Energy Mini Labs

Name: _____

For each of these mini labs, complete the task provided and show all work.

Equations and Constants

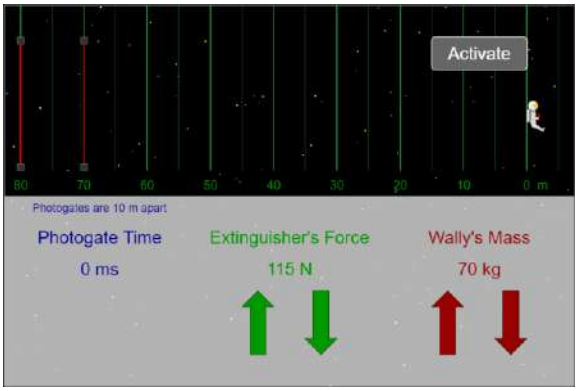
$v = d/t$	$PE_g = mgh$	$KE = \frac{1}{2}mv^2$	$PE_e = \frac{1}{2}k\Delta x^2$	$W = Fscos\theta$	$g = 9.81\ m\ s^{-2}$

Part 1: Wall-E and the Fire Extinguisher – (TUTORIAL)

There's a classic scene in the Pixar movie Wall-E where he propels himself through space using a fire extinguisher. In this lab, you will set initial conditions to predict the final velocity and ultimately the time it takes Wall-E to pass through a set of photogates 10 meters apart.

How to use the Simulation: (SIMULATION LINK)

- Click on the up/down arrows to increase/decrease the extinguisher's force and Wally's Mass.
- Click on "Activate" to turn on the extinguisher and begin applying the force.
- Once the backpack reaches the desired distance, click on "Shut Off" to stop the force and allow Wally to continue at a constant velocity.
- The photogate time is measured in milliseconds and represents the time it takes for Wally to pass through the 10-meter gap between lasers.



Choose one from each column			
Extinguisher's Force	Distance	Wally's Mass	Calculate the work done:
50 N	5 m	35 kg	
55 N	10 m	42 kg	
65 N	15 m	50 kg	Calculate the final velocity:
85 N	20 m	55 kg	
100 N	25 m	62 kg	
115 N	30 m	70 kg	
130 N	35 m	75 kg	
155 N	40 m	79 kg	Calculate the time to go 10 meters at final velocity:
175 N	45 m	82 kg	
190 N	50 m	85 kg	
200 N	55 m	90 kg	

Calculated Time from above		Measured Time from Simulation	

Part 2: Wall-E Design Problem

Now that you have a feel for the simulation, your task is to determine a set of conditions that will result in a desired outcome. You will be able to choose any combination of settings, but must include both a screenshot of the simulation matching the target time and calculations showing that the values work.

Time to go through 10 m Photogate	**750 ms**

Note: Your calculations and simulation run must be within 50 ms of the target (0.7-0.8 seconds)

Extinguisher's Force	**Distance**	**Wally's Mass**

Calculations:

Screenshot of the Result: