

2 In this experiment, you will investigate the tension in a string.

- (a) • Set up the apparatus as shown in Fig. 2.1.

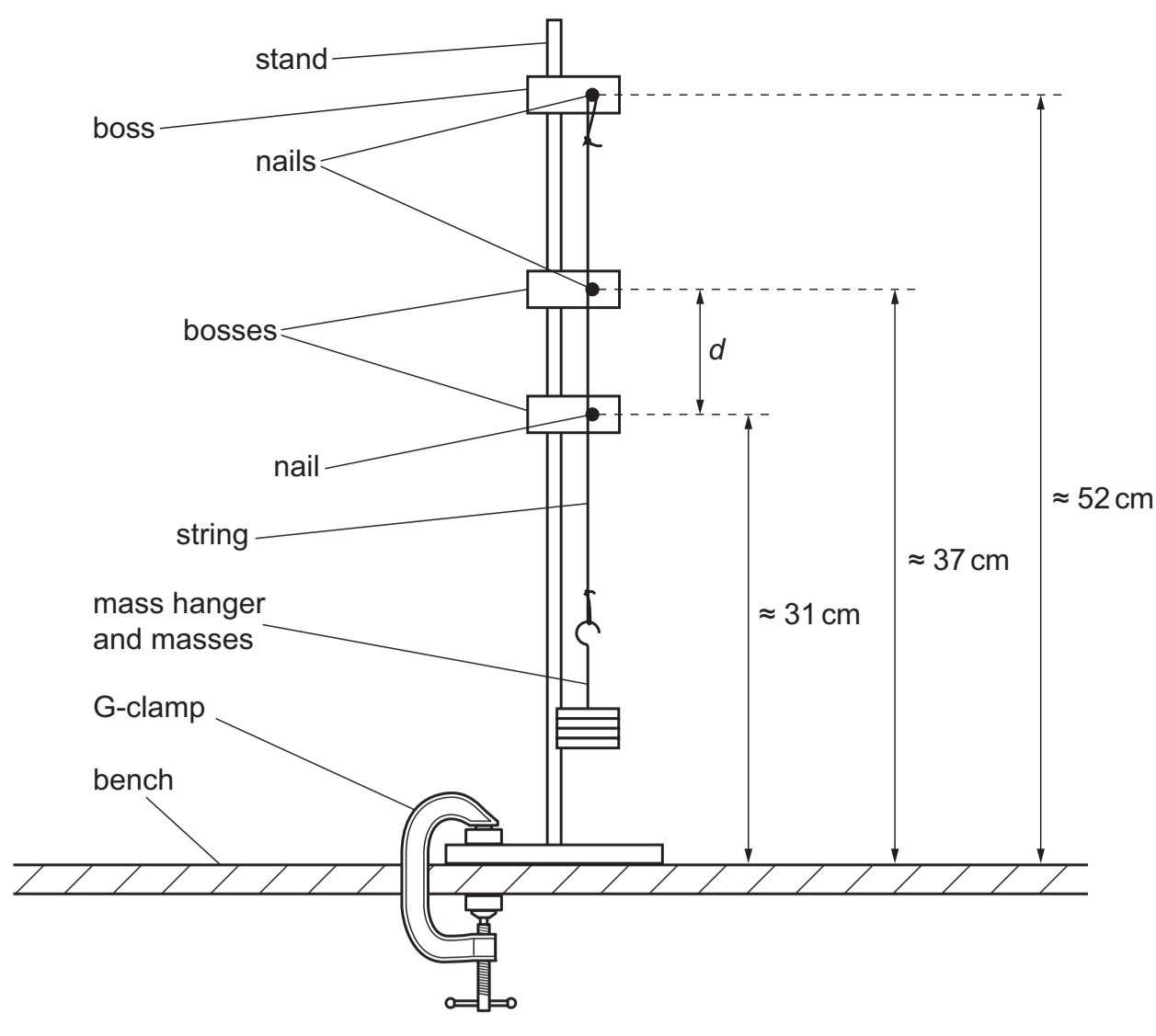


Fig. 2.1

- The mass hanger and masses should have a total mass  $M$  of 0.400 kg.
- The distance between the two lower nails is  $d$ , as shown in Fig. 2.1.

