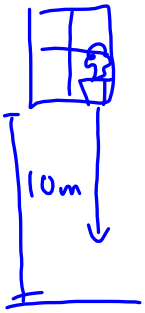
SPH3U: 1.6 Acceleration Near Earth's Surface

1. Acceleration due to gravity

Acceleration due to gravity:	acceleration when an object is allowed to fall freely. $g = 9.8\ m/s^2$.
free fall	when there is no air resistance. only actually happens in a vacuum (close enough).

2. Falling straight down

A flowerpot is knocked off a window ledge and accelerates uniformly to the ground. If the window ledge is 10.0 m above the ground and there is no air resistance, how long does it take the flowerpot to reach the ground?



G: $a = 9.8\ m/s^2$, $\Delta d = 10.0\ m$, $v_i = 0\ m/s$.

R: Δt F: $\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ($v_i = 0$)

S: $\Delta d = \frac{1}{2}(9.8)\Delta t^2$ $\Delta t = \sqrt{\frac{2\Delta d}{a}}$

$= \sqrt{\frac{2(10)}{9.8}} = 1.43\ s$.

What is the final velocity of the flowerpot just before it hits the ground?

R: v_f F: $v_f^2 = v_i^2 + 2a\Delta d$

S: $v_f = \sqrt{0^2 + 2(9.8)(10)}$

$= 14.0\ m/s$.

3. Thrown straight up

A tennis ball is thrown straight up in the air, leaving the person's hand with an initial velocity of 3.0 m/s, as shown to the right. How high, from where it was thrown, does the ball go?

G: $\vec{v_i} = 3.0\ m/s\ [up]$, $\vec{a} = 9.8\ m/s^2\ [down]$,
$\vec{v_f} = 0\ m/s$.

R: $\vec{\Delta d}$ F: $\vec{v_f}^2 = \vec{v_i}^2 + 2\vec{a}\vec{\Delta d}$

S: $\vec{\Delta d} = \frac{v_f^2 - v_i^2}{2\vec{a}} = \frac{0^2 - 3^2}{2(-9.8)}$

$= \frac{-9}{-19.6} = 0.459\ m$

$= 0.46 m$.

How long will it take the ball above to reach its maximum height?

R: Δt E: $\vec{v_f} = \vec{v_i} + \vec{a}\Delta t$

S: $\Delta t = \frac{\vec{v_f} - \vec{v_i}}{\vec{a}} = \frac{0 - 3}{-9.8}$

$= 0.306\ s$

$= 0.31\ s$.

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