

Friction

Required Equipment:

- Rubber band
- Small container (any box or shoe)
- Ruler
- Smooth surface
- Plastic soda/juice bottle
- Rice (enough to fill the bottle)
- One wooden chopstick

Pre-Lab Lecture Key Points:

- *Friction* = a force between two objects that slows down motion
- *Coefficient of friction* = a number that determines how much an object will slow down
- The goal of this experiment is to explain friction and show that the amount of friction an object experiences depends on its weight
- There are of course two type of friction (static and kinetic); it is suggested that this fact be left out altogether or until the end of the lesson when students have a grasp of the main concepts
- The first experiment is quantitative and involves measuring how much force is required to pull objects of different weights; this will be achieved using an elastic rubber band, which will of course stretch more if more force is required
- The second experiment is more qualitative and will allow students to pick up an entire bottle of rice using just chopsticks
- It is somewhat important to mention that each object/surface has its own coefficient of friction, which for all intents and purposes is directly related to its roughness (so sandpaper will have a much higher coefficient of friction than a piece of plastic)

Student Lab Procedure:

1. Place the small container onto a smooth surface.

2. Cut the rubber band and securely tie one end to the container.

*It may be easier to poke a hole in the box and then thread the rubber band through it

3. Gently pull the rubber band until the container starts to slowly slide across the surface.

4. Have one of your classmates measure the length of the rubber band as the container is slowly sliding and record this value on your worksheet.

5. Now stop the container and place some weight (such as a cup of water or a few pencils) inside.

*Make sure students don't put too much weight in the container or the rubber band will of course break

6. Again gently pull the rubber band until the container starts to slowly slide and have one of your classmates measure the length using the ruler.

7. Record this value on your worksheet and compare it to the one from step 4!

8. Now take the empty soda/juice bottle and fill it completely with rice.

*Here, it is very important that the rice be tightly packed; occasionally tapping the bottle against a hard surface will aid in compacting the rice

9. Now stick one chopstick into the rice.

10. Pull the chopstick up and observe what happens.

11. Now tap the bottle gently against a tabletop. This will pack the rice tightly around the chopstick.

*There is a small chance that the bottle will not be lifted by the chopstick; if this happens, try tapping the bottle more firmly or adding more rice

12. Pull the chopstick again and observe what happens.

Wrap-Up:

→ Ask students to explain why the rubber band stretched more when the container held the objects inside (heavier objects experience more friction)

- Also ask students to explain why the bottle of rice was lifted by the chopstick when the rice was packed (closer packing and more rice in contact with the chopstick means more friction)
- It might be worth it to mention that the rice experiment does not work with an object such a straw because it has a different (lower) coefficient of friction