Traveling Science Shows

THE FRANKLIN INSTITUTE

Pre-Show

THE SCIENTIFIC METHOD

About the Show

What is a scientist? Do they all wear glasses and white coats? Actually, what defines a scientist is less about how they look and more about how they think: Scientists are problem solvers. One tool they often use to tackle questions is the scientific method.

The scientific method is not a rigid step-by-step process. Instead, scientists rearrange, revise, and even repeat steps. Moreover, scientists use a variety of different techniques. Astronomers, for example, test their hypotheses by observing the solar system rather than experimenting on planets in the laboratory. All these methods have one thing in common: testing ideas with evidence from the natural world.

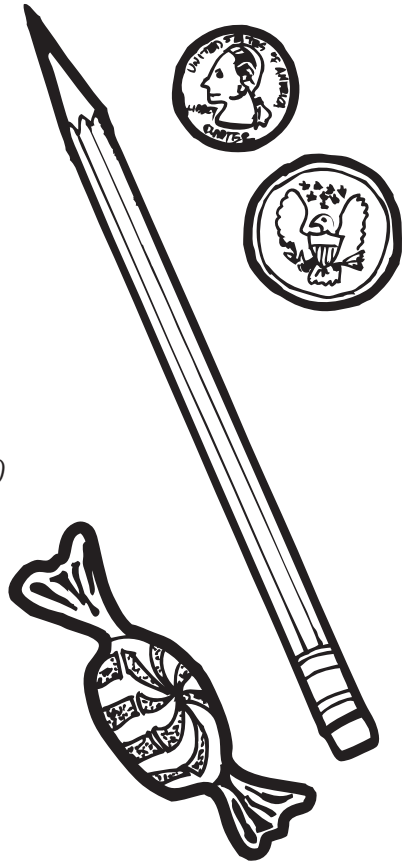
During the show, we'll ask, "Why doesn't our paper cup catch fire when we put it to a flame?" We will follow one path a scientist might choose to investigate this question. Students will use the scientific method to explore some surprising properties of heat and temperature. We may find the answer to our question, but most importantly, we'll leave students with dozens more questions and the tools to explore them!

We have provided the following activities to help students preview some of the major concepts covered in our show. Please remember to use appropriate safety measures for all activities. Adults should always supervise students during experiments.

Thank you for scheduling a Franklin Institute Traveling Science Show.
We are excited to visit you soon!

GETTING TO KNOW YOU

FOR GRADES 1-4



An important part of the scientific method is making observations and collecting data. In the upcoming show, we will practice using our senses, as well as various tools, to observe and collect data. In this activity, students make detailed observations for use in a game.

EQUIPMENT

Miscellaneous objects such as coins, puzzle pieces, blocks, and beads (one per student)
Magnifying glasses
Rulers
Scale or balance beam
Paper and pencils

PROCEDURE

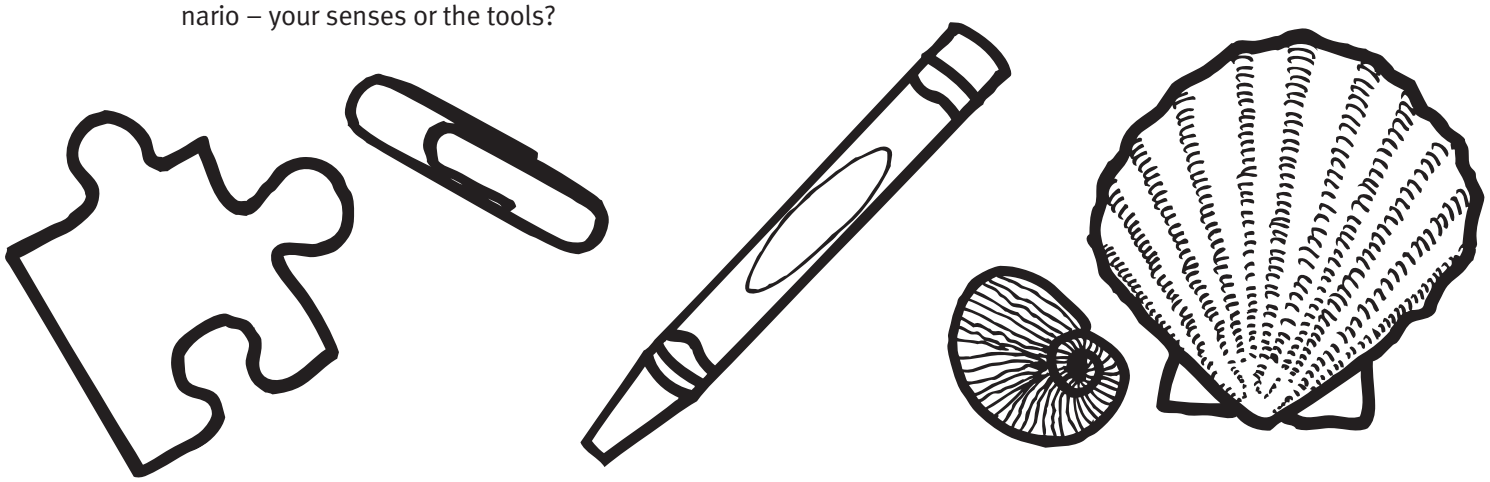
1. Pass out a sheet of paper and a pencil to each student. Pass out one object to each student and instruct them to keep the object hidden from others.

2. Ask students to write a detailed description of their object *without naming it*. Encourage students to use all of their senses, except taste, to make qualitative observations (such as color, shape, and texture). Students should also use tools such as a scale or ruler to make quantitative observations (such as length and weight).

