Building a Density Tower
Student Worksheet

Name:

Class:

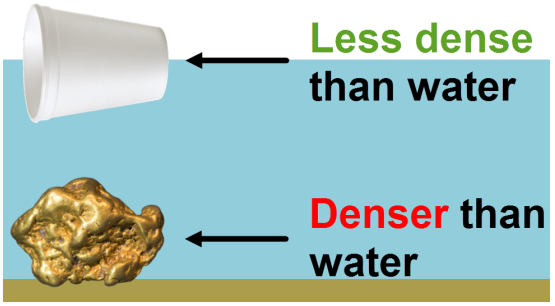
Date:

Aim

To build a density tower and use it to compare the densities of different objects.

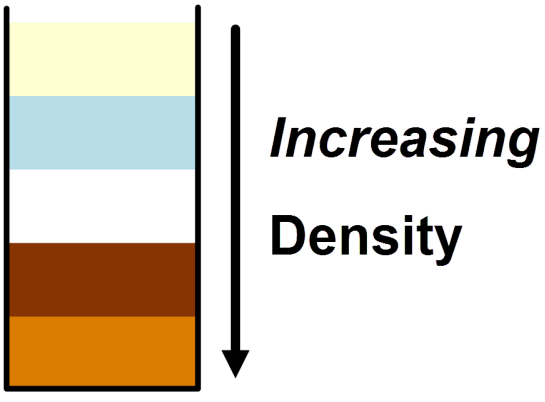
Background Information

Density is the ratio between mass and volume. An object that is heavy for its size will have a high density, while an object that is light for its size will have a low density. To find the density of an object or substance, divide its mass by its volume.



Density determines what floats and what sinks. An object (or fluid) will sink when it is more dense than the fluid it is placed in and float when it is less dense. For instance, gold and maple syrup are more dense than water, so they sink in water. In comparison, Styrofoam and vegetable oil are less dense than water, so they float in water.

This can be seen in a density tower. A density tower contains layers of fluids with different densities. The low density fluids float on top of the high density fluids. This means the density of the layers increases as you move down the tower.



If an object is dropped into the tower, it will sink through fluids that it is more dense than, but will float once it hits a fluid that it is less dense than. By seeing how far down different objects sink, you can compare their densities and identify which objects are more dense than others.

Pre-Practical Questions

1) The density of a substance is the ratio between what two traits?

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2) Mercury is a liquid metal with a density of 13.56 g/mL. In comparison, water has a density of 1.00 g/mL. Does mercury float or sink in water? Justify your answer.

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3) When you mix sand, oil and water, the sand sinks to the bottom and the oil floats to the top, creating three layers.

   In the space below, rank these substances from least dense to most dense.

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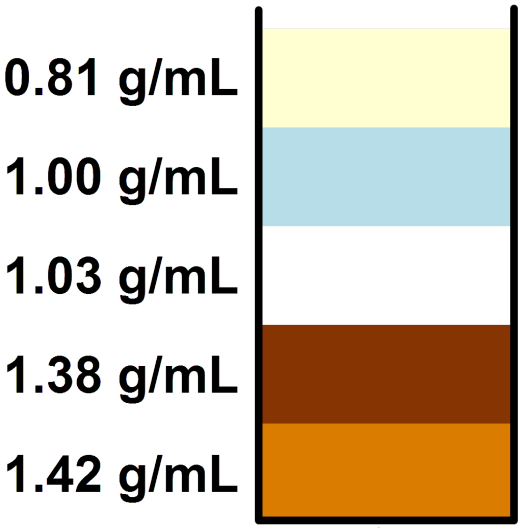
4) This is a diagram of a density tower. Included are the densities of the different fluids. Three objects are dropped into the tower: a square with a density of 1.20 g/mL, a circle with a density of 0.92 g/mL and a triangle with a density of 1.48 g/mL. Draw a square, circle and triangle to indicate where in the tower these objects will sink to.



5) Before starting the investigation, take a look at the six small objects your group has been given.

   Rank these objects from what you think is the least dense to what you think is the most dense. This will serve as your hypothesis for this investigation.

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Practical

Instructions

Go through the safety information with your teacher.

Collect your protective gear.

Ensure all long hair is tied back.

Clear the area you will use for your experimental work.

Read through the practical instructions and make sure you understand the requirements.

When you are ready you can begin.

Materials

- Ethanol (or rubbing alcohol or lamp oil)
- Olive oil (or canola oil or another vegetable oil)
- Water
- Dish soap
- Corn syrup (or maple syrup or glycerine)
- Honey
- Glass cylinder
- Pipette
- Food colouring (two different colours)
- 6 x Small objects

Method

Important Note: Add fluids slowly and carefully to avoid mixing them together. The techniques described in this method can be seen in the following video: https://www.youtube.com/watch?v=-CDkJuo_LYs.

1) If not already done for you, mix some food dye with the water and ethanol to give them colour. If possible, use different coloured dye for each.

2) Pour honey into the glass cylinder until it makes a layer 2 cm thick. Avoid getting honey on the sides of the glass.

3) Repeat step 2 with syrup. Add the syrup slowly to avoid mixing.

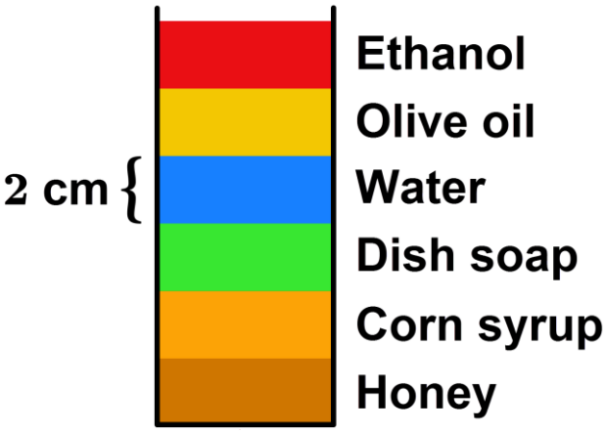
4) Use a pipette to add 2 cm of dish soap. To prevent mixing with the syrup, lower the tip of the pipette close to the top of the syrup.

5) Use a clean pipette to add 2 cm of coloured water. To prevent mixing with the soap, angle the tip of the pipette against the side of the glass just above the top of the soap. Allow the water to run gently down the inside of the glass.

6) Repeat step 5 using olive oil.

7) Repeat step 5 using coloured ethanol.

8) Gently drop the six objects into the tower.



Results Questions

1) Order the six objects from the one that sank the least to the one that sank the furthest.

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2) Identify any two (or more) objects that floated in the same layer in the density tower. This indicates they have similar densities.

Discussion Questions

1) According to your results, which object is the most dense and which is the least dense? If two objects tie for most or least dense, list both of them.

2) Did your results support your hypothesis (prediction)? If not, how were they different? Be sure to restate your hypothesis.

3) Suggest at least two ways this investigation could be improved.

Extra for Experts

The plastic that rubber ducks are made from is denser than water. This means it should sink.

Using deductive reasoning or research, explain why rubber ducks do not sink in water.