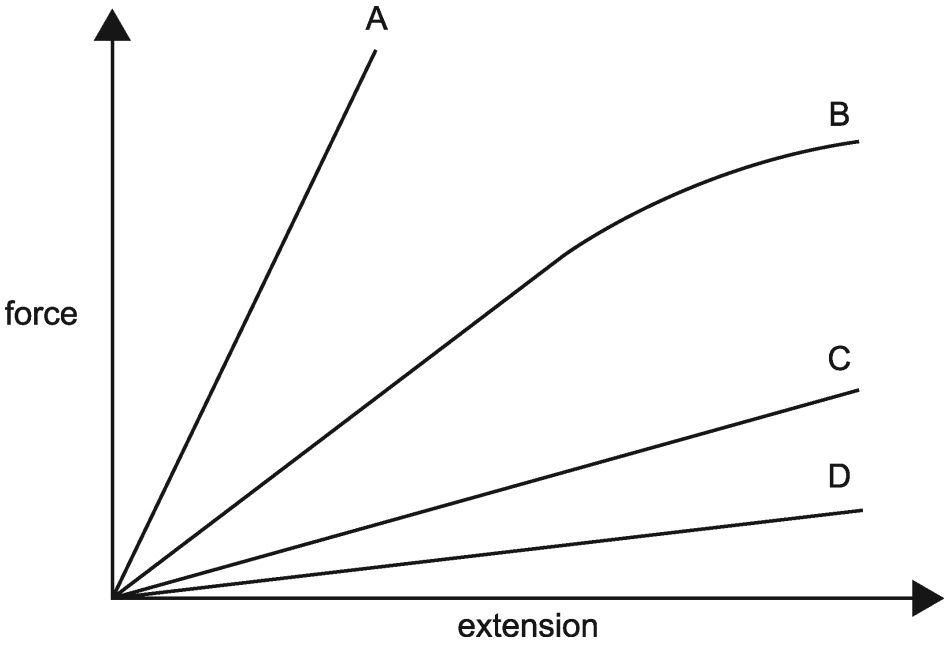
OCR
Oxford Cambridge and RSA

Gateway Science Physics A

J249/01 Physics A P1-P4 and P9 (Foundation Tier)

Question Set 21

21 The force–extension graphs for four different springs (**A**, **B**, **C** and **D**) are shown below.



.

(a) Explain which of the springs (**A**, **B**, **C** or **D**) has the largest spring constant. **[2]**

A as it has the greatest gradient and K is F/x which is the gradient (largest F + shortest x)

(b) Explain why the line for spring **B** has a different shape from the other lines. **[2]**

It reached the elastic limit and stopped following hooke's law and is now permanently distorted

(c) (i) A spring has a spring constant of 27 N / m.

The spring is stretched to an extension of 25 cm.

The energy transferred can be calculated using the formula:

energy transferred = 0.5 × spring constant × extension^2.

Calculate the energy transferred in stretching.

$0.5 \times 27 \times 0.25^2 = \frac{27}{32} = 0.84375$

$= 0.844$ (3 sf)

Answer = 0.844 ..... J

[2]

(ii) A student set up the apparatus shown in **Fig. 1.1**.

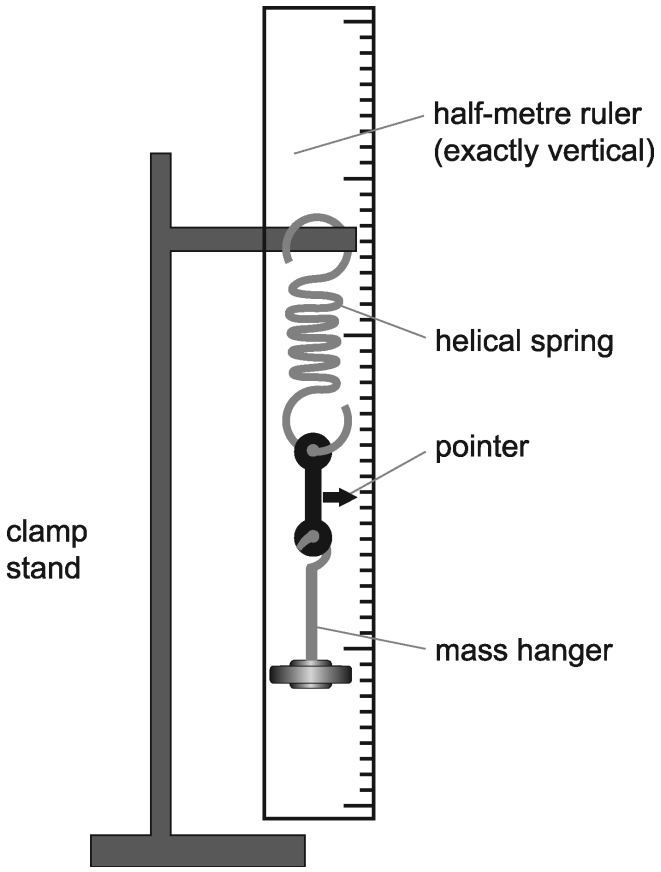


Fig. 1.1

The students want to plot a force–extension graph for this spring.

Describe how they could use this apparatus to collect data so that the graph could be plotted.

The student will first record the original length. Then will add a mass to the spring and the student will then measure the new length. The extension will be new length - original length. The student will repeat the previous steps for different masses then repeat the experiment for all the masses 3 times to get an average. The force will be the mass and the student can plot the force against the mean extension. **[4]**

(iii) The spring in **Fig. 1.1** has a spring constant of 30 N / m.
This is replaced by a spring with a spring constant of 10 N / m.

What changes should the student make to this method to investigate this spring? **[2]**

Use smaller weights and measure smaller intervals as at the same force the extensions will be much larger than the 30 N/m spring.

Total Marks for Question Set 21: 12