Name _____   Lab Partners _____

Calculating the Coefficient of Kinetic Friction

Consider the problem:

> A knob slides down a 0.58 m long ramp set at an angle of 30.0°. a) What is the coefficient of kinetic friction, μ_k, between the knob and the ramp? b) How does the angle of incline of the ramp affect the coefficient of friction? c) How does the surface area of the knob affect the coefficient of friction?

When an object is sliding down a ramp, the frictional force opposes its forward motion. Frictional force can account for a loss of acceleration as much as 75% or more. Frictional force can be determined by the two surfaces in contact and the amount of force applied perpendicular to the incline (normal to the surface of contact). The factor that accounts for the two surfaces in contact is the coefficient of friction, μ. The coefficient o friction depends only on the two surfaces in contact. It does not append on the angle at which the object is moving. In this lab, you will verify this using your knowledge of forces and friction.

Materials

- Ramp
- Knob
- Scale
- Stopwatch
- Meter stick

Procedure:

1. Calculate the theoretical coefficient of kinetic friction, μ_k, by placing the knob on the ramp set at 0° (flat on the table). Slowly raise the ramp while tapping on the top of it. When the knob slides down the ramp at a constant speed, tighten the clamp on the ramp. Find the angle ($\theta=\sin^{-1}(h/L)$) where h is the height of the ramp from the table top and L is the length of the ramp.

   θ = _____

2. Find the coefficient of kinetic friction by taking the tangent of the angle. This is your theoretical value.

   μ_k = _____

3. Using the materials listed above, design an experiment that will prove that the value calculated in step 1 is truly the coefficient of kinetic friction between the knob and the ramp. Include in your experiment that this coefficient is independent of the angle of incline. In order to complete this experiment, you will need to use the linear motion equations, equations for the sliding force, frictional force and Newton's second law of motion. Hint: Use different trials at different angles

Lab Requirements

1. A plan of action that shows how you went about finding the coefficient of friction.
2. A data table showing all relevant measured values.
3. One set of calculations showing how you found the coefficient of kinetic friction.
4. A data table showing all calculated values.
5. Calculation of percent error between your originally calculated coefficient and the one you found by your experiment. $\%error = \left|\frac{Theoretical\ -Measured}{Theoretical}\right| X100$
6. A well written conclusion including a restatement of the lab goals, a restatement of data including the theoretical and calculated coefficients of friction and identification of your percent error and possible experimental errors.
7. Complete a single lab report for your lab group.
8. Individually write a reflection on the lab and include information about each member's specific contributions and how you think the group worked together.