Watermelon Board Problem

A very dense watermelon is dropped from the top of a 30.0m high cliff at the same instant that an arrow is fired up from ground level at the bottom of the cliff. Assume they hit in the air. Where and when? (Assume the arrow is fired up at 20.0 m/s) [*Be very careful with notation here. A 'right' answer arrived at because you've confused distance, displacement and position would not get much credit!*] [*Style: A few words will help the math 'flow' better for the reader.*]

watermelon

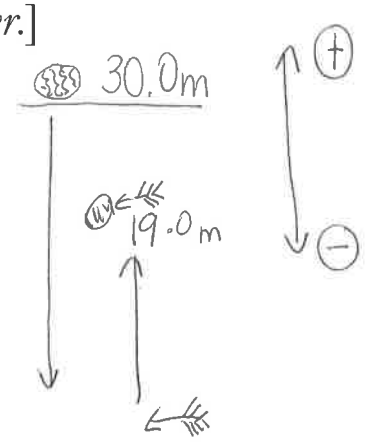
$\vec{v}_i = 0\,m/s$

$\vec{d}_i = 30.0\,m$

arrow

$\vec{d}_i = 0\,m$

$\vec{v}_i = 20.0\,m/s$



$t_w = t_a \qquad d_{f_w} = d_{f_a}$

$\vec{a} = -9.81\,m/s^2$

$$\Delta x = \vec{d}_f - \vec{d}_i = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$$

$$\vec{d}_f = \vec{d}_i + \vec{v}_i t + \frac{1}{2}\vec{a}t^2$$

d_f of watermelon $=$ d_f of arrow

$$d_i + \cancel{v_i t} + \cancel{\tfrac{1}{2}at^2} = \cancel{d_i} + v_i t + \cancel{\tfrac{1}{2}at^2}$$

$30.0\,m = v_i t$ (arrow) $\qquad 30.0\,m = 20.0\,m/s\; t \qquad t = 1.50\,s$

$$d_f - 30.0\,m = \cancel{v_i t}^{\,0} + \frac{1}{2}at^2 \qquad d_f = 30.0\,m + \frac{1}{2}(-9.81\,m/s^2)(1.50\,s)^2$$

$$d_f = 19.0\,m$$