Mandatory 3: Designing with a Discourse Practice – Joseph R. Blankenship

1. The big idea I will be teaching in this series of lessons has to do with the movement of atoms when there is a change in pressure, temperature, or both, within a system. When the movement of atoms is sufficiently sped up or slowed down beyond a particular threshold, a change of state can be observed. Students are able to see the results of these changes in matter (ice melting into water, water boiling into steam, etc.) but are often lost when asked to describe what is happening to the particles that make up the matter in question. The players at work in these observable changes are invisible to the naked eye.

   The instructional model I will be using for this particular lesson involves a science demonstration where I create a cloud in a 2-liter bottle using some rubbing alcohol, a cork, and a bicycle pump. Alcohol is used in place of water in that it takes a lot less energy to get it to evaporate. This is explained in the course of the demonstration. Sixth-grade students at this point in their physical science unit(s) will be familiar with the following:

   - All matter is made of particles called atoms.
   - Atoms are always in motion.
   - Properties of solids, liquids, and gases
   - Solids, liquids, and gases can change from one to the other and back when enough energy is added or taken away.

   Additionally, seventh-grade students will be at least somewhat familiar with the Law of Conservation of Mass, the hydrologic cycle, and the concepts of conduction, convection, and radiation.

   The discourse strategy I am using will involve a model in which students will be asked to illustrate the movement of atoms in a 2-liter bottle before air pressure is added, during the time in which air pressure is added, and immediately after the added pressure is released. Students will be asked to draw what is happening to the atoms inside the bottle, indicate the change in temperature on a thermometer and the change in pressure on a gauge. No mathematics will be used in this discourse strategy. Speed, temperature, and pressure will be all be indicated as merely increasing or decreasing.

2. The following describes the various elements of this discourse strategy:
   a. The big idea in this series of lessons on phase change involves the fact that when atoms in a system, in this case a couple of splashes of rubbing alcohol placed in a 2-liter bottle, are sped up or slowed down sufficiently due to an increase or decrease in energy, a change of state can be observed even though the atoms themselves cannot.
   b. My anchoring question for students is, ***"What happens to the atoms in a substance when energy in the form of heat and/or pressure is added or taken away?"***

c. The following standards addressed in this strategy are from **Ohio's Learning Standards for Science** adopted in 2018:

   i. **6.PS.1** - Matter is made up of small particles called atoms.
   ii. **6.PS.2** - Changes of state are explained by a model of matter composed of particles that are in motion.
   iii. **7.ESS.1** - The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere, and atmosphere.
   iv. **7.ESS.2** - Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns.
   v. **7.PS.2** - Matter can be separated or changed, but in a closed system, the number and types of atoms remains constant.

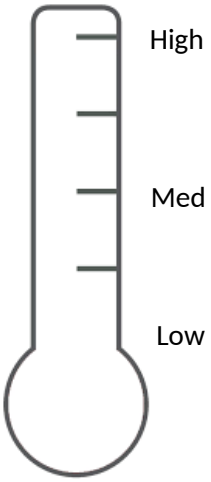
d. Students will view the following video demonstration posted HERE and then show their thinking using the explanatory model provided on the next page.

Name: _____ Class Period: _____

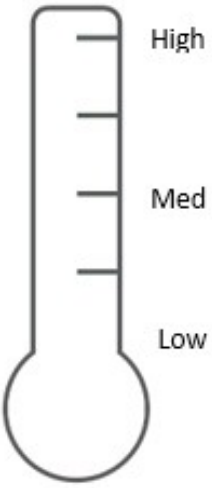
Before, During, After… *with Atoms!*

Instructions: Use dots, arrows, or a combination of both to illustrate the **movement of atoms** of rubbing alcohol inside a two-liter bottle **before, during,** and **after** air is pumped into it. Then mark the pressure gauge and thermometer accordingly to indicate whether air pressure and/or temperature is increasing or decreasing at each stage of the demonstration.

Before:



During:



After: Before: