

- 3 A small ball is thrown horizontally with a speed of 4.0 m s^{-1} . It falls through a vertical height of 1.96 m before bouncing off a horizontal plate, as illustrated in Fig. 3.1.

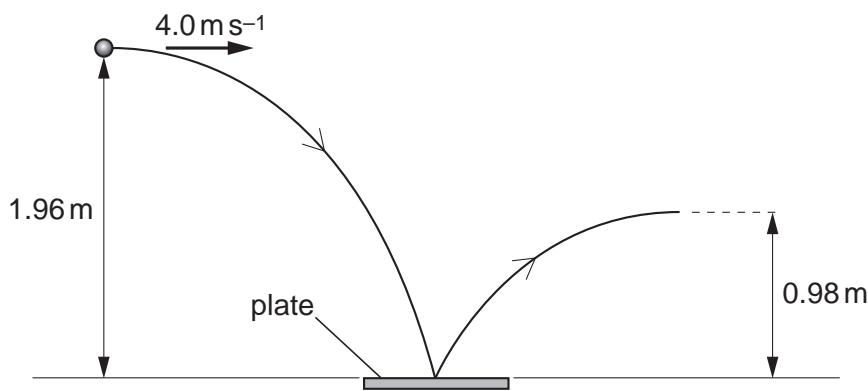


Fig. 3.1

Air resistance is negligible.

- (a) For the ball, as it hits the horizontal plate,

- (i) state the magnitude of the horizontal component of its velocity,

$$\text{horizontal velocity} = \dots \text{ ms}^{-1} \quad [1]$$

- (ii) show that the vertical component of the velocity is 6.2 m s^{-1} .

[1]

- (b) The components of the velocity in (a) are both vectors.

Complete Fig. 3.2 to draw a vector diagram, to scale, to determine the velocity of the ball as it hits the horizontal plate.

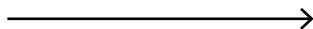


Fig. 3.2

velocity = ms^{-1}

at ° to the vertical

[3]

- (c) After bouncing on the plate, the ball rises to a vertical height of 0.98 m.

- (i) Calculate the vertical component of the velocity of the ball as it leaves the plate.

vertical velocity = ms^{-1} [2]

- (ii) The ball of mass 34 g is in contact with the plate for a time of 0.12 s.

Use your answer in (c)(i) and the data in (a)(ii) to calculate, for the ball as it bounces on the plate,

For
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Use

1. the change in momentum,

$$\text{change} = \dots \text{kg m s}^{-1} [3]$$

2. the magnitude of the average force exerted by the plate on the ball due to this momentum change.

$$\text{force} = \dots \text{N} [2]$$