

MOTION AND FORCES



GRADE LEVEL: ELEMENTARY SCHOOL
2ND - 5TH GRADE

Student Objectives

- Conduct an experiment(s) demonstrating a force moving an object
- Re-define what a force is and name forces they know (push and pull, gravity, friction, etc.)
- Identify what and how forces impact racing (photo and video interpretation)
- Understand Newton's laws of motion (1st and 3rd) and how they apply to racing
- Conduct an experiment with the impact of force (gravity, friction and Newton's laws)

Materials List

2nd - 5th Grade

- Videos:
 - o Talladega 2019: <https://www.youtube.com/watch?v=B6j-FNfQTvM> (steep banking)
 - o Bristol 2019: <https://www.youtube.com/watch?v=hLkFEH47PN8>
 - o New Hampshire 2019: <https://www.youtube.com/watch?v=Ym-zXYJtRlQ>
- Photos: Friction, Gravity (Banking) and Laws of Motion
- Car Build Experiment Materials:
 - o Wheels (items that are round either from toys or make your own – such as k-cups, caps from bottles, cardboard wheels)
 - o Balloon (if your child has latex allergy, see alternative power source in instructions)
 - o Axel (bamboo skewers, wooden sticks, connecting rod, piece of wire from hanger, paper clip)
 - o Base/Chassis – plastic cardboard, sturdy cardboard, file folders or other flat surfaces.
 - o Bushing - Straw or tube to thread axel through to connect wheels
 - o Alternative Power Source – Straw or stick or tube and paper
 - o Scissors
 - o Tape





Lesson Plan and Procedures for Adults

2nd - 5th Grade

Notes: You can either conduct the [K-1 lesson](#) as a review or you can start at this point.

2nd grade children are introduced to the idea that motion has different forms, such as a wave especially for sound and light.

3rd grade children are introduced to different types of forces - namely gravity. Students learn what gravity is and how it works (downward pull and how we push against gravity).

4th grade children learn about friction as a force – two surfaces rubbing against each other and producing heat energy.

5th grade children learn about how forces and motion have “laws” to define how they work, otherwise known as Newton’s laws of motion.

1. Have the student(s) recall what a force is (makes an object move) and how objects move.
2. Ask the student(s) to share the types of forces they have studied at school. (Reference above.) Review the definitions of those forces or movements (push, pull, wave, gravity, friction, etc.)
3. Have them think about the forces they encounter in their daily life. Examples include getting out of bed, brushing teeth, walking, riding a bike, etc. See if they can name the force acting on them. (Remember more than one force can be acting on them at the same time.)
4. Think about forces and NASCAR, as racing is about forces in motion. Select a NASCAR race (suggested links above) and view the action in the race and a pit stop. Watch about 3 to 4 minutes of the video. Have the student(s) explain where and how they see forces occurring:
 - Push: pushing the car through inspection, pushing the tires, pushing the gas can into the gas receptacle.
 - Pull: pulling a tire, pulling the gas can out of the gas receptacle, tires pulling the car along the track, pulling on a firesuit/helmet/gloves/shoes.
 - Gravity: pushing down on the top car, pulling the car down, especially in turns.
 - Friction: tires against the track, cars rubbing against each other/the wall.
 - Air: pushing and pulling on the car, affecting the speed of the car.
5. Watch the clip again and ask the child to identify different forces in action.





6. Explain the term banking. Ask the student(s) to think about why the turns on a racetrack would be built this way. It allows the cars to go faster and doesn't require the driver to slow down.

For 2nd, 3rd and 4th grade students, go to experiment step 10.

For 5th grade students, continue to experiment step 7 (laws of motion.)

7. In 5th grade, students are introduced to Newton's laws of motion. Review each of the laws of motion, having the student repeat the laws back.
 - First law: An object at rest will remain at rest. An object in motion will stay in motion unless an outside force acts on it. Illustrate this with any object. Place a toy on a table and have the child push it. What makes it move? What made it stop?
 - Second law: Formula – Force = Mass x Acceleration. Discuss what mass and acceleration are.
 - Third law: For every action, there is an equal and opposite reaction. A good illustration is a rocking chair.
8. Watch one of the race video clips (suggestions above) and have the student identify what outside forces are present that could impact the car, causing it to stop such as friction, gravity, other cars or the wall.
9. Have the student(s) identify where they saw the third law happening (such as cars bumping into each other, cars hitting and bouncing off the wall, etc.)
10. Gather supplies to build a car using a balloon that can move under its own power as the force. When building the car, follow these rules to demonstrate the laws of motion in action.
 - The car should have at least three wheels.
 - The car needs to have axles that can turn the wheel since wheels do not turn by themselves. (HINT: You will need to create a hole in the middle of your tires/wheels. Then, use a paper clip, skewer or hanger to push through the hole as the axle. If the child tapes the axle to their chassis/base, the wheel will not turn. Place the axle through a tube, straw or another vessel that is larger than the axle. The bushing (tube) can be taped to the car as it doesn't need to move.)
 - The car will move by air or balloon power. Do not push or pull it with your hands. (HINT: Use a straw or tube to create a single stream of air. If the child tapes the balloon on first without a straw attached, the balloon and force [2nd law] will not be as effective.)
 - You can try this experiment either outside or inside on different surfaces to see which allows the car to move farther.





Allergy Alternative: Sail Car

- Use the same materials to build a car, minus the balloon. Have the student(s) think about how to create a source of power to move the car with air, considering other objects that move by air power – i.e. sailboat.
 - Have the child brainstorm how to create a sail for their car to make it move. (HINT: Create a single mast and sail for the car using a stick, tube or anything that is straight. Tape it to the car in the center for balance and add a horizontal sail. Using an air pump, handheld fan or book, create wind to push the car forward.)
 - Try different surfaces for the car to move on.
11. Review experiment with child and discuss what forces were used to move their car, what force made the car stop and what force may have caused the car to slow down. For 5th grade students, review Newton's law of motion as they applied to the car moving.

