

- 3 A steel ball falls from a platform on a tower to the ground below, as shown in Fig. 3.1.

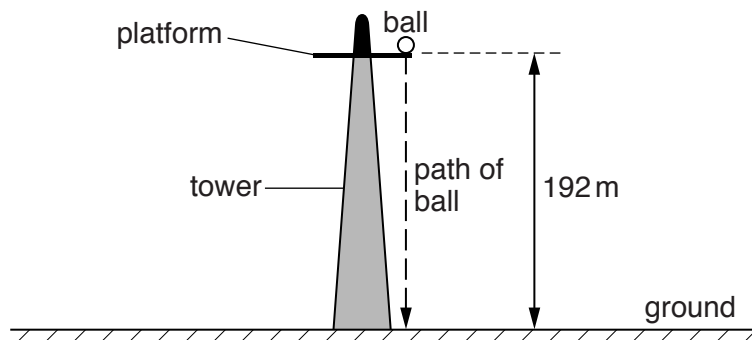


Fig. 3.1

The ball falls from rest through a vertical distance of 192 m. The mass of the ball is 270 g.

- (a)** Assume air resistance is negligible.

- (i)** Calculate

1. the time taken for the ball to fall to the ground,

time taken = s [2]

2. the maximum kinetic energy of the ball.

maximum kinetic energy = J [2]

- (ii)** State and explain the variation of the velocity of the ball with time as the ball falls to the ground.

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.....[1]

- (iii)** Show that the velocity of the ball on reaching the ground is approximately 60 m s^{-1} .

- (b) In practice, air resistance is not negligible. The variation of the air resistance R with the velocity v of the ball is shown in Fig. 3.2.

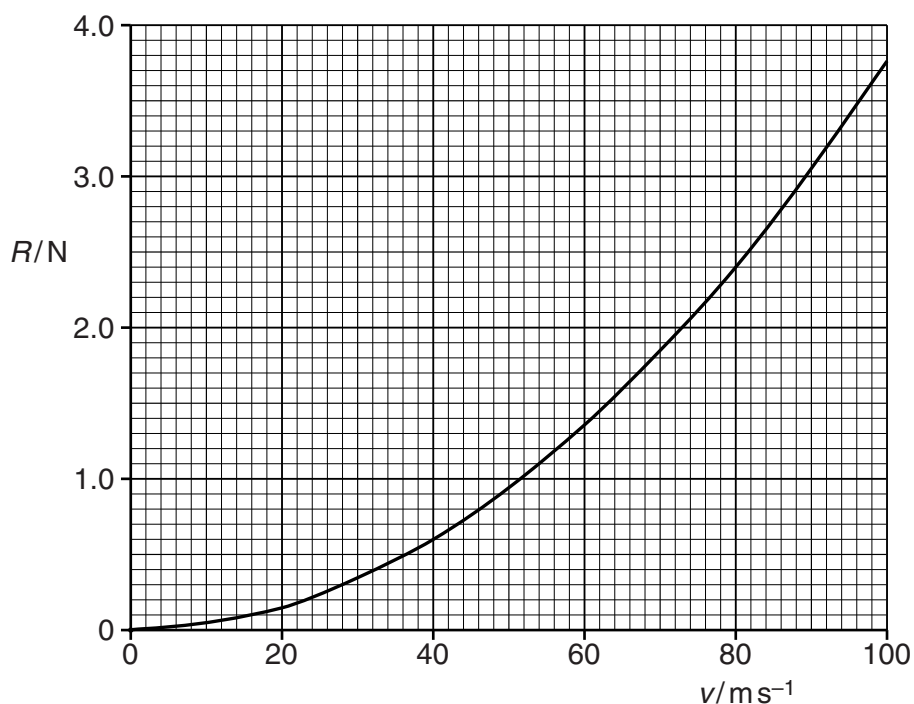


Fig. 3.2

- (i) Fig. 3.2 to state and explain qualitatively the variation of the acceleration of the ball with the distance fallen by the ball.

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[3]

- (ii) The speed of the ball reaches 40 ms^{-1} . Calculate its acceleration at this speed.

acceleration = ms^{-2} [2]

- (iii) information from (a)(iii) and Fig. 3.2 to state and explain whether the ball reaches terminal velocity.

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[2]