NEWTON'S LAWS OF MOTION

OVERVIEW: Newton's Laws of motion will introduce students to the world of physics and demonstrate that the world is truly a place of wonder. Using toys and other everyday objects students will discover the world of physics and how "Newton's Laws of Motion" affect everything physical that happens

OBJECTIVE: The students will gain insight into action/reaction, force/velocity, inertia, center of gravity, etc

GRADE LEVEL: 4-8

COMMON CORE STANDARDS: GRADE 4 PHYSICAL SCIENCE: Energy can be transformed from one form to another or can be transferred from one location to another.

GRADE 5 PHYSICAL SCIENCE: The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.

GRADE 6 PHYSICAL SCIENCE: An object's motion can be described by its speed and the direction in which it is moving.

Grade 8 PHYSICAL SCIENCE: Forces and Motion. 1. Forces have magnitude and direction. 2. There are different types of potential energy

TIME: 45 minutes

VOCABULARY

Motion: Result of unbalanced forces

Inertia: Resistance to change

Force: Push/pull

Mass: Amount of matter in an object. The mass never changes

Weight: Measure of gravitational attraction/force/gravity pulling an object toward the center of another. Weight can change

Speed: Distance travelled per unit of time

IMPORTANT:

Read all instructions before proceeding

MATERIALS: 3 containers and 2 brooms

Need:

1 raw egg

1 hard boiled egg

2 identical brooms

Paper towels

4 empty egg shells

Pie plate

Cups

Stack of coins

Wet rag

Marbles

Glass pop bottles

Barbie dolls and car

Various balls

Skateboards

Scale

Alka Seltzer and film canisters

Balloons

Pins

String

Straws

Pencils

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Newton's 1st Law: An object at rest tends to stay at rest unless acted upon by an outside force. An object in motion tends to stay in motion unless acted upon by an outside force.

1. Put these objects in this order, then strike the pie plate with a broom to knock it away, allowing the egg to fall straight down into the glass

Egg, toilet paper tube, pie plate, pitcher of water, edge of table

2. Flick out index card with the set up in this order: Coin, index card, cup

3. Roll Marble around paper plate (if they have an overhead, use that). Show the students the path it takes. Next, show students the plate with the cutout. Ask them to predict the direction the marble will go. Will it: a. Continue around the circle as though the piece is still there b. Continue in the direction of its last contact with the paper plate c. Move outward as soon as it leaves the paper plate

It will go straight because it is on a straight path. The plate was an outside force acting upon it, making it go in a circular path

4. Twirl a wet rag – Have the students line up in a circle. Have them raise their hand if they got wet. Which direction does the water fling?

5. Raw vs. Hard boiled eggs. Spin them on a tabletop, or overhead. Observe the spin. Stop the spin by placing a finger lightly on top of the spinning egg, and then quickly release your finger from the egg. The raw egg should then resume its spin, but the hard boiled egg will remain still. Have students guess which one is hard boiled, and which is raw.

6. Stack of coins: Flick another coin at the stack. It should only take out the bottom coin. Ask about what you are contacting? Where is the force being applied? That is why the bottom coin is the only one to move

7. Two glass pop bottles stacked mouth to mouth with a dollar bill in between. Snatch the bill and the bottles will stay.

8. 2 Barbie dolls with and without seatbelt and show how the one flies out of the car.

Newton's 2nd Law: F=ma

1. Broom race with various balls of different masses. Explain the difference of weight and mass. Set up cones and tap with broom to get around cones. The ball with the most mass won't win because it wants to continue going in a straight line. It also requires a greater force to move.

2 people on rolling chairs, facing each other, or on a skateboard. When they push off of each other, the larger (more mass) person should have less acceleration, whereas the lighter (less mass) person should have greater acceleration.

Ex. Takes a train longer to stop than a car (at the same speed) Why? Larger mass = more force/greater inertia

3. Throw objects – Heavier ball (basketball) and lighter ball (bouncy ball) to a volunteer. Ask: Which one takes more effort (F) to catch (decelerate.)

4. Drop a bouncy ball and a basketball on the floor. They will hit the floor at the same time, but the basketball will hit with much more force. Then have a volunteer lay down on the mat and do the same thing (the volunteer will feel the greater force)

Deep Knee Bend on a bathroom scale - weight decreases as you accelerate down and equalizes when you stop. Stand and see what you weigh. Squat and see if the weight drops.

Newton's 3rd Law" For every action there is an equal and opposite reaction

1. Alka Seltzer and film canisters. Set sideways to see that both objects move in opposite directions (have paper towels ready)

2. Ruler with marbles in the track (like Newtonian Demonstrator) – on overhead

3. 2 equal sized people on skateboards. Only one will push, yet both will move

4. Blow up a balloon and release

Set up a balloon taped to a straw on a string and make a rocket balloon that travels down the string

Use string and ring stands. Have a piece of tissue paper at the release point to show air coming out in the opposite direction as the balloon is moving

6. Blow into a bent straw. It moves in the opposite direction of the bend

If time allows, allow the students to make their own balloon rockets. There is a handout for this activity