

Name: \_\_\_\_\_ Pd. \_\_\_\_\_ Date: \_\_\_\_\_

### Newton's Laws: Making the Connection Activity

#### **Introduction:**

One way that something can change is simply by traveling to a new location. When an object changes its position, we call the change motion. Isaac Newton formulated three laws that apply to every motion in the universe. In order to demonstrate how this change works and what forces are needed to generate this type of change, this activity will require you to apply your knowledge of Newton's three laws.

#### **Task One:** Reviewing Newton's Three Laws of Motion

Directions: Answer each of the following questions in complete sentences.

#### **Newton's Law of Inertia**

1. An object at \_\_\_\_\_ stays at rest.
2. An object in motion stays in motion, in a \_\_\_\_\_, unless acted on by an external \_\_\_\_\_ force.

#### **Newton's Law of Acceleration**

3. An \_\_\_\_\_ acting on an object causes it to \_\_\_\_\_.
4. Acceleration is directly related to the size of \_\_\_\_\_ in the same direction of the force.
5. Acceleration is inversely related to the \_\_\_\_\_ of an object.
6. Write the formula used to calculate force: \_\_\_\_\_

#### **Newton's Third Law**

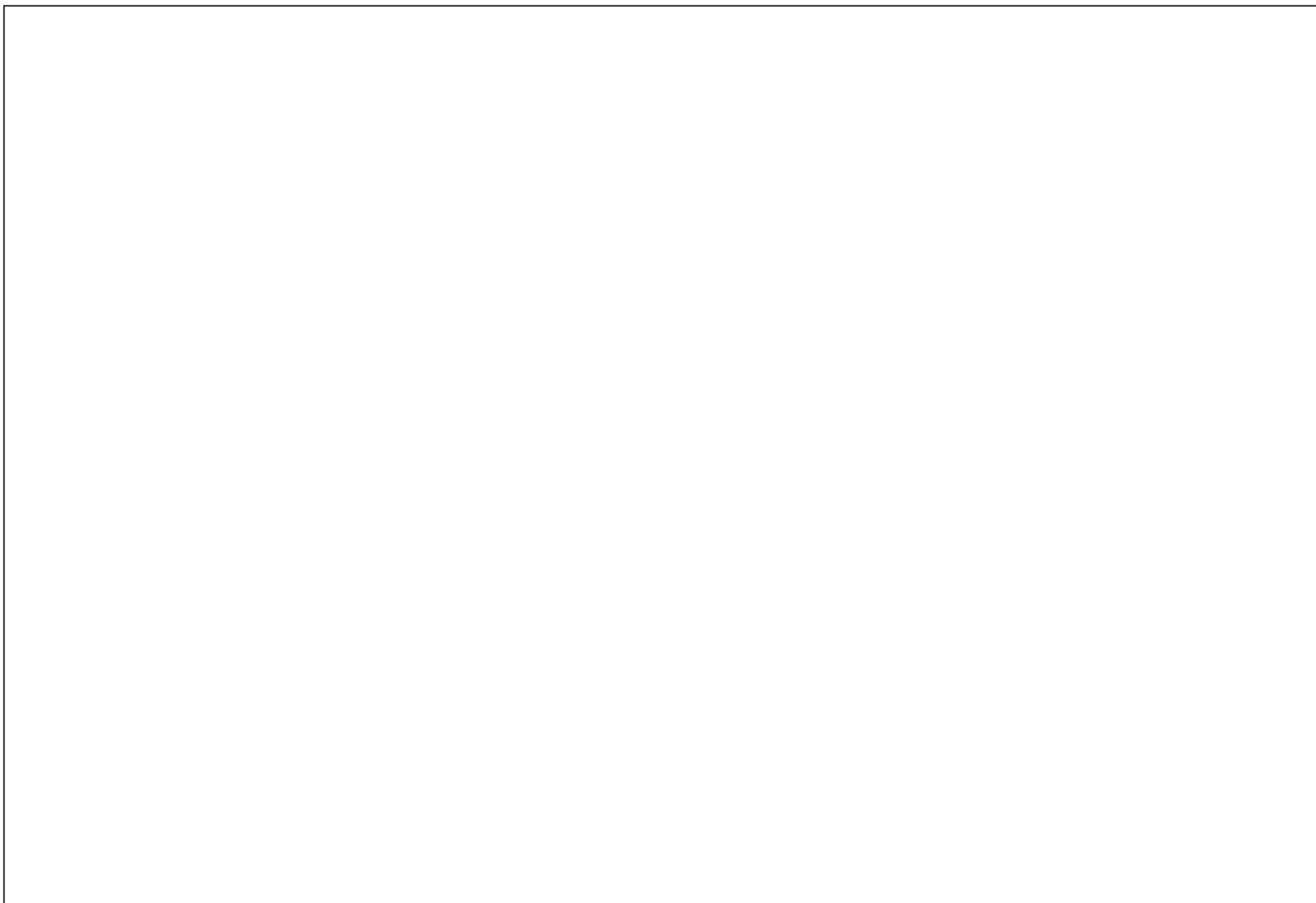
7. For every action force there is an \_\_\_\_\_ and \_\_\_\_\_ reaction force.

