

Two bodies are thrown vertically upward with the same initial velocity of 98m/s but 4 second apart. How long after the first one is thrown will they meet?

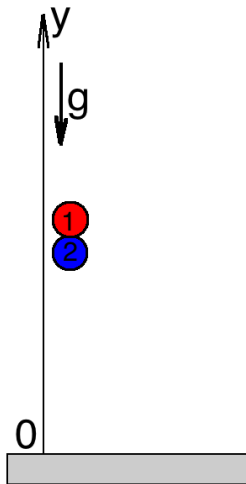
Solution:

t – time passed after the first body was thrown;

t_m – time before the the meeting of the bodies;

$\Delta t = 4s$ – delay time;

$V = 98 \frac{m}{s}$ – velocity of the bodies.



Equation of motion for the first body:

$$y_1 = Vt - \frac{gt^2}{2}$$

Equation of motion for the second body:

$$y_2 = V(t - \Delta t) - \frac{g(t - \Delta t)^2}{2}$$

The condition of the meeting:

$$y_1(t_m) = y_2(t_m)$$

$$Vt_m - \frac{gt_m^2}{2} = V(t_m - \Delta t) - \frac{g(t_m - \Delta t)^2}{2}$$

$$Vt_m - \frac{gt_m^2}{2} = Vt_m - V\Delta t - \frac{gt_m^2}{2} + gt_m\Delta t - \frac{g\Delta t^2}{2}$$

$$gt_m\Delta t = V\Delta t + \frac{g\Delta t^2}{2}$$

$$2gt_m\Delta t = 2V\Delta t + g\Delta t^2$$

$$t_m = \frac{\Delta t(2V + g)}{2g\Delta t} = \frac{4s \cdot \left(2 \cdot 98 \frac{m}{s} + 9.8 \frac{m}{s^2} \cdot 4s\right)}{2 \cdot 9.8 \frac{m}{s^2} \cdot 4s} = 12s$$

Answer: bodies will meet after 12s .