



# SCIENTIST IN RESIDENCE PROGRAM

**Science Unit:** *Fossils and the Changing Earth*

**Lesson 1:** *How Science Works: Observations, Inferences, and Questions*

School Year:	2016/2017
Developed for:	Sir Sandford Fleming, Vancouver School District
Developed by:	Kathryn Gregory Wodzicki (scientist); Gale Nyden and Monica Treanor (teachers)
Grade level:	Presented to grade 6-7; appropriate for grades 4 - 7 with age appropriate modifications
Duration of lesson:	1 hour

## Objectives for students:

1. To understand that science is process for answering questions about our world, not just a collection of facts
2. To learn the difference between observations (data) and inferences (opinions) by making observations on an object that is not what it seems (a cheese stick “candle”).
3. To practice making observations by examining two collections of beach rocks - one from the beach cliffs and one from the sandy shore.
4. To practice being curious by asking questions about the two rock collections.

## Background Information

*“Without data, you’re just another person with an opinion”* - W. Edwards Deming

What is science, exactly? Many students have misconceptions; they may think science is a collection of facts in book, or something done by lone geniuses in white lab coats. It is important for students to understand that **science is a process for answering questions about our world**. It is often a very social activity, and one that *anyone* can do. To do science, we make observations and then develop inferences to explain them.

In this lesson, students learn about the process of science by examining a collection of rocks. They make observations and then ask questions. By the end of the lesson, students should have a better idea of how science works.

## Materials:

- Cheese stick “candle” with almond “wick”, and matches to light candle
- Collection of local rocks, or other natural objects from the local environment that the students can observe (for example, evergreen and deciduous foliage and seeds)
- Magnifying glasses or hand lenses
- [Slide show](#)
- Each student will need: pencil, science notebook or paper, [handout](#)
- Seedlings in a jar experiment: Large glass jar that can be sealed, seeds, soil, balance beam (accurate to 0.01 kg)



# SCIENTIST IN RESIDENCE PROGRAM

## **In the Classroom**

### **Observation Exercise: [Cheese Stick Candle](#)**

- Tell students that observations are important in science. Define what an observation is. You do not need to go into much detail at this point, as there will be further discussion later in the lesson.
- Tell students “Today we will practice making observations on an object”. Ask them to take out a piece of paper and a pencil
- Light the almond “wick” and walk around the class, showing the students the “candle”
- After all the students have had a chance to observe the “candle”, blow out the almond, and tell students to put down their pencils. You can ask them to pass up their papers if you wish.
- Casually tell students that you are hungry because you didn’t have much breakfast/lunch and eat the candle. Students will be surprised! Ask how many wrote that the object was a candle.

### **Explanation: Observations vs. Inferences**

- Explain to students the difference between observations and inferences using the [slide show](#).
- Class discussion: What are observations for the cheese candle? What are inferences?
- Explain that observations can lead to questions.
- *“Without data, you’re just another person with an opinion” - W. Edwards Deming*

### **Science Activity: Rock Observation**

- Put out a collection of cliff rocks (angular, crumbly, easy to break, fossiliferous) on one table and a collection of beach pebbles (rounded, dull looking, very hard, difficult to break) on another table.
- Split the class into 2 groups and have them spend 5-10 minutes at each table writing down observations on the rocks on the handout
- Have students return to their desks, and write down some questions that they have about the rocks they observed. What do they want to know about the rocks?

### **Wrap-up discussion**

- What observations did students have about the rocks? What questions did they have?

### **Activity: Set up Experiment**

- Set up the [“seedlings in a jar”](#) experiment for week 3.



## SCIENTIST IN RESIDENCE PROGRAM



Cliff rocks from Vancouver beaches.

### Vocabulary:

Science	A process for answering questions about our world
Observation	Information that we gather with one of our five senses; a fact, measurement, or description
Inference	An explanation for an observation; made with our brain and based on prior experience

### Extensions

For further practice making observations and inferences, students can:

1. [Examine a collection of shoes](#)
2. [Analyze a dialogue](#) from the tv show “Sherlock”
3. [Diagnose why a lamp does not work](#)
4. [Infer characteristics of a person from their hand](#)
5. Try to figure out what is inside [mystery eggs](#)
6. Borrow an animal skull or skeleton from a science museum or university. Can students figure out what kind of creature it is from?

This lesson can link with language arts lessons, especially a unit on mystery stories (Sherlock Holmes) or books with unreliable narrators (such as *Liar and Spy* or *Harry Potter and the Prisoner of Azkaban*)

### References

1. Clague, J., and Turner, Bob. 2003. Vancouver, City on the Edge. Tricouni Press. (information about Vancouver geology)
2. Konicek-Moran, Richard. 2013. Everyday Life Science Mysteries: Stories for Inquiry-based Science Teaching. NSTA press. (seedlings in a jar experiment)
3. <<http://www.e-missions.net/elabs/style/doc/Pre-missionLessonEdibleCandle.pdf>> Science Magic Pre-Lab Lesson Plan The Edible “Candle” . Accessed February, 2017.
4. <<http://undsci.berkeley.edu/teaching/misconceptions.php>> Misconceptions about science. University of California at Berkeley Understanding Science website [list of student misconceptions about science]. Accessed November, 2015.