Multiple Object Friction

Background:

Friction is the resisting force encountered when one tries to slide one surface over another; this force acts along surfaces in contact. The force necessary to overcome friction depends on the nature of the materials in contact, i.e., their roughness or smoothness but not on the area of contact.

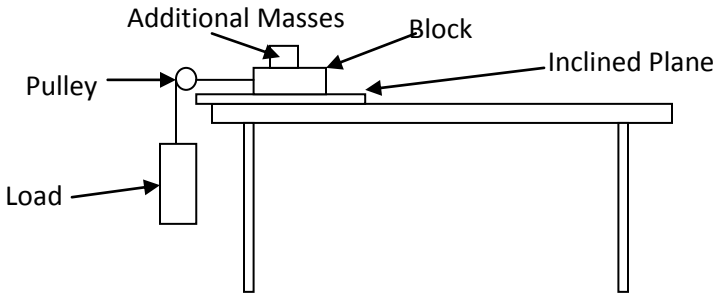
How friction acts on two surfaces depends not only on the surface, but also the angle of incline and whether the object is moving up or down the incline.

Objective:

In this lab you are going to explore the factors that affect the force of sliding friction and compare how the motion of the system affects the acceleration.

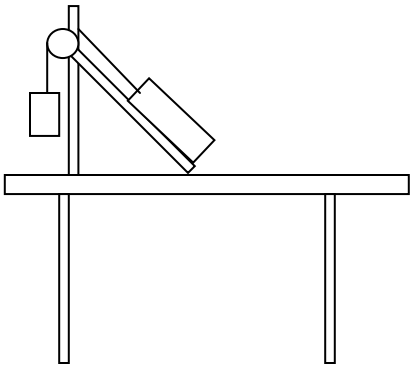
Horizontal Procedure:

1) Find the mass of the wooden block using the triple beam balance and record the mass on your own paper.
2) Calculate the weight of the block and record it on your own paper.
3) Place the inclined plane in a horizontal position (θ=0°) on the lab table with its pulley projecting beyond the table's edge (as shown in the figure to the right). Be sure that the surfaces of both the board and the wood block are clean, dry and free of any dust or grit. Begin the experiment by setting the block on with its largest surface in contact with the board's surface. Run the string which is attached to the block over the pulley and attach it to the load platform.



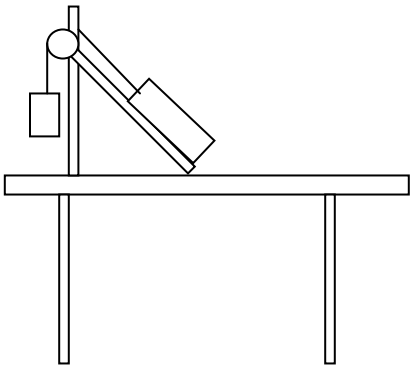
4) Measure how long the string is between the block and the pulley.
5) Place some masses on the platform (remember the platform has mass too). Slowly increase the load until it is just sufficient to keep the block sliding slowly but is accelerating. You may have to begin its motion with a small push. Time how long it takes for the block to move from its starting point to where the block touches the pulley. Record the time.
6) Record the mass of the load and the weight of the load.
7) Create a free body diagram of each object and write a net force equation for each object.
8) Calculate the acceleration of the system and record your answer.
9) Calculate the tension in the string and record your answer.
10) Calculate the coefficient of kinetic friction between the block and the inclined plane.
11) Calculate the percent error between your coefficient of kinetic friction and the real value of 0.4.

Sliding Up the Incline Procedure:



1) Place the inclined plane on a ring stand as shown in the picture to the right. Set the ramp to 30°
2) Measure how long the string is between the block and the pulley.
3) Place some masses on the platform (remember the platform has mass too). Slowly increase the load until it is just sufficient to keep the block sliding up the incline slowly but is accelerating. Time how long it takes for the block to move from its starting point to where the block touches the pulley. Record the time.
4) Record the mass of the load and the weight of the load.
5) Create a free body diagram of each object and write a net force equation for each object.
6) Calculate the acceleration of the system and record your answer.
7) Calculate the tension in the string and record your answer.
8) Calculate the coefficient of kinetic friction between the block and the inclined plane.
9) Calculate the percent error between your coefficient of kinetic friction and the real value of 0.4.
10) Repeat steps 1-9 with an angle of 20°.

Sliding Down the Incline Procedure:



1) Place the inclined plane on a ring stand as shown in the picture to the right. Set the ramp to 30°
2) Measure how long the string is between the block and the pulley.
3) Place some masses on the platform (remember the platform has mass too). Slowly increase the load until it is just sufficient to keep the block sliding down the incline slowly but is accelerating. Time how long it takes for the block to move from its starting point to where the block touches the pulley. Record the time.
4) Record the mass of the load and the weight of the load.
5) Create a free body diagram of each object and write a net force equation for each object.
6) Calculate the acceleration of the system and record your answer.
7) Calculate the tension in the string and record your answer.
8) Calculate the coefficient of kinetic friction between the block and the inclined plane.
9) Calculate the percent error between your coefficient of kinetic friction and the real value of 0.4.

Questions:

1) Does the angle of incline? Explain your answer based on the results of your experimentation.
2) Does your graph show that the frictional force is directly proportional to the normal force? How can you tell? Explain using the results of your experimentation.
3) What is the coefficient of kinetic friction between the two wood surfaces?
4) Calculate the % error if the real value is 0.4. Show all your calculations.
5) Write a reflection for this lab. In your reflection, discuss the relationship between the surface area and friction and how, if at all, this lab helped focus your understanding of the force of friction.