



Rubber Duck Rescue

Rubber duckies overboard! A shipment of rubber ducks fell off a cargo ship on their way from Hong Kong to the United States, and we need your help to collect them before they pollute the ocean! Design a Sphero™-powered rescue device to collect the ducks before they drift out to sea.

TEKS:

SCI 5.5A: The student is expected to classify matter based on physical properties, including mass, magnetism, physical state (solid, liquid, and gas), relative density (sinking and floating), solubility in water, and the ability to conduct or insulate thermal energy or electric energy.

TECH K-2.1C: The student is expected to explore virtual environments, simulations, models, and programming languages to enhance learning.

TECH K-2.1D: The student is expected to create and execute steps to accomplish a task.

TECH 3-5.1A: The student is expected to create original products using a variety of resources.

TECH 3-5.4D: The student is expected to evaluate technology tools applicable for solving problems.

Materials:

- 2 6 x 6-inch aluminum foil sheets
- 4 binder clips
- 2 craft sticks
- Cube of clay (or packaged rectangles)
- Plastic bin with water (or kiddie pool)
- Small rubber ducks (or anything that floats)
- Smart device with Sphero™ Edu App
- Sphero™ SPRK+ (or other Sphero™ bot) – can be purchased [here](#)
- 1 6 x 6 x 1-inch Styrofoam piece
- 2 tongue depressors
- 4 wooden skewers

How To:

Connecting and Driving Sphero™ in Water

1. Make sure the Sphero™ and smart device are charged.
2. Download the Sphero™ Edu App on the smart device.

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3. You can create a login or select "Continue as Guest." Creating a login will save your programs, but you will only need "Drive" mode and can just continue as a guest for this activity.
4. Next, press the "Home" tab at the bottom left corner of the screen. Press "Connect Robot." Then, select "Sphero™ SPRK+." Double tap the Sphero™ with the edge of the smart device. The robot should connect to the phone via Bluetooth. The Sphero™ will blink a blue light when it is connected.
5. After the robot is connected, carefully place it into the plastic bin filled with water to test it. Be careful, if the Sphero™ is dropped too far underwater it will lose its Bluetooth connectivity and will need to be reconnected.
6. Use "Drive" mode on the highest speed to drive the Sphero™ around on the top of the water.
7. Once you are confident that the Sphero™ is moving in the water smoothly, design and connect your rescue device to it!

Making the Rescue Device

1. Using the materials listed (or anything else you can think of) design a rescue device that can work with Sphero™ to collect all the rubber ducks! Consider the following when designing your device:
 - Sphero™ is waterproof and floats on water.
 - Overall, your device must be less dense than water to float. What materials will float? Test them out!
 - Sphero™ moves in all directions, so think about how you will attach the device to Sphero™ without restricting its movement.
 - Which part of your device will collect the ducks?
 - Test your device in water to be sure it will float on top of the water!

Rescuing the Ducks

1. Spread the rubber ducks along the surface of the water for your device to rescue. If you do not have rubber ducks, try rescuing something like ping pong balls or packing peanuts.
2. Once your device is connected to the Sphero™, drop it into the water.
3. Use "Drive" mode to steer the device around the plastic bin to collect the rubber ducks!

STEM Explanation:

Sphero™ is a spherical robot that is designed to work with the Sphero™ Edu App. A team of engineers had to work hard to fit all the mechanics and circuitry into the little robot, as well as programming it to work using the app. While driving the robot through the app is simple for users, the commands for this task are quite complex. If you want to start to understand how computer programmers write the code, there is a block programming section of the app that simplifies the code so you can drag and drop together your ideas of how the robot should move!

Have you ever wondered why big ships float even though they are heavy? This is because the density of an object, rather than just the mass of an object, determines whether or not the object will be able to float. Density is calculated by dividing the mass of the object by the volume of the object. Things like our Sphero™ and the rescue device are less dense than water, so they float on top of water. Objects that are denser than water sink.

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Career Connection:

Marine engineers research, create, and construct new boats, ships, and marine transport parts. A marine engineer might create blueprints or drawings, design engines, test prototypes, and supervise the construction of full-sized ships.

Resources:

<https://edu.sphero.com/>

<https://www.sphero.com/>

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