1 (a) A ball is kicked from horizontal ground towards a vertical wall, as shown in Fig. 1.1.

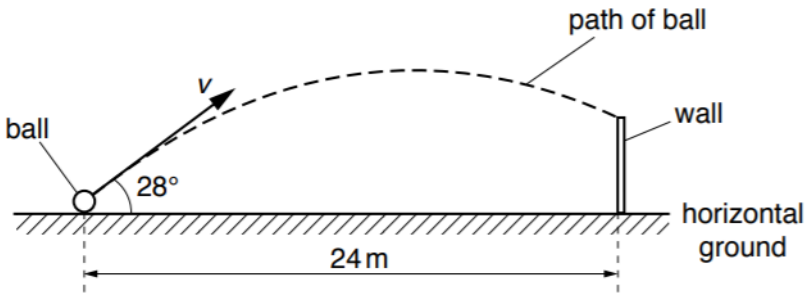

Fig. 1.1 (not to scale)

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° above the horizontal. The ball hits the wall after a time of 1.50 s. Air resistance is negligible.

(i) Calculate the initial horizontal component v_X of the velocity of the ball.

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

(ii) Show that the initial vertical component v_Y of the velocity of the ball is 8.5 m s^{-1}.

[1]

(iii) Calculate the time taken for the ball to reach its maximum height above the ground.

time = ... s [2]

(iv) 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. On Fig. 1.2, sketch the variation with time t of v_Y for the time until the ball hits the wall. **Label this graph Q.**

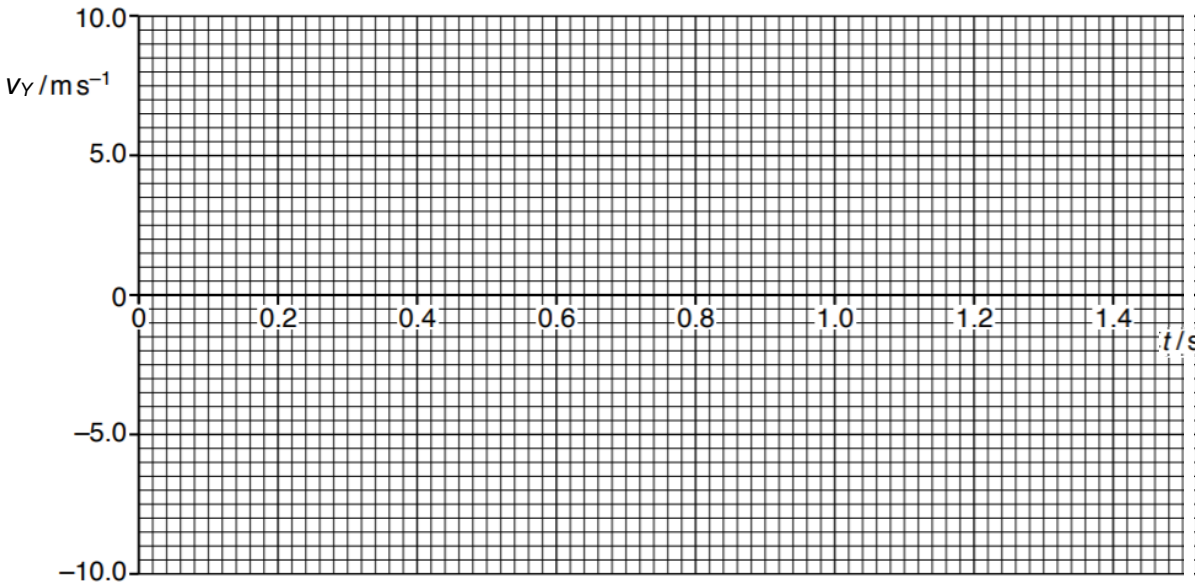

Fig. 1.2 [1]

(v) Use your graph in Fig. 1.2 to estimate the height of the wall.

height of wall = ... m [2]

(b) On Fig. 1.2, sketch a possible v_Y against t graph if air resistance acts on the ball. Assume the ball does not reach the ground before 1.50s. **Label this graph R.** [2]