#### **Task Two: Building a Balloon Racer**

##### **1. The rules to this activity are simple:**

- The car must be powered by balloons.
- You can build the car out of anything.
- It must have at least three wheels. Wheels are defined as anything that is round and goes around.
- The wheels cannot be wheels from a toy car. They must be made out of something that was not originally meant to be used as wheels.
- The car may not leave the ground.
- The car must be capable of traveling at least 3 meters.

**2. Design your car here (label your picture with the materials you will be using):**



**3. List the parts and materials used for your car below. Applying your knowledge of Newton's Laws of Motion, explain why you chose this item.**

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_

4. Build your car
5. Test your car as much as you'd like, but you can make modifications **ONE time only**.
6. List any modifications you made and explain why you made them.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

**Task Three: Test Day**

1. As we test each group's balloon, you will be recording data on each balloon racer

Data Table:

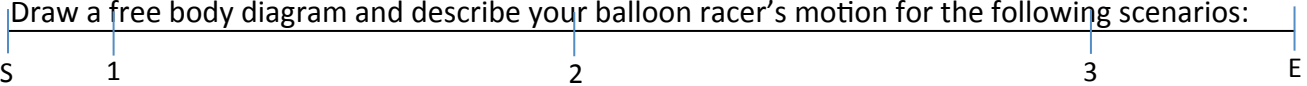
Group #	Trial 1 Distance Traveled (m)	Trial 2 Distance Traveled (m)	Trial 3 Distance Traveled (m)	Average Distance Traveled (m)

**Task Four: Analyzing the Data**

After you finish the race come back and complete these reflection **questions on a separate sheet of paper**

1. Newton's first law states that an object in motion will stay in motion unless an outside force acts on it. What did you do to prevent any outside forces (such as friction) from acting on your car?
2. Newton's second law states that if the same amount of force is used, lighter objects will accelerate faster than heavier objects. Specifically, how did you manipulate your car's mass?
3. Newton's third law states that for every action, there is an equal and opposite reaction. Draw a picture of your car. Label the action force and the reaction force on your car.

4. Draw a free body diagram and describe your balloon racer's motion for the following scenarios:



- a. Your car at the start line
- b. Your car at point 1
- c. Your car at point 2
- d. Your car at point 3
- e. Your car after the balloon is empty

5. View the winning balloon racer's design. Analyze, in terms of Newton's three laws, why the design of the winning car performed better than the other racers in the class.
6. Based on your observations from question #5, write a paragraph to explain at least 3 ways you could improve your car design from your design.
7. Considering Newton's Laws of Motion, what are three pieces of advice that you would give to someone trying to make one of these cars next year?