Lab 3:Friction Lab — Physics 112

The purpose of this lab is to investigate frictional forces and develop an understanding of friction, normal force and coefficient of friction. No formal lab write up is required for this lab. You must, however, hand in the sheets with the graph and the solved problems.

Friction is the force which opposes motion. The force of friction always acts parallel to the surfaces that are sliding over each other, and in the direction opposite to that of the motion.

Procedure and Observations

1. Using a spring scale and some string, find the weight of your textbook. The weight of the textbook is _____ N (Newtons).
2. Without using the spring scale, make a guess of approximately how much force would be required to pull the textbook across the table at constant speed.
   Your guess is _____N.
3. Using a spring scale, pull the book across the table at constant speed. (Keep the string parallel to the table). The force actually required to do this is _____N.
4. Compare the book's weight with the force required to pull it horizontally at constant speed. (Which one is larger?) _____
5. The actual force required to pull the book horizontally at constant speed is equal in magnitude to the force of friction (f) which is opposing the motion.
6. It always takes more force to start an object than to keep it moving at a constant speed. WHY? _____
7. The force of friction in part #3 was _____N. Would it be more or less if you pulled the book across
   a. ice _____
   b. sand _____
   c. rough concrete _____
   d. waxed floor _____
8. How is the force of friction affected by changing the surface from smooth to rough?
   _____
9. Pull the book across the table once more but at a different constant speed. The force required to do this should be about the same. Is it? _____
10. Does the force of friction depend on the speed of the motion? _____
11. The Normal Force (N) is defined to be the force that the surface applies to the object at 90 degrees to the surface over which the body is sliding. In this exercise the Normal Force is _____N.

12. Change the normal force by successively adding more books to the original one. Record the weights of each book, calculate the normal force in each situation, and then find and record the resulting force of friction in the following table.

    Weight of book A _____N Weight of book C _____N
    Weight of book B _____N Weight of book D _____N

Books	Normal Force	Friction	
A			
A+B			
A+B+C			
A+B+C+D			

13. The ratio of the force of friction to the normal force (f/N) is called the coefficient of sliding friction (μ). This is a Greek letter pronounced "mu". Equation (formula):_____

    Use this equation to calculate the coefficient of friction in the last column of the above table.

14. From your equation, what are the units for "mu"? _____

15. Plot a full page graph of the force of friction vs. the normal force. (friction on the ordinate, Y axis) and normal on the abscissa, X axis).

16. On the basis of the graph, what relationship exists between the force of friction and the force pressing the books into the table (normal force)?

    _____

17. How should the coefficient of friction compare for each of your answers in the data table?

    _____

Problems

1. A body weighing 30 N is pulled at constant speed across a level surface by means of a force of 10 N. (a) What is the force of friction that opposes the motion? (b) What is the coefficient of friction?

2. Find the force needed to pull a body which weighs 50 N across a table at constant speed if the coefficient of friction between the body and the table is 0.20.

3. Calculate the coefficient of friction between a crate and the floor if 120 N of force is needed to push it across the floor at a constant speed. The crate weights 600 N.