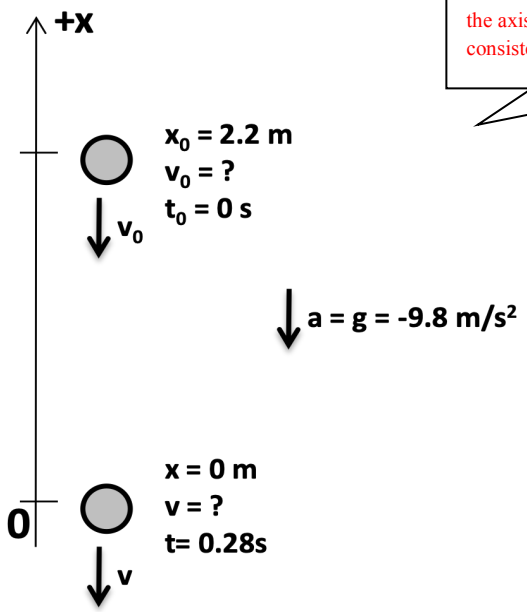
44. This problem involved three different positions of the object. To solve it, we can break it into two separate problems.

Part 1 (From the top of the window to the bottom of the window):

Figure:

You could also use "y" for the position variable, since the axis is vertical. Either way is correct, just be consistent throughout the entire problem.



Given: (See Figure)

If we can find out how fast the rock is moving at the top of the window, we can use that information to find out how far it had to travel to be moving that fast.

Want: v_0

Calculations:

Equation for Uniformly Accelerated Motion

$x = x_0 + v_0t + \frac{1}{2}at^2$

~~x~~ $= x_0 + v_0t + \frac{1}{2}at^2$

$- v_0t = x_0 + \frac{1}{2}at^2$

$v_0 = -(x_0 + \frac{1}{2}at^2)/t$

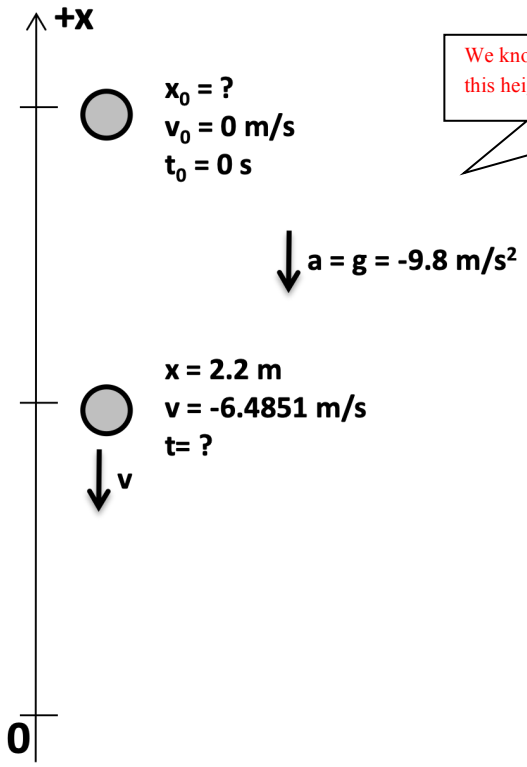
$v_0 = -[2.2\text{ m} + \frac{1}{2}(-9.8\text{ m/s}^2)(0.28\text{s})^2]/(0.28\text{ s})$

$v_0 = -6.4851$ m/s

Use this equation because the others have more than one unknown.
x = 0, so it cancels out.
Solve for v_0.
Note that v_0 is a negative number. This should make sense, since the rock is moving *downward*. Keep several decimal places until the very end of the entire problem.

Part 2 (From above the window to the top of the window):

Figure:



We know that v_0 is zero since it was *dropped* from this height.

Given: (See Figure)

Want: $x_0 - x$

We want $x_0 - x$ because x_0 is the distance above the *bottom* of the window. We want to know how far above the window the rock was dropped from.

Calculations:

Use this equation because we don't have any information about the time. We need an equation that allows us to solve for x_0 without knowing about the time.

v_0 is zero, so it cancels out.

Solve for x_0.

Equation for Uniformly Accelerated Motion

$v^2 = v_0^2 + 2a(x - x_0)$

$v^2 = \cancel{v_0^2} + 2a(x - x_0)$

$v^2 = 2a(x - x_0)$

$v^2/2a = (x - x_0)$

$(v^2/2a) - x = - x_0$

$x_0 = x - (v^2/2a)$

$x_0 = 2.2 \text{ m} - [(-6.4851 \text{ m/s})^2/(2 \cdot -9.8 \text{ m/s}^2)]$

$x_0 = 4.3458 \text{ m}$

$\Delta x = x - x_0$

$= 4.3458 \text{ m} - 2.2 \text{ m}$

$\Delta x = 2.1458 \text{ m}$

$\Delta x = 2.1$ m

Conclusion: The rock fell from 2.1 m above the top of the window.