

Q- A marble is thrown horizontally with a speed of 20 m/s from the top of a building. When it strikes the ground, the marble has a velocity that makes an angle of 37° with the horizontal. From what height above the ground was the marble thrown?

The velocity of the marble in horizontal direction remains constant.

The initial velocity in vertical direction is zero.

If the height of the building be h , then the final vertical velocity is given by

$$[v^2 = u^2 + 2*a*s]$$

$$V_y^2 = 0 + 2*9.8*h$$

Gives $V_y = \sqrt{2*9.8*h}$

But the velocity vector is making an angle of 37° with horizontal, hence we have

$$\tan 37^\circ = \frac{v_y}{v_x}$$

Or $\tan 37^\circ = \frac{\sqrt{19.6*h}}{20}$

Or

Gives $\sqrt{19.6 * h} = 20 * \tan 37^\circ$

Or $19.6 * h = (20 * \tan 37^\circ)^2$

Or $h = \frac{(20*\tan 37^\circ)^2}{19.6} = \frac{(20*0.75)^2}{19.6} = 11.5 \text{ m}$