Effects of Forces

Question Paper

Course	CIE IGCSE Physics
Section	1. Motion, Forces & Energy
Topic	Effects of Forces
Difficulty	Medium

Time Allowed 40

Score /27

Percentage /100

Question 1a

The class is investigating the behaviour of a spring, and then using the spring to determine the weight of an object.

The apparatus is shown in Fig. 3.1.

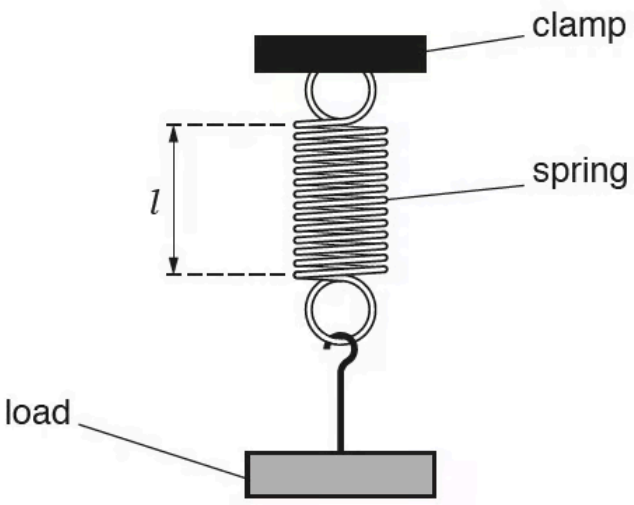

Fig. 3.1

The stretched length l of the spring, indicated in Fig. 3.1, is to be measured.

Describe two precautions that could be taken when measuring the length of the stationary spring, to ensure an accurate reading. You may draw a diagram.

[2 marks]

Question 1b

A student measures the length l_0 of the spring without any load.

l_0 = 2.1 cm

Various loads *L* are hung on the spring.
The stretched length l of the spring for each load is recorded in Table 3.1.

Table 3.1

L/N	l/cm	e/cm
1.0	6.3	
2.0	10.5	
3.0	14.7	

Calculate, and record in Table 3.1, the extension e of the spring for each load *L*.
Use the equation $e = (l - l_0)$

[1 mark]

Question 1c

The loads are removed and an object **X** is suspended from the spring.

