EXPLORATION 1

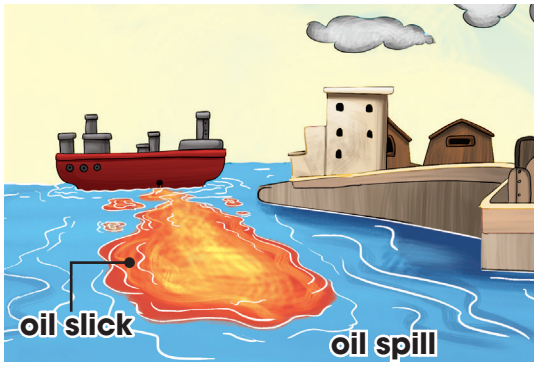
# A Density Tower

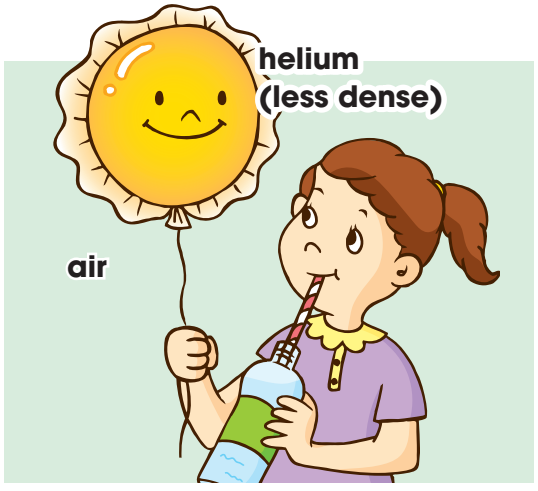
**Investigate the density of different solids and liquids.**

Density is a measure of the amount of matter (mass) an object has in relation to its volume. The density (*d*) of an object can be determined by dividing its mass (*M*) by its volume (*V*). The formula for density is $d = \frac{M}{V}$. If an object is heavy and compact, it has a high density.

Here are some examples of density:

- Oil is less dense than water. If there is an oil spill in the ocean, the oil spreads out across the water's surface to form an oil slick.
- A Styrofoam cup is less dense than a ceramic cup. That is why a Styrofoam cup floats on water and a ceramic cup sinks.
- Helium balloons rise because helium is less dense than air. Over time, the helium escapes from the balloon and is replaced by air. As a result, the balloon falls.




Different liquids have different densities. This allows us to layer liquids based on their properties. Try the activity below to create a density tower.

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In this activity, you will put nine different types of liquids in layers to create a density tower. The liquid at the topmost level should have the least density and the one at the lowest level should have the greatest density.

Before doing this activity, number the liquids according to their densities from 1 to 9, from the least density to the greatest density.

**Materials:**

- a large cylindrical glass vase or glass storage container
- 9 small cups
- a turkey baster

| 9 Liquids | My Density Estimate (1 – the least; 9 – the greatest) |
|---|---|
| • dish soap | ☐ |
| • corn syrup | ☐ |
| • maple syrup | ☐ |
| • honey | ☐ |
| • whole milk | ☐ |
| • lamp oil | ☐ |
| • rubbing alcohol | ☐ |
| • water | ☐ |
| • vegetable oil | ☐ |

Add some food colouring to the water and rubbing alcohol to make your density tower more colourful.

e.g. water – blue
rubbing alcohol – red

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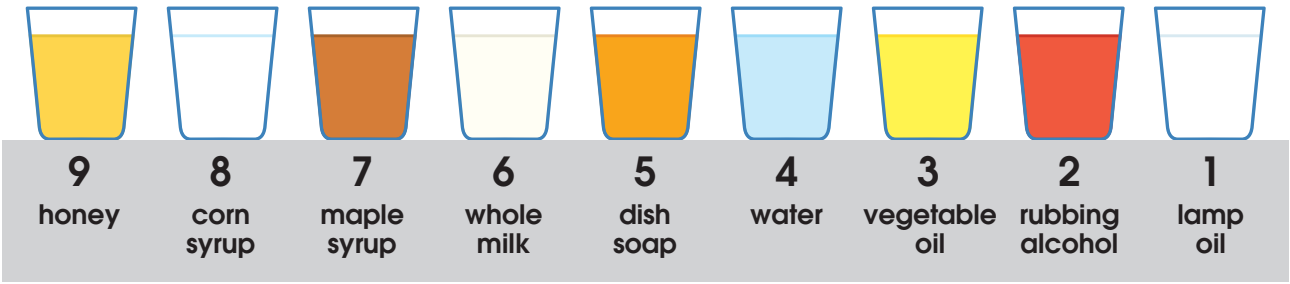
## Steps:

1. Label each cup with the name of the liquid. Pour equal amounts of the liquid in each cup.
2. Arrange the cups as shown.




3. Start building the tower by pouring honey into the centre of the container, followed by corn syrup and maple syrup. Take your time and make sure they do not touch the sides of the container.
4. Use the turkey baster to add the milk slowly in the centre of the container. Then wash the baster and do the same for the dish soap.
5. Clean the baster. Use the baster to add water by squeezing gently to let the water flow down the side of the container onto the dish soap. Then do the same for the vegetable oil, rubbing alcohol, and lamp oil.


* To make this activity more fun, you can drop two objects – a nail and a grape – into your density tower. You should notice that the nail will sink to the bottom and the grape will float in the middle.

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## Explanation:

Density is how much stuff is packed into a particular volume. If the mass of an object increases but the volume remains the same, the density of the object increases.

Lighter liquids such as water or vegetable oil are less dense than heavier liquids such as honey or maple syrup. That is why the less dense liquids float on top of the heavier ones.

This same rule applies for the objects added. The nail is denser than all the liquids; therefore, it sank all the way to the bottom. The less dense object, the grape, floated on the layers of the tower.