

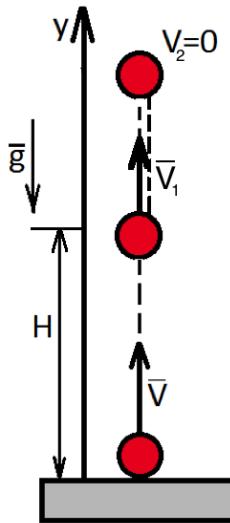
An object thrown vertically up from the ground passes the height 5 m twice in an interval of 10 s. What is its time of flight?

Soltuion:

$$H = 5 \text{ m}$$

$$t = 10 \text{ s}$$

T – time of the flight



If the ball flies twice a height of 5 meters in 10 seconds, then on top of it was $t_2 = 5$ seconds after the first span along the height of 5m.

Rate equation for the ball, in the end of the flight speed of the ball is zero:

$$0 = V_1 - gt_2$$

$$V_1 = gt_2 \quad (1)$$

The equation of motion for the ball for the height of 5 meters:

$$y: H = Vt_1 - \frac{gt_1^2}{2} \quad (2), \quad t_1 - \text{flight time to reach the height } H = 5 \text{ m}$$

Rate equation for the ball

$$V_1 = V - gt_1$$

$$V = V_1 + gt_1 \quad (3)$$

(1)in(3):

$$V = gt_1 + gt_2 \quad (4)$$

(4)in(2):

$$H = g(t_1 + t_2)t_1 - \frac{gt_1^2}{2}$$

$$gt_1^2 + 2gt_2t_1 - 2H = 0$$

We have a quadratic equation:

$$9.8t_1^2 - 98t_1 - 10 = 0$$

Real positive root of the equation: $t_1 = 10.1 \text{ s}$

Flight time up is equal time of the fall:

$$T = 2 \cdot (t_1 + t_2) = 2 \cdot (10.1 \text{ s} + 5 \text{ s}) = 30.2 \text{ s}$$

Answer: time of the flight is 30.2s