Force Introduction

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Concept: 1) What is force? 2) Types of forces 3) Investigate what forces are like and can do

Description of Activity: We started the class with games (tug of war and arm wrestling) to have the students "feel" force. We had a discussion about the games concerning the definition and effects. We then had 3 activities (one for friction, gravity and magnetic) for each group to work through on investigating forces. We emphasized "exploration" throughout the activities. The friction activity had the students testing how much force it required them to pull their tennis shoes across the floor. The gravitational component had them observing falling objects and finding acceleration due to gravity. The magnetic had them investigating what materials are magnetic and how magnets pull or push depending on orientation.

Anticipatory Set: Have the students answer "What is force?" through writing down examples thoughts and definitions. Get them thinking about the topic.

State Standards:

- PS.6.6.3 Conduct investigations of various forces using SI units (newton)
- PS.6.6.4 Recognize and give examples of different types of forces: gravitational forces, magnetic forces, friction
- PS.6.6.6 Compare and contrast weight and mass

Materials:

- Magnets (preferably neodynium)
- Force scales
- string
- plastic cup
- tape
- Triple Beam Balance
- Miscellaneous droppable items
- rope

Prerequisite Skills: Measure with a triple beam balance.

Key Questions:

- What is force?
- What effects do force have?
- What types of force are there?

Management Suggestions: Be careful with fingers getting pinched if neodynium magnets are being used.

Procedure:

1 Force Introduction Outline

What is force?
Materials:

- Rope

1. The "Do Now" section on the board should have the students answering, "What is force?"
2. After class is started, get them to come up with a class definition and write it on the board. Remind them to pay attention to the activities today and see if they have the right definition of force.
3. Take them outside if possible and play tug of war. Start with a random, even number configuration. Do variations: 1) all boys vs. all girls 2) all older students vs. younger students. 3) ask for a brave volunteer, and then tell him he is going to be by himself pulling. (All of the variations should give a feel for different amounts of forces and whether or not they were balanced.)
4. Next, have an arm wrestling match. Have a girls only and a guys only tournament (Tiffany suggested this because it would go faster, and the girls would probably be more involved.) Carry out the full single elimination tournament or shorten depending on time.
5. Bring them back inside and ask them if they saw or felt any forces. Get them to identify what the main force was in both games (push in arm wrestling; pull in tug of war). Ask them what happened when one force was greater than the other. Ask the brave volunteer how he felt pulling by himself. Get them to understand the general tendency of the motion of objects when forces act on them. Ask them if they ever experienced "balanced forces", which means that the object in question was at a stand still.

2 Types of Forces

The students should be encouraged to explore during these activities. Challenge them to go beyond what we tell them and then be ready to share what they find out. Praise anything beyond the normal during the wrap up discussion.
Give all supplies and instructions to each lab group, so they can work at their own pace.
Friction
Materials:

- Spring Force Scale

1. Have them test every shoe in the group on at least two surfaces of their choice.
2. Have them attach the SFS to their shoe and pull horizontally across the floor. Make sure they pull slowly because they will record the number on the scale when the shoe begins to move.
3. Repeat for every shoe on two surfaces.

Magnetic Materials:

- 10 Neodynium magnets

  string

- Tape

1. Have them begin by examining which objects are affected by magnets in the room. Have them make a table of objects that are and those that aren't.
2. Next have them answer the question "Does a magnet push or pull?"
3. Finally, have them attach a magnet to a piece of strng. Have them vary the distance from the object and write down how strong the magnet felt as it was moved closer and father away.

Gravity
Materials:

- 3-4 droppable items

  Spring Force Scale

- cup
- string
- triple beam balance

1. Have them drop 2 items and see if they can tell which one hit first. Repeat 3 times using various sized objects.

2. Next, measure the mass of all the objects they dropped. Divide this number by a 1000 and record in a table.

3. Now, we need to measure its weight using the SPS. Hang the cup on the SPS via the string. Record the number from the SPS. Place the first object in the cup. Record the number on the SPS. Subtract the first number from the second and record this as the weight of the object. Repeat for each object.

4. Divide the weight of the object by the mass. Record this number for each object.

Discussion & Follow Up Activities:

After the students complete the above activities, allow 20 minutes for discussion on what they have learned. Below are some key concepts that will help you lead the discussion to make sure it is discovered as the students talk about what they have found:

- Have them think about why one surface would take more force than the other?
- Friction is a contact force. It exists whenever two objects touch each other
- Friction always opposes the object's direction of motion.
- Magnets have poles (North and South). This explains why magnets can attract and repel.
- The magnetic force gets stronger the closer it is to the object.
- Where are magnets used today? TVs, stereos, washing machines, motors, and many more.
- Ask them if they could tell conclusively that one object hit the floor first. Ask how they let the objects go at the *same* time. Hopefully you'll get some unique ideas.
- Inquire what they thought about the numbers they got from dividing the weight by the mass. They should all be about 9.8. Inform them this is the rate at which gravity pulls *ALL* objects.
- Now mess with their minds by dropping a ball and a piece of paper at the same time. Ask them why the paper didn't hit at the same time as the ball. The answer is air resistance. The paper has a large surface area that interacts with all of the air molecules that exert a force upward against the paper and slows it down.

Hopefully by the time you cover all of that with students asking questions, you will have spent twenty or more minutes discussing what they've discovered.

Assessment Plan:

Participation in the discussions is what I go by in the immediate evaluation. It lets me know what they experienced. Later on we do quizzes to see if they've developed the "terminology" to describe what we've learned better.

Extension & Enrichment:

Ask the students to list where and how forces are used in everyday life. Get them to think about the importance of forces and how we know they are at work around us all the time.

Reflection: Overall, I really enjoyed the lesson and pleased at how well the kids explored in the lab. The kids really enjoy the games at the beginning as well as the magnets.
One item that I did poorly on was making sure the objects I chose for the gravitational experiment. Make sure the objects they drop actually make a significant reading on the force scale.