Hammer Time!

Summary

Students will predict, observe, and compare what happens when a force is applied to an object.

Materials

Straws
2" x 2" pieces of paper
2" x 2" pieces of cardboard
- Science Standard III Previously Taught at the Elementary CORE Academy pdf
- Swinging Hammer Construction Instructions pdf
- Swinging Hammer Diagram pdf
- Hammer Time! Data Sheets pdf

5 feet of (Schedule 40) 1/2" PVC Pipe
6 non-threaded PVC 1/2" Caps
3 non-threaded PVC 1/2" Standard T's
1 non-threaded PVC 3/4" x 3/4" x 1/2" Bullhead T
2 non-threaded PVC 1/2" Standard 90's (aka Elbows)
1 metal fingernail file or fine sandpaper
petroleum jelly
2-3 cotton swabs
PVC pipe cutter or PVC saw
retractable tape measure
pencil
1 40mm stone/glass/ metal sphere
1 golf ball
1 ping-pong ball

Background for Teachers

Prior to teaching this lesson, 3rd Grade Science Standard III, Objective 1 should already have been taught. Students will already understand that push and pull are two forces. They will understand how simple machines work. Students should also understand the Math concepts of right angles, and angles that are greater than or less than a right angle. See *Science Standard III Previously Taught at the Elementary CORE Academy* sheet.
Students will already know the following terms: push, pull, forces, motion, acute, obtuse, right, greater, less, simple machines, pulley, wheel & axle, inclined plane, lever, screw, wedge.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills.
2. Manifest Scientific Attitudes and Interests.
3. Understand Science Concepts and Principles.
4. Communicate Effectively Using Science Language and Reasoning.

Instructional Procedures

Invitation to Learn

When the students come in from recess, have the straw, paper, and cardboard waiting for them on their desk. Tell them to put the paper and the cardboard next to each other on the edge of their desk and try to blow them off. When they've had a chance to try each one, have them set down their

straws and ask them which one was easier to blow off their desk. Ask them why. Discuss how some kids can blow harder than others, etc.

Instructional Procedures

Construct the swinging hammer according to the directions on the *Swinging Hammer Construction Instructions* sheet prior to the lesson.

Have the students get out their journals. Pass out one *Hammer Time! Data Sheet* to each student. Have them write their name on it. It doesn't matter where, because they will be cutting them out later to tape into their journals.

Tell the students that you are going to explore forces and motion further today.

Find the place in your room on the floor that has the longest straight shot for a ball to roll and then setup the swinging hammer there. Carpet is best so that the ball is less likely to roll away before the hammer hits it. If you only have tile, you can make a tee by punching a hole in a piece of cardboard.

Tell the students that we are going to explore different forces first. We'll use the golf ball on each of three swings so that we have the same weight.

Have two student volunteers help you by each holding down one side of the stand. This will insure that it doesn't move during the swinging. Arrange the rest of the class around you so that they don't obstruct the path of the ball.

Move the hammer back about 30 to form an acute angle. Place the golf ball on the floor exactly in the center of the stand. Ask the students what they think might happen. Tell them to record their predictions in their journals. Then, let the hammer swing. It will hit the ball, and the resulting movement will be relatively slow, with the golf ball traveling a relatively short distance. Use the measuring tape to measure how far the golf ball went. Have them record it on their data sheet . Remind them to include the units, not just the number.

Repeat the procedure with a right angle and an obtuse (about 150) angle. Discuss the results with the students. Have them record their observations in their journals.

Get out the ping-pong ball and the stone sphere. This time, use a right angle for all three swings.

Repeat the procedure three more times, using the ping-pong ball, golf ball, and stone sphere. Be sure to discuss and record as before.

Extensions

For advanced learners, find spheres of approximately the same weight, but different material (e.g. rubber, cork, wood, clay, etc.). They don't have to be the same size, just the same weight. Have them use a right angle for each swing, and then observe what happens when each sphere is struck. Have them write down their theories as to why some balls go further than others when they are the same weight and the same force is applied.

For advanced learners, find objects with the same weight, but not the same shape (e.g. sphere, cone, cube, toy car, rock, candle, etc.). Have them use a right angle for each swing, and then observe what happens when each object is struck. Have them write down their theories as to why the objects don't respond the same, even though they are the same weight and the same force is applied.

For advanced learners, ask them how each of the simple machines could be used to alter the swinging hammer. Have them demonstrate if possible.

Make additional swinging hammers so that students can work in small groups to conduct the activity and further explorations.

Family Connections

Make additional swinging hammers that students may check out and take home to show family members what they have learned in school by giving a mini lesson.

Make additional swinging hammers that students may check out to take home. Students would

experiment with their family using different balls and then share their findings with the class.

Assessment Plan

Have the students cut out *Same Weight, Different Force* and *Same Force, Different Weight* from their *Hammer Time! Data Sheet* paper. Students should then tape them into their journals and record their observations in complete sentences, using correct vocabulary.

As a game or center, use a flat circle (paper works fine) and set it on the ground between one and ten feet away from the swinging hammer (also on the floor). Then students must choose the correct weight of ball and use the correct swinging force to get the ball in the circle without it going past. Each person takes a turn until someone gets it in the circle. Then, move the circle and do it again.

Bibliography

Research Basis

MacKenzie, A. H. (2001). The role of teacher stance when infusing inquiry questioning into middle school science classrooms. *School Science and Mathematics*. 101, number 3, 143-153.

This study was done to show how teacher attitude about science affected student attitude about science. Student wonder and "not knowing" is emphasized and valued. Science is not absolute knowledge, but rather contextual. Students learn to synthesize their own knowledge through exploration and experimentation. They are required to use their imagination to solve problems and reach scientific goals. Class discussion is important, as is student inquiry. This article explains how to accomplish this in the classroom.

Caram, C. A., & Davis, P. B. (2005). Inviting student engagement with questioning. *Kappa Delta Pi Record*. Fall, 18-23.

Questioning is important in the classroom. It taps into children's natural curiosity. This article gives a list of strategies to use to encourage questioning. It also has a Thinking Skills Model to give examples of all levels of questioning, so that all learners' needs are met.

Authors

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