Physical Science 303 - Activity

1 Finding the coefficient of friction

1.1 Review

We first review the different types of frictional forces.

1. Static frictional force: the frictional forces acting on the bodies at rest but subjected to certain external forces. The direction is opposite to the tendency of the relative motion. The magnitude is given by

$$|\vec{F}| = \mu_s N \tag{1}$$

   where μ_s is the coefficient of static friction and N is the normal force.

2. Kinetic frictional force: the frictionl force acting on the bodies in motion. The direction is opposite to that of the relative motion. The manitude is given by

$$|\vec{F}| = \mu_k N \tag{2}$$

Experimentally $\mu_s > \mu_k$.

1.2 Activity

1. **Required Box**: Box 1
2. **Required Items**: 5N Pull Springs, Thread Spool, Friction Box, Super Pulley

1. Prepare the setup as shown in the figure.
2. Gradually start pulling the pull spring till the friction box just starts moving.
3. Observe and note the reading in the pull spring. *Make sure to write appropriate units.*
   Force:_____
4. Finally using the pull spring, weight the friction box and write down with appropriate units.
   Weight:_____

1.3 Theoretical Analysis

In this section we aim to find the coefficient of static friction.

1. Draw the free body diagram corresponding to the friction box and the pulley with string (essentially you just need to show tension for the pulley). Use the generic labels for the forces and tension.

2. In the experiment, you observed the force for which the box *just* starts moving. Does is correspond to the static or kinetic friction?

3. Using the appropriate formula for the friction and observed values (force and weight), compute the coefficient of friction.

Answer the following questions

1. If you increase the weight of the friction box, will the coefficient of friction change? Why or why not?

2. Is the experimental value of the coefficient of kinetic friction exactly equal to the theoretical value? Why not? List three reasons.