

# Oily Ice

**Category:** Chemistry, Physics

**Type:** Class Experiment (30 min)

**Materials:**

1 cup	Vegetable oil
1	Clear plastic cup
1	Bottle of dark food coloring
1	Ice tray
	Water



**Video:** <http://youtu.be/KPakMMym2bo>

**How To:**



Make blue ice by adding one drop of blue food dye to each section of an ice tray and fill with water. Place in the freezer until frozen.



Fill  $\frac{3}{4}$  of a clear plastic cup with oil.



What will happen when the ice is placed in the oil? Will it sink or float?



Gently place the ice in the oil and observe what happens. What will happen when the ice melts?



Observe what happens. Why is this happening?

### Fine Points:

- A glass can be used instead of a plastic cup.
- The oil can be poured back into its container and used for further experiments. Do not pour the water/oil mixture at the bottom of the cup back in.

### Objectives:

*During this lab students will learn:*

1. Liquids have different densities.
2. Liquids have hydrophilic and hydrophobic properties.

### Concepts Involved:

- The density of a liquid determines whether it will float above or sink below another liquid.
- A liquid will float if it is less dense than the liquid it is placed in.

### Focus Questions:

1. What are the possibilities for what will happen when the ice is dropped in the water?
2. What will happen when the ice starts to melt?
3. Would a single drop of water sink or float in a big barrel of oil? Would a single drop of oil sink or float in a big barrel of water?

### Elaboration:

Liquids, like solids, have a mass and a volume, and also a density. The mass of something tells you how heavy it is. The volume tells you how much space it takes up. The quantity called density is determined by using both the mass and the volume; density takes both of these other quantities into account. The density of something depends on how closely packed its molecules are, and the mass of those molecules.

Things float or sink in a fluid depending on their density and the density of the fluid. Everything that floats in water – boats, wood, ice, people – is less dense than water. Things that sink in water – nails, marbles, rocks, golf balls – are more dense than water. With two liquids together, it is the same. Whichever has the larger density will fall to the bottom. Oil floats on top of water because oil is less dense than water.

It may seem simpler to say oil is lighter than water, but whether it is lighter or heavier depends on how much of it there is. For example, a tiny drop of water is lighter than a whole bucket of oil, but it will sink to the bottom of that oil, just like in this experiment.

One of the interesting points in this activity is that ice floats, but water sinks, even though ice and water are the same thing! Most liquids get smaller when they freeze, which means the solid form is denser.

However, when water freezes, it gets larger. It still weighs the same, but it takes up more space, which means it is less dense. That is why ice floats in oil. This is also why water in ponds and lakes and the ocean freezes on top and the bottom can remain liquid. This obviously makes a big difference for the animals that live in the water under the ice.

Oil and water do not mix because they cannot form any chemical bonds with each other. Water is made up of highly charged, 'water loving' molecules (scientifically known as hydrophilic), while oil is made up of long chains of carbon that are 'water hating' (hydrophobic). Oils do not have a charge and are therefore not attracted to the water molecules, causing the separation we see. In this experiment, you will observe a drop of water hanging from the bottom of the ice cube. When the drop gets large enough it pulls free of the ice and slowly sinks to the bottom of the glass.

### **Links to k-12 CA Content Standards:**

#### Grades k-8 Standard Set Investigation and Experimentation:

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

#### Grades k-12 Mathematical Reasoning:

1.0 Students make decisions about how to approach problems:

- 1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
- 1.2 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:

- 1.1 Use estimation to verify the reasonableness of calculated results.
- 1.2 2.2 Apply strategies and results from simpler problems to more complex problems.
- 1.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
- 2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students move beyond a particular problem by generalizing to other situations:

- 3.1 Evaluate the reasonableness of the solution in the context of the original situation.
- 3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
- 3.3 Develop generalizations of the results obtained and apply them in other circumstances.

#### Grade 1 Standard Set 1. Physical Sciences

Materials come in different forms (states), including solids, liquids, and gases. As a basis for understanding this concept:

- 1.a. Students know solids, liquids, and gases have different properties.
- 1.b. Students know the properties of substances can change when the substances are mixed, cooled, or heated.

#### Grade 3 Standard Set 1. Physical Sciences

Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:

1.e. Students know matter has three forms: solid, liquid, and gas.

1.h. Students know all matter is made of small particles called atoms, too small to see with the naked eye.