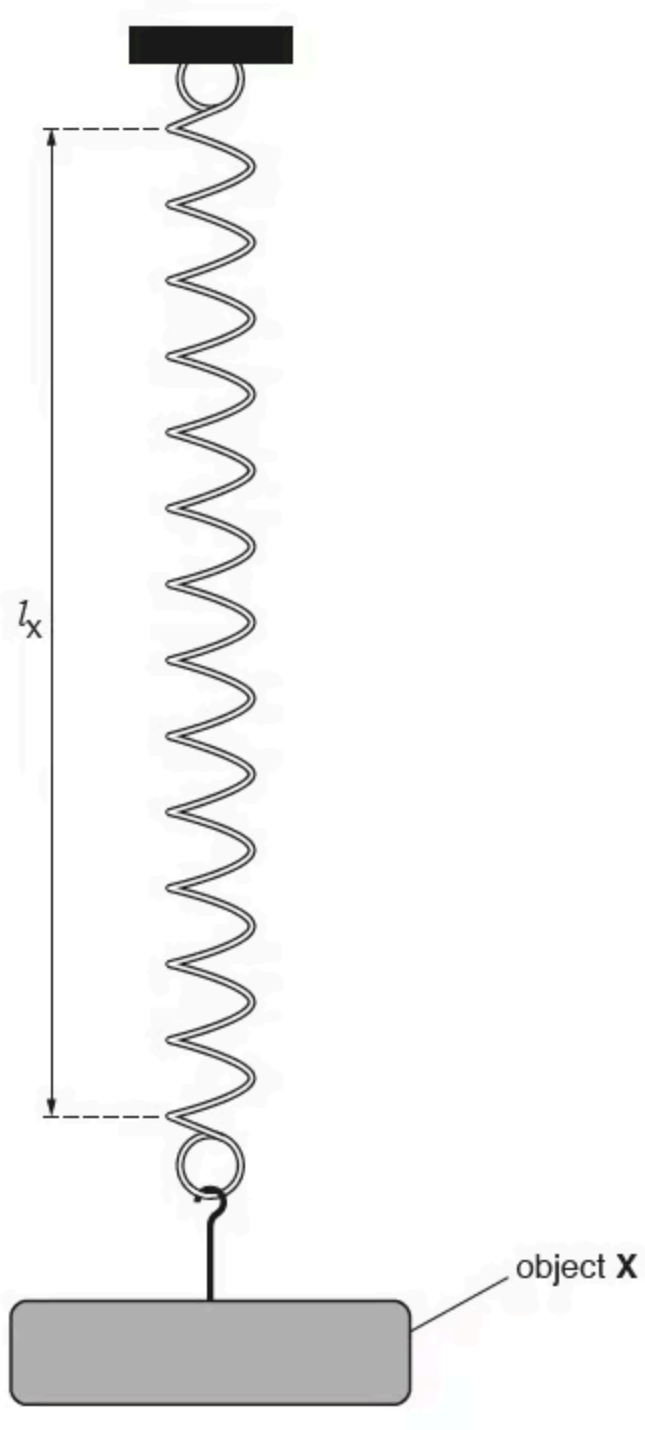

Fig. 3.2

The unstretched length l_x of the spring on Fig 3.2 is 11.4 cm

Estimate the weight W_X of object **X**.

Explain how you obtained your answer.

W_X = ... N

[1 mark]

Question 1d

A student measures the weight of a different load using a similar method. He gives the weight as 4.532 N.

Explain why this is not a suitable number of significant figures for this experiment.

[1 mark]

Question 1e

(i) Another student suggests that e is directly proportional to *L*.

State whether the results support her suggestion.

Use values from the results in Table 3.1 to justify your statement.

[2]

(ii) The student wishes to plot a graph of *L* against e to test if the two quantities are directly proportional.

State how her graph line could show that e is directly proportional to *L*.

[2]

[4 marks]

Question 2a

A student is determining the spring constant *k* of a spring by two methods.

Fig. 1.2 shows how the apparatus is used.

Method 1

On Fig. 1.1, measure the unstretched length l_0 of the spring, in mm.

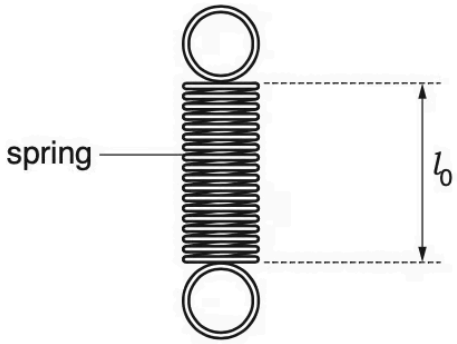

Fig. 1.1

l_0 = ... mm

[1 mark]

Question 2b

Extended tier only

The student attaches the spring to the clamp as shown in Fig. 1.2.

He hangs a 300 g mass on the spring.

