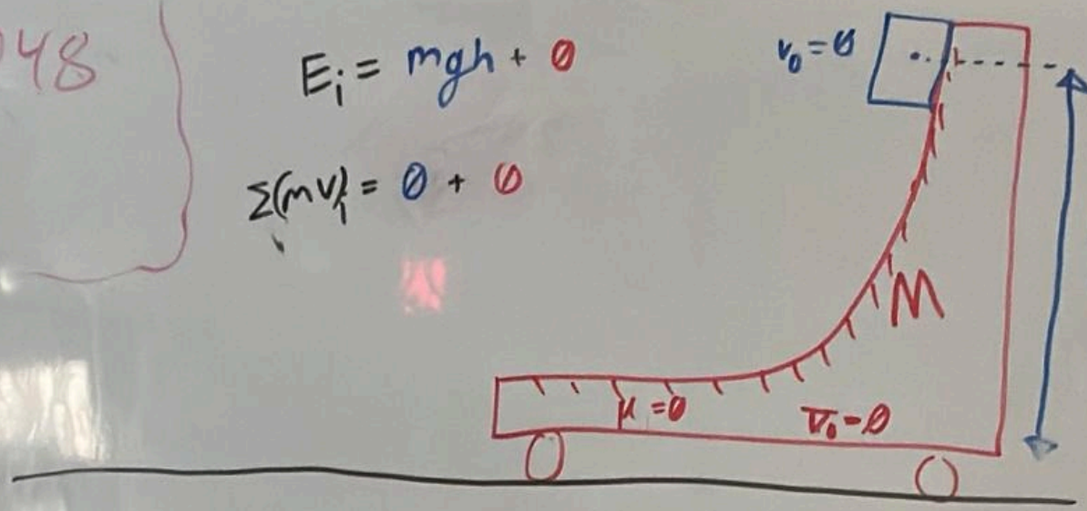
Phy2048

W/Kaleb

10:30-12:00

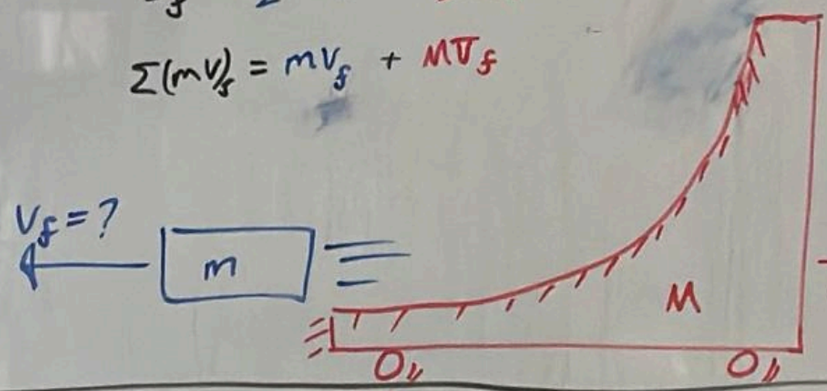
$E_i = mgh + 0$

$\Sigma(mv)_i = 0 + 0$



$E_f = \frac{1}{2}mv_f^2 + \frac{1}{2}MV_f^2$

$\Sigma(mv)_f = mv_f + MV_f$



Observation 1

$\mu = 0 \Rightarrow F_{friction} = 0$

And the other forces are all conservative.

$\Delta E = W_{\text{non conserve}} \to 0$

Thus $\begin{cases} \Delta E = 0 \\ \text{Energy is conserved} \end{cases}$ ☒

Observation 2

No external forces so impulse is zero.

$\Delta(mv) = \int F_{ext} \to 0$

$\Delta(mv) = 0$

⇓

Conservation of momentum ☒

2 equations

2 unknowns (v_f & V_f)

eq1 $\Delta E = E_f - E_i = 0$

$\Rightarrow \frac{1}{2}mv_f^2 + \frac{1}{2}MV_f = mgh$

eq2 $\Delta(mv) = (mv_f + MV_f) - 0 = 0$

$\Rightarrow mv_f = -MV_f$

$V_f = \frac{mv_f}{M}$ sub

$\frac{1}{2}mv_f^2 + \frac{1}{2}M\left[\frac{m}{M}v_f\right]^2 = mgh$

$\frac{1}{2}mv_f^2 + \frac{1}{2}M\left[\frac{m^2}{M^2}v_f^2\right] = mgh$

$\frac{1}{2}mv_f^2\left[1 + \frac{m}{M}\right] = mgh \to v_f = \sqrt{\frac{2gh}{(1+\frac{m}{M})}}$ & $V_f = \frac{m}{M}\sqrt{\frac{2gh}{(1+\frac{m}{M})}}$