

Lesson Plan: Newton Nuggets

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6 November 2016

Classes: 7th Honors

Unit / Lesson: Forces in Motion

Key Concept / Essential Question: Newton's 3 laws of motion

Standards:

- 7.PS.4 Investigate Newton's first law of motion (Law of Inertia) and how different forces (gravity, friction, push and pull) affect the velocity of an object.
- 7.PS.5 Investigate Newton's second law of motion to show the relationship among force, mass, and acceleration.
- 7.PS.6 Investigate Newton's third law of motion to show the relationship between action and reaction forces.

Materials: Magic Tablecloth (Tablecloth, heavy dishes and Styrofoam dishware), Push and Pull (2 spring scales, 2 bathroom scales), Speed it Up (Bowling ball, basketball or volleyball, tape for start and finish lines, rolled up pieces of paper), Looking Back (Wire frame with balls on ends... see image on instruction sheet), Balloon Zip Line (Balloons, tape, straws, yarn or other string, places to tie string off).

Objective: Students will...

- Investigate all 3 of Newton's laws, determining which law is best illustrated by each activity.
- Explain why the law that they chose applies to the activity.
- Apply their knowledge of Newton's laws to answer extension questions.

Grouping: Ideal group size is 3-5

Bell Ringer: Find Newton's laws in your textbook and re-write them in your own words.

Engage: Students will see stations set up around the room and be interested in what they get to do today.

Teacher support: Introduce activity (possibly while wearing the inertia frame from Looking Back??), and let the students go.

Explore: Students are allowed 7 minutes at each station to explore the activity. They can perform the described experiment as much as they would like to be sure they really know what's going on.

Teacher support: Clarify instructions and demonstrate activity if necessary.

Explain: The students must choose one of the three laws that they feel best explains what they're observing at that station, and explain what exactly they're observing that leads them to that conclusion.

Teacher Support: Discuss with student groups and ask clarifying/focusing questions if necessary.

Extend: For each station there is a second question that asks the students to think a little bit harder about the activity at the station, possibly trying something a little different, or creating a hypothetical difference. The students must use their knowledge of forces and what they observed at the station to determine what would happen in this slightly different situation.

Teacher support: Discuss with student groups and ask clarifying/focusing questions if necessary.

Reflection:

This lab seemed to have gone really well, I hope that the content stuck with the kids, but I think they really had to think about the laws and how they apply to real things which was good. Grading was difficult because the range of correct answers was so broad, basically if they had sound reasoning for their selected law they got points, but the hardest to grade things are probably usually the most impactful for the kids... unfortunately! ;)

In the original lab, for the “speed it up” station, the directions said to use a rolled up piece of paper to push the balls. I found that the students struggled with this, so changed the directions so they can just use their hands instead.

Name: _____ Date: _____

LAB: Newton Nuggets

Directions: Write the number of Newton's Law of motion that best describes what's happening at each station. More than one law can apply at each, BUT you must explain the reason you chose each law by relating the law with what you observed. There is an extension question for each station as well, be sure you leave enough time at the stations to complete them!

Law #1: If left alone, an object will keep doing what it is doing. If an object is not moving, it "wants" to stay not moving; if an object is moving, it "wants" to keep moving.

Law #2: The harder something is pushed or pulled, the quicker its speed will increase. If you push two objects with the same amount of force, the one that weighs the least will speed up quicker.

Law #3: If something is pushed or pulled, it will push or pull right back with the exact same amount of force.

Station 1: Magic Tablecloth

Law: _____

Explanation of law:

Now try using a styrofoam plate and plastic silverware instead of the heavier dishes. Did the weight of the objects matter? If so, why?

Station 2: Push and Pull

Law: _____

Explanation of law:

Can you push or pull in a way that will produce a higher reading on one scale than the other? Why or why not?

Station 3: Speed It Up

Law: _____

Explanation of law:

Is there anything you can do to make the bowling ball cross the finish line before the basketball while still releasing them both from the starting line at the same time? Explain.

Station 4: Looking Back

Law: _____

Explanation of law:

If the objects on the ends of the frame were lighter (say, cotton balls instead of tennis balls), do you think the frame would be more or less likely to move as you spin underneath it? Why?

Station 5: Balloon Zip Line

Law: _____

Explanation of law:

What would happen if you taped a second, same-size balloon onto the straw facing the other direction? Try it if you'd like to! Just be sure to record your results to answer the question!