3. After students have had time to write about their object, collect their descriptions. Put all objects in a pile where everyone can see. Select one student's description and read it aloud, one clue at a time. Other students guess which object is being described, and the author can confirm when someone has guessed correctly!

4. Discuss how students made their observations. Which senses did they use? Which tools did they use? How do we use our senses and tools in science?

5. To make it more challenging, pass out objects that are similar. For instance, give all students various kinds of rocks. Why is it harder to distinguish these objects from one another? How could you change your description to help differentiate between the various rocks? Which were more helpful in this scenario – your senses or the tools?



THE EDIBLE CANDLE

FOR GRADES 3-6

We often make assumptions, but they sometimes turn out to be completely wrong! As we will discover in the show, science is one way to test our assumptions about the world around us. In this activity, students observe a surprising demonstration and discuss why assumptions can be misleading.

EQUIPMENT

Large potato
Knife
Apple corer
Almond Slivers (available in the baking section of most grocery stores)
Plate
Match or lighter

PROCEDURE

1. Before class, prepare the "candle." Use a knife to cut the top, bottom, and four sides off of a potato, forming a tall rectangular solid. Use an apple corer to create a piece of potato that is cylindrical and resembles a standard emergency candle. Trim down the almond sliver into a long, thin wick.

2. If preparing the candle well in advance of the demonstration, store the potato in a container with water to prevent browning. Store the almond wick in a dry location.

3. Have students prepare a chart to record observations. While they do this, covertly assemble the "candle" by gently inserting the almond sliver into the top of the potato.

4. Place the candle on a plate on a desk at the front of the room. From their seats, have students begin to record observations. Encourage students to estimate observations they cannot directly measure, such as height.

5. Turn out the lights. Use a match or lighter to ignite the almond sliver. Students should continue writing observations. You may want to say things like, "Do you smell the vanilla sent?" or "Can you see the wax starting to melt?"

6. When the wick is low, blow out the flame. Pick up the whole candle, bite off a piece and crunch loudly! Students should continue to write observations.

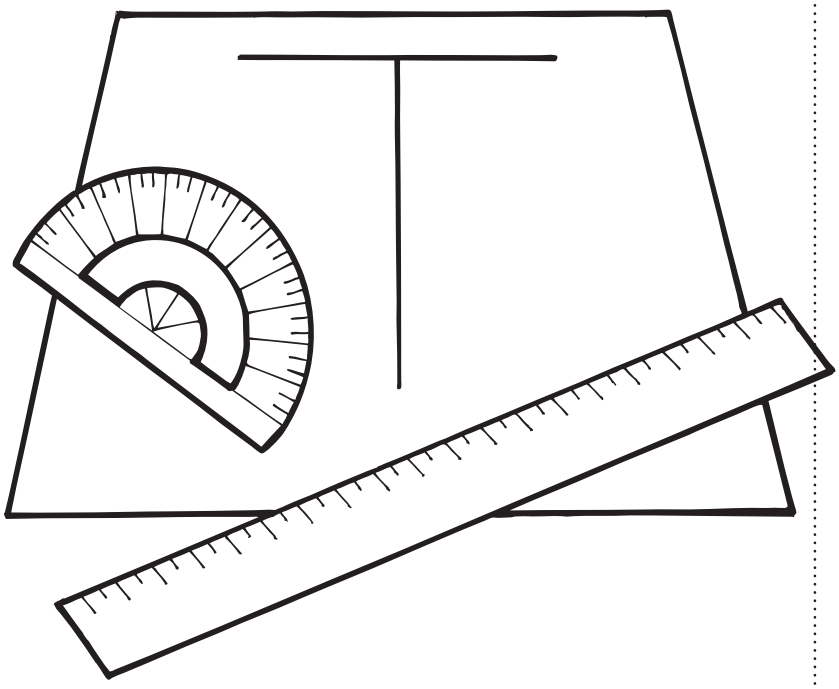
7. Have students share their observations. What assumptions did you make about the "candle," and were they correct? What additional observations would have helped you figure out what the "candle" really was? How does science help us test our assumptions?

8. Dispose of materials in the trash.

THE SCIENCE OF ILLUSION

FOR GRADES 5-8

Our senses are useful tools for collecting information, but sometimes they can deceive us. Optical illusions, for instance, "trick" our brain. During the show, we will find out how science allows us to uncover illusions and reveal how they work. In this activity, students will brainstorm ideas about how an optical illusion works and plan methods to test their hypotheses.



EQUIPMENT

Paper
Pencils or pens
Rulers
Protractors (optional)

PROCEDURE

1. Pass out to each student a paper with a T on it (see illustration). Ask which line looks longer – the horizontal line or the vertical line? Take a vote and tally responses.

2. Have students use rulers to measure the two lines. Share results and point out that the two lines are identical in length.

3. Discuss why this is an illusion. What aspect of the drawing might be responsible for the illusion? Record possible ideas. For example, students may say the illusion is due to the angle between the two lines, the rotational orientation of the T, whether or not the lines touch, or even the color of the T.

4. Ask students to work in pairs or small groups to pick a variable from the list they just brainstormed, and design a procedure to test whether that aspect affects the illusion. For instance, students that think the angle between the lines determines the illusion could draw sets of intersecting lines at different angles and ask people whether the lines are the same length.

5. If time permits, revisit these procedures after viewing the Scientific Method Show. If you have any revisions, make changes. Then try out your procedure and share what you discover!