Friction Lab Report

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Objective/Background

Our objective in this laboratory experiment is to observe friction on everyday objects. We want to know how friction works on various objects by determining the relationship between height, length and angle of inclination. Our main goal is to determine the coefficient of friction on various surfaces. This will help us understand how an object interacts with the surfaces on which it rests. In this experiment, known-mass objects will be placed on inclined surfaces and the angle of the inclination will be changed while the height and length are measured. With the help of trigonometry and fundamental physics, the coefficient of friction can be calculated. This experiment is intended to give us a practical understanding of how friction works and how those principles can be applied to real-world situations. The data collected and analyzed will help us gain a better understanding of how friction behaves in different situations. Friction comes in two forms: Static and Kinetic.

Static friction prevents objects from moving when they are pushed or pulled. It's similar to the resistance you'd feel when trying to push a heavy box. When you get past that resistance and the object begins to move, you've entered the world of kinetic friction.

$$Ff = \mu s Fn$$

Kinetic friction, on the other hand, is the force acting against the motion of moving objects. It's what causes a sled to slow down on the snow or a book to slide to a halt on a desk. Static and kinetic friction are determined by the materials used and the force acting on the surfaces, and are measured using friction coefficients. Knowing these forces helps us create things that move more easily or, in some situations, stay where we want them.

$$Ff = \mu kFn$$

What is the coefficient of friction? Friction is a measure of the resistance of surfaces to slide against one another. In the case of inclined planes, such as a ramp, this resistance is affected by the slope of the ramp. For static friction (the prevention of motion), the coefficient relates to the steepness of the ramp. Maximum static friction force is related to both angle and weight. How do I find the coefficient? To find the coefficient of friction, I would use the following formula: height/length = sin-1 angle = tan().

Experimental Procedure

To do this, start with four or five different materials, such as a wooden block, metal plate, plastic toy, glass surface, rubber mat, etc. Then, arrange one of these materials on a table and slowly raise the inclined plane to ensure a smooth rise. Take note and write down the angle that the chosen object begins to slide. You can also measure the angle by taking the angle of the inclined plane minus the reading of the Goniometric Circle. To confirm your results, reduce the inclined plane a bit, stop sliding, and raise the inclined plane again to see if the object begins to slide at this angle. Let's repeat this process for each selected material and see how different materials affect the angle of sliding on the inclined plane. This hands-on method provides an interesting way to see how material composition affects friction and object movement.

In this example, we were testing different materials on an inclined scale. We start with 4 or 5 objects made of different materials, like a phone, a small bottle of water, a marker, or lipgloss. We set each object up on the table and gradually raise the angled plane. The goal is to gradually raise the angle until the object starts to slide. Then, we measure the critical angle where the sliding begins. We measure the angle formed by the inclined plane between the base of the object and the inclined plane itself. To make sure our measurements are accurate, we always lower the inclined plane first and then raise it, making sure that the object is always sliding at the exact same angle. This systematic approach lets us compare and see how the shape of the objects affects the angle they start to slide on the inclined surface.

Data

Object: 1

Object: Phone			
Ramp Height (cm)	Ramp Length (cm)	Ramp angle (radians)	Coefficient of Friction
12.9	37.5	0.35	0.37
12.6	37.9	0.34	0.35
12.3	37.7	0.33	0.35
12.9	38	0.35	0.36
	Average	0.34	0.36

Object: 2

Object: Water			
Ramp Height (cm)	Ramp Length (cm)	Ramp angle (radians)	Coefficient of Friction
7.3	35.5	0.21	0.21
7.9	36.3	0.22	0.22
7.4	36.5	0.20	0.21
8	36.6	0.22	0.22
	Average	0.21	0.22

Object: 3

Object: Expo Marker			
Ramp Height (cm)	Ramp Length (cm)	Ramp angle (radians)	Coefficient of Friction
13.7	38.1	0.37	0.39
14.7	39.1	0.39	0.41
15.3	39.4	0.40	0.42
15.6	39.5	0.41	0.43
	Average	0.39	0.41

Object: 4

Object: Lip Gloss			
Ramp Height (cm)	Ramp Length (cm)	Ramp angle (radians)	Coefficient of Friction
19.8	42	0.49	0.54

22.6	43	0.55	0.62
21.2	40	0.56	0.63
23.8	44	0.57	0.64
	Average	0.54	0.61

a. Calculations/Equations used

Ff = μsFn
Ff = μkFn
$\Theta = sin$-1 height/length
$\mu = tan\Theta$

Error

The purpose of the experiment in the lab was to determine the effect of different materials on the sliding friction of objects on an inclined surface. The theory proposed that the angle of slope and weight of the object would influence the sliding friction. To determine if the experiment was successful, we compared the predicted results from the theory to the measured results. If the measured results match the predicted results, then the experiment was successful. If the measured results do not match the predicted values, then the experiment has failed. We can use percentages to measure the closeness of the results. If the results are too close to the predicted values, it is because we did not think of everything, we made mistakes in measuring, or we did not take into account things like air that messes things up. To improve the experiment, we should correct the errors and conduct more experiments with similar items to get a better understanding of how things slide.

Analysis

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Conclusion

Based on the results of this experiment, we can see that different materials act differently on a slope. For example, phones slide, markers slide, water slides, lip gloss slides, and more. Some materials are lighter, while others are heavier. Some materials are long, while others are short. Now, I want to know what makes something slide the most or the least. Is it the bumpiness of the surface? Is it the height of the surface? What about the shape? To improve the experiment, I would like to keep things such as the surface consistent and repeat the experiment with multiple objects from each material. Checking whether the weight of objects matters could also provide more useful information. All in all, this experiment gives us a better understanding of why things slide and how friction plays a role.