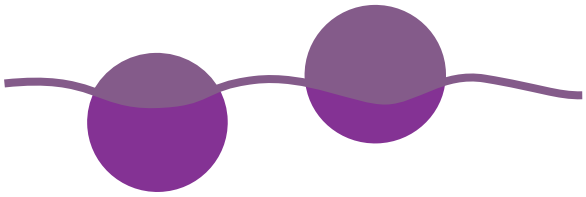
bitesizeactivities

Nature of Density



Activity Description

Explore the concepts of density and buoyancy at home using everyday household objects.

Materials

1	Bottle cap (metal)
1	Bottle cap (plastic)
1	Can of regular sugary soda
1	Can of diet soda (same variety as regular soda)
1	Egg
various	Other miscellaneous objects as desired

Preparation and Safety

Be careful with containers of water, especially around electrical items, infants, or anything else that might be damaged or harmed by our experiment.

General Introduction

The universe is made up almost entirely of stuff called matter, and density is the amount of matter in a given amount of space, or volume. An object that is very dense has a lot of matter squeezed into the volume of the object, while a less dense object has less matter relative to its volume.

What causes something to sink or float? The weight of an object is only part of what causes it to sink/float. When we put an object in water (or any other fluid), there is a contest going on between the object and the water as they "push" on one another. It is not a contest of the weight of the object versus the total weight of the water (otherwise, EVERYTHING would float in the ocean!), but rather a contest of the density of the object versus the density of the water. This relationship between the force or "push" of a fluid, like water, and an object's weight is called **buoyancy**.

Archimedes' Principle

Archimedes' Principle states that if you put an object in a fluid, like water or air, then the buoyant force that the fluid exerts on the object is equal to the weight of the amount of the fluid that the object displaced (weight is the force produced by gravity). What does

Activity Description (continued)

that mean? It means that when you put an object in a fluid, let's use water for example, it takes up space and moves some water out of the way. If the object weighs less than (or equal to) that displaced water, then the water underneath buoys the object up and the object floats. If the object weighs more than the displaced water, the water underneath doesn't buoy it up enough and the object sinks.

So where do we see Archimede's Principle in real life? We see it with anything that floats! Boats, ducks, lilypads, baloons – all of these things weigh less than (or equal to) the fluid that they're displacing. We also see it with anything that sinks! Stones, paperclips, keys – all of these things generally weigh more than the fluid they're displacing.

Plankton are a great example of an organism that uses Archimedes' Principle to its advantage. "Plankton" is the term that generally refers to the "floaters," the organisms in the ocean that drift with the currents. This includes the algae, zooplankton ("animal plankton"), phytoplankton (plankton that are capable of photosynthesis), and bacteria. Plankton are at the mercy of the wind and the waves, but not all are completely immobile. Some types of plankton can swim, but they swim only weakly or vertically in the water column. And not all plankton are tiny - jellyfish are considered plankton.

Plankton are known as "slow sinkers" – they weigh slightly more than the water that they displace, so they sink very slowly through water. When this slow sinking combines with ocean currents, the plankton are able to float within the ocean. This allows them to get the sunlight they need from the top layers of the ocean by keeping them from sinking to the bottom, but it also prevents them from floating on the top and risking overexposure.

Procedure

1. We're going to need somewhere we can happily and safely get things a least a little wet, like a sink, bathtub, or bucket, maybe we can even take this experiment outside!
2. We will be testing the buoyancy of different objects by observing whether they float or sink.
3. Observe the behavior of different objects in the water. Which ones sink and which ones float.
4. Can you combine some of these materials to make an object that sinks very slowly, meaning the object will be only very slightly denser than the water?

Extensions or Adaptations

- Testing Soda:
    1. If you have them, let's compare two objects that are exactly the same volume to see if they have the same density. We can use two different cans of soda, one diet and one regular.
    2. Place these in the water and observe. Do they both float? If so, do they float at the same height?
    3. Different soda have diiferent ingredients and can have different densities, so even though the cans are the same volume (355 ml), they can float differently due to the different relationships between their density and their bouyancy in water.
- Continue exploring the density and bouyancy realtionships of other objects. What patterns did you notice?
- You can dissolve things in your water and see how this changes the level at which your objects float. You could try floating an egg in a glass of tap water and then try floating it again after dissolving salt in the water. What's happening to the density of the water when you add the salt? (hint: you are adding more matter without changing the volume.)