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Virtual CLASSROOM

Physics Fun with Newton Lesson Guide

Lesson Guide | Description

Instructor: Paige Kelpine
Grade Level: 3 - 8
Subject: Physics

Students will explore Newton's 3 Laws of Motion.

Wonder How:

Have you ever wondered why things move the way they do? Why does your body move forward when someone slams on the brakes, or why is it harder to push a full shopping cart versus an empty one, or why a rocket goes up?

Goal:

Students will design and build a carnival game using one of Newton's 3 Laws of Motion.

Lesson Guide Agenda:

- Vocabulary
- Materials List
- Activity Instructions
- Challenge!
- Additional Resources
- Oklahoma Academic Standards

Lesson Guide | Vocabulary

Inertia - The tendency of an object to resist a change in motion.

Force – A push or a pull.

Balanced Forces – Two forces acting in opposite directions on an object; the sum of the net forces on an object is zero; results in no change in motion.

Unbalanced Force – A force that changes the motion of an object.

Mass – A measure of the amount of matter in an object.

Acceleration – The rate at which an object changes its velocity.

Velocity – The speed of an object in a given direction.

Physics Fun with Newton

Materials Needed:

Metal washers or a few pennies
A smooth, flat surface
Paper to record your results
Pencil or pen
2 Toy cars or trucks (identical cars or trucks works best) OR 2 ping pong balls and 2 golf balls
Piece of sturdy cardboard, wood, or book
Tape
Balloon
String, dental floss, or sewing thread will work
1 Straw
A place to attach the ends of your string (2 chairs, 2 walls, etc.)

Watch the "Physics Fun with Newton" video before continuing to the challenge!

Be sure to print the "Newton Carnival Worksheet" found on HomeRoom for your challenge at the end of this lesson.

If you have any questions throughout this lesson, please email teachers@oerb.com.
We would love to hear from you!

Newton's 1st Law "Inertia" Investigation

Materials Needed:

Metal washers or a few pennies
A smooth, flat surface
1 Piece of paper to record your results
Pencil or pen

Newton's 1st Law Instructions:

1. Stack all but one of the washers or coins.
2. Aim the extra one at the bottom of the stack.
3. On a piece of paper sketch the set up.
4. Predict what will happen when the extra washer or coin is pushed towards the bottom of the stack.
5. Give the coin or washer a good flick or push. You may have to try a couple of times to get the right amount of force.
6. Take time to record the results on the data sheet.

Newton's 2nd Law "F=ma" Investigation

Materials Needed:

2 toy cars or trucks (identical cars or trucks works best) OR 2 ping pong balls and 2 golf balls
1 Piece of sturdy cardboard, wood, or book
Pennies or metal washers
Piece of paper
Pencil or pen
Tape – to attach pennies and make a finish line

Newton's 2nd Law Instructions:

1. Lay the piece of cardboard, wood, or book flat on a table (or the floor).
2. Place a piece of tape approximately a hands length from the end of the ramp to mark the finish line.
3. Tape the pennies or washers together in a stack.
4. Place both cars (or the ping pong balls) at the top of the ramp.
5. Slowly lift the ramp. The cars or ping pong balls should cross the finish line at the same time – it may take a few tries.
6. Once the release is mastered, it's time to change the mass of one of the objects. With some tape, attach 15-20 pennies to one of the cars (or switch to golf balls).
7. On a piece of paper, sketch this setup.

Newton's 2nd Law Instructions:

8. Predict what will happen when the objects with different masses are released.

9. Time to test!

10. Slowly lift the cardboard. Record the results.

11. Repeat this test 2 more times and record the results.

Newton's 3rd Law "Action/Reaction" Investigation

Materials Needed:

Balloon
String, dental floss, or sewing thread
Tape
1 Straw
A place to attach the ends of your string (2 chairs, 2 walls, etc.)

Newton's 3rd Law Instructions:

1. Cut the straw in half.
2. Thread the string through the straw.
3. Attach the ends of the string to stationary objects (2 chairs, walls, tables, etc.).
4. Place a piece of tape over the top of the straw – make sure there's enough tape hanging over the sides to attach the balloon.
5. Blow up the balloon, but **DO NOT** tie off the end.
6. Tape the balloon to the straw and move it to one end of the string.
7. Predict what will happen when the balloon is released.

3....2...1...BLAST OFF!

Challenge!

Most carnival-type games use Newton's Laws of Motion to bring fun and entertainment to our lives.

- Design and create your own at-home carnival-style game, using materials from around your home.
- Your games should demonstrate at least one of Newton's Laws of Motion.
- See the "Newton's Carnival Challenge" worksheet for more details!

WANT TO WIN A PRIZE?

Share pictures or a short video of your carnival-type game with us by emailing teachers@oerb.com and on Facebook/Instagram by tagging us @oerbok.

Be sure to include your name, grade, school, and teacher!

The teacher with the most student submissions will win a $100 Amazon Gift Card!

Check out these additional resources!

1. Science | State Department of Education
   https://sde.ok.gov/science

2. Sir Isaac Newton Online (Short Biography with Video)
   http://sirisaacnewton.info/sir-isaac-newton-biography/sir-isaac-newton-biography-kids/

3. Science of the NFL: Newton's 1st Law of Motion (Video)
   https://www.nbclearn.com/science-of-nfl-football/cuecard/50884

4. Science of the NFL: Newton's 2nd Law of Motion (Video)
   https://www.nbclearn.com/science-of-nfl-football/cuecard/50974

5. Science of the NFL: Newton's 3rd Law of Motion (Video)
   https://www.nbclearn.com/science-of-nfl-football/cuecard/51076

Check out these additional resources!

6. NASA STEM Engagement (Series of Videos)
   https://www.nasa.gov/stem-ed-resources/Introduction_to_Newtons_Laws.html

7. NASA Jet Propulsion Laboratory (Hands-on Activities)
   https://www.jpl.nasa.gov/edu/teach/tag/search/Rockets

8. Institute of Physics Spark (First Law of Motion Experiments)
   https://spark.iop.org/nodes/Newtons%20First%20Law#gref

9. Sciencing.com (Second Law of Motion Experiments)
   https://sciencing.com/second-law-motion-experiments-6952612.html

10. Steve Spangler Science (Force and Motion Experiments)
    https://www.stevespanglerscience.com/lab/categories/experiments/forces-and-motion/

Lesson Guide | Oklahoma Academic Standards

3-PS2-1 Plan and conduct investigations on the effects of balanced and unbalanced forces on the motion of an object.

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.
- Objects in contact exert forces on each other.

3-PS2-2 Make observations and/or measurements of the object's motion to provide evidence that a pattern can be used to predict future motion.

- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.

MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two objects.

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).

Lesson Guide | Oklahoma Academic Standards

MS-PS-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change.
- The greater the mass of the object, the greater the force needed to achieve the same change in motion.
- For any given object, a larger force cases a larger change in motion.

To learn more about the Oklahoma Academic Standards for Science click here.