

# A Wild Ride! Week 2: Grades 6-8

## Day 5: The Triple Crown!

### Teacher/Parent Background:

To help your child learn more about Newton's three laws of motion, begin with a review of each law:

- Newton's first law of motion states that an object at rest tends to stay at rest, and an object in motion tends to stay in motion at a constant speed in a straight line. That is, the state of motion of an object does not change unless it is acted upon by an unbalanced force. Therefore, if the net force is 0, nothing happens.
- Newton's second law of motion states that the relationship between force ( $F$ ), mass ( $m$ ) and acceleration ( $a$ ) is  $F = ma$ . More force makes things accelerate at a greater rate, and more mass slows the rate of acceleration.
- Newton's third law of motion states that for every action force, there is an equal and opposite reaction force. Forces always occur in pairs, never alone. When you push on something, it pushes back with an equal amount of force in the opposite direction.

### Overview:

In this activity, students will design and build their own roller coasters that include at least 1 hill, 1 loop and 1 turn.

### Related Standards:

- Use non-algebraic mathematics and computational thinking to explain Newton's laws of motion

### Key Terms:

- Friction
- Gravitational Potential Energy
- Kinetic Energy
- Momentum
- Inertia

## Materials List:

- [Foam pipe insulation](#) or foam pool noodles cut in half, lengthwise
- Masking Tape
- Marbles
- Various objects such as blocks, boxes, chairs, etc. to use as support

## Activity Description:

- Using the knowledge gained in the past 4 days about roller coaster design, students will build a roller coaster using foam pipe insulation that must meet the constraints given in the challenge details from day 3.

## Closure:

Discuss the following with students:

Where on your roller coaster do you see evidence for each of Newton's Laws?

### First Law

*Most roller coasters run by the Law of Inertia. Since an object at rest stays at rest, all roller coasters have to be pushed or pulled to get started. The student's roller coaster started at the top of a big hill. At the top, the marble has the largest amount of gravitational potential energy. Gravity pulled on the marble and put it in motion. Once put into motion, the marble stayed in motion but friction slowed it down.*

### Second Law

*The second law states that the acceleration of an object depends on the object's mass and magnitude of the force acting upon it ( $F=ma$ ). The marble could probably feel this second law when it went down the hills. The marble has mass. The gravity provides acceleration. That causes force. The rider feels the force as it moves the cars along the coaster track. The track directed the force and the marble.*

### Third Law

*Newton's third law of motion says, "For every action there is an equal and opposite reaction." So that applied to the student's roller coaster, between the marble and the track. When the marble went up and down the hill, it created different forces onto the track. Those forces were applied back into the track and students may have noticed the track moving as the marble ran through it.*

## Extension:

Instagram!: Students can record an instagram video of their roller coaster in action and tag @azscience

Read & Learn: [Newton's Laws and Roller Coasters](#)