**Physics 20 Lab: Friction and Incline Planes**

***Problem***: What is the proportional relationship between the Force of Friction (Ff) and the Normal Force (FN)

Part A: Horizontal Surface

A wooden block is placed on a horizontal surface. A spring scale is used to measure the *minimum* force required to keep the block moving at a constant velocity. The mass on the block is gradually increased and the new force is measured.

Materials:

* Incline Plane
* Wood Block
* Spring Scale
* Masses

Observations:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mass of block (kg) | Weight of Block (N) | Normal Force (N) | Applied Force (N) | Force of Kinetic Friction (N) |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Analysis:**

1. Draw and Label a Free Body Diagram
2. Draw a graph showing the Force of Kinetic Friction vs the Normal Force *(Include proper titles, labels, line of best fit and data points).*
3. Using your line of best fit determine the coefficient of kinetic friction.

**Conclusion:**

1. Why is it important that the applied force is applied horizontally rather than at an angle?
2. Why is it important for the block to be pulled at a constant speed?
3. What is the relationship between the applied force and the force of friction?
4. What is the relationship between the weight and the normal force?
5. What is the correct unit for the coefficient of friction? Show this algebraically.

Part B: Incline Planes

A wood block is to be placed on a wood incline that is raised until it starts to slide, and the angle is measured so that both *F*// and  can be determined, and μ can be found as a result.

**Materials:**

* Wood blocks
* Wood plank
* Protractor

**Observations:**

Mass of Block: \_\_\_\_\_\_\_\_\_\_ kg

|  |  |
| --- | --- |
| Trial | Maximum Angle |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

**Analysis:**

1. Draw a Free Body Diagram for the Block
2. Calculate the forces and component forces acting on the block.
3. Determine the coefficient of kinetic friction (μs)

**Conclusion:**

1. Discuss any discrepancies between the coefficient of frictions between part A and part B.

Part C: Acceleration

**Problem:**

What is the acceleration of the wooden block when it is connected to a 500 g mass hanging across a pulley?

1. *Use your results from parts A and B to predict what the acceleration of the pulley system will be. Show all your steps including Free Body Diagrams, Net Force Equations and relevant calculations.*
2. Use the ticker timer to complete the table below. Use that data to experimentally determine the acceleration of the pulley system.

|  |  |
| --- | --- |
| Time (s) | Position (m) |
| 0.10 |  |
| 0.20 |  |
| 0.30 |  |
| 0.40 |  |
| 0.50 |  |
| 0.60 |  |
| 0.70 |  |

1. Compare your prediction with the experimental results. Explain any discrepancies.