

Forces and Distortion of Objects

- 1 An engineer is building a rope swing as part of an assault course. For safety reasons, when a person is on the swing, the rope must not extend by more than 7 cm.

The engineer is deciding between two ropes, A and B, to make the swing from.

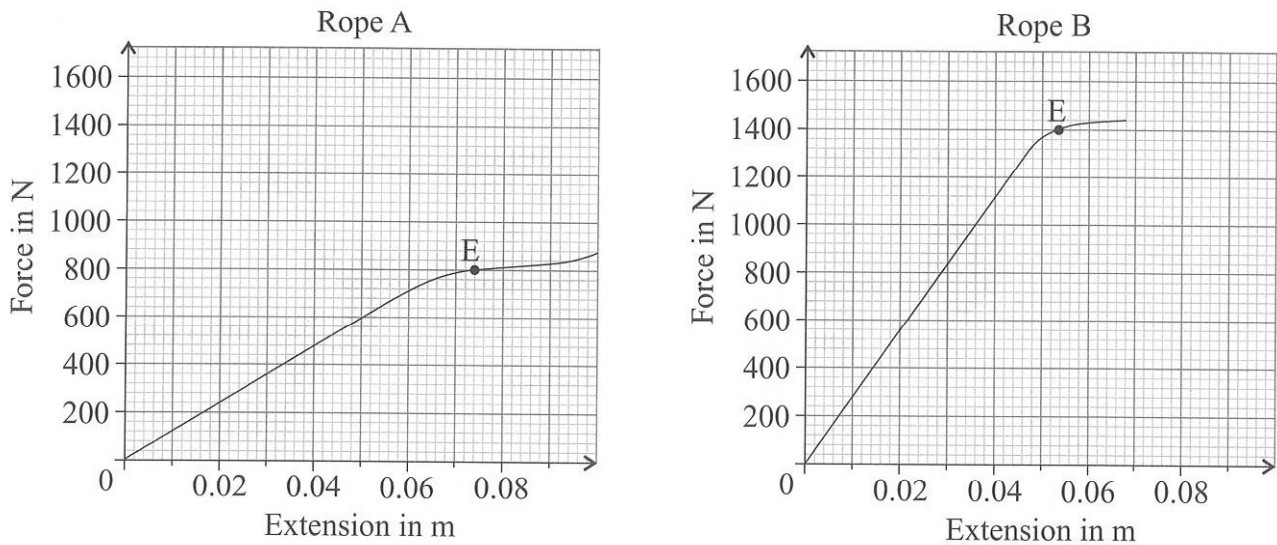
The force-extension graphs for samples of the two ropes are shown in **Figure 1**.

The samples used were the correct length for use in the rope swing.

Point E on each graph labels the elastic limit. Beyond this point, each rope distorts inelastically.

The extension of a rope can be described using the same equations as the extension of a spring.

Figure 1



- a)* Using **Figure 1**, state and explain which rope the engineer should make the rope swing from. It can be assumed that the average weight of a person is 700 N.

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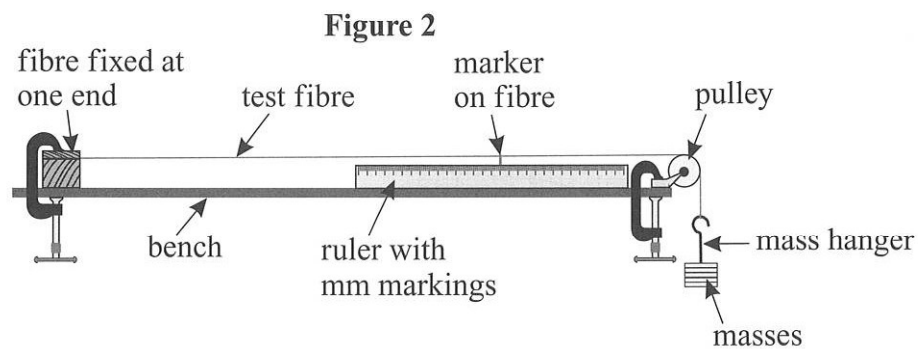
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[6]

- b) Using **Figure 1**, calculate the extension of rope B when 21.0 J of work is done to stretch it from its original length. Give your answer to three significant figures.

Extension = m
[5]

- c) **Figure 2** shows apparatus that can be used in the laboratory to test the extension of individual rope fibres. There are initially no masses on the hanger and no marker on the fibre.



- i) A small mass is added to the hanger and a marker is placed on the fibre to show the unextended length of fibre to be tested. Explain why a mass is added before marking the unextended length.

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[1]

- ii) The spring constants of a 2.0 m length of nylon fibre and a 2.0 m length of hemp fibre are measured using the apparatus shown in **Figure 2**. The spring constant of a hemp fibre is found to be 10 times larger than that of the nylon fibre. When a force F is applied to the nylon fibre, it extends by 17 mm. What is the extension of the hemp fibre if the same force F is applied to it?

- A 17 mm
 B 1.7 mm
 C 170 mm
 D 34 mm

[1]

[Total 13 marks]

Exam Practice Tip

You can't always reach the answer to a calculation question in just one step. Decide how you're going to tackle longer, trickier questions and break them down into manageable parts before you start doing any maths. That way you can be sure you won't miss any vital details along the way.

Score:

13