Lesson: Temperature Affects Density retrieved from

Resource: http://www.middleschoolchemistry.com/lessonplans/chapter3/lesson6 (ACS, 2019)

My daughter a junior in high school and her boyfriend a senior in high school were my “students”. We first discussed what they knew about the density of water and if they thought it changed with temperature. Next I showed them the video of a jar of yellow hot water being placed over a jar of blue cold water - one had hypothesized it would mix the other thought it would not. After the demonstration we discussed the density of hot vs cold water and they were able to understand the hot water was less dense than the cold water - the reason the hot water did not mix with the cold water. I then asked them what they thought would happen if we reversed the jars and put the blue cold water on top of the yellow hot water. They both thought the water would mix. We then watched the demonstration. The colors mixed and the water turned green as they had expected. Next we did an activity to look at the affect of colored hot and cold water when placed in room temperature water. To make the activity a little more interesting and interactive I had them choose the two dye colors they wanted to use. They were required to use the chart on the dye package to pick colors which would produce a third color when mixed. (Turns out they selected similar colors but reversed the hot and cold colors.) They each performed the activity and filled out the activity sheet. We discussed each step before and after they did it. Before each step I would ask what they expected to happen, after we would discuss what happened and why. After we did the cold and hot water activities, I showed them the animation of water molecules and we filled out the chart on the activity sheet together. There was some confusion on the mass of the hot and cold water in relation to the room temperature water. If I was to run the lesson again I would look for a better way to explain the mass, volume and density relationships than the animation provide in this lesson. Instead of doing the last demonstration in the lesson provided under “Taking it Further” I had my students each do it on their own- they are older and fully capable of performing it – this also held their attention and curiosity. Then we discussed what happened to the dye in the room temperature water when ice was added.

The density activities clearly demonstrated how the density of water changed with temperature. But the animation of the water molecules did not provide the clarity needed in terms of mass. Both students immediately thought the mass of the water changed. They were confused by the formulas given which showed a different mass for each scenario. Perhaps a hands on activity measuring the volume of water before and after heating and cooling or a review of previous activities (we did lesson 6 in Chapter 3) would have made this phenomena clearer.

The lab got a little messy even with the older students and I would not recommend letting younger students work with the dyes. Overall the lesson went well. My students enjoyed the lesson and seemed to have fun doing it!