3 A ball falls from rest onto a flat horizontal surface. Fig. 3.1 shows the variation with time t of the velocity v of the ball as it approaches and rebounds from the surface.

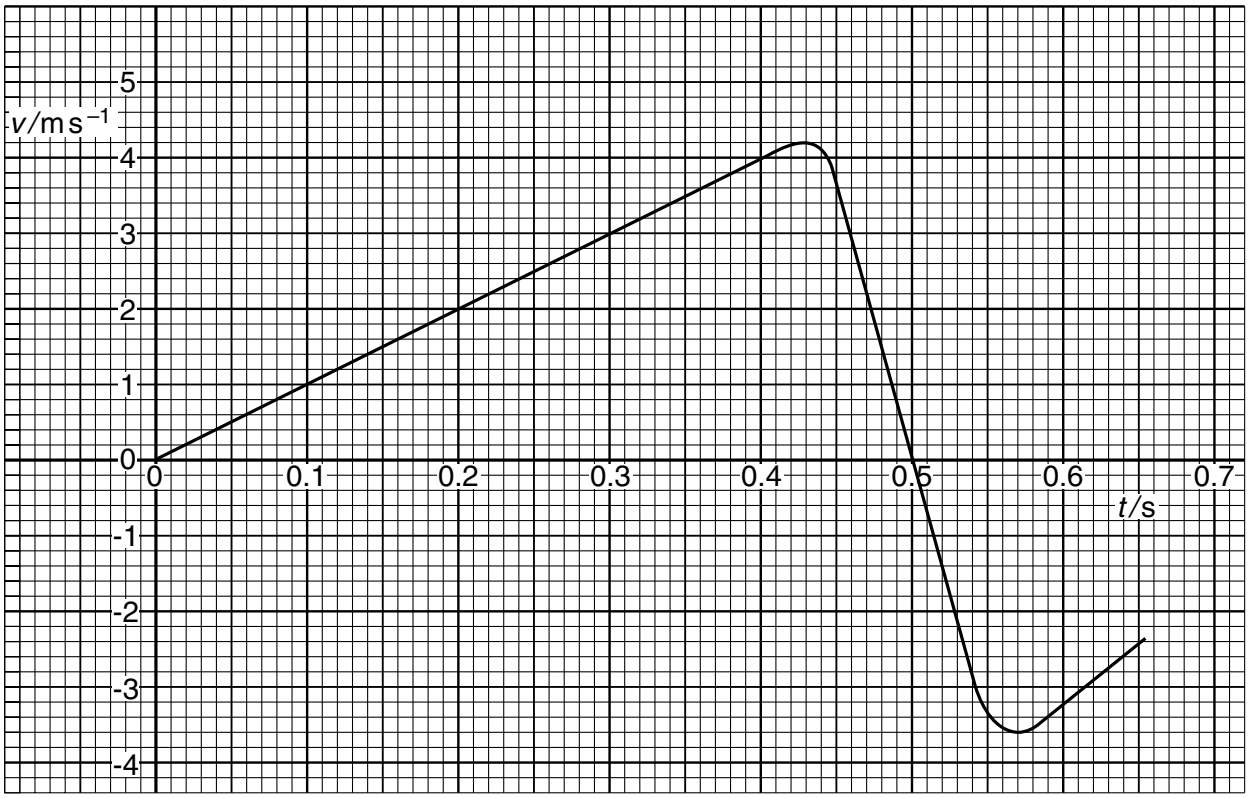

Fig. 3.1

Use data from Fig. 3.1 to determine

(a) the distance travelled by the ball during the first 0.40 s,

distance = ... m [2]

