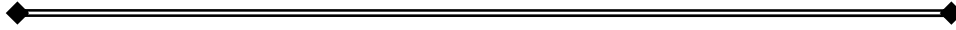


Coefficients of Friction

Name _____ TA _____

Partners _____

Section # _____ Date _____



- **Static friction**

Use inclined plane method ONLY!

For each combination of contact surface and mass, raise the angle of the inclined track by pushing the lower end of the track gradually, as smoothly as you can to find the angle of repose. Use $\mu_s = \tan \theta$ (= vertical / horizontal) to find coefficients of static friction. θ is the angle of repose. There are 8 different trials, i.e. 4 different surfaces, each w/ and w/o the inverted cart on the top.

Hint: Due to the unevenness of the track, mark on the track and put the wood block on the same position for each trial.

Mass M	Object configuration		θ	μ_s
	Wood, Wide, Block alone			
	Wood, Narrow, Block alone			
	Felt, Wide, Block alone			
	Felt, Narrow, Block alone			
	Wood, Wide, With cart			
	Wood, Narrow, With cart			
	Felt, Wide, With cart			
	Felt, Narrow, With cart			

- **Kinetic friction**

Use Atwood's machine method ONLY!

In order to perform this part successfully, first you need to use a small hanging mass, just large enough to let the wood block go (think why). I would recommend a 50g mass pulling the block alone. Second, place the hanging mass as close as possible to the first photogate before you release it. This is important especially for this lab. Use extra care or you might get negative friction!

Use $a = 2d/t^2$ to find acceleration.

Use equation $\mu_k = \frac{m}{M} - \frac{(M + m)a}{Mg}$ to find the coefficient of kinetic friction.

Hanging mass $m =$ _____ Wood block mass $M =$ _____

Contact surface	Falling distance d	Falling time t	Acceleration a	μ_k
Wood, Wide				
Wood, Narrow				
Felt, Wide				
Felt, Narrow				

Questions:

- For Static Friction

1. How does static friction coefficient depend on nature of surface, i.e. wood and felt? *(Empirically, wood has more friction than felt. Considering this fact, discuss the question.)*
2. Does it depend on contact surface area, i.e. Wide and Narrow? *(Theoretically, the answer is no. Think about the reason, and compare it with your experimental data.)*
3. Does it depend on mass, i.e. block alone and block w/ inverted cart on top? *(Theoretically, the answer is no. Think about the reason, and compare it with your experimental data.)*

- For Kinetic Friction

4. How does kinetic friction coefficient depend on nature of surface, i.e. wood and felt? *(Empirically, wood has more friction than felt. Considering this fact, discuss the question.)*
5. Does it depend on contact surface area, i.e. Wide and Narrow? *(Theoretically, the answer is no. Compare it with your experimental data.)*
6. How does it compare with static friction of the same surface? *(Theoretically, static friction is more than kinetic friction under the same condition. Compare it with your experimental data.)*

If your results deviate from the theory, discuss the possible causes.

Final comments:

This is the trickiest lab of the semester. You won't get consistent results unless you use extreme care. If you are unable to get the results consistent with the theory, try to make some sensible discussion and comments to explain why.