Molecular Nature of Water Constructivist Lab

(Middle/High School) Using 3D Molecular Designs' Water Kit©

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Important: These activities are intended to be spread out over several periods.

1. **Student investigation of interaction between small pieces ("free play") in groups of about four.** (To prepare for this first activity, remove water molecules from cups and unassembled if the water molecules were previously assembled. Place Water Kit cups, tray and box where students won't be able to see them.)
   - As you hand out the red and white pieces don not tell the students that the pieces are components of models of water molecules. Tell students that they are to investigate all properties of and interactions between model parts.

2. **Students report findings of properties of and interactions between model parts.**

3. **Teacher facilitated class discussion.**
   - What could these plastic pieces represent? (Atoms/molecules)
   - What could the "interactions" represent? (Bonding)
   - Is there more than one type of "interaction" and what could they represent? (Different types of bonding)
   - What does a water molecule look like?
   - How could we model a water molecule with these pieces?

4. **Student investigation with assembled water molecules (play).**
   - Focus question: How do water "molecules" interact?

5. **Students report findings regarding interactions.**

6. **Teacher facilitated class discussion.**
   - What do the attractions between molecules represent?
   - What properties of water result from these attractions?
   - How could these molecular models be used to show water as a gas? liquid? solid?

7. **Student Challenge:** Model the 3-D geometry of ice crystals on a molecular level

8. **Teacher Macro Demo of a water property:** Use burettes of water and hexane, create fine stream into beaker, and show stream reaction to charges such as balloon rubbed on hair, etc.

9. **Student Discovery Challenge Game**
   - Make the pin (or strawberry green plastic basket container, they are larger and easier for younger students to work with) stay on top of water surface. (Make sure some cups given to students have been "contaminated" with a surfactant – detergent, soap, etc.) Note: Pins and baskets do not float, so don't allow that word to be used. You might also get into properties of something that truly floats.

10. **Teacher facilitated class discussion.**
   - Why did some pins (or baskets) stay on surface?
   - Why might some pins (or baskets) not stayed on surface?
   - What are some things that might prevent a pin (or basket) from staying on top of the water surface, and what might be some practical uses of these?
   - How do water striders stay on the surface of water?

11. **Class activity**
   - Have students add surfactant to the water floating their pins (or baskets).

12. **Student Challenge**
   - Model the surfactant – water molecule interaction using 3D Molecular Designs Water Kit©.

13. **Teacher facilitated class discussion.**
   - How do surfactants work?