1. Get a computer, launch the Firefox web browser, and go to the following URL:
http://my.ign.com/atari/asteroids
In order to navigate your ship in this game, you'll need to use the left-arrow, right-arrow, and up-arrow keys. When you think you have the controls learned, begin a New game.

> NOTE: At some point during this lab your spaceship will almost certainly be destroyed by asteroids. We're actually not concerned about the asteroids for most of this lab, so if your spaceship gets destroyed, just wait for a new spaceship to appear on the screen, or begin a new game, and continue your work on the lab.

2. Relative to the stars in the background, is your spaceship moving when the game begins?

3. Newton's First Law of Motion refers to a non-moving body as "a body at rest." If you *don't* press any of the navigation buttons (rotate left, rotate right, accelerate), how does the motion of your spaceship change over time?

4. Newton's First Law of Motion states, in part, that "a body at rest tends to stay at rest." Does your spaceship follow this rule?

5. Rotate your ship so that it points to the left of the screen, and press the accelerate key very briefly.
   a. What do you notice about your ship's motion?

   b. Tap the accelerate key a few more times. What do you notice about your ship's motion?

6. Newton's First Law of Motion states that "a body at rest tends to stay at rest, unless acted upon by a net force."

a. Did your spaceship follow this rule?

b. What caused the force (meaning what pushed or pulled) on your spaceship?

NOTE: Your ship may have been hit by an asteroid during the time you were answering these questions. If so, get a new ship and set it in motion as instructed in #5 above.

7. Newton's First Law of Motion (which turns out to be a very long law), ALSO states that "a body in motion tends to stay in straight-line motion, unless acted upon by a net force." ***Once it is already moving***, does your ship tend to stay in straight-line motion?

8. What are two forces that can act to cause your moving spaceship to NOT travel in a straight line anymore?

9. Near the surface of the earth, things flying *through the air* with an initial horizontal velocity (like a baseball thrown by a pitcher) don't act like the straight-line Asteroids spaceships at all: they tend to fall down, ***and*** they tend to slow down horizontally as they travel. And yet Newton's First Law correctly predicts the motion of these objects too.

a. Why does an object traveling horizontally through the air near the surface of the earth tend to fall toward the Earth in an arc-shaped path, instead of traveling in a straight line? Explain the object's motion specifically using terms found in Newton's First Law of Motion ("at rest," "in motion," "net force," "tends to," etc.)

b. Why does an object traveling *through the air* near the surface of the earth tend to slow down in the horizontal direction as it travels? Again, explain this motion specifically using terms from Newton's First Law.

BONUS QUESTION

10. Another one of Newton's Laws states that all bodies that have mass (like your spaceship, the stars, the asteroids) experience a force of gravitational attraction toward each other. If this is true, and the game designers did a good job of designing this game so those forces are actually occurring in the game, why don't we see the spaceship being attracted by the stars' gravity, or the asteroids' gravity?

Teacher Notes (do not distribute this page to students)

1. Make sure you get a chance to test out the game on the computers before the day of the lab! An internet connection is required, of course, and the computers may need to have Java or Flash installed to be able to run the game.
2. If the link given doesn't work, search around on the Internet for a suitable replacement. The game selected does need to exhibit the proper characteristics of frictionless travel: the spaceship shouldn't slow down when the thruster button is not being pushed.