**Tools of the Trade – Thermometers and Microscopes**

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**Benchmarks:**

Thinking like a Scientist –

* I can employ simple equipment and tools to gather data and extend the senses.
* I can communicate about observations, investigations, and explanations.

**Materials:**

* Microscope
* Smartboard
* Laptop
* Various items to look at under the microscope: penny, leaf, onion slice, butterfly wing, feather, piece of paper, bug? … (After you start with a few things, have the students make suggestions, such as someone’s t-shirt or finger or a piece of someone’s hair)
* Thermometers
* Hot water (hot water from the sink is good…it doesn’t need to be scalding)
* Cold water
* Food coloring
* Graduated cylinder
* Beakers
* Worksheets (there is one for each lesson)

**Initial Discussion:**

Begin by introducing yourselves and telling the students what “type” of scientist you are (chemist, physicist, etc) and what you study! Please allot 10 minutes for this!

Tell the students we will be learning about tools that scientists use. The tools we will use today are safety tools, various measuring tools (thermometer, graduated cylinder) and a microscope. They will also be recording what they did in a lab notebook (worksheet) just like a scientist.

This lesson will be done in stations. Have the teacher help divide up into group. There will be a microscope station (2 volunteers working at the smartboard so that all the students can see what you’re looking at) and a measuring temperatures station (divide the kids into as many groups as there are extra volunteers).

**Procedure:**

**Station 1: Measuring Temperatures of water**

1. The teacher will divide the class into groups (of preferably 4 or 5). There should be ONE volunteer with each group of students. Each group should have a large container of hot water and a large container of cold water (maybe with ice to keep it cold). *Optional: color each one with a different (primary) color.*
2. Since you are scientists, you will need to wear goggles. Talk about the safety reasons for wearing goggles.
3. To practice measuring once goggles are on, talk to the students about the measurements on the side of each graduated cylinder. They should be able to look at the graduated cylinder and tell you the maximum measurable volume in mL of the graduated cylinder.
4. Talk about the thermometer. Ask the students questions such as
	1. What does a thermometer do?
	2. What are the units of temperature?
	3. One bowl contains very warm water. Will the temperature be: *low* or *high*?
	4. One bowl contains very cold water. Will the temperature be: *low* or *high*?
	5. Does anyone know the boiling point of water?
	6. Does anyone know the freezing point of water?
5. Have one student use the thermometer to find the temperature of the hot water. Everyone should write this down on their “lab notebook” worksheet.
6. Have another student use the thermometer to find the temperature of the cold water. Everyone should write this down on their “lab notebook” worksheet.
7. Ask them what they think the temperature would be if you mixed the hot and cold water. Why do they think that? Encourage *educated* guesses based on what they know (i.e. the temperatures of the other two) rather than just guesses. If you have colored the water, you can also ask them what they think the colors of the waters will be if you mix them together

Have a student (help them with this) measure out 100 mL of the hot water using the graduated cylinder and pour it into a clean beaker. Have another student (help them with this) measure out 100 mL of the cold water and pour it into the same beaker. A third student can briefly stir. Now have another student measure the temperature of the mixture. Everyone should write down the temperature (and color). Have a discussion… were their predictions correct? Did they learn anything?

1. If you have extra time: what will happen if you have more warm water than cold water or vice versa? Have them hypothesize and then try it out. Make sure they have 5-10 minutes to write/ draw in their lab notebook worksheets.

**Station 2: Microscopes**

1. Begin with a discussion on what microscopes are and why we use them. Rather than telling them first, have the students tell you what all they know to get the conversation started.
2. After telling them a little about why scientists use microscopes, you can run the demo part of the lesson however you’d like. Basically, just show them a variety of items under the microscope. You’ll be connected to the smart board so you can show the entire group at once. A few options
	1. You could put something under the microscope and not tell them what it is, letting them guess.
	2. You could show them a few things under the microscope and then let them suggest other things in the classroom to look at.

Either (or both) of these would be a great way to engage the kids in the lesson! If you can tell them anything about your research that relates to microscopes, that would be great too. Be sure to give them 5-10 minutes to write in their “lab notebook” worksheets about what they learned.

Science Lab Notebook: Measuring Temperature

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Science Lab Notebook: Microscopes

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