

2014-15 Science Fair Research Plan Worksheet

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What is the problem you will be working on?
Lab A: What are the coefficients of ^{static} friction (μ_s) 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 manufactures know which shoe material is best to use for their shoe.

What is your research question?
How does different temperatures affect static friction in different shoe brands.

Write your hypothesis here.

Lab A: IF the shoe has a rubber type sole, then it will have a coefficient of static friction more than those without rubber.
Lab B: IF the temperature increases, then the coefficient of static friction will increase.

What variable (independent) will you be changing?

Lab A: Shoes

Lab B: Temp

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

Lab A >
1. Nike Air
2. Converse
3. Reebok
4. Hunter's Bay
5. Adidas
6. Saucony

Lab B >
1. Oven Temperature
2. Fridge Temperature
3. Freezer Temperature

What will you measure (dependent variable)?

Force of Friction

What other types of data will you collect from your experiment?

None

What will be your control?

Lab A: Shoe Type

Lab B: Temperature

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

Lab A: Temperature & Surface in Contact with the shoe

Lab B: Shoe and Surface

Describe how you will conduct your experiment. Include all procedures and materials (include measurement increments). Use the space below or attach another page if you need more space.

Lab A: Measure Normal Force (F_N) of shoe with dual-ranged force sensor. Then set sensor for 50 samples per second, for every 200th of a second for 10 sec. zero the sensor and attach it to the shoe. Press start and pull across surface at constant speed. Do that 3 times to get the average for FF. Then divide FF by F_N to get μ_s . Record data and do that for each shoe.

Lab B: Do same as above but with different temp location.

What are the expected results of your experiment?

Lab A: IF the shoe has a rubber type sole, then it will have a coefficient of static friction (μ_s) more of those without rubber.

Lab B: IF the temperature increases, then the coefficient of static friction (μ_s) will increase.

Describe how you plan to show your results?

In different, various bar graphs.

List your references here:

- 1.
- 2.
- 3.
- 4.
- 5.

NOTE: You must have this research plan approved before you start your experiment. Please have your teacher sign below.

I approve this research plan.

Teacher Name: _____

Teacher Signature: _____

NEXT STEP: Attach your completed research plan to Form 1A.

Experiment Results

Room Temperature (67°F/20°C) Experiment

Rank	Shoes	FN	FF	U of Friction	M rounded
1st	Nike Air	4.645	3.525	0.7588	0.769
4th	Converse	4.121	2.824	0.6853	0.685
5th	Reebok	2.257	1.483	0.6570	0.657
3rd	Hunter's Bay	4.804	3.327	0.6925	0.693
2nd	Adidas	3.364	2.443	0.7262	0.726
6th	Saucony	3.634	2.432	0.6692	0.669

The shoe with the most μ is Nike Air. Followed by Adidas, Hunter's Bay, Converse, Reebok, and then Saucony.

Freezer Temp (-18°C/0°F) Experiment

Rank	Shoes	FN	FF	U	M rounded
1st	Nike Air	4.645	3.219	0.6930	0.693
3rd	Converse	4.121	2.886	0.7003	0.700
6th	Reebok	2.257	0.730	0.3232	0.323
2nd	Hunter's Bay	4.804	3.731	0.7760	0.777
1st	Adidas	3.364	2.88	0.8562	0.856
5th	Saucony	3.634	1.771	0.4813	0.481

Fridge Temperature (3°C/37°F)

Rank	Shoe	FN	FF	M	M rounded
1st	Nike Air	4.645	3.244	0.6983	0.698
6th	Converse	4.121	2.256	0.5474	0.547
3rd	Reebok	2.257	1.546	0.6849	0.685
2nd	Hunters Bay	4.804	3.342	0.6956	0.696
4th	Aldias	3.364	2.131	0.6343	0.634
5th	Saucony	3.634	1.961	0.5829	0.583

Oven Temperature (150°F/65.5°C)

Rank	Shoe	FN	FF	M	M rounded
1st	Nike Air	4.645	3.082	0.6635	0.664
3rd	Converse	4.121	2.580	0.6260	0.626
4th	Reebok	2.257	1.403	0.6216	0.622
2nd	Hunters Bay	4.804	3.045	0.6338	0.634
5th	Aldias	3.364	1.987	0.5906	0.591
6th	Saucony	3.634	2.095	0.5764	0.576