**2nd Law Lab** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In this activity you will use a plastic spoon to test the effects of force and mass on acceleration. The plastic spoon with serve as your catapult and the spheres will be the projectiles you launch into the air. You will be testing two different independent variables. At first you will test how mass affects the acceleration of an object. Then you will test how force affects the acceleration of the object.

**Materials Needed**: plastic spoon, ping pong ball, gold ball, ruler or measuring tape. (golf ball and ping pong ball can be substituted for any spheres that are similar in size, but have different masses)

**Driving Question:** How do mass and force affect the acceleration of an object?

**Predictions:**

1. If the spoon is pulled back the same distance, which project tile do you think will travel farther, golf ball or ping pong ball? Explain your thoughts.
2. If you change the distance you pull back on the spoon, but use the same ping pong ball, how do you think the distance the ping pong ball travels will be affected?

**Part 1---Procedures: (Testing Mass)**

1. Hold the handle of the spoon with the scoop pointing up. Place your thumb on the back of the handle and your fingers on the front of the handle.
2. Place the ping pong ball in the scoop of the spoon (where the food would go)
3. Holding the sphere in place, pull back on the spoon and release the ball.
4. Measure the distance from where you are standing to where the sphere first hit the ground. Record the information in your chart.
5. Repeat the same steps (1-4) again using the ping pong ball for a second time. Record the distance the sphere travels on the chart below for trial 2.
6. Hold the handle of the spoon with the scoop pointing up. Place your thumb on the back of the handle and your fingers on the front of the handle.
7. Place the golf ball in the scoop of the spoon (where the food would go)
8. Holding the sphere in place, pull back on the spoon and release the ball. Be sure to pull back the same amount as before.
9. Measure the distance from where you are standing to where the sphere first hit the ground. Record the information in your chart.
10. Repeat the same steps (1-4) again using the golf ball for a second time. Record the distance the sphere travels on the chart below for trial 2.

**Data Chart-Testing Mass (create this chart on notebook paper, OR print the page and write on the chart)**

|  |  |
| --- | --- |
| Trial 1Ping Pong Ball | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  Trial 2Ping Pong Ball | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Average Distance:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Trial 1Golf Ball | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Trial 2Golf Ball | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Average Distance: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Questions:**

1. Which sphere traveled farther? Why do you think this happened?
2. If you had a real catapult and were able to launch a 10 pound bowling ball and a 2 pound kick ball, which ball do you think would travel the farthest (the catapult is pulled back the same distance for both)? Explain your thoughts.
3. Complete the following statement in your own words: When mass increases the acceleration of the object ….

**Part 2---Procedures: (Testing Force)**

1. Hold the handle of the spoon with the scoop pointing up. Place your thumb on the back of the handle and your fingers on the front of the handle.
2. Place the ping pong ball in the scoop of the spoon (where the food would go)
3. Holding the sphere in place, pull back on the spoon and release the ball. (attempt to measure how far back you pull the spoon)
4. Measure the distance from where you are standing to where the sphere first hit the ground. Record the information in your chart.
5. Repeat the same steps (1-4) again using the ping pong ball for a second time. Be sure to pull the spoon back the same distance as before) Record the distance the sphere travels on the chart below for trial 2.
6. Hold the handle of the spoon with the scoop pointing up. Place your thumb on the back of the handle and your fingers on the front of the handle.
7. Place the ping pong ball in the scoop of the spoon (where the food would go)
8. Holding the sphere in place, pull back on the spoon, BUT this time pull back farther than before. (attempt to measure how far back you pull the spoon)
9. Measure the distance from where you are standing to where the sphere first hit the ground. Record the information in your chart.
10. Repeat the same steps (1-4) again using the ping pong ball and pull the spoon back the same distance as you did for step 8. Record the distance the sphere travels on the chart below for trial 2.

**Data Chart-Testing Force (create this chart on notebook paper, OR print the page and write on the chart)**

|  |  |
| --- | --- |
| Trial 1 (pull the spoon back normal distance) | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Trial 2 (pull the spoon back normal distance) | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Average distance traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Trail 1 (pull the spoon back farther) | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Trail 2 (pull the spoon back farther -same as trial 1 before) | Distance Traveled:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Average distance traveled: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Questions:**

1. When did the ball travel father, when the spoon was pulled back normal distance, or when the spoon was pulled back farther? Why do you think this happened?
2. Pretend you are at the grocery store, why do you have to push harder when the cart is full of groceries and push less when the cart is empty?
3. Complete the following statement: When force increases the acceleration of the object …