SAN DIEGO MESA COLLEGE

PHYSICS 195 LAB REPORT

TITLE: Frictional Force

Name:____________________

Date:____________Time:______

Partners:____________________

____

____

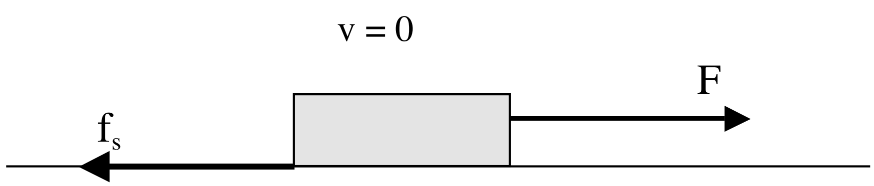
____

Objective:

To demonstrate the effects of frictional forces and to determine the coefficients of friction for a particular set of materials.

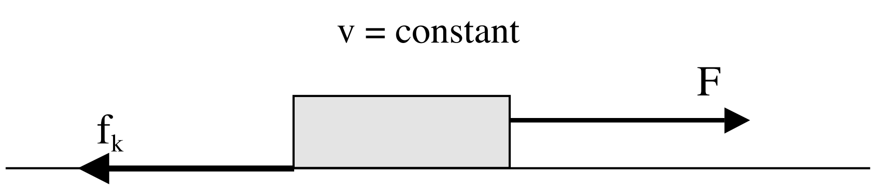
Theory:

For the body in static equilibrium shown below:



$f_s \le \mu_s n$ { where μ_s is the coefficient of static friction. }

For the body in dynamic equilibrium shown below:



$f_k = \mu_k n$ { where μ_k is the coefficient of kinetic friction. }

Both μ_s and μ_k are empirical constants. That means they are found from experiment. In this lab you will determine both μ_s and μ_k between two surfaces in contact. You will need to draw complete force diagrams and apply Newton's 2nd Law in component form to determine these constants.

Equipment:

Aluminum track	Large wooden blocks	Pulley
Lab Jack	Meter stick	Wood/felt block
Cart with metal masses	String	50-g Mass hanger
Slotted masses (2 sets)		

Procedure: Part1: Determination of μ_s.

Set up the apparatus as shown:

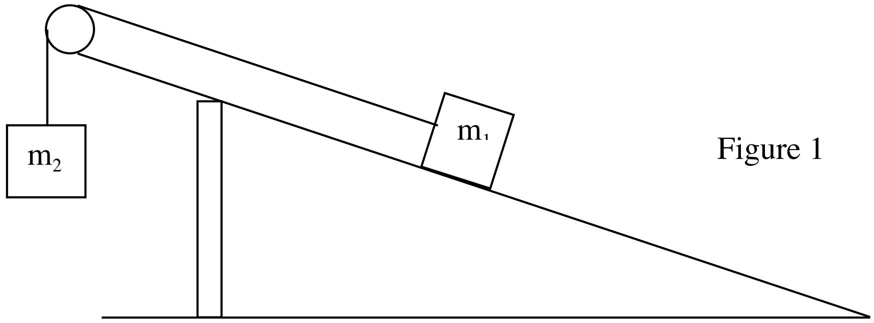


Figure 1

1. Measure and record the mass m_1. *Slowly* add small mass increments to the mass hanger to find the greatest amount of mass m_2 (which translates to tension in the string) that can be placed on the mass hanger for which the system will remain in static equilibrium.

Mass m_1:___________grams

Mass m_2:___________grams

θ : __________°

Draw all forces on the above diagram to get a symbolic expression for μ_s.

$\mu_s(m_1, m_2, \theta) =$ [ ]

2. Solve your expression for μ_s using your values of m_1, m_2, and θ. Show substitution of all values with units.

$\mu_s =$ ____________

3. Calculate a numeric value for each resolved and unresolved force in Figure 1, and label each force with its numeric value. Do your values confirm $\sum \vec{F}_{ext} = 0$?

Procedure: Part 2: Determination of μ_k.

Set up the apparatus as shown:

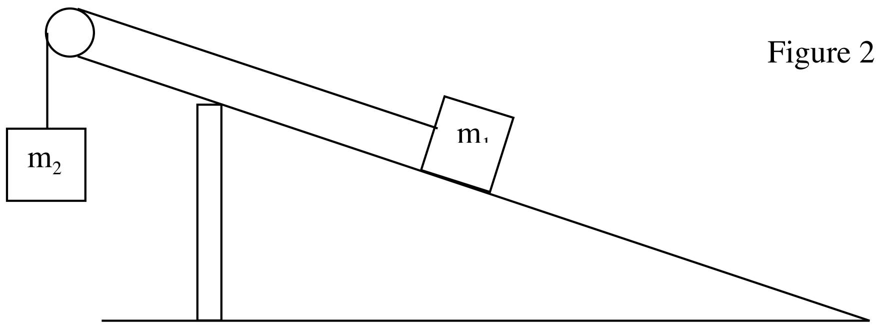


Figure 2

1. If you exceed the maximum mass, m_2, for the system in Part 1, contact is broken and m_1 will accelerate up the incline. However, to find μ_k, you want the system to move without accelerating along the track.

Starting with just the mass hanger as m_2, s*lowly* add small mass increments to the mass hanger to find the smallest amount of mass (which translates to tension in the string) that can be placed on the mass hanger for which the system will *move at constant speed*. Note: the system is still said to be in equilibrium since the acceleration is zero ($\sum \vec{F}_{ext} = 0$). As you add incremental mass to m_2, give m_1 a ***slight*** nudge with your finger to see if it will move up the incline at *constant* speed. When enough mass has been added to the mass hanger so that m_1 moves with constant speed, record that mass as m_2.

Mass m_1:___________grams

Mass m_2:___________grams

θ : __________°

2. Draw all forces on the above diagram to get a symbolic expression for μ_k.

$\mu_k(m_1, m_2, \theta) =$ [ ]

3. Solve your expression for μ_k using your values of m_1, m_2, and θ.

Show substitution of all values with units.

$\mu_k =$ ____________

4. Calculate a numeric value for each resolved and unresolved force in Figure 2, and label each force with its numeric value. Do your values confirm $\sum \vec{F} = 0$?

Conclusion and Summary of Results:

Write a brief conclusion, including a brief discussion of the physics involved in this experiment, including possible sources of error, and indicate whether your results give support or validate the purpose of the lab exercise.