SPH 4C

# COEFFICIENT OF KINETIC FRICTION

**Problem**: What is the coefficient of kinetic friction of a shoe on the classroom floor?

**Apparatus**: spring scale, shoe, various known masses, Vernier Logger Pro 3.8

**Procedure**:

1. Hang the shoe from the spring scale and measure its weight in Newtons. Enter this value in the Observations chart.
2. Pull the empty shoe at a constant speed with the spring scale parallel to the classroom floor. Enter the force required to pull it (the applied force) in Newtons in the spreadsheet in the Trial #1 Force of Friction column.
3. Calculate the coefficient of the shoe on the classroom floor by using the equation below, and record it in your chart:

**µ = Ff ÷ Fg**

1. Place a 200 g mass in the shoe. With the added mass, repeat steps 1 to 3.
2. Repeat this with 4 other known masses.
3. Calculate the average of the coefficient of friction for the shoe on the classroom floor. Use the equation:

$$average=\frac{(value 1+value 2+value 3+value 4+value 5)}{5}$$

This is your experimental value for the coefficient of friction.

**Calculations**:

1. Use Vernier Logger Pro 3.8. Plot a graph with the force of friction (the dependent variable, y-axis) against the normal force (independent variable, x-axis).
2. Choose Linear fit and record the slope. This is the accepted value for the coefficient of friction.

**Analysis Questions**

1. State the average value of the coefficient of friction for your shoe on the classroom floor. (1 mark)
2. Is a high value for the coefficient or a low value most likely to indicate a shoe that grips well? (1 mark)
3. Draw a free body diagram of your shoe being pulled at a constant velocity across the floor. (4 marks)
4. Assuming that you pulled at a constant velocity, what relationship exists between the applied force and the force of friction? (1 mark)
5. If you were to pull the shoe along a much rougher surface,
	1. What effect would this have on the applied force? Why? (3 marks)
	2. What effect would this have on the coefficient of friction? (1 mark)
6. Take your shoe out to the parking lot with 500 g. Begin pulling the shoe on the pavement and carefully watch the spring scale. Explain why the spring scale often reads slightly higher just before the shoe began to move. (3 marks)
7. Describe the procedure steps you would follow to determine if the speed you pulled your shoe at has any effect on the force of friction. (4 marks)

**Error Analysis**

* List sources of error
* Perform the percent error calculation
* Suggest ways to reduce the error

**Conclusion**

Write a concluding paragraph to sum up the investigation.