Liquid Layers

It takes about 50 gallons of water to wash a load of clothes.

One of the physical properties of any substance is density, a measure of its mass or weight per unit volume. If liquids do not mix or mix slowly, layers form according to density with the heaviest layer on the bottom and the lightest on the top of the column. This activity allows participants to observe differences in density and to discuss those differences.

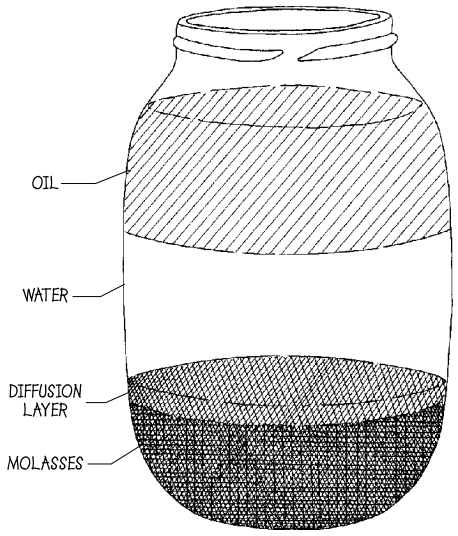
Equipment/Materials

clear glass jar, jug or glass or graduated cylinder

water*	molasses
postal scale	cooking oil
small measuring cups	paper clip
cork	raisin
piece of candle	aluminum foil

* amounts from a few milliliters to a cup as required by the container

Procedure



1. Have participants guess which of the liquids is the most dense.
2. Carefully measure equal amounts of each one and weigh on a postal scale or similar device. Note that the volume is the same for each one, so the weight is a good estimate of its density.
3. Have the participants predict which of the substances will be on the bottom, in the middle and on top of the column when they are all added to one container.
4. Gently pour each liquid into the container. Although it may not be necessary with these three liquids, you may want to pour the liquids over the bowl of a spoon to break up the force of the fall and to keep them from mixing too much.
5. Observe the liquid layers as they form. Determine which of the liquids is on the bottom ***[molasses, a dense sugar solution].*** Is it the most dense of the three? ***[Yes]*** Why would it form the bottom layer?

   Molasses is the most dense of the three liquids used in this experiment, therefore it sinks to the bottom of the container and forms the bottom layer.

6. Repeat the discussion with the other two layers that are formed. Which liquid is the most dense? Which liquid is the lightest? If the liquids stand for very long, participants may notice a narrow zone of mixing (in still containers that are not disturbed). This is the result of the molasses dissolving in the water.

   The sugar solution gradually will become completely dissolved in the water through the process of diffusion. The cloudy or slightly colored band in the container is a diffusion layer.

7. Participants may wish to experiment with a variety of objects to see which layers may or may not support them. Bits of cork, candle wax, strips of aluminum foil, raisins, paper clips, a small bit of eraser or similar objects may be used. What does their position in the column say about their density?

   They will sort in the column by relative density or by other characteristics, like their hydrophilic or hydrophobic structure.

8. Why do the materials tend to be either at the top or at the bottom of any given liquid layer instead of remaining suspended in the middle of a layer?

   Most of them are likely to lie in the interfaces between the layers because they are more dense than the upper liquid but less dense than the lower one. Nearly none of them will remain in suspension within a single liquid layer.

9. Why do oil slicks form on the surface of the ocean when oil spills occur?

   Most petroleum products that are carried by tankers are lighter (less dense) than water.

10. Why are tar balls found at the bottom of the ocean and on beaches after a marine oil spill?

    Lighter parts of the oil evaporate, leaving only the denser parts of the crude oil. Those parts of the crude oil form tar balls that sink and are carried inshore by currents and tidal action, washing up on beaches at high tide.