Name_____
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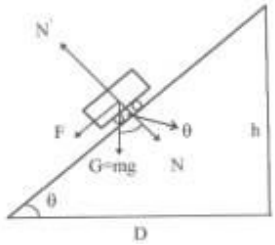
Friction and Newton's Laws

Purpose: To determine the coefficient of static friction and gravitational constant g.

THEORETICAL WORK:



Object on an incline plane experience the following forces: Normal force, weight, friction and inertia. As a result equation of the motion can be written as:

$$mg\sin\theta = ma + F$$

$$mg\sin\theta = ma + \mu mg\cos\theta$$

$$\mathbf{a = g\,(\sin\theta - \mu\cos\theta)} \qquad \mathbf{Eq.1}$$

As you can see acceleration is not related with the mass of the object. If we find the angle that **block just** begins to move, acceleration of the block will be **zero** (a=0) at this very moment, so we can calculate the static friction coefficient as:

$$0 = g\,(\sin\theta - \mu\cos\theta)$$

$$\mathbf{\mu_s = \tan\theta_s} \qquad \mathbf{Eq.2}$$

Part 1 : Determing μ_s

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1. Place the block on the surface of the incline plane.
   2. Slowly lift the incline plane until the block just begins to move.
   3. Measure and record the angle. Repeat steps 1 and 2 (at least 3 times) Using **Eq.1** calculate μ_s and fill out the following table.

θ_s	μ_s
Mean value of μ_s =	

4. Raise the incline plane at an angle bigger than θ_s **.**

5. Measure the time (t) required for block to reach the bottom of the incline plane from five different length on an incline plane, calculate t^2 and fill out the following table.

Slope of the plane θ = h / d =			
#	Length x(cm)	Time, t(s)	t^2 (s^2)
1			
2			
3			
4			
5			

6. Draw (x-t) graph of the motion. (this graph should be a curve !)
7. Draw ($x-t^2$) graph of the motion. This graph should be a straight line and the slope of this line is equal to ½ a . Using this equation calculate the acceleration of the block.
8. Now using **Eq.1** calculate the gravitational constant g.

CONCLUSİON

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Compare your result with g = 9.81 m/s^2. What are the possible errors in this experiment?