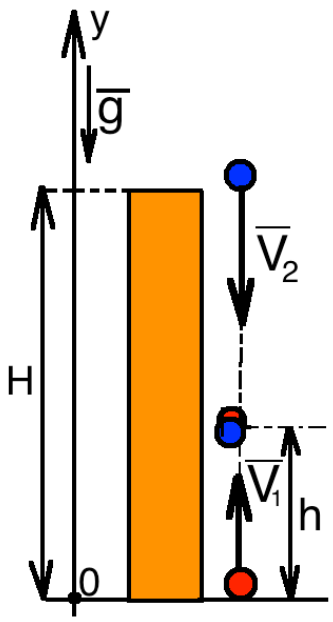
Answer on Question#39362 – Physics – Mechanics

A glove is dropped from a 40 m tall building and simultaneously a ball is thrown from the ground at the speed of 40 m/s. when and where do they meet??

Solution:



$V_1 = 40\frac{m}{s}$ – velocity of the stone, which was thrown down;
$V_2 = 0$ –velocity of the glove, which was thrown up;
$H = 40m$ – height of the building;
h – height of the point where the stone and glove cross paths (above the base of the building).
t – time after glove and the ball will meet

The equation of motion for the stone (which was thrown up) respect to the Y-axis:

$$y_1 = V_1 t - \frac{gt^2}{2} \qquad (1)$$

The equation of motion for the glove (which was thrown down) respect to the Y-axis:

$$y_2 = H - V_2 t - \frac{gt^2}{2} = H - \frac{gt^2}{2} \qquad (2)$$

When stone and glove cross paths, their coordinates are equal:

$$y_2 = y_1 \qquad (3)$$

(3)and (2)in (1):

$$V_1 t_{cross} - \frac{g{t_{cross}}^2}{2} = H - \frac{g{t_{cross}}^2}{2}$$

$$H = t_{cross} V_1$$

$$t_{cross} = \frac{H}{V_1} = \frac{40m}{40\frac{m}{s}} = 1s \qquad (4)$$

$$h = y_2(t_{cross}) = y_1(t_{cross}) = H - \frac{g(t_{cross})^2}{2} = 40m - \frac{9.8\frac{m}{s^2}\cdot 1s^2}{2} = 35.1m$$

The location (above the base of the building) of the point where the paths of the stone and glove will cross:

$$h = 35.1\ m$$

Answer: paths will cross after 1 second at the hight $h = 35.1$ m above the base of the building.