PUSHES AND PULLS LAB

Name: _____ Date: _____ Period: _____

**Purpose**: 1. Which type of friction, (_____, _____, or _____) resists motion the most? 2. Does a "push" or a "pull" require different amounts of force to generate motion? 3. What factors increase/decrease resistance due to friction?

**Hypothesis**: State your "if, then, because" hypothesis statement here for question 1 & 2 only:

1. **If** I test different friction types, **then** the most resistance will come from _____friction **because** _____

_____

2.**If** _____

_____

_____

**Experiment:** ***Safety Issues:***

- **NO objects other than the instructed materials are to be used or on your table during this lab.**
- **Nonsense behaviors will decrease points for your ENTIRE GROUP!**
- **Captains, it is your responsibility to make sure that this does not happen. Please respect all lab equipment!!**

**Materials:**

- Several textbooks, 1 with loop attached
- Spring scales (multiple)
- Colored Pencils
- Smooth/Rough Surfaces
- Calculator

**Procedures***: Remember* ⇧ ***Safety First!!!***

1. Place a loop the inside the cover of a textbook and hook a spring scale onto the loop.

***Practice the next three steps before you collect data.***

2. Slowly increase the pull on the loop and record the lowest pull required to get the book to start moving. Repeat two more times, determine the average (static) resistant force. Repeat the same process but with a "**Push."

** Use the non-hook end of the spring scale in order to determine how much force is required in order to push and move the books. Be sure to attempt to "Push" the books in a straight path (find the center of gravity).

3. After the book begins to slide, record the force required to keep the book moving as slow as you can. Repeat 2 more times, determine the average (sliding) resistant force. Repeat the same process but with a "Push"
4. Place 4-5 round pencils under the book, then pull the loop and record the force required to keep the book rolling. Repeat 2 more times, determine the average (rolling) resistant force. Again, repeat with a "Push."

****Friction Experiment 2 and 3****

Directions:

**Experiment #2: Weight Increase:** Repeat static, sliding and rolling friction, but add 2 more books and note the frictional forces in the table.

**Experiment #3: Surface Roughness:** Repeat static, sliding and rolling friction, but increase the "roughness" under the book and note the frictional forces in the table. Example: use the concrete outside

## Data Collection and Analysis:

1. Record the average resistant for each scenario stated below. Be sure to stay organized and record your data in the correct box on the next page. Be sure to complete each part of the entire data table (Next Page).

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| Types of Friction | Experiment #1 ⇩ Frictional Forces in Newtons (N) 3 trials | | | Friction Force Best Value | Experiment #2 ⇩ Weight Increase ____ books | | | | Experiment #3 ⇩ Rougher Surface (_____) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | | T1 | T2 | T3 | BV | T1 | T2 | T3 | BV |
| **Static Resistance (pull)** | | | | | | | | | | | | |
| **Static Resistance (push)** | | | | | | | | | | | | |
| **Sliding Resistance (pull)** | | | | | | | | | | | | |
| **Sliding Resistance (push)** | | | | | | | | | | | | |
| **Rolling Resistance (pull)** | | | | | | | | | | | | |
| **Rolling Resistance (push)** | | | | | | | | | | | | |

2. Graph your results by creating a "bar graph." Remember to title the graph and label each variable along the X and Y axis of the graph: Make a **separate bar** for **each** friction scenario in the spaces below. Be sure to label each bar or make a key to help identify each bar.

Key:

**Title:** _____

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**Conclusion:**

1. Which **<u>type</u>** of friction provides the **greatest** resistance? Which **<u>type</u>** provides the **least**? *use data as evidence to support your claim

_____
_____
_____
_____
_____

2. How might rubbing your hands together rapidly similar to that of a space shuttle or rocket entering Earth's atmosphere? Remember our discussion from earlier in the unit, and answer this question **<u>IN DETAIL</u>** and in **<u>COMPLETE SENTENCES</u>**.

_____
_____
_____
_____

3. Did the **<u>pull</u>** or the **<u>push</u>** make the books move easier? Why so? Explain your answer with evidence from your experiment.

_____
_____
_____
_____

4. How can any of the forces described in this experiment be "applied" to your bottle rocket launch and flight? Explain using details and evidence.

_____
_____
_____
_____
_____
_____

5. If you needed to move a very heavy object like a piano, what could you do to make your job easier, and why? **<u>(provide three different possible tools/solutions)</u>**

_____
_____
_____
_____
_____