

5B Friction – Air Friction

How does friction affect motion?

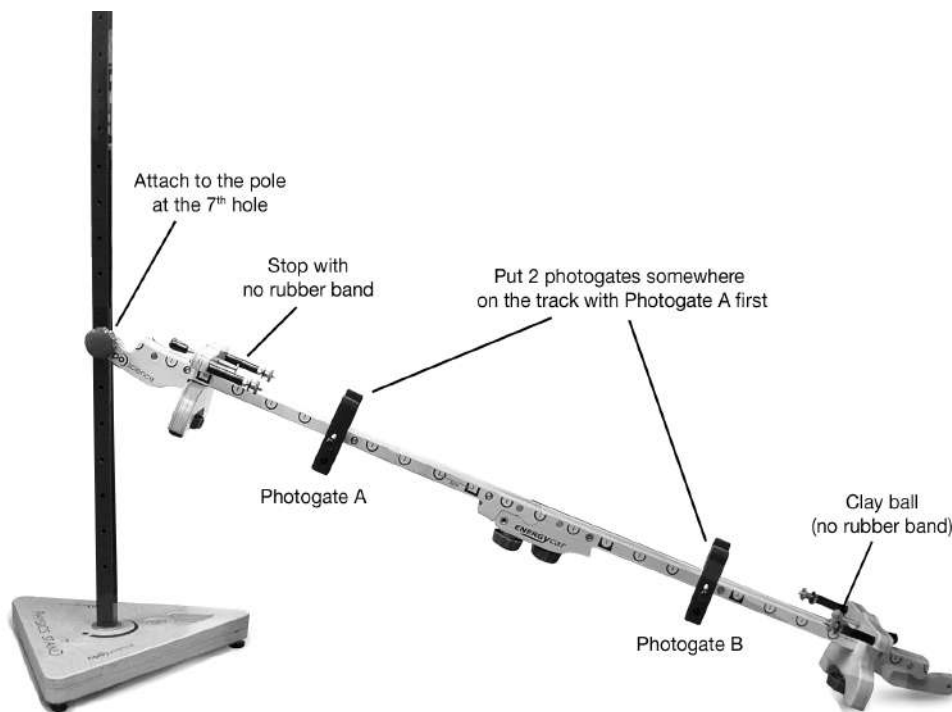
Friction is always present. Sometimes we want friction. For example, friction between tires and the road allows a car to be steered safely and to maintain its direction when moving. Other times we want to reduce friction. Changing the oil in your car allows the engine to work more efficiently. This investigation explores different effects of friction.

Materials:

- Energy Car kit
- Physics stand
- Data Collector and photogates
- Tongue depressor or nail files
- Large paper plate
- Tape

1. Control setup

The kind of friction you will be investigating today is air friction. You will begin by finding out how the car moves before you add extra air friction.



- 1 Set up the track as a long straight hill as shown above.
- 2 Attach the track to the stand at the seventh hole from the bottom.
- 3 Place one photogate near the top of the track and one near the bottom of the track.
- 4 Put a steel ball in the middle pocket of the car.
- 5 Let the car roll down the ramp, and record the time from A to B.

Name: _____ Block #: _____ Date: _____

- 6 Measure the distance between the photogates.
- 7 Use the distance to calculate the average speed of the car.
- 8 Repeat two more times, for a total of three trials.
- 9 Calculate the average speed from your three trials.

Table 1: Control speeds

| Trial | Time A to B (s) | Distance between A and B (cm) | Speed (cm/s) $S = D / T$ |
|------------------------------------|-----------------|-------------------------------|-----------------------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| (add the 3 speeds and divide by 3) | | Average Speed: | |

2. Create the “sail” car

A paper plate “sail” adds air friction (drag) to the car.

- 1 Tape a tongue depressor to the flag on the side of the car.
- 2 Tape a paper plate to the tongue depressor. Use enough tape to make sure it is securely attached.



3. Your hypothesis

Write a hypothesis that compares the speeds of the “sail car” and the normal car.

Name: _____ Block #: _____ Date: _____

Explain the reasoning behind your hypothesis. Use complete sentences!!

4. Do the experiment

- 1 The track and photogates should be set up as in part 1.
- 2 Put a steel ball in the middle pocket of the car.
- 3 Let the sail car roll down the ramp, and record the time from A to B.
- 4 Calculate the average speed of the car.
- 5 Repeat two more times, for a total of three trials.
- 6 Calculate the average speed from your three trials.

Table 2: Experimental speeds; sail car

| Trial | Time A to B (s) | Distance between A and B (cm) | Speed (cm/s) S = D / T |
|----------------|-----------------|-------------------------------|---------------------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| Average Speed: | | | |

Name: _____ Block #: _____ Date: _____

5. **Stop and think**

Did your results confirm your hypothesis? **Explain.**

How did air friction affect the car's motion?

6. **Applying what you have learned**

Friction is a force that opposes motion. Explain where the friction force on the sail comes from.

How could you increase the air friction on the car? How could you decrease it?

Is the sail the only source of friction? Does the car have any other frictional forces acting on it other than air friction? How do you think they compare to air friction? **EXPLAIN YOUR ANSWER!!!**
