Intermolecular Attractions Labs

***For each lab, (pre-lab)define the background concepts in your lab notebook, cut/paste the procedures, and develop a data table for each demonstration describing the molecular interactions (observations), and intermolecular forces involved. Answer the discussion questions and write a conclusion analyzing your results and comparing/contrasting the demos.*

I. Floating Oil Droplet

Background Info
- Density
- Surface Tension
- Polarity

Procedure
1. Place 200ml of isopropyl alcohol in a 500-mL hydrometer cylinder or tall-form beaker.
2. Use a graduated Beral-type pipet to place 2-3 mL of red oil into the isopropyl alcohol. Note: Droplets of red oil will form on the bottom of the cylinder
3. Use a wash bottle to slowly add distilled or deionized water to the cylinder. Add the distilled water down the side of the beaker. Do not mix the solution. As the water is added, the oil droplets will clump together and start to float.
4. Continue adding water until the droplets float in the middle of the cylinder.

II. Bubble Shapes

Background Info
- Hydrophilic
- Surface Tension
- Hydrophobic

Procedure
1. Submerge a model in the bucket containing the soap solution.
2. Pull the model out in one smooth motion. Note: It may take several "dips" in order to achieve the internal geometric soap patterns arranged as desired.

III. Capillarity

Background Info
- Adhesive forces
- Cohesive forces
- Surface tension

Procedure
1. Place the Petri dish on an overhead projector. Use a wash bottle to add distilled water to fill the dish about ¼ full.
2. Place the ruler at the top of the overhead screen.
3. Turn the over head on.
4. Place the capillarity tube in the Petri dish below the surface. Observe the water rise in the tube.
5. Hold your index finger over the top of the capillary tube.

6. Raise the tube out of the dish and place it sideways along the ruler. Adjust the tube's position to reveal the height of the water in the column, in millimeters. Have students note this value.
7. Ask the students what is causing the solution to rise up the tubing.
8. Repeat steps 1 through 6 for anhydrous ethyl alcohol. How does the height compare to that of distilled water?

IV. Vanishing Volume

Background Info

- Intermolecular forces-hydrogen bonding
- Polar molecules

Procedure

1. Carefully measure out exactly 50 mL of water in a 100-mL graduated cylinder.
2. Carefully measure out exactly 50 mL of anhydrous ethyl alcohol into a second 100-mL graduated cylinder.
3. Pour the water form the first graduated cylinder into the graduated cylinder containing the ethyl alcohol.
4. Stir the mixture of alcohol and water with a stirring rod and wait about one minute for the bubbles to come out of solution.
5. Observe that the final volume of liquid in the cylinder is less than 100 mL.

Discussion:

1. Why does the oil droplet float? Use the concepts listed in the background info to support your answers.
2. What are the colors on the bubbles a result of?
3. How is a detergent molecule hydrophobic and hydrophilic? A geometric shape is formed between the detergent and water.
4. In the interaction of the glass tube with water, the _____forces between the polar water molecules and the polar Si-O bonds at the surface of the glass are _____ than the _____ forces between the water molecules.
5. When equal volumes of water and ethanol are mixed, the total volume is less (about 10%) than that of 2 liquids before mixing. Why is difference?
6. Continuing with #5, draw a diagram exhibiting a network of molecules attracted to one another in this experiment.
7. Consider butyl alcohol and diethyl ether. Both have the same formula and the same molecular weight. Butyl alcohol, however, boils at 118 deg C and diethyl ether boils at 35 deg C. Why the difference?

Resources:

Conclusion: