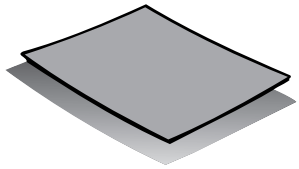
Chapter Science Investigation Name _____

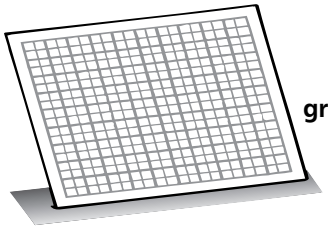
Speed and Acceleration

Have students repeat this activity several times and compare their results from the multiple trials. Use the same rider each time or use different riders and have students draw conclusions about the data.

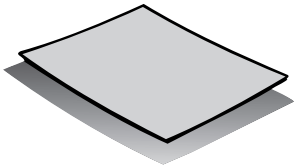
What You Need



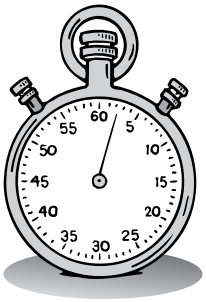
red paper or cloth flag



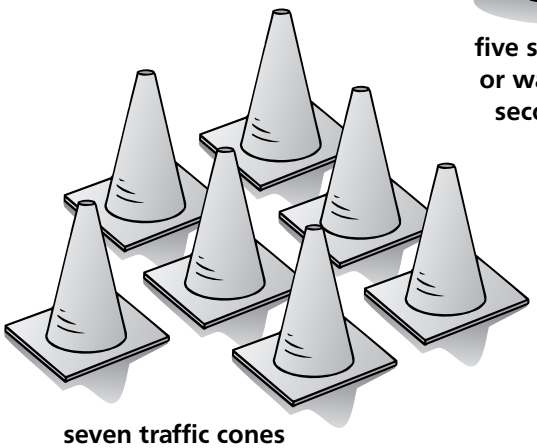
graph paper



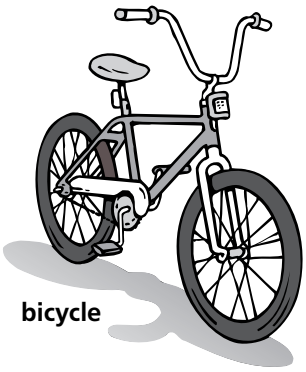
green paper or cloth flag



five stopwatches or watches with second hands



seven traffic cones



bicycle

meterstick

pencil

Find Out

Do this activity to see the difference between speed and acceleration.

Process Skills

- Controlling Variables
- Using Numbers
- Measuring
- Interpreting Data
- Experimenting

Time

- 30 minutes to set up
- 30 minutes for testing
- 30 minutes for recording sometime over the next two weeks

What to Do

1. With your group, find a safe place to test the bicycle speed outside. The area will need to be at least 30 m long.

2. Put one traffic cone at the starting point. Hang a green flag on the cone.

3. From the starting cone, **measure** 5 m. Put a second cone on the ground. Continue to place a cone every 5 m until you reach 25 m. On the last cone, hang the red flag.

4. Have one person stand across from each cone. Everyone except for the person at the starting cone should have a watch.

5. The person on the bike should place the front wheel at the edge of the starting cone. At the sound of "go," the rider should pedal the bike past the cones as fast as possible. **Record** how long it takes for the front wheel to cross each cone.

   Safety! ***Be sure to wear a helmet when riding the bike.***

6. **Repeat** the activity, and **record** the times.

7. Have the rider do the activity a third time, but the rider should begin 15 m before the first cone. **Record** the times.

8. Repeat steps 5–7 several times.

9. When inside, use the graph paper to **create a bar graph** for each test. **Compare** the times it took to travel between each cone. **Compare** the difference between the standing starts and the moving starts.

Comparing Speed and Acceleration					
Variables	**5 m**	**10 m**	**15 m**	**20 m**	**25m**
Standing Start, First Time		Student data will vary.			
Standing Start, Second Time					
Moving Start					

Conclusions

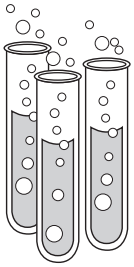
1. Compare the times that it takes the rider to travel between each cone. What relationship do you see?
The rider should take less time to travel between each consecutive cone.