4 A steel ball of mass 73 g is held 1.6 m above a horizontal steel plate, as illustrated in Fig. 4.1.

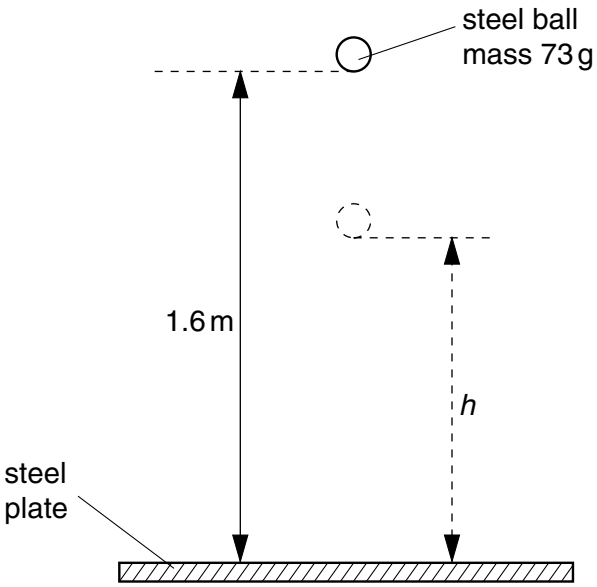

Fig. 4.1

The ball is dropped from rest and it bounces on the plate, reaching a height *h*.

(a) Calculate the speed of the ball as it reaches the plate.

speed = ... $m\,s^{-1}$ [2]

(b) As the ball loses contact with the plate after bouncing, the kinetic energy of the ball is 90% of that just before bouncing. Calculate

(i) the height *h* to which the ball bounces,

h = ... m

(ii) the speed of the ball as it leaves the plate after bouncing.

speed = ... $m\,s^{-1}$

[4]

(c) Using your answers to **(a)** and **(b)**, determine the change in momentum of the ball during the bounce.

change = ... N s [3]

(d) With reference to the law of conservation of momentum, comment on your answer to **(c)**.

.....

.....

.....[3]

Answer **all** the questions in the spaces provided.

1 Distinguish between the *mass* of a body and its *weight*.

mass .....

.....

weight .....

.....[4]

2 A student determines the acceleration of free fall using the apparatus illustrated in Fig. 2.1.

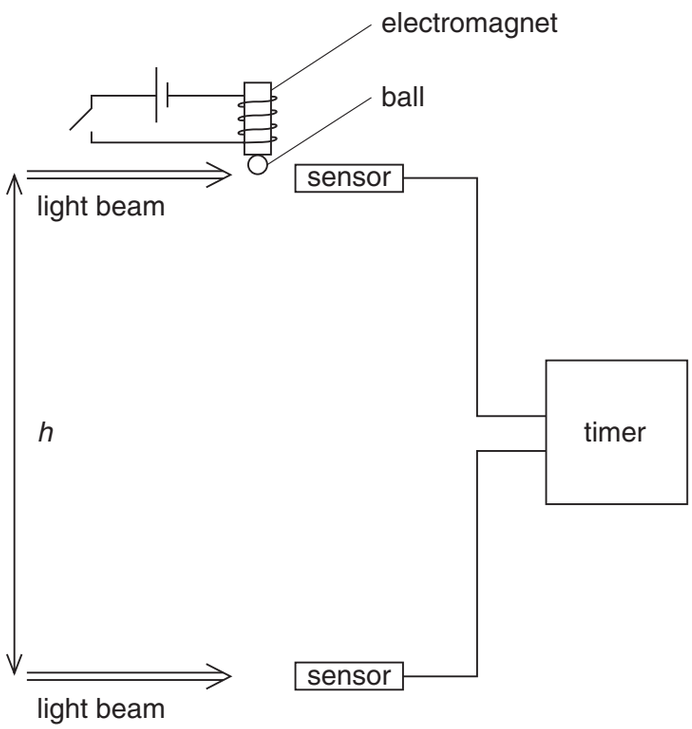

Fig. 2.1

A steel ball is held on an electromagnet. When the electromagnet is switched off, the ball immediately interrupts a beam of light and a timer is started. As the ball falls, it interrupts a second beam of light and the timer is stopped. The vertical distance h between the light beams and the time t recorded on the timer are noted. The procedure is repeated for different values of h. The student calculates values of t^2 and then plots the graph of Fig. 2.2.

