STEM CAREER ADVENTURES

Oceanographer: Submarine Buoyancy

Adventure Description:

In this adventure, students will think like an oceanographer and learn to control the buoyancy of a research submarine.

Activity

Teacher Note: This lesson requires some teacher preparation. Please see Handout: Teacher Prep.

Step One: Background Information on Oceanographers and Buoyancy (5 minutes)

- Tell students that oceanographers are scientists that study the ocean.
- To study the ocean, oceanographers use research submarines that weigh over 200,000 pounds! These submarines take oceanographers all the way to the bottom of the ocean to conduct research. Even though these submarines are so heavy, they maneuver very easily underwater because they are buoyant!
- When something is buoyant, it has the ability to float. This happens because there are two forces at work: gravity and buoyancy!
- Gravity is a natural force that causes things to fall toward the Earth. It also "pulls" everything toward the center of the Earth. Gravity is the reason why your desk stays on the floor, and doesn't float away!
- Submarines float because the buoyant force is greater than the force of gravity. Submarines have special tanks that can fill with either water or air to change the weight of the entire submarine. Show Handout: Submarines.
- Explain to students that they will be testing different factors to learn about the buoyancy of submarines.

Step Two: Build a Submarine (10 minutes)

- Explain to students that they will build a submarine to learn more about buoyancy!
- Divide students into pairs or small groups.
- Provide students with Handout: Building a Submarine. Walk through the steps as a class.
- Provide students with the following materials:
  - Empty drink bottle and bottle cap with 1/16" hole drilled in the bottom
  - Prepared propeller with 1/16" hole drilled in the center
  - Small paperclip
  - Bead
  - 2 1/2" rubber band (about half the length of the water bottle)
  - 12" wire

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STEM CAREER ADVENTURES

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  - Hot glue
  - Large container, sink or tub of water
  - Pennies or other objects to use as weights for the bottle
- Have students complete Step 1 on the handout.

Step Three: Testing Your Submarine (15 minutes)

- Explain to students that they will now test the buoyancy of their submarines. Have students complete Step 2 on the handout.
- While students are working, ask them the following:
  - Why do you think we are using a water bottle instead of using something that looks more like a boat, like a plastic bowl? (Oceanographers study the surfaces under the surface of the ocean. If we used an open boat, it would fill up with water and sink. A water bottle can hold air inside of it without filling up with water.)
  - What do you think will happen when the propeller spins? (the submarine will move back and forth)
  - How are adding water to the bottle or adding pennies to the outside of the bottle similar? (They both add weight to the bottle.)
  - What do you think will happen when you add water or pennies to the bottle? (it will sink further in the water)

Step Four: Discussion (5 minutes)

- Have students showcase their submarines and discuss what worked well and what didn't. Did students have to add weights?
- As a class, discuss all of the variables that were changed while testing their submarines. Discuss how different variables can be tested, such as how many times the propeller is wound, the amount of water in the bottle, or the number and type of weight that is attached to the bottle.
- Extra Time? Have each group test one variable and report their results to the class.

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Materials List

Provided online:

- Handout: Teacher Prep
- Handout: Submarines
- Handout: Building a Submarine

Not provided (each student or group needs):

- Empty drink bottle
- 3 popsicle sticks
- Small paperclip
- Bead
- 2 1/2“ rubber band (about half the length of the water bottle)
- 12“ wire
- 1/16“ drill
- Hot glue
- Large container, sink or tub of water

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