1 On a bench, a steel ball of radius r is used to compress a spring by a distance x. The ball is held at rest in this position, as shown in Fig. 1.1.

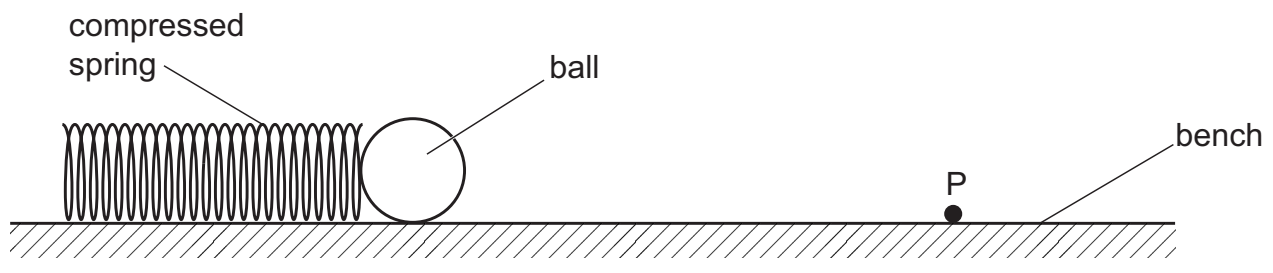

Fig. 1.1

The ball is released and rolls along the bench. At a fixed point P, the ball has speed v. The speed of the ball at P is determined using **one** light gate connected to a timer.

Several steel balls of different radii are available.

It is suggested that v is related to r by the relationship

$$v^2 = \frac{Ykx^2}{r^n \rho}$$

where k is the spring constant of the spring, ρ is the density of the steel, and Y and n are constants.

Plan a laboratory experiment to test the relationship between v and r.

Draw a diagram showing the arrangement of your equipment.

Explain how the results could be used to determine values for Y and n.

In your plan you should include:

- the procedure to be followed
- the measurements to be taken
- the control of variables
- the analysis of the data
- any safety precautions to be taken.

Diagram

[15]