2

A ball is kicked from horizontal ground towards a vertical wall as shown in Fig. 2.1.

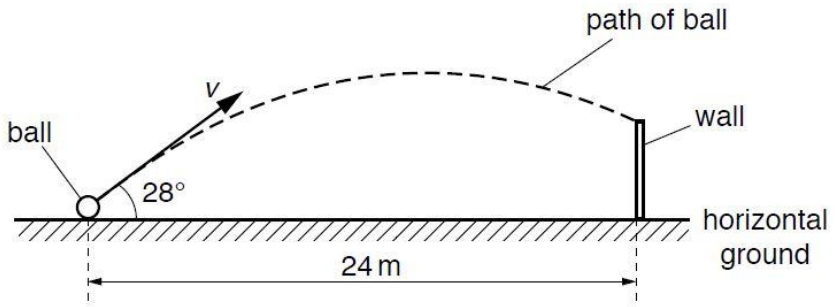

Fig 2.1 (not to scale)

The horizontal distance between the initial position of the ball and the base of the wall is 24 m. The ball is kicked with an initial velocity v at an angle of 28° to the horizontal. The ball just hits the top of the wall after a time of 1.5 s.

(a)

Calculate the horizontal component v_X of the velocity of the ball.

v_X = ... m s^{-1} [1]

(b)

Hence or otherwise, show that the initial vertical component v_Y of the velocity of the ball is 8.5 m s^{-1}.

[1]

(c)

The ball is kicked at time $t = 0$. Assume that the vertical component v_Y of the velocity of the ball is positive in the upwards direction.

(i)

On Fig. 2.2, sketch the variation with time t of v_Y for the time until the ball hits the wall.

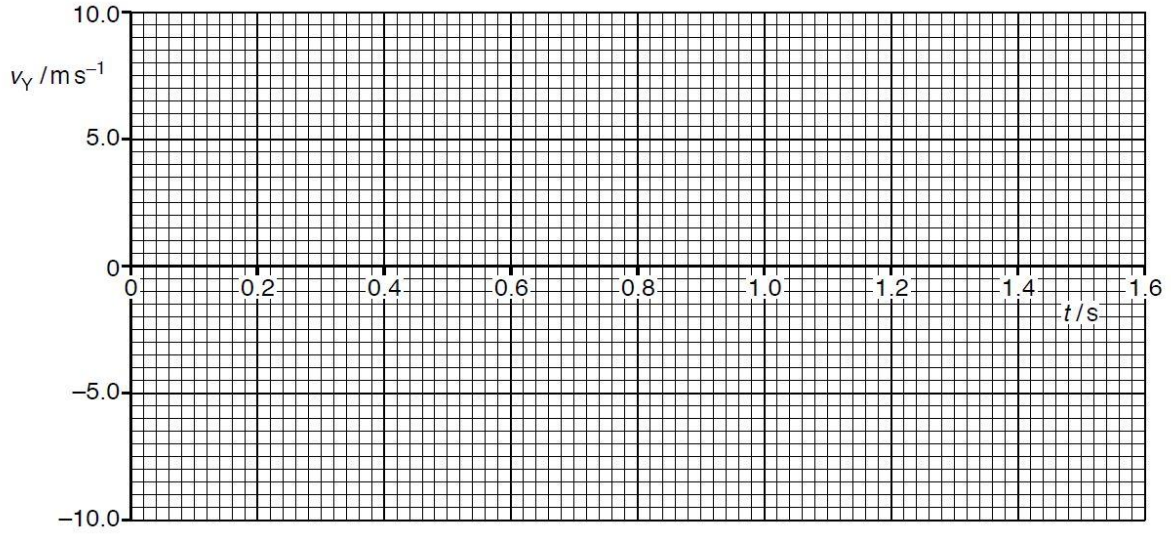

Fig. 2.2

[3]

(ii)

Using Fig. 2.2, determine the maximum height above the ground that the ball reached.

maximum height = ... m [2]

(iii)

Hence or otherwise, determine the ratio of its $\frac{\text{kinetic energy}}{\text{gravitational potential energy}}$ when the ball is at its maximum height.

ratio = ... [2]

(iv)

If air resistance is not negligible, on Fig 2.2, sketch the variation with time t of v_Y for the time until the ball hits the ground.

Label this line W. [2]