

- 3 A girl stands at the top of a cliff and throws a ball vertically upwards with a speed of 12 m s^{-1} , as illustrated in Fig. 3.1.

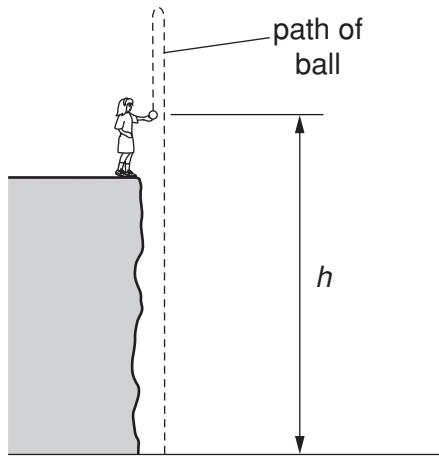


Fig. 3.1

At the time that the girl throws the ball, her hand is a height h above the horizontal ground at the base of the cliff.

The variation with time t of the speed v of the ball is shown in Fig. 3.2.

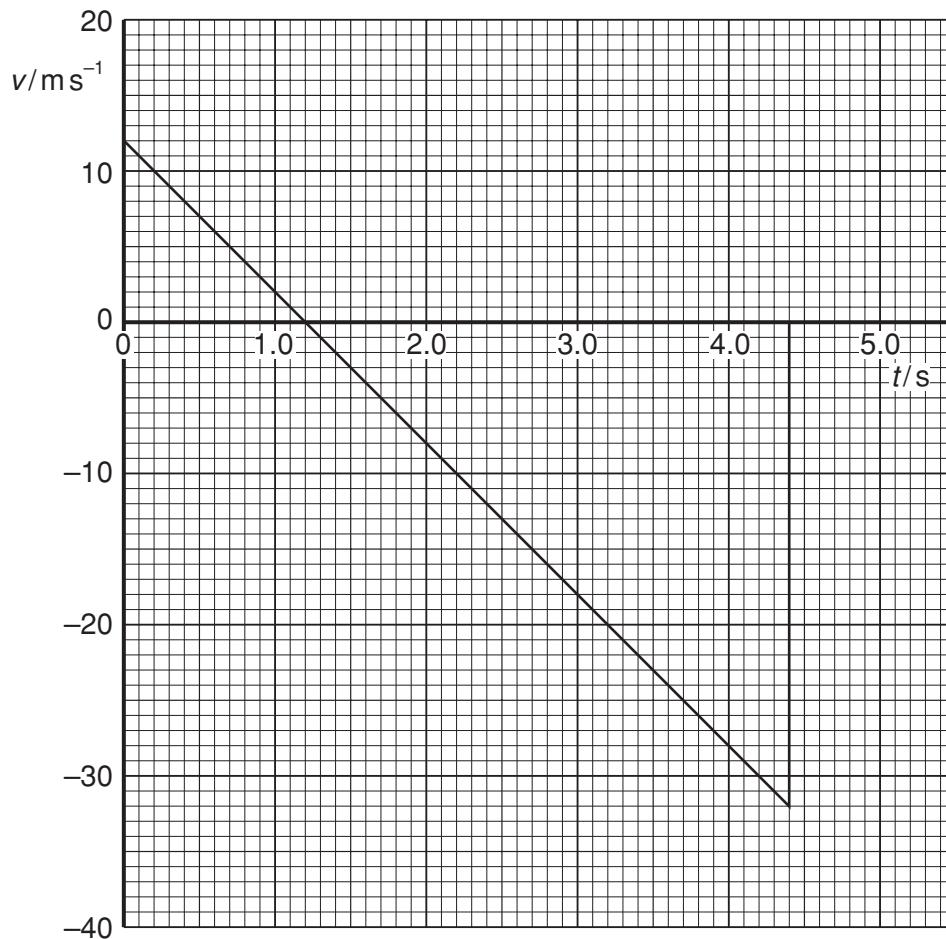


Fig. 3.2

Speeds in the upward direction are shown as being positive. Speeds in the downward direction are negative.

- (a) State the feature of Fig. 3.2 that shows that the acceleration is constant.

..... [1]

- (b) Use Fig. 3.2 to determine the time at which the ball

- (i) reaches maximum height,

time = s

- (ii) hits the ground at the base of the cliff.

time = s
[2]

- (c) Determine the maximum height above the base of the cliff to which the ball rises.

height = m [3]

- (d) The ball has mass 250 g. Calculate the magnitude of the change in momentum of the ball between the time that it leaves the girl's hand to time $t = 4.0\text{ s}$.

change = Ns [3]

- (e) (i) State the principle of conservation of momentum.

[2]

- (ii) Comment on your answer to (d) by reference to this principle.

[3]

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