Children's Museum of Houston

Pre/Post Classroom Activities

Clay Float: Exploring Archimedes' Principle

Rationale

FlowWorks gives visitors a chance to experiment with the power and properties of water. Water's natural physical and chemical properties come to life as the exhibit simulates a variety of natural phenomena, such as vortices and rapids, as well as human-created devices such as sprays and pumps. Visitors harness water's power through lock systems, boat building, and dams and, through various inquiry-based explorations, visitors have the opportunity to examine transformations of energy (ex. potential to kinetic or even kinetic to electrical) using water as a medium.

TEKS Objectives (Science)

5.2: The student uses scientific methods during field and laboratory investigations.

5.3: The student uses critical thinking and scientific problem solving to make informed decisions.

5.4A: Collect and analyze information using tools including calculators, microscopes, cameras, sound recorders, computers, hand lenses, rulers, thermometers, compasses, balances, hot plates, meter sticks, timing devices, magnets, collecting nets, and safety goggles.

5.7D: Observe and measure characteristic properties of substances that remain constant such as boiling points and melting points

Background

In this lesson plan, children become familiar with the concept of Archimedes' Principle (buoyancy) and how this concept relates to building a boat that will float. Archimedes' Principle states that the buoyant force on a submerged object is equal to the weight of the fluid that is displaced by the object. In order for an object to float, it must displace enough water to equal its weight, before it is fully submerged. An object will float if it weighs less than the amount of water it displaces. It will sink if it weighs more than the water it displaces. Differently shaped objects displace water differently, even if they are of the same material and have equal weight. This explains why huge steel ships float even though a ball of steel sinks. While in the exhibit, visitors will be able to test out their new found knowledge about buoyancy at the Currents' Boat Race Course by building boats and racing them.

Vocabulary

Buoyancy – the ability to float

Density – the measurement of how much matter is in a given amount of space

Mass- the amount of matter an object has

Volume- the amount of space an object takes up

Archimedes Principal- the weight of an object is equal to the weight of the liquid that the object displaces

Materials (per group of students)

- One small plastic container (bottom half of 2-liter soda bottle or similar container)
- Modeling clay
- Masking tape
- Ruler
- Balance
- Paper and pencil

Procedure

Set Up: Discuss Archimedes' Principle. After an introduction to Archimedes' Principle, students will be ready to explore the phenomenon through this activity.

1. Fill the clear plastic container with water.
2. Attach a piece of masking tape to the container vertically, running from the top of the container to the bottom. Mark the starting water level on the tape.
3. Using modeling clay and a balance, create two balls of equal mass.
4. Drop the first ball into the water. Observe and record whether it sinks or floats. Mark the resulting water level on the masking tape and use a ruler to measure the total change in water level. Record this measurement.
5. Remove the clay ball and put it aside. Check to make sure your water level still matches what is was when you started. If not, add more water.
6. Take the second clay ball and think about how you might shape it so that it will float. Shape the clay accordingly and place it in the water.
7. Observe and record whether the clay sinks or floats. Keep trying until you get a shape that floats.
8. Mark the resulting water level on the masking tape. Measure and record the total change in water level.

Questions to ask

- Why did one shape sink and the other float? Remember that the two pieces of clay are of equal mass.
- How did the shape of the clay effect the change in water level?
- How does this demonstration relate to Archimedes' Principle?

Extensions

Add weights (ex. washers) to the boat shaped clay, one at a time. See how many weights your "boat" can hold before it sinks. Describe what you observe using Archimedes' Principle.

NOTE: Build a Boat is an excellent follow-up activity for this activity post-visit.

Resources

http://www.instructables.com/id/Pop-pop-or-put-put-steamboat-made-easy-for-childre/ - This is a site with instructions on how to build a very simple steam-powered boat

http://pbskids.org/zoom/activities/sci/sodabottleboat.html - This website has a chemically powered (very safe) water bottle boat

http://pbskids.org/zoom/activities/sci/survivalraft.html - This challenge is a fun way to take this activity up yet another step

http://en.wikipedia.org/wiki/Buoyancy - More in-depth understanding of buoyancy and Archimedes' principle