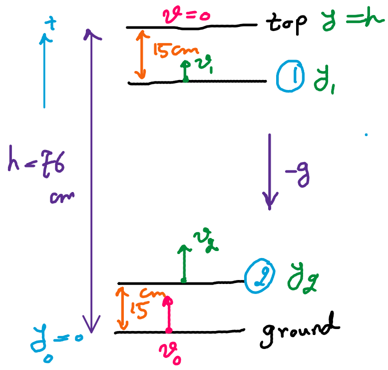
62 H BIO FCP A basketball player grabbing a rebound jumps 76.0 cm vertically. How much total time (ascent and descent) does the player spend (a) in the top 15.0 cm of this jump and (b) in the bottom 15.0 cm? (The player seems to hang in the air at the top.)



a) $v^2 - v_1^2 = -2g(y - y_1)$

$\rightarrow -v_1^2 = -2\times 9.8 \times 0.15 \Rightarrow v_1 = \mp\sqrt{2\times 9.8\times 0.15} = +1.7146\ m/s$

$a = \frac{\Delta v}{\Delta t} \rightarrow \Delta t = \frac{v - v_1}{-g} = \frac{0 - 1.7146}{-9.8} \simeq 0.175\ s$

$\Rightarrow T = 2\times 0.175 \simeq 0.350\ s$

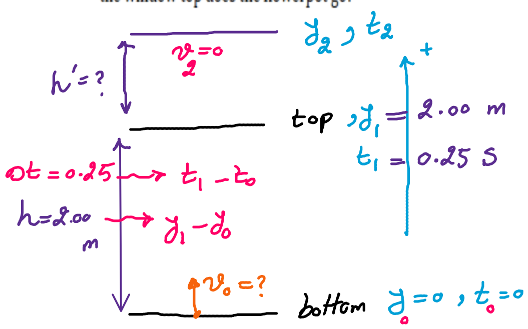
b) $v^2 - v_0^2 = -2g(y - y_0) \rightarrow v_0^2 = \underbrace{2\times 9.8\times 0.76}_{14.896} \rightarrow v_0 = \mp\sqrt{2\times 9.8\times 0.76} \simeq +3.8595\ m/s$

$v_2^2 - v_0^2 = -2g(y_2 - y_0) \Rightarrow v_2^2 - 14.896 = -2\times 9.8\times 0.15 \rightarrow v_2^2 = 11.956$

$\Rightarrow v_2 = \mp\sqrt{11.956} = +3.4577$

$a = \frac{\Delta v}{\Delta t} \Rightarrow \Delta t' = \frac{v_2 - v_0}{-g} = \frac{3.4577 - 3.8595}{-9.8} \simeq 0.041\ s \rightarrow T' = 2\times 0.041 \simeq 0.082\ s$

63 H GO A drowsy cat spots a flowerpot that sails first up and then down past an open window. The pot is in view for a total of 0.50 s, and the top-to-bottom height of the window is 2.00 m. How high above the window top does the flowerpot go?



$y_1 = -\frac{1}{2}g t_1^2 + v_0 t_1 + y_0$

$2 = -2\times 9.8\times(0.25)^2 + v_0\times 0.25 + 0$

$\rightarrow v_0 = 9.225\ m/s$

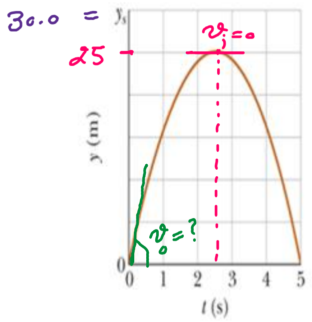
$v_2^2 - v_0^2 = -2g(y_2 - y_0)$

$\Downarrow$

$-(9.225)^2 = -2\times 9.8\times y_2 \rightarrow y_2 \simeq 4.34\ m$

$\rightarrow h' = 4.34 - 2 \simeq 2.34\ m$

64 A ball is shot vertically upward from the surface of another planet. A plot of y versus t for the ball is shown in Fig. 2.21, where y is the height of the ball above its starting point and $t = 0$ at the instant the ball is shot. The figure's vertical scaling is set by $y_s = 30.0$ m. What are the magnitudes of (a) the free-fall acceleration on the planet and (b) the initial velocity of the ball?



$t_i = 2.5\ s \longrightarrow y_i = 25\ m$

$t_f = 5\ s \longrightarrow y_f = 0$

a)

$$y_f = \frac{1}{2} a (t_f - t_i)^2 + v_i (t_f - t_i) + y_i$$

$$0 = \frac{1}{2} g_p (5 - 2.5)^2 + 25 \longrightarrow g_p = \frac{-50}{(2.5)^2} = -8.0\ m/s^2 \longrightarrow |g_p| = 8.0\ m/s^2$$

b)

$$a = \frac{\Delta v}{\Delta t} \Rightarrow g_p = \frac{v_i - v_0}{t_i - t_0} \longrightarrow v_0 = 8.0 \times 2.5 = 20\ m/s$$