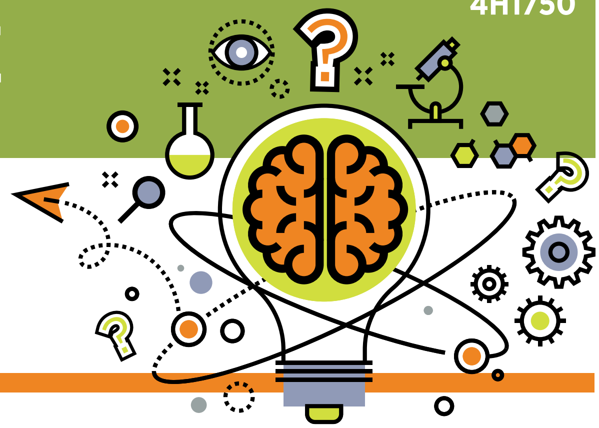
4H1750

TEACHING SCIENCE

...when you don't know diddly-squat



How can you make the best cooler?

Purpose:

The purpose is **not** to teach specific content, but to teach the process of science – asking questions and discovering answers. This activity encourages young people to try to figure things out for themselves rather than just read an answer on the internet or in a book. As a leader, try not to express your opinion, but let the youth engage in argument based on evidence.

Time required:

At least 3 1/2 hours, but most of that time is not active

Assembly (30 min)

Temperature checks (over a 3-hour period)

Materials:

❏ Stopwatch
❏ Probe thermometer or meat thermometer (for each group of participants)
❏ Random materials for youth to build their own cooler (for example, plastic foam such as Styrofoam, bubble wrap, paper, leaves, straw, moss, old clothing and other items)
❏ Ice

SCIENCE PRACTICE: Asking questions and defining problems

1. *Can you design a cooler that will keep ice cold? What materials do you think might work best for making a cooler? How much ice would be appropriate for a test? Should the cooler be built around the ice, or should the cooler be finished before adding the ice?*

2. Take some time as a group to decide what is important to you in designing the cooler: *Is it maximum size or thickness of the walls? Do you decide the amount of ice you would add by weight or number of cubes or volume (such as one cup of ice)? Are you limited on the number of materials you can use in your cooler design? Does everyone use the same materials or does everyone get to pick whatever they want to use? How long does everyone have to build the cooler?* These are just sample questions to think about. **You** decide what is important to you in testing cooler design.

SCIENCE PRACTICE: Planning and carrying out investigations

3. Have youth build their own cooler based on answering the questions important to the group talked about earlier. They can build them in groups or individually, depending on the amount of thermometers and materials you have. They need to design the cooler to hold ice and allow for a thermometer to be inserted so it can be read without opening the cooler. Put the same amount of ice in each cooler. Check the temperature at the beginning of the experiment and again at one hour, two hours and three hours. After two hours, ask the youth to predict what will happen to the temperature after three hours.

SCIENCE PRACTICE:
Using mathematics and computational thinking

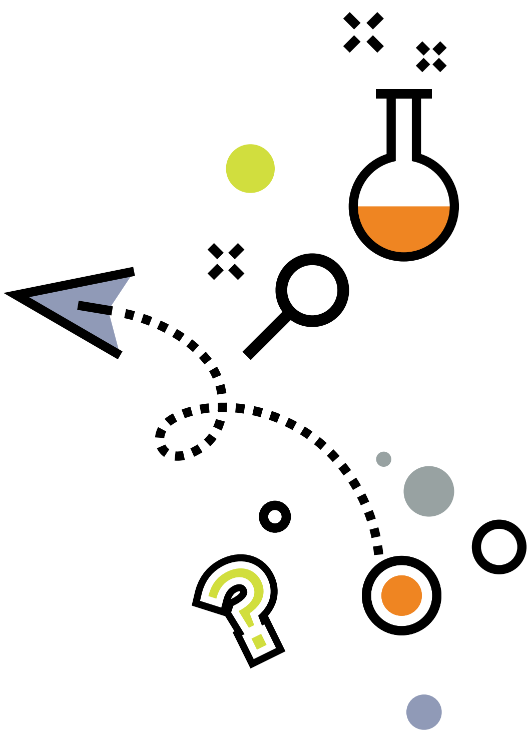
4. Create a chart like the one following:

Tracking Cooler Temperatures

Cooler creator	Temperature at the beginning	Temperature at 1 hour	Temperature at 2 hours	Prediction for temperature after 3 hours	Temperature at 3 hours

What cooler worked the best? Did the same cooler perform the best after the first hour as compared to the second and third hours?

