

# Training for Educators

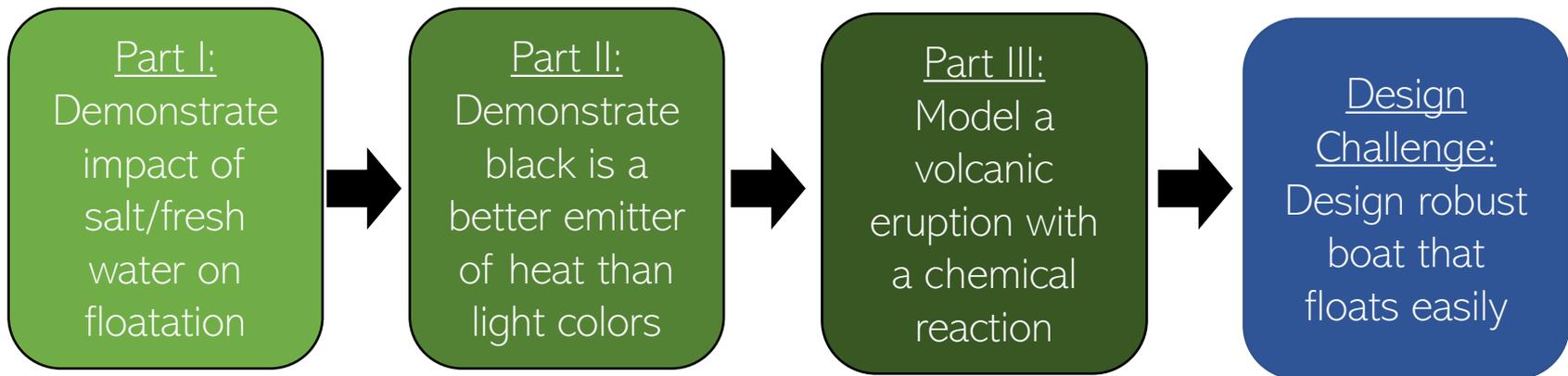
## Experiencing the Natural World

Secondary Level  
Ages 12-18

# Mission of the lab

- This lab kit will teach secondary level students about floatation, heat transfer and emission, and the mechanics of a volcano and volcanic eruption.
- The main takeaways are:
  - The density of the fluid must be equal to or greater than the density of an object for it to float.
  - Salt water is more dense than fresh water, thus objects float better in salt water.
  - Heat transfer occurs by conduction, convection, and radiation.
  - Darker colors are better absorbers of light and better emitters of heat.
  - Volcanic eruption is the process by which magma and gas are pushed at high speeds through a small opening in the Earth's surface.

# Summary of experiments



There are 2 experiments and 1 demonstration in total.

# Supplies list

- Water
- Eggs
- Salt
- Spoons (teaspoon sized)
- Wooden sticks
- Clear plastic or glass jars or cups
- Tin or metal cans (half outside painted black and half painted white or left shiny)
- Candles
- Wax/butter/coconut oil
- Matches or lighter
- Wood blocks (or metal or glass pieces) to act as stand for metal can
- Empty bottles
- Vinegar
- Baking soda
- Food coloring (natural or synthetic)
- Clay soil
- Wood blocks to act as stand for model volcano

# Safety considerations

Before the students begin the laboratory, please take into consideration the following safety concerns:

- While the lab utilizes some food items, students should not taste or smell any of the chemicals during the experiments.
- Students should handle fire and candles with care, as well as the metal can once it is heated by the candle, to ensure they do not burn themselves.

# Setting up your space

- Gather your supplies and separate by experiment(s) on your table.
- These are our recommendations:
  - Each student should have a pencil or pen.

Groups of 2-4 students can be given the following supplies:

- 2 clear jars, 2 eggs, 1 spoon, 1 stirrer, 1 can (half painted black/half painted white or left shiny), wood blocks to act as a stand for the can, 1 candle, 2 wax coated sticks, wood base, 1 empty bottle

The class can share the following supplies based on availability

- Water
- Salt
- Lighter/matches
- Baking soda
- Vinegar
- Food coloring
- Clay soil

# Part I. Effect of Density on Floating Object

- Set-up:
  - Each group of 2-4 students gets 2 clear jars, 2 fresh eggs, 1 spoon, and 1 stirrer. The class can share salt and water.
- Procedure:
  - Students add salt to water and see the effect of density on the eggs floating or sinking.
- Results:
  - The egg in the fresh water will sink, while the egg in the salt water will float

The takeaway is that the density of the fluid must be equal to or greater than the density of an object for it to float and salt water is more dense than fresh water.

# Part I. Effect of Density on Floating Object: Results



# Part II. Heat Transfer & Emission

- Set-up:
  - Each group (2-4 students) will need 1 can (half-painted black/half-painted white or left shiny), 2 wooden sticks (can already be covered with wax or other very low melting point material, like butter or coconut oil), 1 candle, and wood blocks to act as a stand for the can.
- Procedure:
  - Students will position sticks on either side of the painted can. The candle will be placed underneath the can.
- Results
  - Students will see that the wax melts faster on the stick nearer to the black-painted side than the white-painted/shiny side.

The takeaway is that black is a good emitter of heat, which has been transferred from the candle.

# Part II. Heat Transfer & Emission: Set-up



# Part III: Volcanic Eruption

- Set-up:
  - Each group (2-4 students) will need 1 empty bottle, 1 spoon, and 1 wood base. The class can share vinegar, baking soda, red food coloring, and clay soil.
- Procedure:
  - Students will pack wet clay soil around an empty bottle (placed opening up). Baking soda, red food coloring, and vinegar will be added to the bottle.
- Results
  - Students will see red foam “erupt” out of their volcano.

The takeaway is that a volcanic eruption is the process by which magma and gas are pushed at high speeds through a small opening in the Earth’s surface, and the simple volcano models this behavior, though with a chemical reaction to create the “eruption”.

# Part III: Volcanic Eruption: Results



# Design challenge

Students are asked to think about constructing a robust boat that can float easily on the water. The instructor should encourage the students to think about different types of materials from which the boat could be made, taking into account different factors like density and properties of the materials.

- Questions to ask the students
  - What materials would you use to create your boat? Why would you choose these materials?
  - How could you make your constructed boat float better?