Young Issac Newton

Grades: 3rd – 6th

Duration: 30 Minutes

Program Description

Explore and learn about Newton's three laws of motion. Your students will participate by using everyday toys to comprehend the meaning of each law.

Louisiana GLE:

Science
Grade 3

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)

2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
4. Predict and anticipate possible outcomes (SI-E-A2)
6. Use the five senses to describe observations (SI-E-A3)
10. Combine information, data, and knowledge from one or more of the science content areas to reach a conclusion or make a prediction (SI-E-A5)
23. Demonstrate how force is a push or a pull by using students' bodies, toy cars, or balls (PS-E-B2)
24. Explain how the amount and direction of force exerted on an object (e.g., push, pull, friction, gravity) determine how much the object will move (PS-E-B2)
26. Explain the effect of varying amounts of force on the motion of an object (PS-E-B4)

English Language Arts
Reading and Responding
Standard 7
20. Apply basic reasoning skills
Speaking and Listening
Standard 4
38. Give and follow precise directions and instructions
42. Use active listening strategies
44. Assume the role of contributor and active listener

Grade 4

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
4. Predict and anticipate possible outcomes (SI-E-A2)
7. Use the five senses to describe observations (SI-E-A3)
27. Describe how the amount of force needed to cause an object to change its motion depends on the mass of the object (PS-E-B4)

English Language Arts

Speaking and Listening

Standard 4

34. Adjust pacing to suit purpose, audience, and setting when speaking
35. Interpret, follow, and give multi-step directions
37. Demonstrate active listening strategies, including asking questions, responding to cues, and making eye contact
38. Adjust speaking content according to the needs of the audience

Science and Inquiry 5th – 8th

1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)

Science
Grade 5

8. Explain that gravity accelerates all falling objects at the same rate in the absence of air resistance (PS-M-B3)
9. Demonstrate a change in speed or direction of an object's motion with the use of unbalanced forces (PS-M-B5)

English Language Arts
Speaking and Listening
Standard 4

32. Adjust diction and enunciation to suit the purpose for speaking
33. Use complete sentences and standard English grammar, diction, syntax, and pronunciation when speaking
35. Restate or describe oral directions/procedures for tasks
36. Adjust volume and inflection to suit the audience and purpose of presentations
38. Demonstrate active listening strategies
39. Deliver formal and informal presentations for a variety of purposes, including:
41. Participate in group and panel discussions

Grade 6

19. Identify forces acting on all objects (PS-M-B3)

Key Terms:

gravity – the attraction between all objects that manifests itself via a gravitational force

inertia – the ability of an object to resist a change in its motion or position and is based on the amount of mass and the way the mass is distributed

laws of motion – three laws developed by Issac Newton that describe the motions of a macroscopic object and ignores the effect of quantum mechanics

Connections to Permanent Exhibits:

1st Floor
Coin Well– Slip a coin through the slot and watch it spiral in to the center. This exhibit mimics the effects of gravity around a black hole.

2nd Floor
Big Lever - Moving the rope will determine how much effort it takes to lift the same engine block

Big Pulley – Each station has a different number of pulleys, and this affects the amount of effort required to pull you up

Space Center
1st Floor
The Foucault pendulum – this exhibit demonstrates inertia and the force of gravity

2nd Floor
Stellar Wobble – Two metal balls of differing masses orbit around another, demonstrating the effects of gravity between a planet and its host star. A star's orbiting movement is often described as stellar wobble

Gravity Assist – Try to shoot the projectiles into a target slot. Notice the ball's trajectory is effected by the spinning well.

Web Resources:

The Galileo Games NOVA\PBS
http://www.pbs.org/wgbh/nova/pisa/galileo.html

The website has a flash interactive experiment discussing the effects of gravity as viewed by Galileo. Although Newton is credited with the "discovery" of gravity, Galileo was among the first to experiment with the force of gravity.

Gravity and Inertia Science Monster
http://sciencemonster.com/gravity_inertia.html

This site features an interactive game where the user tries to land a spaceship on the different platforms. The game changes based on which planet/moon you are trying to land. Be forewarned, this site does contain ads!