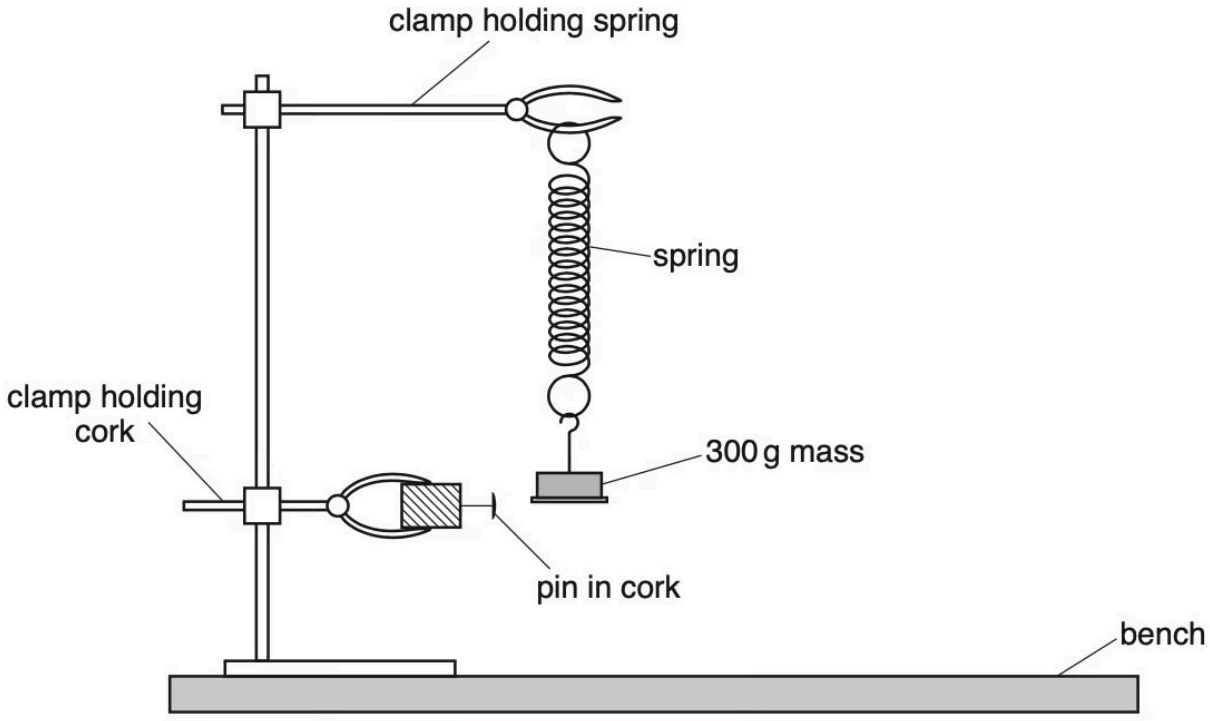

Fig. 1.2

He measures the new length l of the spring.

l = 53 mm

(i) Calculate the extension e of the spring using the equation $e = l - l_0$.

e = ... mm [1]

(ii) Calculate a value for the spring constant *k* using the following equation:

$$k = \frac{F}{e},$$

where *F* = 3.0 N.

k = ... N/mm [1]

[2 marks]

Question 2c

Method 2

The student pulls the mass down a short distance and releases it so that it oscillates up and down. Fig. 1.3 shows the time *t* taken for 10 complete oscillations.

Fig. 1.3

(i) Record the time *t* taken for 10 complete oscillations.

t = ... [1]

(ii) 1. Calculate the time *T* taken for one complete oscillation.

T = ...

2. Calculate T^2.

T^2 = ...
[2]

(iii) Calculate the spring constant *k* using the following equation:

$$k = \frac{0.040m}{T^2},$$

where m = 0.300kg.

k = ... N/mm [1]

[4 marks]

Question 2d

State and explain whether your two values for k are the same within the limits of experimental accuracy.

[2 marks]

Question 2e

A student states that repeating Method 1 with different masses would improve the reliability of the value obtained for k.

Suggest additional values for the mass m that you would use when repeating the experiment to improve the reliability.

[2 marks]

Question 3

A student wants to investigate the effect of air resistance on the swing of a pendulum.

Plan an experiment which will enable him to investigate how air resistance changes the way in which a pendulum swings.

The apparatus available includes:

a light wooden rod, approximately 80cm long with a hole at one end, through which a nail will fit

a piece of modelling clay to act as a pendulum bob, as shown in Fig. 4.1

a sheet of thick card which will provide the air resistance when the pendulum swings.

In your plan, you should:

- list any additional apparatus needed
- explain briefly how you would carry out the experiment including exactly which measurements should be taken
- state the key variables that you would control
- draw a table, or tables, with column headings, to show how you would display your readings (you are **not** required to enter any readings in the table)
- explain how you would use your readings to reach a conclusion.

You may add to Fig. 4.1 or draw an additional diagram if it helps to explain your plan.

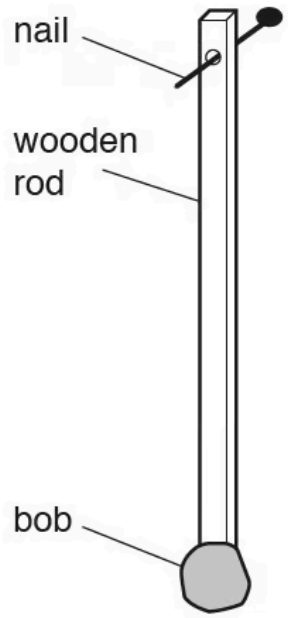

Fig. 4.1

[7 marks]