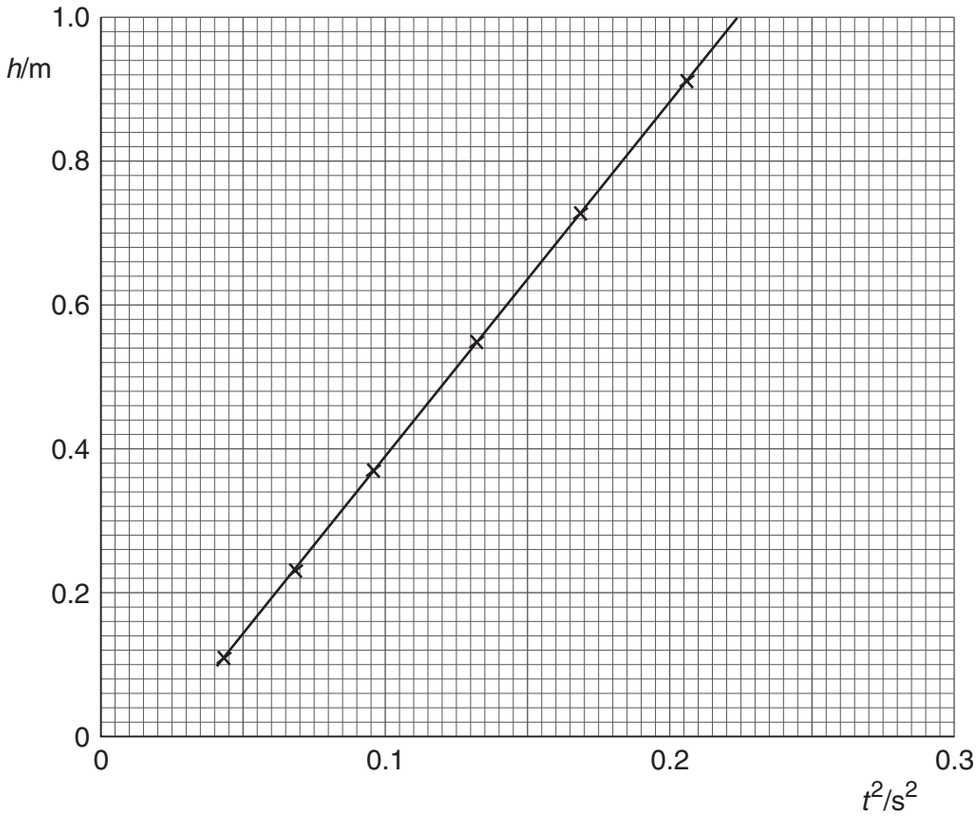

Fig. 2.2

(a) Use Fig. 2.2 to calculate a value for g, the acceleration of free fall of the ball. Explain your working.

g = ... $m\,s^{-2}$ [4]

(b) Identify one possible source of random error in the determination of g and suggest how this error may be reduced.

.....