NASA
http://www.lerc.nasa.gov/WWW/K-12/airplane/newton.html

Although the language may be advanced, there are activities to help breakdown Newton' laws.

Pre-Visit Activities

The Tablecloth Trick and Inertia

Objectives

- Students will learn about inertia.
- Students will use observation skills to draw conclusions and make predictions.

Materials

- Plastic mug
- A smooth piece of paper
- Water
- Flat table top
- Ruler
- Journal

Procedure

1. Start with a mini-lesson about **inertia**. Here is some background information:

   As **Newton's First Law of Motion** states, an object in motion wants to stay in motion. When you are riding in a car, both you and the car are in motion. When the driver steps on the brakes, the brakes create friction with the car's tires, causing the car to slow down.

   Usually, if the car slows down gradually, you'll slow down with it. The friction of your legs against the seat, the seatbelt holding you down, your feet pressing against the floor, and other things combine to help you slow down.

   But if the car stops suddenly, **inertia** will cause you to keep going forward unless you are somehow tied down, like with a seatbelt.

   So, because of **inertia**, it's important to wear your seatbelt when you ride in a car, to make sure that you stop when the car stops.

   The opposite is true for objects that are at rest. In this project you will observe that an object at rest wants to stay at rest.

   Instructions for the Project:

2. Fill the mug half way with water.
3. Set the mug down in the middle of the piece of paper on a table or other flat, smooth surface. Make sure the outside of the mug and the paper are completely dry.
4. With a sharp jerk, pull the paper out from under the mug. If you have trouble keeping the mug in place, move it closer to the edge of the table. Grab hold of the paper that is hanging over the edge of the table, hold it straight out, and quickly strike the paper with a downward blow using a ruler. Why does the mug stay on the table?
5. Try pulling the paper out from under the mug using a variety of motions and forces.
6. **Record** your observations.

Post-Visit Activity

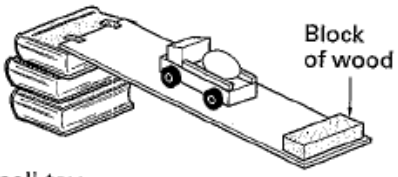
Seat-Belt Safety

Name_____ Date_____

Seat-Belt Safety

Science Seat belts and air bags protect the driver and passengers when a car stops abruptly.

Stuff Cardboard ramp (about 1 foot × 4 feet); several books; masking tape; small toy car; block of wood; hard boiled egg (or small doll) that fits inside car; cotton balls



What to Do

1. Tape a cardboard ramp to the top of the pile of books.
2. Tape a block of wood at the lower end of the ramp. The block of wood should be almost the same height as the front of the car.
3. Take a test run without the egg in the car by starting the car from the top of the ramp. Allow it to roll down the ramp and hit the block of wood. The car should hit the block of wood and stop. If it pitches over the wood, you will have to adjust the height of the wood stop.
4. Place the egg in the car.
5. Start the car from the top of the ramp. Observe what happens to the egg when the car hits the block of wood at the end of the ramp.
6. Use tape to secure the egg inside the car, and repeat step 5.
7. Tape cotton balls to the front of the egg that is taped in the car. Repeat step 5.
8. Remove the tape that was used to secure the egg inside the car. Tape the cotton balls to the front of the egg. Repeat step 5.

What's Going On Here

Newton's first law of motion says that an object in motion stays in motion unless some outside force acts on it. This law is also called the law of inertia. When the car with the egg in it rolls down the ramp, they are both in motion. At the end of the ramp, the car hits the block of wood and stops abruptly. If the egg is not fastened securely in the car, it continues moving, right over the top of the block of wood, and may even crack on the table or floor. This shows what can happen if you are not wearing seat belts and your car stops suddenly, as it would in an accident. When the egg is taped securely in the car, it stops along with the car at the end of the ramp. It may pitch forward a little bit, and the egg may actually hit the block of wood at the end of the ramp. Similarly, when you wear your seat belt, you may be injured in an accident, but you generally stay inside the car. The cotton balls attached to the front of the egg cushioned the egg when the car hit the block of wood, just as air bags do in real cars.