You do not need all the answers to teach science. You simply need an inquisitive mind and to be willing to carry out an investigation.



SCIENCE PRACTICE:
Developing and using models

5. *Based on your first two hours of data, could you predict what would happen after the third hour? If the ice didn't melt completely after three hours, when do you think it would be completely melted?*

SCIENCE PRACTICE
Analyzing and interpreting data

6. *What cooler worked the best? How did you define* "best"*? Why do you say that? What things do you think influenced how well the cooler worked? Were all the coolers the same color? Were they all stored in the same place? Were any in the sun?*

SCIENCE PRACTICE:
Constructing explanations and designing solutions

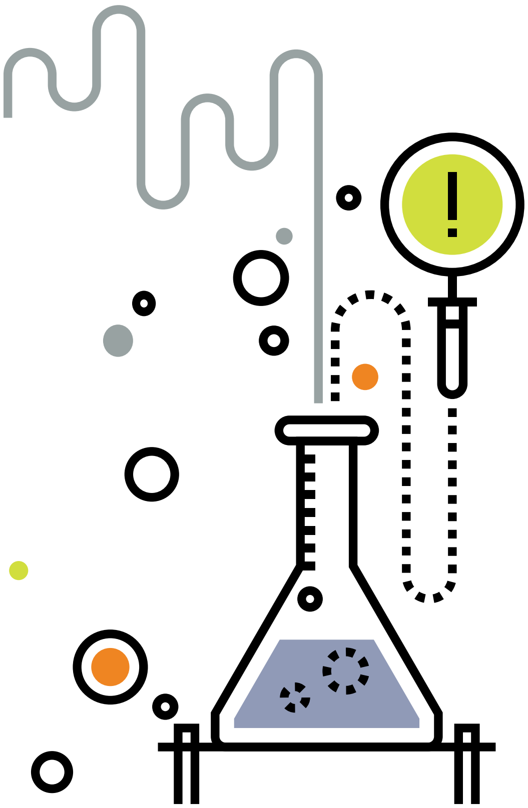
7. *Based on the data you collected today, why do you think the "best" cooler worked so well?*

SCIENCE PRACTICE:
Asking questions and defining problems

8. *What would you do differently to improve your cooler in the future? If the weight of the cooler was an issue, (for example you had to carry it a long distance) would you do things differently?*

SCIENCE PRACTICE:
Engaging in argument from evidence

9. *Why do you think the "best" cooler worked effectively? Would you trust your homemade cooler to keep your food in the* ***safe zone*** *(cooler than 40 ° F), so people don't get sick?*



Other thoughts:

- *Do you think you could repeat this experiment with a boiling cup of water or coffee? Do you think the same device for keeping things cold would also work for keeping things hot? Why or why not?*
- *Do you think the temperature gained for the ice would be similar to temperature lost for the boiling liquid? Why or why not?*
- *How much effect do you think the environment has? If you did the same experiment in a temperature-controlled house compared to outside, would there be a difference?*
- *How do your homemade coolers compare to store-bought coolers? Could you use this experiment to test store-bought coolers?*
- *What would the results be if you conducted this experiment over a longer period of time, such as overnight?*
- *How long do you think it would take for the temperature inside the cooler to reach room temperature?*

Science & Engineering Practices:

These eight Science and Engineering Practices come from *A Framework for K–12 Science Education* (National Research Council, 2012, p. 42). These research-based best practices for engaging youth in science are connected to in-school science standards that all children must meet.

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Reference:

National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press.