

# STEM in the lab

.....● Inspiring Idaho's future STEM workforce

## OIL SPILL EXPERIMENT



### GRADE LEVELS

This activity is appropriate for grades K-5.



### VOCABULARY

**ECOSYSTEM:** a biological community of interacting organisms and their physical environment.

**EMULSION:** putting two or more liquids together creates an emulsion if the liquids do not mix.

**EMULSIFIERS:** molecules that have two different ends: a hydrophilic end (water-loving) that forms chemical bonds with water but not with oils, and a hydrophobic end (water-hating) that forms chemical bonds with oils but not with water.

**HYPOTHERMIA:** when your body loses heat faster than it can produce heat, causing a dangerously low body temperature.

**OIL SPILLS:** the release of a liquid petroleum hydrocarbon into the environment, especially the marine ecosystem, due to human activity, and is a form of pollution. The term is usually given to marine oil spills, where oil is released into the ocean or coastal waters, but spills may also occur on land.

**POLLUTION:** the presence in or introduction into the environment of a substance or thing that has harmful or poisonous effects.

### ABOUT THIS ACTIVITY

Oil is used every day in our lives. We use oil to fuel our cars, trucks, and airplanes. By products from oil refining are used in the production of plastics and chemicals, as well as many lubricants, waxes, tars, and asphalts. Sometimes accidents happen with the transportation of oil. When accidents happen, the oil can leak or spill oil into the ocean. Oil spills are a form of pollution generally found in marine ecosystems. Oil spills are harmful to marine birds, mammals, and fish. Oil coats the feathers and fur of marine life, which leaves the animals susceptible to hypothermia because their fur cannot protect them from the weather. Oil can also blind animals when it gets in their eyes, making them no longer able to watch for predators. Birds can die from oil spills if their feathers are covered in oil. When they try to clean their feathers, they ingest the oil and are poisoned. Soap has helped clean thousands of animals affected by oil spills. In this activity, you will see what happens when soap is added to an oil and water mixture.



### MISSION

Test what happens when soap is added to oil and water.

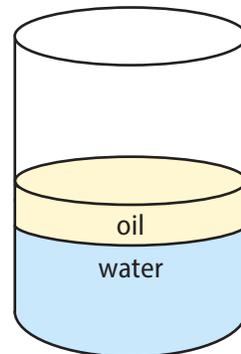


### MATERIALS

- » Tin pan (or cake pans)
- » Water
- » Dawn dish soap
- » Cooking oil
- » Natural food coloring
- » Medicine dropper
- » Spoon
- » Paper towels
- » Cotton balls

## INSTRUCTIONS

- 1 Fill the tin pan about halfway with water.
- 2 Add about 1 tablespoon of cooking oil and observe. Because water is denser than oil, the liquids will separate, and the oil will rise to the top.
- 3 Add a few drops of food coloring and observe what happens.
- 4 Try different ways to clean up the oil. Can you use the cotton balls? The paper towels? How about the spoon or medicine dropper to scoop out the oil?
- 5 Next, add 2 teaspoons of dish soap. The dish soap acts as an emulsifier by breaking the oil down and allowing it to mix with the water.
- 6 Notice how the food coloring tints the water to a uniform color and the oil no longer rises to the top.



## THE SCIENCE BEHIND IT



Oil and water don't mix. Oil is sticky and greasy, and hard to clean up. If you look at the chemical properties of oil and water, you can see why. Each water molecule is made of two hydrogen atoms and one oxygen atom. When the two hydrogen atoms bond with the oxygen, they attach to the top of the molecule. This molecular structure gives the water molecule polarity, or a lopsided electrical charge that attracts other atoms. The end of the molecule with the two hydrogen atoms is positively charged.

The other end, with the oxygen, is negatively charged. Just like a magnet, where north poles are attracted to south poles (opposites attract), the positive end of the water molecule will connect with

the negative end of other molecules. Because of their polarity, water molecules are strongly attracted to one another. What happens when oil and water are put together? The two liquids won't mix.

Oil and water don't mix, so they separate into two different layers. When soap is added to the mixture, it breaks up the oil into smaller drops, which lets the oil mix with the water. It works because soap is made of molecules with two very different ends. One end of soap molecules love water; they are hydrophilic. The other end of soap molecules hate water; they are hydrophobic.

When you add oil to water, the oil floats on the surface of the water. And if you shake the two together, then leave them to stand, tiny droplets of oil float upwards. These droplets join until eventually the oil is floating on the water again. To stop the two liquids from separating, you need a substance called an emulsifier. This is how soap cleans your hands – it causes drops of grease and dirt to be pulled off your hands and suspended in water. These drops are washed away when you rinse your hands.

## EXTENSIONS

- » Try other things like a sponge, very fine mesh strainer or cheesecloth to remove the oil
- » Research how scientists take care of animals that have been exposed to oil spills
- » Dip feathers into the oil/water mixture. What happens to the feathers?

## RESOURCES

- » Oil Spills: Sad But True  
<https://www.kidzworld.com/article/24170-oil-spills-sad-but-true>
- » Soap: How does it get things clean?  
<http://www.planet-science.com/categories/under-11s/chemistry-chaos/2011/06/soap---how-does-it-get-things-clean.aspx>



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