

(2)

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(ii) A student uses the graph to obtain an approximate value of the energy stored before launching. Show that 0.06 J is a reasonable approximate value.

(2)

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(iii) The student launches the marble vertically in order to determine the energy transferred to it when it is launched. Show that the maximum possible height attainable is about 2 m.

mass of marble = 3.8 g

(2)

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(b) The student obtains the following set of measurements for the height reached.

30.0 cm, 30.3 cm, 25.8 cm, 29.7 cm

(i) Explain why the student obtained a value of 30.0 cm for the height reached.

(2)

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(ii) Explain why the height reached is so much less than 2 m.

(2)

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 (iii) Suggest how the marble launcher could be adapted so that the height reached by the marble could be increased.

(1)

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(Total for question = 11 marks)

Q2.

A force meter measures force by making use of Hooke's Law.

The extension of a spring inside the force meter allows the magnitude of the force applied to be read from a scale.

The spring in one type of force meter extends by 5.5 cm when a force of 2.5 N is applied.

(i) Show that the stiffness of the spring is about 50 N m^{-1} .

(2)

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(ii) Two identical force meters of this type support a mass of 0.400 kg as shown.



Diagram not to scale

(Source: adapted from <https://image.slidesharecdn.com/balancedunbalancedgravityfriction-170509114658/95/balanced-unbalanced-gravity-friction-14-638.jpg?cb=1494330595>)

Calculate the extension Δx of each spring.

(4)

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$$\Delta x =$$

(Total for question = 6 marks)