STEAM Subject: Marine Science
Lab: Saltwater Density

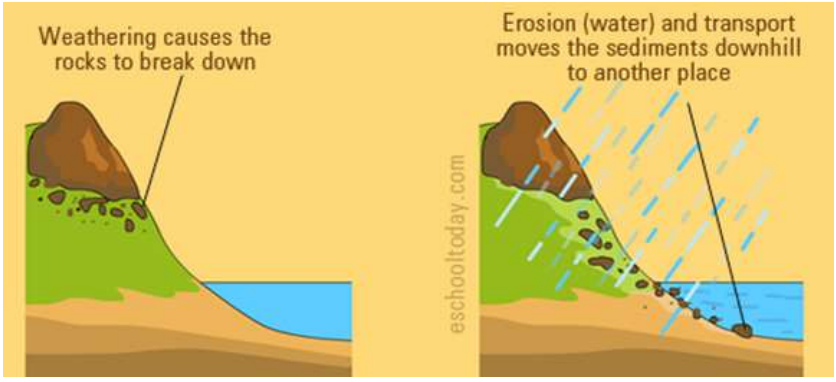
Grades: 2-6

Learning objective:
Students will be able to observe differences in salinity and its relation to water density, and discuss how density and salinity changes can affect marine organisms.

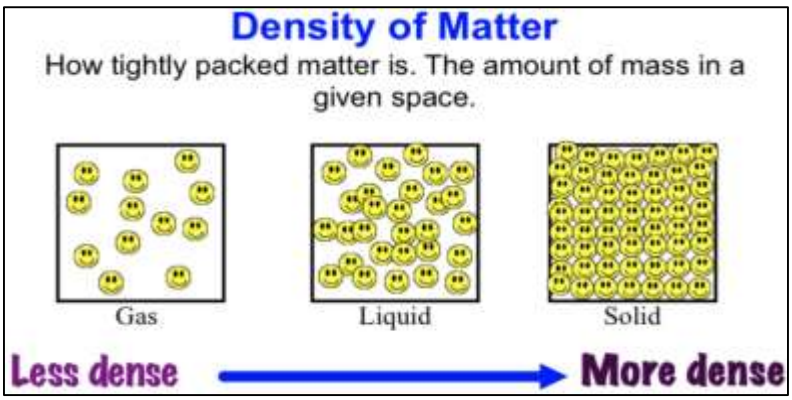
Key Concepts:
- Density is the relationship between the size of an object and its mass.
- Salt can change the density of water by adding more mass.
- Objects that sink in fresh water will sometimes float in saltwater, due to the difference in density. The addition of salt will make heavier objects float as well.
- Salt concentration in the ocean can change based on weather, rivers, evaporation, etc.
- Changes in salt concentration can affect habitats and animals in the ocean.

ENGAGE:
Ask students the following questions:
- Have you ever tried to float in the ocean? What about in a pool?
- Is it easier to float in the ocean or a pool? We float easier in saltwater because of its higher density.
- What about some of the biggest mammals on earth that float easily in the ocean? Animals like blue whales, which weigh almost 200 tons, use the density of saltwater to help them live and grow to such a large size.

EXPLORE:
Intro to density and salt water:
- Why do you think the ocean is salty?
  - Salt comes from the rocks on the land that have been broken down by erosion; it is carried by streams to the ocean.
  - Erosion is the gradual breakdown of rocks by wind, water, or other natural processes.
  - Image credit and more information about erosion: http://www.eschooltoday.com/rocks/erosion-and-transportation-of-rock-sediments.html



- What is density?
  - Big items that feel light, like a ping pong ball, are less dense than smaller items that feel heavy, like a gold ring. When added to water, objects that are denser than water sink and those that are less dense than water float.



  - Image credit and more information about the states of matter: http://www.atmo.arizona.edu/students/courselinks/fall16/atmo336/lectures/sec1/gas.html

- What do you think happens when you add salt to the water? The density would increase as there are more molecules. Could we change whether the object sinks or floats?

Floating Egg Activity*:*

Materials needed per student:
- 2 clear glasses or cups (big enough to hold an egg)
- Warm water
- Salt
- 2 eggs

Experiment Set up:
- Fill the glasses up about $^{2}/_{3}$ full with warm water.
- Leave one glass with just water (no salt) and add 3 tablespoons of salt to the other glass.
- Mix well to dissolve the salt.

Directions:
Ask students *what they think will happen if you drop the egg into the glass of just water*.

- Students will add the egg to the water-only glass. *Then ask the students what they think will happen when you drop the egg into the salty water*.
- Students will add the second egg to the salty water. The second egg should float due to the change in density of the water.

Optional Activity:
Students can experiment with different objects around the room as well. Start with small plastic items then move on to others. If the object sinks in the salt water, ask the students what they think they should do to make it float (should they add more salt?).

Discussion:
Adding salt water makes the water denser. As the salt dissolves in the water, it adds mass (more weight) to the water. This makes the water denser and thus allows more objects to float on the surface that would otherwise sink in fresh water.

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Probing/clarifying questions:
- What happened to the first egg? The second?
- What does this tell you about the ocean?
- Do you think salty water sinks or rises compared to fresh or less salty water? *It will sink below the fresh water.*
- What kinds of natural process make the ocean less salty? *Rain, fresh water runoff.* What would make it saltier? *Evaporation, sediment runoff.*

EXPLAIN:
Watch video about salinity and its effect on marine life.
- https://www.youtube.com/watch?v=jzTBR2APU-k

Discuss how changes in the salinity of the water could affect the ocean and the organisms that live there.
- Changes in the salinity of water could affect the movement of ocean currents due to stratification of water.

- Marine life is adapted to a certain concentration of salt, just as they are adapted to a specific temperature. Changes in salinity could negatively affect organisms, as they would need to regulate their intake of saltwater. Fresh water plants and animals need to maintain the same salinity inside their bodies as outside, which is difficult to change quickly.
- Many parts of marine life cycles are affected by salinity. For example, the growth and development of fish eggs and larvae are dependent on salinity.

Review STEM Vocabulary:

- **Density:** the degree of compactness of a substance; measured by the quantity of mass per unit volume.
- **Erosion:** the gradual breakdown of rocks by wind, water, or other natural processes.
- **Evaporation:** the process of a substance in a liquid state changing to a gaseous state due to an increase in temperature and/or pressure; a fundamental part of the water cycle and is constantly occurring throughout nature.
- **Fresh water inputs:** any source of fresh water that is deposited into the ocean (rain, rivers, human inputs, etc.)
- **Halocline:** vertical zone in the oceanic water column in which salinity changes rapidly with depth, located below the well-mixed, uniformly saline surface water layer.
- **Salinity:** the concentration of dissolved salt in a given volume of water.
- **Stratification:** when water masses of different properties (salinity, temperature, density, etc.) form layers that act as barriers to water mixing.

EVALUATE:

Have students think of ways that drastic changes in salinity in the ocean might affect human life (agriculture, drinking water, seafood, etc.)

RESOURCES:

https://littlebinsforlittlehands.com/simple-salt-water-density-science-experiment-saturday-science/