Measure and record  $d$ .

$d = \dots\dots\dots$  cm [1]

- (b) The tension in the string is  $T$ .

Calculate  $T$  using  $T = Mg$ , where  $g = 9.81 \text{ N kg}^{-1}$ .

$T = \dots\dots\dots$  N [1]

- (c) (i) • Hook the newton meter on the string half-way between the two lower nails and pull it horizontally with a force  $F$  of 5.0 N, as shown in Fig. 2.2.

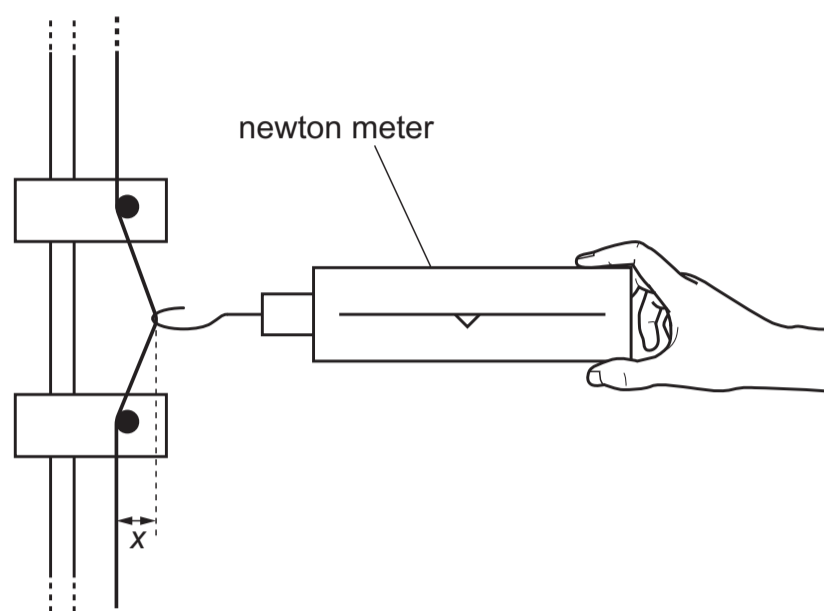


Fig. 2.2

- The force  $F$  causes the string to deflect a distance  $x$ , as shown in Fig. 2.2.
- Measure and record  $x$ .

$x = \dots\dots\dots$  cm [2]

- (ii) Estimate the percentage uncertainty in your value of  $x$ . Show your working.

percentage uncertainty =  $\dots\dots\dots$  % [1]

- (iii) Calculate  $y$ , where

$$y = \sqrt{\left(x^2 + \frac{d^2}{4}\right)}$$

$y = \dots\dots\dots$  cm [1]

- (d) • Add slotted masses to the mass hanger so that the total mass  $M$  is 0.700 kg.

- Repeat (b), (c)(i) and (c)(iii).

$T = \dots\dots\dots$  N

$x = \dots\dots\dots$  cm

$y = \dots\dots\dots$  cm [3]

- (e) It is suggested that the relationship between  $y$ ,  $T$  and  $x$  is

$$ky = Tx$$

where  $k$  is a constant.

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

first value of  $k = \dots\dots\dots$

second value of  $k = \dots\dots\dots$  [1]

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

.....  
 .....  
 ..... [1]

- (f) 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 (e).

.....  
 .....  
 ..... [1]

- (g) (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 ..... [1]

2 ..... [1]

3 ..... [1]

4 ..... [1]

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

1 ..... [1]

2 ..... [1]

3 ..... [1]

4 ..... [1]