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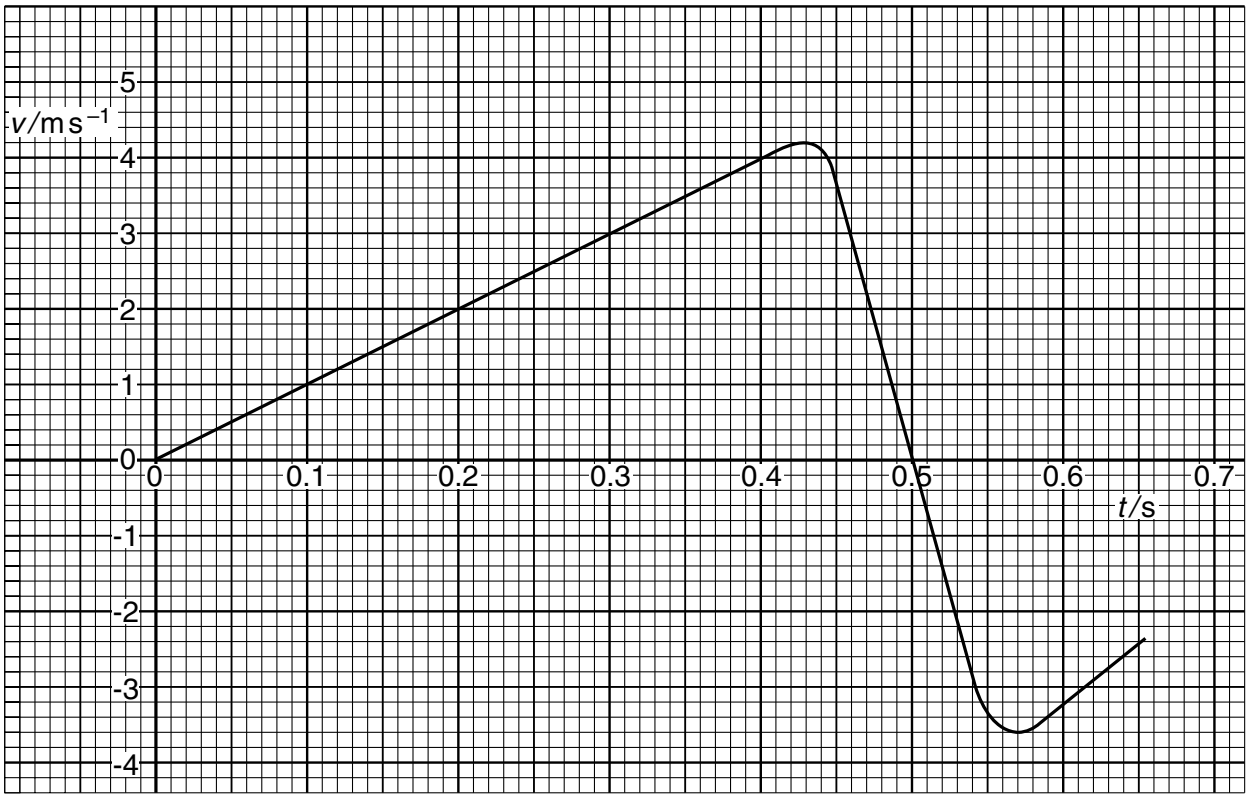

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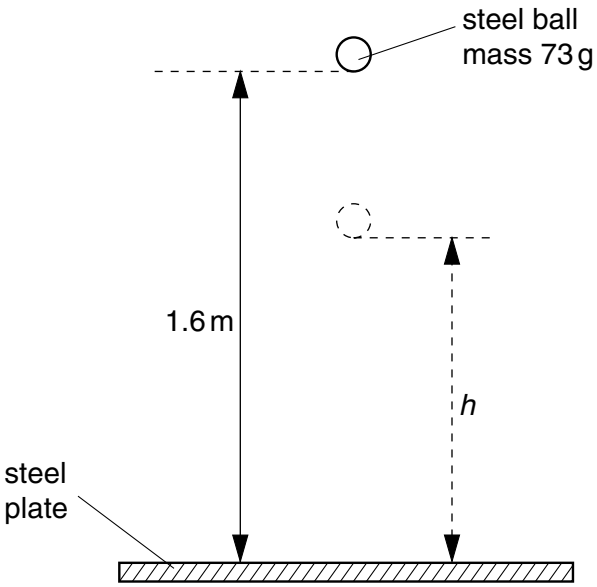

