LESSON 3: Science and Engineering Practices

The tools and techniques of **science and engineering** overlap in many ways, but there are some fundamental differences in how **engineers** use them versus how **scientists** do. One main distinction is purpose. In general, the goal of **engineering** is to solve problems, while the goal of **science** is to explain natural phenomena. (calacademy.org)

This is an activity that will help you gain familiarity with Science and Engineering practices in conducting Science and Engineering Fair projects. You will analyze and evaluate each scenario and identify the main practice highlighted in each one. Your discussions will draw out important points to consider such as the interconnections between the practices and the idea of intentionality in doing a science fair investigatory project or an engineering design project.

Time: 30 minutes

Group Size: 3

Materials: handouts, pens

Part 1. Introduction and Directions (10 minutes)

1. Work in pairs or in groups of 3.
2. You are to read, analyze and evaluate excerpts from different lab activities. Identify the best practice that is represented. (Note: some prompts clearly target one practice, and some are vague in order to spark thoughtful discussions. Additionally, some scenarios might include multiple practices but focus on the underlined portion of the text to help you identify the one practice that is best represented by that phrase.)
3. Write your answers on the chart that is provided.

Part 2. Analyze/Evaluate the following activities

Scenario 1: A MATTER WITH SOILS

A. What should you <u>do to find out</u> the difference between two kinds of soil, including how
well they can hold water?
B. Compare and contrast two soil samples. <u>Make a chart that shows your findings.</u>

Scenario 2: GETTING TO KNOW A FLOWER

Take a flower apart and describe what you find<u>. Draw a series of pictures with labels.</u>

Scenario 3: THE MELTING OF ICE

Put an ice cube in each of the two cups labeled ‘‘fresh water’’ and ‘‘salt water” respectively. Observe what happens to the ice. What do you observe? What do you think could be causing this? What evidence supports your idea?

Scenario 4: THE EARTH: An EGGxample

A hardboiled egg is used to represent the Earth. The shell represents the earth’s crust, the egg white is the mantle, and the yolk is the core. Cut an egg in half, showing all the layers. What do you notice about the relative sizes of these layers? How does comparing the egg to the Earth help you understand the Earth’s structure? What are the limitations of using the egg to represent the Earth?

Scenario 5: THE LIFE OF YEASTS

Put a packet of yeast to warm water, add sugar and watch what happens. Based on your observations, what do you want to find out about yeasts? How would you test that?

Scenario 6: CRICKETS

A student wants to find out if the number of times a cricket chirps in a minute could be used to determine temperature. She makes four measurements: Aug. 1: 70°F, 111 chirps/min Aug. 4: 72°F, 120 chirps/min Aug. 1: 66°F, 107 chirps/min Aug. 1: 74°F, 125 chirps/min

A. Does her data support the idea that temperature can be determined by the rate of cricket chirps?
B. Estimate how many chirps/min a cricket would make at 68 °F and at 80°F

Scenario 7: CARTESIAN DIVER

Squeeze the plastic bottle and observe closely what happens to the eyedropper. One student claims that ‘‘ The air inside the diver gets denser and that causes it to sink.’’ What do you see that supports or refutes this claim?

Part 3: Group Discussion

Guide Questions:

1. Explain why you think a given scenario represents a particular practice.
2. Why do some scenarios demonstrate how a single activity can be related to different practices? Explain the importance of intentionality of practice?

(Adapted from the California Academy of Sciences)