2. Compare the times with the standing starts and the times with the moving start. What do you notice?
The standing start times should lessen as the rider gains speed. The moving start times should not differ as much because the rider will not be accelerating as much.

New Questions

1. Speed can be determined by how fast you are moving per second. What speed was the bike going at the 10-m cone the first time? The second time? The third time, with the moving start?
Answers will vary depending on data.

2. Who could accelerate the bike faster from a standing start, a large person with a heavy bike or a small person with a lightweight bike? Explain your answer.
The heavier bike and person have more mass so they will take more force to accelerate. The lighter person and bike have less mass so they will take less force to accelerate. The lighter person and bike may accelerate faster from a standing start but the heavier person and bike may travel at a faster speed once the bike has been accelerated.



Name _____

ACTIVITY

Comparing Density

Estimate the mass of the

- penny-and-foil wad.
- penny-and-foil boat.

Estimates will vary.

Calculate the mass of the

- penny-and-foil wad.
- penny-and-foil boat.

The mass for each pair should be the same.

What happened when you placed these in water?

- penny-and-foil wad

They sank.

- penny-and-foil boat

They floated.

Name _____

Conclusions

1. Which foil-and-penny pair had a greater mass?
Their masses were equal.

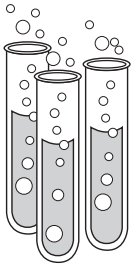
2. Which pair had a greater density than water? How do you know?
The wadded-up foil and penny had a greater density than water. They sank in the water.

3. Why do you think the two pairs acted differently in water?
The "boat" traps some air so that the total density of foil, penny, and trapped air is less than the foil wad and the penny. It is also less than water, so the "boat" floats.

Asking New Questions

1. If the mass of an object stays the same but the volume decreases, what happens to the density?
If the mass stays the same and the volume decreases, the density would increase because there would be more mass in a smaller space.

2. **Predict** what shape of aluminum boat will hold the most pennies in water. **Design an investigation** to test your prediction.
Student predictions will vary. Encourage students to experiment with their designs.



Name _____

ACTIVITY

Observing Inertia

Record your measurements in the table below.

Test Number	How Far Did the Figure Fall?

Name _____

Conclusions

1. What happened to the clay figure and the car when they collided with the ruler?
The car stopped. The clay figure continued to move forward.

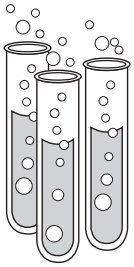
2. What did you **observe** when you raised the ruler higher?
The car moved faster and the clay figure flew farther.

3. Why do you think this happened?
The car and the figure both have inertia. The pencil stops the car, but the figure continues moving until air molecules and gravity cause it to fall. The faster the car moves, the more inertia the car and the figure have.

Asking New Questions

1. **Predict** what will happen if you place the pencil farther away from the end of the ruler. Test your prediction.
Student predictions will vary.

2. Why should people wear seat belts in cars?
Without seat belts, people will continue moving forward when a car makes a sudden stop. The seat belts apply force to stop people from moving forward so they will be safe.



Name _____

ACTIVITY

Using Simple Machines

In the space below, **draw** or **write** about your group's two plans for moving the tape.

Drawings or descriptions will vary depending on student plans.

	Plan 1	Plan 2
What happened?		
What went wrong?		
How can we fix it?		

Name _____

Conclusions

1. How many ways did you come up with to raise the tape to the top of your desk? Which one worked the best?
Answers will vary. Accept any reasonable solutions.

2. What materials did you use?
Answers will depend on the design.

3. What forces did you use?
Answers should include a description of the pushes and pulls used.

Asking New Questions

1. Why didn't some of your ideas work as well as others?
Answers will vary. Use students' responses to the assessment strategies to discuss the answers to these two questions.

2. Which idea required the least amount of effort to do?
Answers will vary depending on the ideas used.

