

Time Independent Kinematic Equation 2D Notes

A.) A ball is tossed straight up in the air beginning at height 20 meters with $V_i = +30 \text{ m/s}$.

The ball reaches its peak and is then allowed to drop to the ground at 0 meters. $g = -10 \text{ m/s}^2$

Without finding time in the air, determine the ball's impact velocity. $g = -10 \text{ m/s}^2$

$$V_f^2 = V_i^2 + 2 a \Delta x$$

one-dimensional motion with acceleration

or

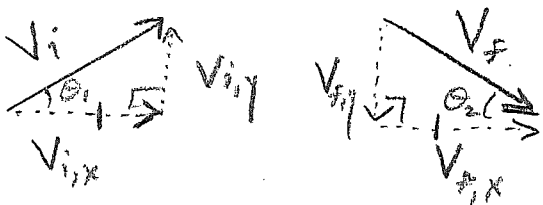
$$V_{f,y}^2 = V_{i,y}^2 + 2 g \Delta y$$

one-dimensional motion with vertical acceleration

B.) Write a literal equation for impact velocity (V_f) in terms of V_i , g , Δy and any necessary constants. You will need to begin with the

following equations :

$$V_{fy}^2 = V_{iy}^2 + 2g\Delta y$$

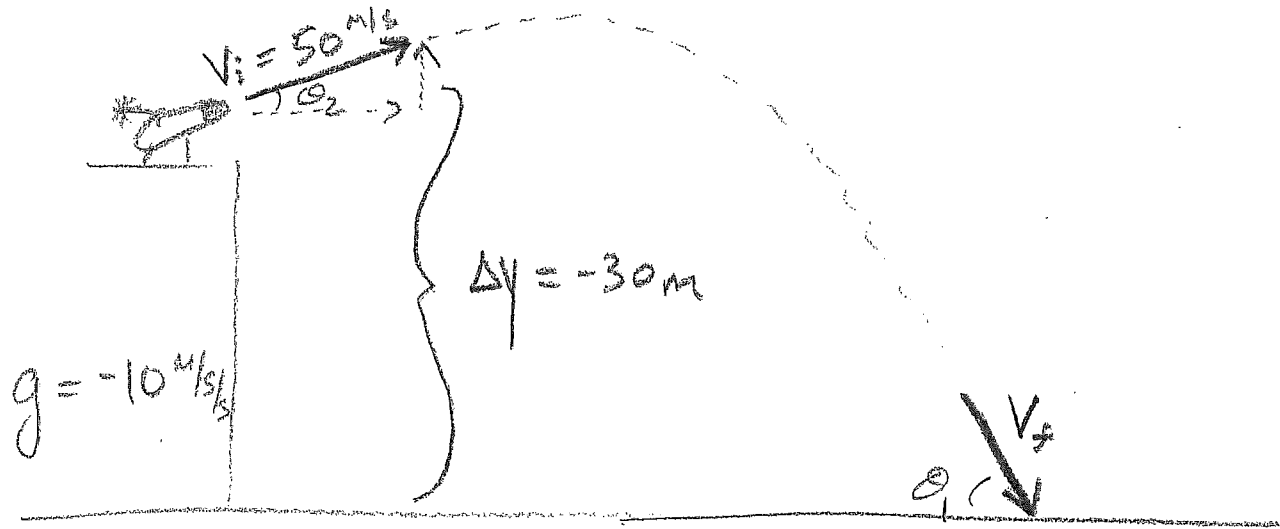


$$V_{ix}^2 + V_{iy}^2 = V_i^2$$

$$V_{fx}^2 + V_{fy}^2 = V_f^2$$

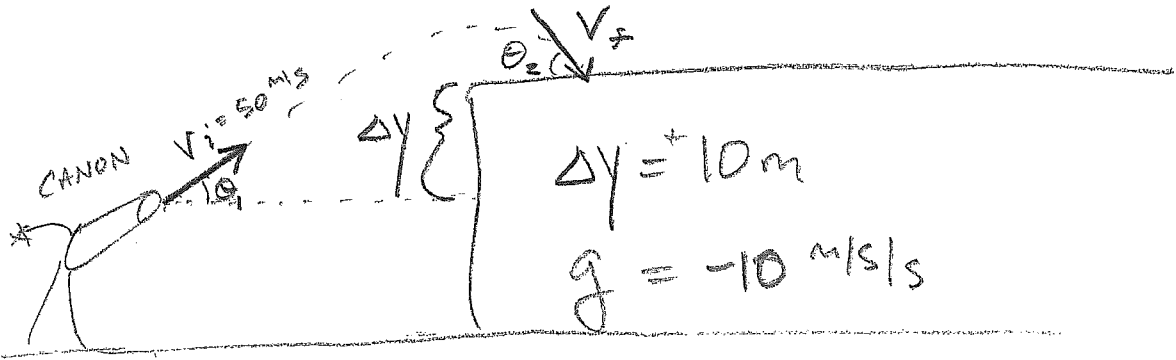
The equation must be valid for $\Delta y_{\text{final}} \neq 0 \text{ m}$ and projectiles launched at any angle:

c.)



Without finding $v_x, v_y, \Delta x$ or time in air, determine the impact velocity (v_f) of the projectile.

D.)



Without finding V_x , V_y , Δx or time in air, determine the impact velocity V_f .