

**What is the problem you will be working on?**

Lab A: What are the coefficients of static friction for several types of shoes?

Lab B: How does temperature affect the coefficient of static friction of the above types?

**Why is this research important?**

So shoe manufacturers know which material is best to use for their shoe

**What is your research question?**

How does different temperatures affect static friction in different shoe brands?

**What is your hypothesis?**

Lab A: If the shoe has more weight, then it will have a greater coefficient of static friction than those with less weight.

Lab B: If the temperature increases, then the coefficient of static friction will increase.

(Note hypothesis of Lab B was incorrect but not sure on lab a)

**What variable (independent) will you be changing?**

Lab A: Shoes

Lab B: Temperature

**What are the levels (amounts or types) of your independent variable that you will be testing?**

Lab A:

1. Nike Air Flights
2. Converse All Stars
3. Reebok Zigtech
4. Hunter's Bay Men's Spencer Oxford
5. Adidas
6. Saucony Progrid

Lab B:

1. Freezer Temperature ( $-18^{\circ}\text{C}$ )
2. Fridge Temperature ( $3^{\circ}\text{C}$ )
3. Oven Temperature ( $65.5^{\circ}\text{C}$ )

**What will you measure (dependent variable)?**

Force of friction

**List all things that remain constant for all experimental groups during your experiment.**

Lab A: Temperature and Surface in Contact with the Shoe

Lab B: Shoe and Surface in Contact with the Shoe

**Describe how you will conduct your experiment. Include all procedures and materials (include measurement increments).**

Lab A: Set up the dual-ranged force sensor and measure the normal force ( $F_n$ ) of all the shoes. Then set the sensor to detect 50 samples per second, for every 200th of a second for 10 sec. Attach the sensor to the shoe and then zero the sensor. Start the test and drag across the surface at a constant speed. Do this test three times and record the highest peak of each test to get the force of static friction. Then take the three forces of static friction and divide it by 3 for the 3 tests to get the average force of static friction. Take your average force of static friction and divide it by the normal force of whatever shoe was being tested to get the coefficient of static friction. Record data. Repeat test with each shoe.

Lab B: Repeat steps above but put shoes in each different temperature location for a hour then perform the test.

**What are the expected results for your experiment?**

Lab A: If the shoe has more weight, then it will have a greater coefficient of static friction than those with less weight.

Lab B: If the temperature increases, then the coefficient of static friction will increase.