Projectiles

Gold

A body is projected at time t = 0 s from a point O with speed U ms^{-1} in a direction inclined at an angle of θ to the horizontal.

a Write down expressions for the horizontal and vertical components of its displacement from O at time t s.

b Show that the range R m on a horizontal plane through the point of projection is given by

$$R = \frac{\left(U^2 \sin 2\theta\right)}{g}$$

c The maximum range is 800 m. Find the speed of projection giving your answer to two significant figures.

Silver

A particle is projected from a point on a horizontal plane with an initial velocity U at an angle 30° above the horizontal and moves freely under gravity until it hits the plane at point B. Given that the acceleration due to gravity is g, find expressions for:

a The time of flight, T.

b The range, R, on the horizontal plane.

Bronze

A cannonball is fired horizontally from the top of a 300 m vertical cliff with a velocity of 100 ms^{-1}. The cannonball hits the sea t seconds later.

a Find the value of t.

b Find the speed with which the cannonball hits the sea.