1   A projectile is fired from ground level with initial velocity u at an angle θ to the horizontal as shown in Fig. 1.1. The projectile strikes a target which is at a horizontal displacement x from the point of projection and a vertical height y above ground level.
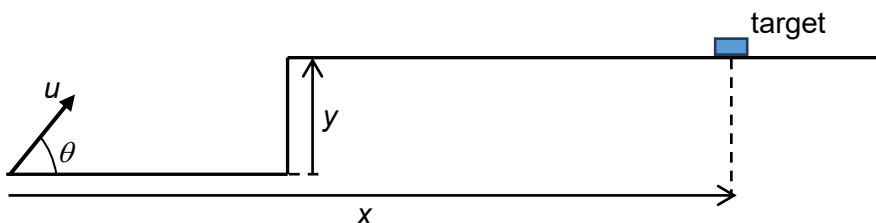

Fig. 1.1

(a) Neglecting the effect of air resistance, show that the vertical height y is given by the expression

$$y = x\tan\theta - 4.91\left(\frac{x}{u\cos\theta}\right)^2$$

[3]

(b) Given that the angle θ is 60°, the horizontal displacement x is 115 m and the vertical height y is 23 m, calculate the speed u.

$u =$ .... m s^{-1} [1]

(c) Fig. 1.2 shows the variation with time t of the vertical velocity v_y of the projectile when air resistance is negligible. On the same axes, sketch a graph to show the variation with time t of the vertical velocity v_y of the projectile when air resistance is not negligible.   [2]
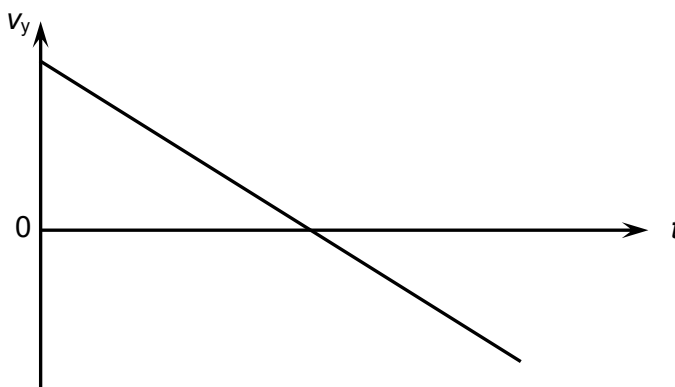

Fig. 1.2

[Total: 6]