

Station 1

Cohesion + Surface Tension

Materials

- Water (cold and hot)
- Mineral oil
- Glycerin
- Microscope slide
- Eye dropper

Procedure

Put one drop of each liquid on the microscope slide. Observe.

Questions

1. What is cohesion?
2. What effect do intermolecular forces have on the surface tension of a liquid?
3. What effect does temperature have on the strength of intermolecular forces in a liquid?

Station 2

Adhesion + Capillary Action

Materials

- Water in plastic tube
- Water in glass tube
- Mercury in glass tube

BE EXTREMELY CAREFUL
WITH THE MERCURY – DO
NOT OPEN!

Procedure

Observe the shape of the meniscus in each test tube.

Discussion

1. What is adhesion? What is capillary action?
2. How do intermolecular forces affect the shape of the meniscus?
3. What would you expect the shape of the meniscus to be for mercury in a plastic test tube?

Station 3

Viscosity

Materials

- Stopwatch
- Marbles (4)
- 100-mL graduated cylinders (4)
- Long forceps
- Canola oil
- Glycerine
- Water
- Coconut oil (liquid)

Procedure

1. Ensure each graduated cylinder is filled to the 100-mL mark.
2. One at a time, drop a marble in each liquid and time how long it takes to get to the bottom.
3. Use the long forceps to remove the marbles from the graduated cylinders.

Discussion

1. What is viscosity?
2. Compare the two polar liquids to each other, and the two non-polar liquids to each other. Use intermolecular forces to explain the differences.
3. Compare the polar liquids to the non-polar liquids. Use intermolecular forces to explain the differences.

Station 4

Miscibility + Solubility

Materials

- Coconut oil (liquid)
- Water
- Food dye (liquid)
- Food dye (gel)
- Test tubes (4)
- Stoppers (4)
- Test tube rack
- Stir rod

Procedure

1. Add 3 cm of water to two test tubes and 3 cm of coconut oil to the other two test tubes.
2. Add three drops of liquid food dye to one tube of water and to one tube of oil. Use a stir rod to add a small amount of gel food dye to each of the other test tubes.
3. Put a stopper on each test tube and shake.
4. Pour the test tube of coloured oil into the test tube of coloured water. Stopper and shake.

Discussion

1. What is miscibility? How is it different from solubility?
2. In chemistry, we often say "like dissolves like". Explain this based on what you see, using science-y terms.
3. Make a conclusion about the intermolecular forces present in each of the types of food dye.

Station 5

Vapour Pressure

Materials

- Eye droppers (5)
- Acetone
- Water
- Ethanol
- Methanol
- Isopropanol
- Stopwatch

Procedure

1. Put one drop of each substance at the same time on the counter top. Start the timer.
2. Determine the order in which the substances evaporate.

Discussion

1. What is vapour pressure?
2. How do intermolecular forces affect the rate of evaporation of each substance?
3. What other factors may affect the intermolecular forces (and vapour pressure) of a liquid?

Station 6

Boiling Point

Materials

- Test tubes (3)
- Acetone
- Ethanol
- Water
- Digital thermometers (3)
- Water bath (100 mL of tap water)
- Hot plate
- Empty beaker
- Test tube tongs

Procedure

Set up in fume hood. Do not start unless sash is closed.

1. Put 1 cm of each liquid in a separate test tube. Place the test tubes in the water bath (not yet heated) with one thermometer in each.
2. Turn the hot plate on to low-medium (3-4). Observe the test tubes and the temperature of each liquid as the bath heats.
3. When the temperature of a liquid plateaus (stay constant) and starts to boil, remove the test tube to the empty beaker so the contents can cool.

Discussion

1. What is boiling point? What happens when a liquid reaches its boiling point? (Express with respect to intermolecular forces.)
2. How do intermolecular forces affect the boiling point of a substance?
3. What other factors may affect the intermolecular forces (and boiling point) of a liquid?