2 In this experiment, you will investigate the elastic properties of rubber cord.

(a) (i) You are provided with a wire with a clip and two slotted masses attached, as shown in Fig. 2.1.

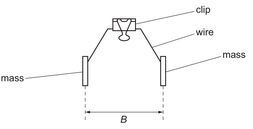

Fig. 2.1

The distance between the centres of the two slotted masses is *B*, as shown in Fig. 2.1.

Measure and record *B*.

B = ... [1]

(ii) Estimate the percentage uncertainty in your value of *B*. Show your working.

percentage uncertainty = ...% [1]

(b) (i) • You are provided with two lengths of rubber cord. Select the **longer** cord.

• The diameter of the cord is *d*.

Measure and record *d*.

d = ... [1]

(ii) • Suspend the clip, wire and masses using the **longer** cord secured in the two clips, as shown in Fig. 2.2.

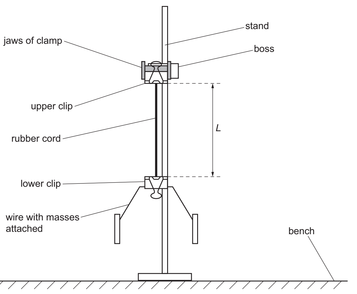

Fig. 2.2 (not to scale)

• The length of cord between the two clips is *L*, as shown in Fig. 2.2.

Measure and record *L*.

L = ... [1]

(iii) • Keeping the cord vertical, rotate the lower clip through approximately 180° and release the clip. The clip will rotate with a small number of oscillations.

• Take measurements to determine the period *T* of these oscillations.

T = ... s [2]

(c) Using the **shorter** length of rubber cord, repeat **(b)**.

d = ...

L = ...

T = ... s
[3]

(d) It is suggested that the relationship between *T*, *B*, *L* and *d* is

$$T^2 = \frac{B^2 L}{kd^4}$$

where *k* is a constant.

(i) Using your data, calculate **two** values of *k*.

first value of *k* = ...

second value of *k* = ...
[1]

(ii) Justify the number of significant figures that you have given for your values of *k*.

.....

.....

..... [1]

(e) It is suggested that the percentage uncertainty in the values of *k* is 20%.

Using this uncertainty, explain whether your results support the relationship in **(d)**.

.....

.....

.....

..... [1]

(f) (i) Describe **four** sources of uncertainty or limitations of the procedure for this experiment.

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....
[4]

(ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....
[4]

[Total: 20]