

STEM from Home

Buoyancy And Surface Tension

A tennis ball looked enviously at a large magnificent ship and wondered how such heavy objects can float on water. After all, everyone knows a tennis ball sinks to the bottom so easily and the ship doesn't, even though it is heavier and bigger. The tennis ball wondered why this was so. Someone will have to teach the tennis ball about buoyancy - the ability of an object to rise or float when submerged in water. Perhaps you can help! Let's begin by exploring these concepts.

In this STEM Pack, you will use an online simulation to understand buoyancy. In the Bonus Activity you will conduct an experiment using the concepts of buoyancy, density, gravitational force and displacement. The Challenge Activity gets you to build a compass using your understanding of surface tension.

Main Activity: Buoyancy Sleuths

Introduction

In this activity, with the help of simulations you will investigate the buoyancy of different materials when immersed in various types of fluids.

What You Will Need

- A device capable of opening a web page e.g., a smartphone, tablet, or a computer.
- Internet connectivity.

What you will learn

1. Neutral buoyancy occurs when the density of an object is equal to the density of the fluid in which it is immersed. An object that has neutral buoyancy will neither sink nor rise.
2. Positive buoyancy occurs when an object is lighter than the fluid it displaces. The object will float because the buoyant force is greater than the object's weight.
3. Negative buoyancy occurs when an object is denser than the fluid it displaces. The object will sink because its weight is greater than the buoyant force.

Let's use a simulation to understand buoyancy.

[Click here to get started.](#)

Bonus Activities

Activity 1: Boats Afloat

Introduction

Archimedes principle states that any object in a fluid is buoyed up by a force equal to the weight of the fluid displaced by the object.

In this activity we will explore this phenomenon and come to a better understanding of buoyancy.

What You Will Need

1. A large tub of water
2. Clay (use an oil based clay so that it doesn't dissolve in water)
3. Lightweight paper to make sails
4. Toothpicks
5. Cello Tape/ Glue

What You Will Learn

- The concepts of buoyancy, gravitational force, displacement and density.
- Thinking observing and experimenting like a scientist.

Gather the resources and then [click here to access the activity guidelines](#)

A Little Bit of History....

Archimedes was a Greek mathematician, physicist, engineer, inventor, and astronomer. He was born on the island of Sicily in the city of Syracuse around the year 287 BC.



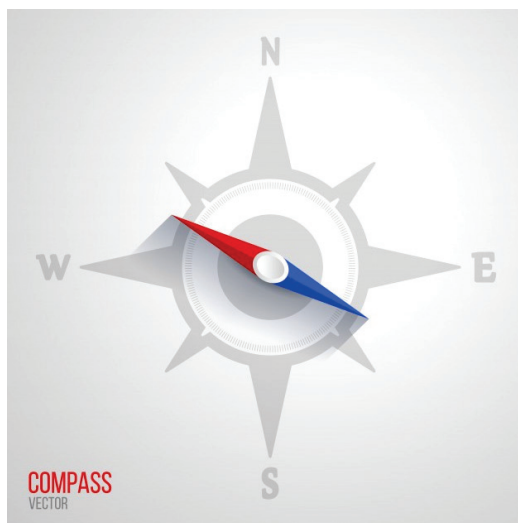
One day, King Hiero received a crown made from pure gold. However, he wasn't convinced that the goldsmith had been entirely honest. Hiero suspected that he had mixed some silver in the gold. So he called Archimedes and instructed him to figure out if the crown was indeed made of pure gold. Archimedes was stumped! He knew the density of gold and the density of silver, but he wondered how to determine the purity of the gold crown?

His Eureka moment came while taking a bath. He realized that he could measure the amount of water the crown displaced and then he could compare that with the weight of the object. Once he had this information, he could determine if the density of the crown matched with pure gold.

Challenge Activity : Floating Compass

Imagine you are out on a trek with your friends in the forest and have lost sight of them, midway. The forest is a confusing place and you are not sure which way to go. Your ultimate destination is southward towards a camping site.

You need to reach the site before sunset.



You need a compass to help you move in the right direction. Unfortunately, you don't have one. Rummaging through your bag, you do find the following things:

1. Some sewing needles
2. A plastic bowl
3. A bottle of water
4. Some wax paper
5. A Magnet

With the help of the things you have, construct a workable magnetic compass. A compass is a device that shows the cardinal directions used for navigation and geographic orientation. It consists of a magnetized needle which can pivot to align itself with magnetic north.

To help you in your task, here is a concept:

Surface Tension: The property of the surface of a liquid that allows it to resist an external force, due to the cohesive nature of its molecules is called Surface Tension. The molecules of water cling to each other to form an elastic thin skin on the surface of the water. Things like needles and paperclips can be made to float if this film on the surface of water is not disturbed.

Here's an [interesting experiment](#) you could try out later after completing your compass challenge activity.

How Magnets Magnetize Other Objects: In magnets, electrons align in the same direction, giving them their magnetic energy. Magnetic metals also have electrons, but they are arranged in different directions. When the magnet rubs against the metal object, it causes the electrons to align and magnetizes the object. The object will hold its magnetism for a while.

Your project needs to be handmade but your final submission can be presented digitally using [Docs](#) or [Presentation](#) software.