



HONORS PHYSICS

L150-002A: Fractional Energy Loss



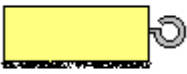





created: 2010 0208

revised: 2010 0217

Overview

In this lab you will investigate whether the fraction of energy lost to friction is dependent on the mass of the object studied.

Equipment

	track		LabQuest
	friction block		Ultrasonic Motion Detector (UMD)
	meterstick		standard masses
	stand		track clamp

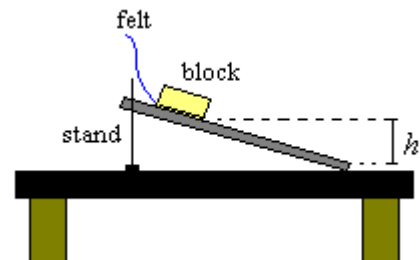
Set-Up

- ◆ Take a track. Spray it lightly with cleaner and wipe it down to remove grime.
- ◆ Place the block on the track (felt side down). Slowly raise the incline until the block slips. Raise the incline a few centimeters more, so that the block slips reliably.
- ◆ On the UMD, move the switch to “track”.
- ◆ Place the UMD at the top of the track facing downward.
- ◆ Hook up the LabQuest as usual.



Data Collection:

- ◆ Mass the block and hold it (felt side down) on the track, about 25 cm from the UMD.
 - Measure the height h of the leading edge above the table.
 - Press “Play” on the LabQuest to start the run.
 - Release the block and allow it to slide down the incline.
 - Record the speed when it reaches the bottom. You will need to click on the LQ screen at the end; you can then read the velocity.
 - Repeat for a total of five times at this mass.
- ◆ Add 50 grams to the block and repeat. You may need to secure the mass in place with tape.
- ◆ Continue to add 50 grams and repeat until you have 5 distinct configurations.



Analysis:

- ◆ For each configuration, compute the kinetic energy gained in each trial: $\Delta K = \frac{1}{2}mv^2$
- ◆ Find the change in potential energy (which is the same for all trials): $\Delta U_g = -mgh$. As always, $g = 9.8 \frac{\text{m}}{\text{s}^2}$. Note that your value will be negative.
- ◆ The efficiency ε is defined through $\varepsilon = \left| \frac{\Delta K}{\Delta U} \right| \times 100\%$. Find it for each trial, find its average ε_{avg} , and compute its standard deviation (“error bar”), σ_ε

Output

- ◆ Using *LoggerPro*, produce a graph of efficiency *versus* mass. Be sure to include error bars!
- ◆ Decide whether the efficiency is dependent on mass or not.
- ◆ Hand in three pages, in this order top-to-bottom:
 - A page with your name, “L150-002 Efficiency”, and an abstract for this lab.
 - The graph you produced, above. It should be “pretty”:
 - It should have a title: “J. Smith L150-002 Efficiency”.
 - It should have the axes correctly labeled, including units if applicable.
 - It should include the error bars for ε .
 - The data table sheet.