Flinkers

Learning Objectives

- Students will learn about forces and how they can be balanced.
- Students will learn about buoyancy and how to reach neutral buoyancy in a fluid.

Activity Overview

- Students will create an object with neutral buoyancy after learning about density and neutral buoyancy and how it relates to submarines and aircraft. They will create a "flinker" that both floats and sinks.

Standards Addressed

Science

- **SC.3.P.8.3** - Compare materials and objects according to properties such as size, shape, color, texture, and hardness.
- **SC.3.E.5.4** - Explore the Law of Gravity by demonstrating that gravity is a force that can be overcome.
- **SC.4.P.8.1** - Measure and compare objects and materials based on their properties including: mass, shape, volume, color, hardness, texture, odor, taste, attraction to magnets.

Materials

Item	Quantity Needed	Notes
Large Clear Plastic Bin	1	*For testing*
Fish Net	1	*To retrieve flinkers*
Washers	75	
Nuts and Bolts	150	
Shammie	1	*For clean up*
Paper Clips	75	
Index Cards	30	
Access to Water		*Sink*

Preparation

- Create 15 sets of materials for the activity:
  a. 1 film canister
  b. 2 index cards
  c. 5 paper clips
  d. 5 washers

e. 5 bolts
f. 5 nuts

- Fill the large clear bin ½ - ¾ of the way with water. Place the bin of water at a table for testing with the fish net and Shammie.

Science Content

Why do things float or sink? Objects float when they are positively buoyant, or less dense than the fluid in which they are immersed. Archimedes' Principle can explain this phenomenon – "When an object is immersed fully or partially in a fluid, it experiences an upward force that is equal to the weight of the fluid displaced by it." Objects need to have a greater ratio of empty space to mass than fluid. Basic understanding of buoyancy, density, fluids, and the Archimedes Principle is necessary in order to understand how things float.

Buoyancy is a force that moves an object upward. This upward force occurs when the object is immersed (either fully or partially) in a fluid that has measurable density. The fluid can be a liquid or a gas (not a solid).

1. **Negative Buoyancy** – An object is negatively buoyant when it is denser than the fluid it displaces. The object will sink because its weight is greater than the buoyant force.
2. **Neutral Buoyancy** - An object is neutrally buoyant when its density is equal to the density of the fluid in which it is immersed, resulting in the buoyant force balancing the force of gravity that would otherwise cause the object to sink or rise. An object that has neutral buoyancy will neither sink nor rise.
3. **Positive Buoyancy** – An object is positively buoyant when it is lighter than the fluid it displaces. The object will float because the buoyant force is greater than the object's weight.

Density is a measure of how much matter occupies a given amount of space. High density substances have tightly packed particles, and low-density substances are made up of loosely packed particles.

Source: http://seaperch.org/page-resources/how-things-work-how-things-float/#Buoyancy

Facilitation Guide

Engage (10 minutes)

1. Ask students if they have ever heard of the word "flinker". What do they predict the word means? *"Flink" is a combination of the words float and sink. A flinker is an object that has reached neutral buoyancy and has equal density of the fluid (water or air).*
2. Tell students today we will be doing an Engineering Design Challenge to see if they can create a flinker.
3. Tell them the goal for today is to make their film cannister flink for at least 15 seconds.

Activity (30 minutes)

1. Tell students that engineers use the **engineering design process** when solving a problem. The engineering process involves five main steps:
    a. **Ask** questions that will help you achieve your goal.
    b. **Imagine** at least two possibilities for your design.
    c. **Plan** the design before building.
    d. **Create** at least one design solution.
    e. **Improve** the design based on evidence around the original design criteria.
2. **ASK:** Ask students, "Before you begin, I'm sure you have some questions for me. What would you like to know to help you design your flinker?" Possible questions include the following:
    a. What materials will we have to use?
        a. 1 film cannister, 5 paper clips, 5 assorted washers, 5 assorted bolts, 2 index cards, and a pair of scissors.
    b. How much time will we have? You will have 7 minutes to imagine and plan with your team. You'll have 15 minutes to create, test, and improve your flinker. You will test and improve your flinker as needed while you try to reach your goal.
    c. How will we test? When your team is ready to test your flinker, you will place your design in your testing bin. Make sure your cannister is fully closed! The cannister must flink for a minimum of 15 seconds. Use the stopwatch to record your time. The cannister no longer flinks when the surface tension is broken or when any part of the cannister or the attached weight hits the bottom. Take your flinker out of the bin using the net and then improve and test as needed until you reach neutral buoyancy!

3. Once all student questions have been answered, students can begin to **PLAN** with their group what materials they will use for their flinker.
4. Students can then build their flinker and come up to the testing area to test their flinker. Students can keep coming up to test and improving their design until time runs out or they succeed at making their design flink for 15 seconds.
5. Remind students to record their trials on your worksheet and to include how you improved!

Reflect (10 minutes)

1. Ask students how buoyancy might affect an aircraft or submarine? Were they able to reach neutral buoyancy with their flinker?
2. Dry off non-consumable materials before storing them (film canisters, washers, bolts, nuts, fish net, clear bin).
3. Leave shammie out to dry before storing.