**Science Friction Lab** Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_

|  |
| --- |
| I can… |
| *Measure mass and force using a spring scale and relate the force of gravity to weight.* |

In this experiment, you will investigate three types of friction- static, sliding and rolling – to determine which is the largest force and which is the smallest force.

**Pre-Lab**

1. Describe friction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What does friction always do? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is a constant speed? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What type of friction is the largest force – static, sliding or rolling? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Form a Hypothesis**

1. Write an **If / Then** statement for question 4 above. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Test the Hypothesis / Collect Data**

1. Cut a piece of string and tie it in a loop that fits in your textbook. Place the loop through the middle of your textbook. Hook the string to the spring scale.
2. Practice the next three steps several times before you collect data.
3. To measure the static friction between the book and the table, pull the spring scale very slowly. Record the largest force on the scale before the book starts to move. Take three measurements and record the average.
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Average =** a + b +c = (total) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ / 3 = **\_\_\_\_\_\_\_\_\_\_\_**.

1. After the book begins to move, you can determine the sliding friction. **Pull the spring scale and record the force required to keep the book sliding at a slow, constant speed**. Take three measurements and record the average.
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Average =** a + b +c = (total) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ / 3 = **\_\_\_\_\_\_\_\_\_\_\_**.

1. Place two rods under the book to act as rollers. Make sure the rollers are evenly spaced. Place another roller in front of the book so that the book will roll onto it. Pull the spring scale slowly. Measure the force needed to keep the book rolling at a constant speed.
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Average =** a + b +c = (total) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ / 3 = **\_\_\_\_\_\_\_\_\_\_\_**.

**Communicate Results**

1. Go to the board and write your three results on the board for your group. Compare your results with those of the other groups. Are there any differences? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Group Results –** Write your group and 3 other group data below in Newtons.

Static Friction Sliding Friction Rolling Friction

|  |  |  |
| --- | --- | --- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Analyze the Results**

1. Which type of friction was the largest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Which type of friction was the smallest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Do the results support your hypothesis? If not, how would you revise your hypothesis? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Relating Mass and Weight**

Why do objects with more mass weight more than objects with less mass? All objects have weight on Earth because their mass is attracted by Earth’s gravitational force. Because the mass of an object on Earth is constant, the relationship between the mass of an object and its weight is also constant. You will measure the mass and weight of several objects to verify the relationship between mass and weight on the surface of Earth.

**Collect Data**

1. Using the metric balance or spring scale, find the mass of five or six small classroom objects designated by your teacher. Record the masses in the table below.
2. Weight is the **force** of gravity on an object. **So to determine weight, use the force equation F = mass x acceleration, with acceleration being 9.8 m/s2.** Remember that mass must be in kilograms.

|  |  |  |  |
| --- | --- | --- | --- |
| **Object** | **Mass (grams) Mass (kg)** | | **Weight (Newtons)** |
|  |  | / 1000 = |  |
|  |  | / 1000 = |  |
|  |  | / 1000 = |  |
|  |  | / 1000 = |  |
|  |  | / 1000 = |  |

**Analyze the Results**

1. Using your data, construct a graph of weight (y-axis) versus mass (x-axis). Draw a Best-fit line for your data points.
2. Does the graph confirm the relationship between mass and weight on Earth? Explain your answer. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_