LIQUID MAGIC: Properties of Liquids

Framework: Skills and Objectives

1. *Diffusion/Surface Tension*
   - Demo: Milk + Dye + Soap
2. *Solubility*
   - Hands-on Experiment: Layers in a Bottle
3. *Phase Changes--Evaporation*
   - Advanced Demo: Cloud in a bottle

Part 1: Diffusion

Materials

Foam plates
Whole or 2% milk
Food color (3 colors minimum)
Q-tips
Dish soap

Procedure

1. Split into groups of 3/4 children
2. Pour milk into plate
3. Allow students to place three drops of each food colorings on the milk
4. Dip Q-tip in soap
5. Tap the surface where the dye is
6. Observe

Example video: https://www.youtube.com/watch?v=rqQSlEViNpk

Discussion

<<Diffusion>>

- Soap dissolves the fat in the milk, causing the fat molecules to move around and be distorted all through out the dish. What is normally invisible is seen by the motion of the dye.
- Introduce the idea of diffusion (e.g. smell of cookies that start from the kitchen travels to your room). Things travel around until equilibrium is reached. When colors stop running is when equilibrium is reached.
- What are some examples of when you've seen diffusion?
- What about when you wash yours hands and use soap to get any "yucky" stuff off?
- Note: this experiment has multiple science aspects happening (like surface tension, solution chemistry, etc) but we are choosing to focus more on the "diffusion" part for simplicity purposes as well as age limitations.

Part 2: Solubility

Materials
Empty water bottles (~12oz) with caps
Water
Food coloring
Vegetable Oil
Dish soap

Procedure
1. Have kids split into groups of 2. Each pair should get a single water bottle.
2. Have volunteer fill bottle with ⅓ water
3. Let kids pick favorite food coloring and add few drops to water
4. Have kids shake the bottle to mix the dye and water
5. Add vegetable oil until the bottle is ⅔ full and ask a student to shake the bottle
    - point out that the two are not mixing, if that hasn't been observed
6. Add a layer of dish soap and ask a student to shake and observe that they mix

Discussion
<<Solubility>>
- Oil and water don't mix because they don't "like each other"
- When things "don't like each other" (ie not of the same solubility) they don't mix
- What are some things that won't mix together?
- Soap comes to the rescue and mixes them together and "makes them friends"
    - Ask students about examples of when things mixed/dissolved:
        - e.g. Kool Aid, Nesquick, Chocolate milk

Part 3: Phase Changes

Material
2L bottle with cap
Basketball pump with needle attachment
Isopropyl alcohol
Additional: cork for easier attachment of pump

Procedure
1. Gather children around large table
2. Add a small layer of isopropanol to bottom of empty bottle, only few cm needed
3. Attach the pump to the bottle and make sure it's tight, cork optional
4. Have one volunteer hold the cap to make sure it's tight, and have another pump
5. Pump several times, until bottle is pressurized.
6. Remove the pump quickly

7. Observe the phase change.
8. Before all the vapor escapes, attempt to reattach pump and repressurize the vapor until the bottle is clear again. (Optional)

Example video: https://www.youtube.com/watch?v=msSVQ903T8k

Discussion

- Phase changes are when something goes from solid to liquid to gas, or the reverse order.
- Evaporation = liquid to gas (what they see)
- When have you seen something change phase? What about evaporate?
- Get discussion started on what could cause those changes!
- Ex: Clouds, water boiling on a stove, ice cubes in the freezer
- Why do you think something evaporates?
- Water boiling turns into vapor because of the heat, but we caused the change with pressure.
- What is pressure? Give examples.
- Refer back to paper plane activity and the pressure differences on wings that make them fly!

Final Conclusions:

- Make connections to all three activities.
- How do these different liquids relate? How are they different?
- What else is interesting about things that are liquid?
- Could these properties be related to gases? What about solids?