FUTURE U.

Energy Team Classroom Visit

Underwater

Buoyancy Exploration

Overview

In this activity, students will pretend they have been invited to join the maritime team at Boeing for an internship that focuses on unmanned undersea vehicles. Before students start their internship, they will investigate the principles of density and buoyancy as they may apply to deep ocean research vehicles. Student groups will rotate through three stations as they investigate negative, positive, and neutral buoyancy to prove they are ready for their internship!

What do you need before you visit the classroom? (All of these are also listed in the activity.)

- One large bowl or container filled with water
- One orange
- Echo Voyager image, one to project or print
- Buoyancy Note Sheet, one per student
- Neutral Station Materials:
    - 3 sets of the following:
        - Neutrally Buoyant Directions, two copies
        - Large bowl or container (filled two-thirds with water), one
        - Large film canisters, pill containers, or anything with a top of a similar size, three
        - Towel or washcloth (for cleanup), one to share
        - Assortment of other items for the groups to share, such as:
            - balloons
            - tape
            - string
            - corks
        - Small masses to give the boats weight such as marbles, pebbles, coins, washers, etc.
        - Sponge (cut into small pieces)
        - Sandwich bags

- Positive Station Materials:
    - 3 sets of the following:
        - Positive Buoyancy Directions, two copies
        - Container of water that is deep enough for an apple to float in
            - *Note*: The container should be able to hold at least four cups of water.
        - Apple
        - Small, inflated balloon
        - Paper clip
        - Play-Doh, one palm-sized ball
        - Towel or washcloth (for cleanup), one to share
- Negative Station Materials:
    - 3 sets of the following:
        - Negative Buoyancy Directions, two copies
        - Small container (recommend solo disposable cups, but other food storage containers, empty hummus or cream cheese containers, etc. work), one
        - Large container (at least four times larger than the small container), one
        - Marbles, several
            - *Note:* In advance, test how many marbles it will take to sink the small container. Then give students a few more than this amount.
        - Pitcher of water, one
        - One marker
        - Beaker with milliliter measurements
        - Scale, at least one for the station to share
            - *Note:* If this is not available, weigh one marble in advance and be ready to share this info with students.
        - Towel or washcloth (for cleanup), one to share

Preparation

- Check with the educator about projection capabilities. In some cases, it may be easiest for you to send the video link to the educator in advance. In other cases, you may be able to easily connect your laptop.
- Connect with the educator ahead of time to copy all handouts.
- Take a moment to read through the lesson directions, but don't worry about following all directions precisely. If student engagement leads you briefly in another direction, that's fine. Just make sure students have enough time to experience all three buoyancy stations.
- Connect with the educator about the best time and place to organize each of the buoyancy stations.

What do you need to do when you get there?

- Set up buoyancy stations before students' arrival.
- Introduce yourself to students once they arrive.
- Follow the procedures listed.

What can you do while students are working?

- Say hello! Ask them what excites them about STEM and what questions they may have about your career or deep ocean research.
- Share a brief story! Students enjoy hearing stories about what you do for fun and what kinds of things you do at work.
- Be available for questions. Rotate to the different stations to help where needed.

Corrosion Report

Overview

Students will be told that Boeing is recruiting their help in expanding their line of ocean vessels. Boeing would like their insight on the optimal ship construction materials that should be used to avoid corrosion. After considering the elements that must exist for rust to occur, students will construct an experiment that tests: A) the types of metals that rust most and/or the fastest and B) whether coatings may be effective in preventing rust. After writing a hypothesis, students will set up their experiment and data capture sheet and the classroom teacher will be left with further instructions on how to continue the experiment over the following two weeks.

What do you need before you visit the classroom? (All of these are also listed in the activity.)

- Access to a device with projection capabilities or printed versions of
    - Warm Up Images
    - Boat Images
    - Corrosion Factors handout, enough for half the class
- Experiment Packet (3 pages, stapled), one per student
- Educator Follow-Up Sheet, one for the classroom teacher
- Part A Experiment Materials:
    - Enough of the following for groups of four students:
        - 5 small cups (clear and not paper), beakers, or test tubes
        - One piece of each of the following wire types:
            - steel
            - silver
            - zinc
            - copper
            - aluminum
                - *Note:* Cut each wire type in advance. Each one should be cut so that when it is placed in the cup, beaker, or test tube that students will be using, fingers can easily pull it out. It should be roughly the height of the container it will be placed in. Once the wires have been cut, place them in clearly labeled bags or containers (e.g., “Steel Wires,” “Silver Wires”, etc.).
        - For the class to share:
            - Painter tape, at least one roll
            - 4 liters of saltwater, separated into at least four different containers
                - *Note:* To prepare the saltwater, mix two tablespoons of salt per liter of tap water. You can mix this in advance and be prepared to explain to the students how you made this solution!