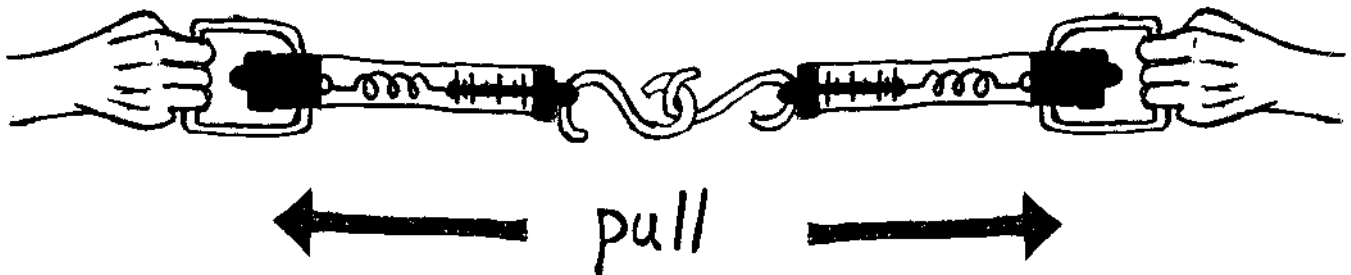
Station 1: Magic Tablecloth

Directions: Haven't you always wanted to try the old table cloth and dishes trick? To perform this time-honored magician's trick, place some of the (non-breakable) objects on the tablecloth, with a foot or so of cloth hanging off the end of the table. Grab the end of the tablecloth and quickly pull the tablecloth OUT and DOWN (do not pull upwards at all!) from under the dishes as quickly as you can. *Don't stop pulling until the table cloth is completely out from underneath the dishes!*



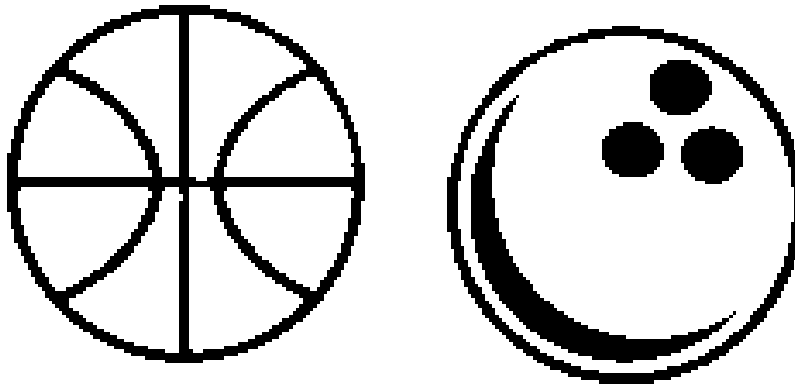
Station 2: Push and Pull

Directions: Start with the spring scales. Hook the scales together so that the handles are facing away from one another (as shown below). Now pull on the handles (don't pull too hard!) and read both of the scales. Now do the same thing with the bathroom scales, this time placing them bottom-to-bottom and having two people push them together. Again be sure to read both scales!



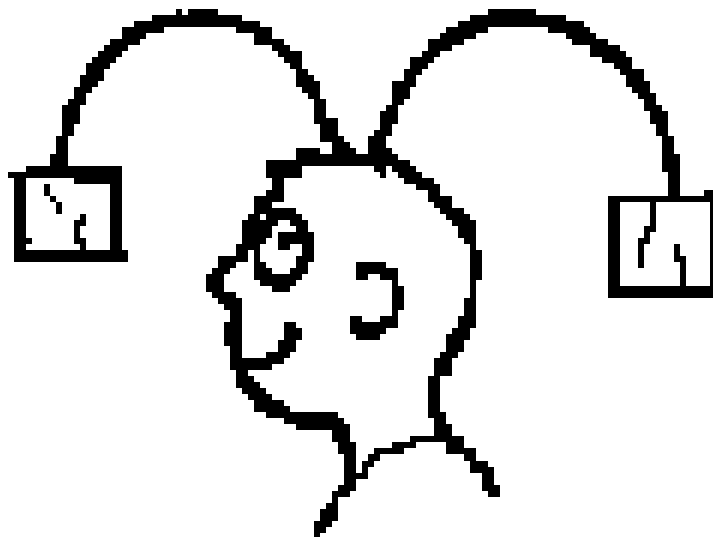
Station 3: Speed It Up!

Directions: Line up both the bowling ball and the basketball at the starting line, they're going to race! But it has to be a fair race, and they both have to be pushed with the same amount of force. Have one group member push the balls at a time to be sure the force is equal on both balls. Now give the balls a push and see who wins!



Station 4: Looking Back

Directions: Balance the center point of the wire on the top of your head. Make certain that no part of the wire frame comes in contact with the sides of your head. Now quickly spin around.



Station 5: Balloon Zip Line

Directions: Blow up the balloon and use a piece of tape to attach it to the straw on the piece of yarn so that the balloon's nozzle is facing the opposite direction from which you want your balloon to go. Release the balloon and watch it go!