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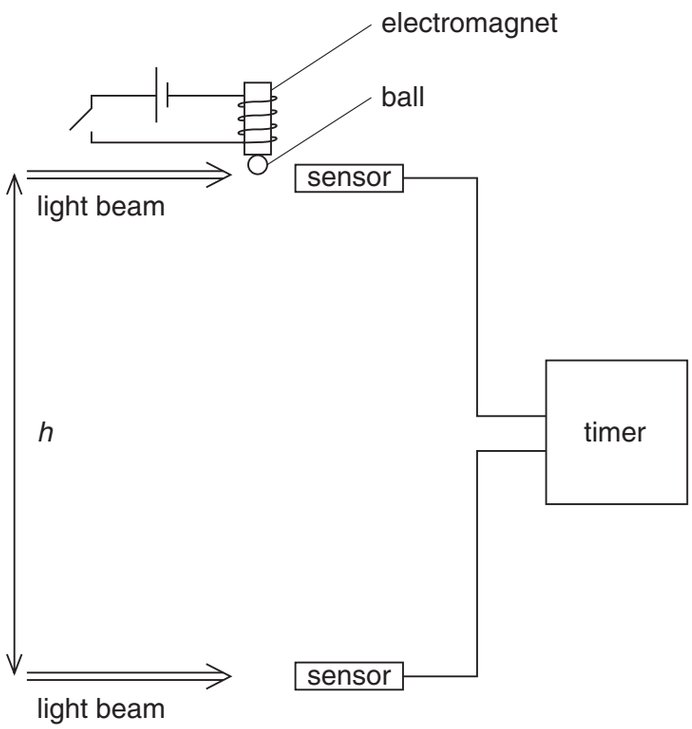

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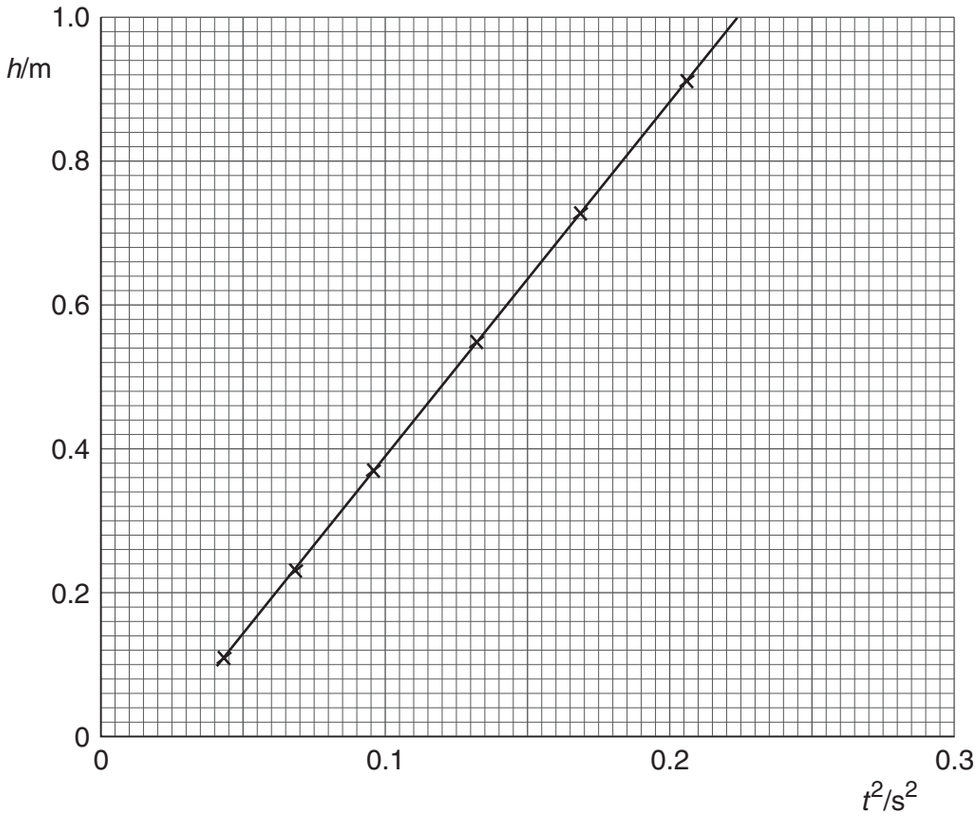

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