

Work and Energy

Name: _____ TA: _____

Partners: _____

Course Number: _____ Section Number: _____ Date: _____

Atwood's Machine (Work and Energy) *Please level the air track before you do this experiment.*

M (kg)	m (kg)	h (m)	t (s)	v_f (m/s) $\left[\frac{2h}{t}\right]$	E_k (J) $\left[\frac{1}{2}(M+m)v_f^2\right]$	E_p (J) $[mgh]$	f_h (J) $[E_k - E_p]$
small	0.02 kg						
small	0.05 kg						
small + small	0.10 kg						
large	0.05 kg						
large	0.10 kg						
large + small	0.10 kg						

- What factors does the work against friction, f_h , depend on?

Simple Pendulum (Conservation Law of Energy)

m (kg)	Diameter of weights (m)	t (s)	v_{\max} (m/s) $[D/t]$	E_k (J) $\left[\frac{1}{2}mv_{\max}^2\right]$	ℓ (m)	θ	E_p (J) $[mg\ell(1 - \cos\theta)]$	$\frac{ E_k - E_p }{E_k} \times 100$
0.10 kg						10°		
0.10 kg						50°		
0.20 kg						15°		
0.20 kg						15°		
0.20 kg						15°		
0.50 kg						40°		

- What conclusions can you draw from the calculation results of final column?
- What factors increase the energy?
- What factors possibly increase errors? Discuss this from your data.

Lab Procedure and Notes for Work and Energy

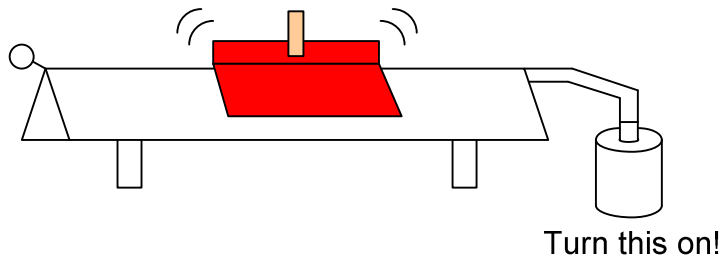
Important Tips:

1. For the first part, please make sure the hanging object is not wobbling before the release.
2. For the first part, please make the glider as close to the first gate as possible.
3. For the second part, please use extreme care about measuring ℓ and θ to obtain an accurate data.

• Energy Conservation in Linear Motion

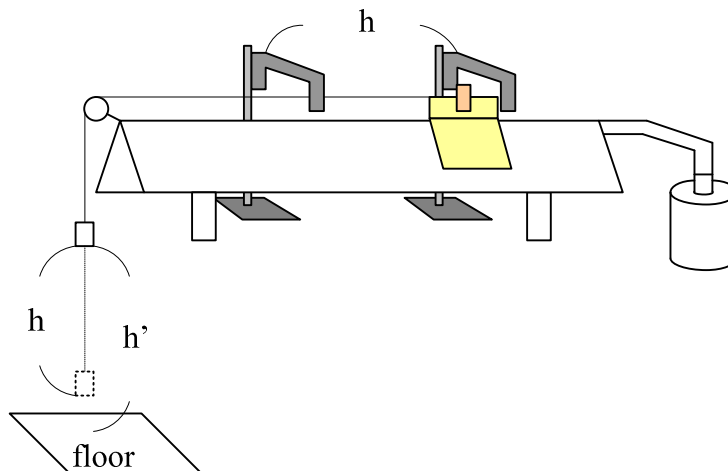
1. Level the (air) track before you start the experiment.

Put a glider on the track and turn the air on. When the glider does not go to either left or right sides, it is leveled. If it is not leveled, adjust it with papers by putting under the legs of the track, etc.



2. Measure the falling distance.

The falling distance corresponds to the distance between photo gates. You do not have to get $h = h'$ exactly; however, h' MUST be larger than h (where h' is the distance from the initial height of the hanging mass to floor.)



3. Try to make the initial velocity zero.

This is the most important thing to perform.

4. Measure the time between gates.

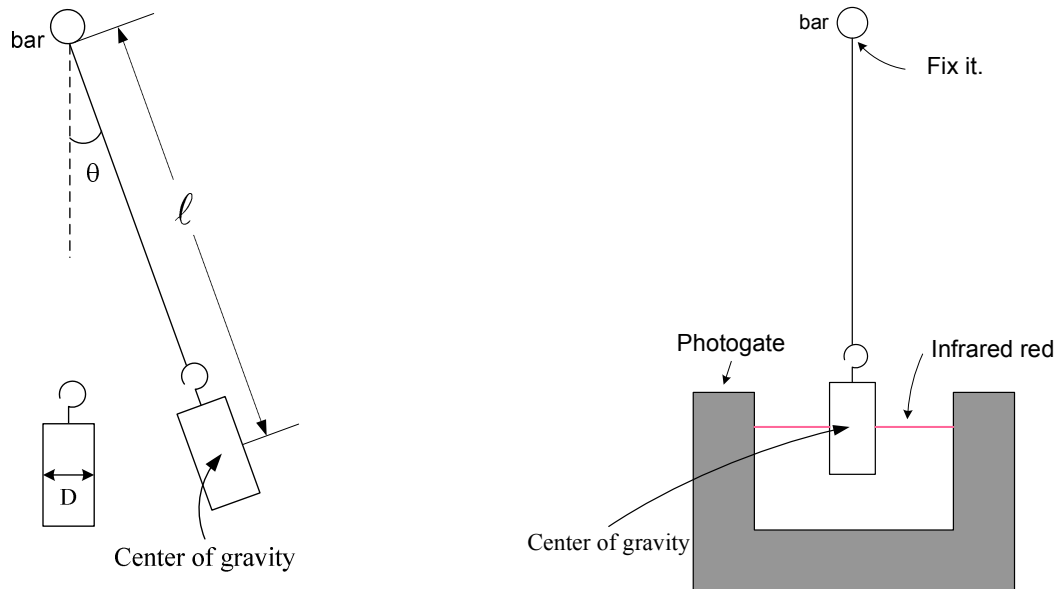
This is to obtain the final velocity of the glider. The average velocity is h/t . Assuming that the acceleration is constant, the final velocity is twice the average one; therefore,

$$v_{\text{final}} = 2v_{\text{average}} = 2h/t.$$

- **Energy Conservation in Pendulum Motion**

5. Measure the length ℓ , angle θ , and diameter of hanging masses D . Set up the photo gate as shown.

The place of the photo gate must be the lowest point of the pendulum motion.



6. Measure “time in gate.”

You are NOT going to measure the period. Here is a hint: The time in gate is really short, like 0.065 s, so if you obtained more than 0.1 s, you should suspect what you are measuring. Also make sure if you got is correct by doing the same trial a few times.

Notes: Please make sure that the string does not get the slack before the release.

