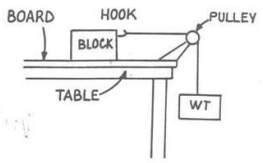
Name _____ Date _____ Period _____

Activity: Cat on a Slippery Substance

Determining Coefficient of Friction



Assignment: Determine the coefficient of kinetic friction for four surfaces.

Questions to consider:

How will I keep the motion controlled well enough for the measurements to be repeatable?
How many trials will I need to conduct in order to be sure of the measurement?
How could I analyze this data with math and graphs?
What will my analysis mean in relation to friction?
What will my analysis mean in relation to forces?
What is the coefficient of friction used for?
What variables would change in order to determine the coefficient of static friction?
How would a change of mass affect my answers?
How would a change in surface area affect my answers?
How would a change in angle of the surface (inclined plane) affect my answers?
Does the coefficient of kinetic friction depend on speed? Weight of the block?
Does the force of kinetic friction depend on speed? Weight of the block?
How does the mu of the shoe affect sports performance?

Cork board
Particle board
Rubber
Sand paper

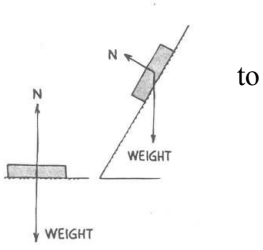
Measure the mass of your wood block. Calculate the weight of the block.
Measure the force necessary to move the block along each of the surfaces at a constant speed.
Measure the forces necessary to pull the block along the surfaces when you have used masses to approximately double, triple, and quadruple the total mass.

Analysis Part I

Create graphs for friction force (vertical axis) vs. normal force (horizontal axis) for each of the surfaces.
Draw a free body diagram for the block in each situation.
Calculate the μ for each surface and compare it to the slope of the line in each of the graphs.
Use Newton's Second Law to determine the force of kinetic friction ($\Sigma F = ma$).

Part II

Arrange your board so that it is at an angle of about 15 degrees from the horizontal. (Record the actual angle that you use) and choose one of the surfaces to continue the investigation with.



Determine the force necessary to pull the block up the incline at a constant speed. Repeat for angles of 30°, 45°, 60°, and 90°.

Analysis Part II

Draw a free body diagram for the block.

Use trigonometry and your artistic skills to determine the component of the block's weight parallel to the incline and the component perpendicular to the incline.

Determine the *Normal Force* (F_N) for each of the angles. It must balance the perpendicular component of the weight.

Determine the *Force of Friction* (F_f) for each of the angles.

The *Applied Force* (F_A) or pull has to balance the *Force of Friction* (F_f) and a component of the weight.

Graph F_f vs. F_N for each angle. Is there a relationship?