DIY Weather Station Part 2- The Thermometer:

Every living thing on Nantucket is influenced by the seasonal temperature changes on here. The plants bloom and fruit during the warmer months, birds and fish migrate by the thousands as the seasons change, and even us humans change how we dress and behave based on what the thermometer reads. The thermometer was invented over five centuries ago and is so useful we have them everywhere- our cars, yards, homes, even some businesses show the temperature on their signs! Today we'll learn how they work, and how to build one right at home.

Here in New England we have the world famous "four seasons." Tourists travel from all over the world to see the spectacular show mother nature puts on as trees leaves change color and *fall*, hence the name of that season. A huge part of this seasonal change is the distinct change in temperature between winter, spring, summer and fall. We measure these temperature fluctuations with a trusty thermometer. Although they have many designs and forms nowadays, the oldest thermometers all operated on the same principle- *thermal expansion and contraction.* Thermal expansion and contraction refer to the fact that liquids and gases often *expand* as they get warmer and *contract* as they cool.

For example, let's imagine an old mercury thermometer: Although mercury is toxic and fell out of favor for use in thermometers, it was commonly used because it would expand and contract readily if contained in a glass tube. The glass tube is "calibrated" by marking it with a scale representing different temperatures. As the mercury warms, it expands, rising in its tube. As it cools its volume decreases which has the opposite effect. Even though we don't use mercury anymore in our thermometers, you'll often hear people describe "the mercury dropping" or "rising" to indicate a change in temperature. Today, we'll design our own thermometer to better understand how we track temperature. Let's get to it!

Materials:

- Clear, empty plastic or glass container, preferably with a narrow mouth
- Modeling clay
- Clear straw or piece of plastic tubing
- Food coloring (optional- this will make your thermometer easier to read.)
- Tap water
- Rubbing alcohol (optional- you can just use water, but it will take longer for your thermometer to register a temperature change.)
- Sharpie
- Scissors
- Plastic dropper
- Measuring cup
- Vegetable oil or olive oil, any brand (optional- a drop of olive oil to cover the water/alcohol in the straw will keep it from evaporating as quickly)
- Ruler

Instructions:

1. **Take your ruler and sharpie and mark a scale in half-centimeters up the clear straw or tube.**
2. **Mix a batch of half tap water, half rubbing alcohol in a measuring cup. There should be just enough to fill your thermometer container ¼ to 1/3 of the way.**
3. **Pour the thermometer liquid into your chosen clear container, filling it ¼ to 1/3 of the way.**
4. **Add a few drops of food coloring to help you read your finished thermometer. Red is the traditional color!**
5. **Wrap a piece of modeling clay around the straw- the modeling clay must be large enough to completely cover and seal the space between straw and container mouth from the atmosphere. A good seal is critical, or your thermometer won't work properly. Get as close to air-tight as possible!**
6. **Make certain the straw extends down into your container and liquid, but not so low that it hits bottom and becomes clogged.**
7. **Mix up ~2 oz more colored thermometer liquid in the measuring cup. Carefully use the dropper to pour this into the straw. It may not take all 2 oz- continue adding liquid with the dropper until the liquid in the straw is above the level of liquid in the main thermometer body. (If the straw will not hold liquid, it could be clogged or the modeling clay does not have a good seal)**
8. **Use the dropper to add a few drops of vegetable oil to the straw. This will cover the thermometer liquid in the straw and slow evaporation from the thermometer.**
9. **Use your thermometer! Make a note of the liquid level in the straw, then place it in the fridge or the yard for an hour or so. Enjoy!**

What to look for:

Your DIY thermometer will be operating on the principle we discussed earlier- *thermal expansion.* As the temperatures rise and fall, so will the level of the liquid in your straw. This is precisely how many of our thermometers work! Try comparing your DIY project to a store-bought thermometer. How do they behave? What could cause these differences between your version and a mass-produced one?

DIY thermometer materials:

Completed thermometer: