Work-Kinetic Energy Lab

Purpose: Investigate the work-kinetic energy relationship in a system and determine how the change in mechanical energy relates to the work done by friction.

Set-up:
You will need your Pasco equipment once again, including the track and a set of friction blocks. Make sure the track is free of dust and dirt that may influence the amount of friction between the friction blocks and the track. You will only be using one Teflon-surface friction block; make sure it is clean also.

You will need to set-up your Spark interface with a force sensor and a motion detector. Attach the motion detector to one end of the track and a pulley and end-stop on the opposite end of the track from the motion detector. Use a level to ensure your track is level both end-to-end and side-to-side.

Data Collection:
First you will need to determine μ_k for the Teflon block and track surface combination. You have determined μ_k for this block in a previous lab, but for a different surface combination. Think back and remember how you did that. Use a large amount of mass in the friction block so that your force data is easy to interpret and you can calculate μ_k after just one trial.

Q1. For your report, show and describe how you calculated μ_k.

After determining μ_k you will then investigate how the change in the kinetic energy of the system relates to the work done by friction. You will need to set up the friction block like we did the carts for the Newton's second law activity. The hanging weight will be provided by a 200g mass. Be sure that the string is level and is not obstructed by the end-stop.

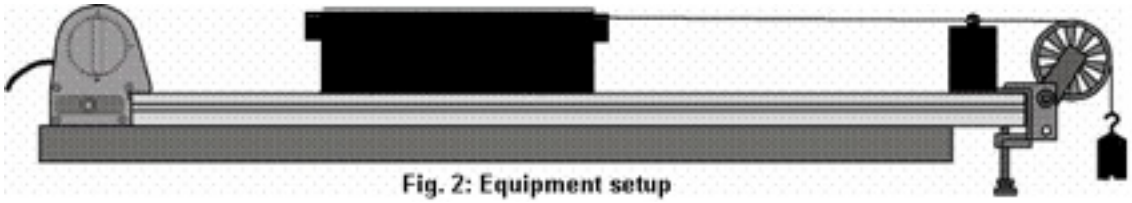

Fig. 2: Equipment setup

The hanging weight should accelerate the friction block containing various masses down the track in a smooth manner. Work on your technique to make sure this happens. You may need to do some trials to find the most consistent part of your track. Also be sure that the block moves in a straight line down the middle of the track; if it drifts near the edge it tends to stop.

You will need to conduct three trials, with the block containing masses of 0.25 kg, 0.5 kg, and 0.75 kg.

It is your goal to determine the work done by friction on the moving block using **(method A) the work-kinetic energy theorem,** and the work done by friction using **(method B) the definition of work and your value of μ_k**. You will need to collect data that will make this possible. Keep in mind the parts of the system that are "working" to increase the kinetic energy and the parts of the system that are "working" to decrease the kinetic energy, and the moving parts of the system that make up the kinetic energy.

Record the data you use in a clearly labeled, easy to read data table (group your data by trial number!).

Discussion:

Q2: Describe qualitatively how you would use the work-kinetic energy theorem to determine the work done by friction on the moving block. (It is not enough to simply write a formula or say, "It is clear that I would plug-in the appropriate variables and use the work-kinetic energy theorem equation.")

Q3: Describe qualitatively how you would use the definition of work to determine the work done by friction. (It is not enough to simply write a formula or say, "It is clear that I would plug-in the appropriate variables and use the formula for work.")

Q4: How should the values for the work done by friction obtained via the two methods relate to one another? Determine the ratio of work done by method A to method B. Report these ratios and describe what they mean.