- Part B Experiment Materials:
    - Enough of the following for groups of four students:
        - 5 small cups (clear and not paper), beakers, or test tubes
        - 5 iron nails
    - For the class to share:
        - Remaining saltwater from Part A Experiment
        - Acrylic paint, at least two small containers
        - Paint brushes, at least four
        - Vaseline, at least two containers
        - Cooking oil, at least two containers
        - Plastic wrap, one carton
        - Scissors, several pairs
        - Painter's tape, at least one roll

Preparation

- Check with the classroom teacher about projection capabilities. In some cases, it may be easiest for you to send the images to the teacher in advance. In other cases, you may be able to easily connect your laptop.
- Copy and staple the Experiment Packet.
- This lesson requires a variety of materials. Try to organize the materials in advance and separate the Part A and Part B experiment materials. Place these in two different areas of the classroom before the session begins.
- Speak with the educator about continuing this experiment with the class and be ready to give him/her the Educator Follow-Up sheet.

What do you need to do when you get there?

- Set up materials for Experiments A and B before students' arrival.
- Introduce yourself to students once they arrive.
- Follow the procedures listed.

What can you do while students are working?

- Say hello! Ask them what excites them about STEM and what questions they may have about your career or marine engineering.
- Share a brief story! Students enjoy hearing stories about what you do for fun and what kinds of things you do at work.
- Be available for questions. Rotate around the room to help where needed.

Waterproof Transport

Overview

Students will be presented with the challenge of delivering materials to Boeing underwater Echo Voyager through the development of a watertight protective carrier. Using as few materials as possible, the carrier should: 1) have a way for the materials to enter; 2) be waterproof; 3) provide protection so the materials do not break; and 4) ensure that the carrier will sink down to the vessel. After constructing their carrier, class-wide testing will be performed, and students will assess each of the group designs. The activity will culminate with a discussion around the opportunities that their innovations present for protecting objects underwater and what may need to be considered if the carriers were to transport humans in the future.

What do you need before you visit the classroom? (All of these are also listed in the activity.)

- Echo Voyager images, to project or print
- Underwater Challenge handout, one per student
- Eggs, one dozen (regular or hardboiled)
- Water Contact Indicator Tape or washable markers
- Balloons, at least 10
- Plastic sandwich bags, at least 10
- Foil, at least one roll
- Duct tape, at least two rolls
- Scissors, at least 10
- Marbles, stones, or some other kind of weight, enough for the class to share
- Cushioning materials: bubble wrap, cottons balls, paper towels, etc., enough for the class to share
- Tall trash bin filled with water (greater than 2 feet tall but shallow enough so that your arm can reach the bottom!), one
- Towel, one for the instructor

Preparation

- Check with the classroom teacher about projection capabilities. In some cases, it may be easiest for you to send the website link to the teacher in advance. In other cases, you may be able to easily connect your laptop.
- Copy the Underwater Challenge handout.
- Prepare the materials in advance. It may be helpful to ask the classroom teacher about the best way to fill the trash bin with water before the session begins.

What do you need to do when you get there?

- Set up the testing station before students' arrival.
- Introduce yourself to students once they arrive.
- Follow the procedures listed.

A (Nursery) School of Fish

Overview

The partnership between NOAA and Boeing with the Wave Glider has revealed infinite possibilities for discovery. One recent discovery is surface slicks, the ocean's own private childcare. With an imaginary trip to Kona, Hawaii, students will get hands-on as they act as scientists using sand to replicate sifting through all the species ocean experts found in slicks. Students will also examine the sustainable technology innovations outfitted on the Wave Glider as it continues to collect and share data. They will walk away with actionable steps they can take to be ocean protectors.

What do you need before you visit the classroom? (All of these are also listed in the activity.)

- One sand kit per group of students:
    - Gallon-size bag of sand containing microplastics, debris, organic material
    - Mesh strainers to use as sieves
    - Large bucket to catch sand falling through the sieves
    - Tray to sort microplastics from other debris
    - Magnifying glass
    - Tweezers
    - Microscope
    - Data collection sheet

Preparation

- Review videos and reference links to familiarize yourself with the topic.
- Check with the classroom teacher about projection capabilities. In some cases, it may be easiest for you to send the videos and images to the teacher in advance. In other cases, you may be able to easily connect your laptop.
- This lesson requires a variety of materials. Try to organize the materials in advance.

What do you need to do when you get there?

- Set up the materials before students' arrival.
- Introduce yourself to students once they arrive.
- Follow the procedures listed.

What can you do while students are working?

- Say hello! Ask them what excites them about STEM and what questions they may have about your career or marine biology.
- Share a brief story! Students enjoy hearing stories about what you do for fun and what kinds of things you do at work.
- Be available for questions. Rotate to help where needed.