**Science Unit:** ***The Electron: Conductivity and Chemistry***

**Lesson 1:** ***Introduction to the Scientist***

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| School Year: | 2011/2012 |
| Developed for: | Trafalgar Elementary School, Vancouver School District |
| Developed by: | James Day (scientist); Kathryn Coulter-Boisvert and Christy Shea (teachers) |
| Grade level: | Presented to grades 6 and 7; appropriate for grades 5 – 7 with age appropriate modifications |
| Duration of lesson: | 1 hour and 15 minutes |
| Notes: | This lesson is a modification of the Introductory Activity - Thinking Like a Scientist, and Lesson 7 - The Scientific Method, in The Earth Around Us: Air Water and Soil science unit, Scientist in Residence Program. http://scientistinresidence.ca/science-lesson-plans/the-earth-around-us-air-water-soil/<br><br>This lesson assumes that students have a partially developed understanding of the scientific method and that students have had some experience in taking and recording their observations. |

### Objectives

1. Appreciate scientific thinking.
2. Define the scientific method and how it is used (i.e., thinking like a scientist).
3. Learn how to keep a scientific logbook.
4. Gain experience recording observations.

### Background Information

The scientific method is a process of thinking through possible solutions to a problem and testing each possibility to find the best solution. Scientists use the scientific method to search for cause and effect relationships in nature; in other words, they design an experiment so that changes to one item cause something else to vary in a predictable way. Understanding the principles behind the scientific method and knowing how to use them will equip students with valuable critical thinking skills that will be of tremendous benefit to them no matter what their path in life may be.

### Vocabulary

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| Scientific method: | A set of techniques for investigating phenomena and acquiring new knowledge, as well as for correcting and integrating previous knowledge. To be termed scientific, a method of inquiry must be based on gathering empirical and measurable evidence subject to specific principles of reasoning. |
| Variables: | Anything that can effect the outcome of your observations. To best understand your observations and summarize your results, all but one of your variables should be kept constant during an experiment. |
| Hypothesis: | A possible explanation for an observation. By performing your experiment, you will be testing whether or not your hypothesis is correct. |

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| Data: | Pieces of information (measurements or observations) collected during your experiment. The data is then used to help determine whether or not your hypothesis is correct. |
| Observations: | An activity consisting of receiving knowledge of the outside world through the senses, or the recording of data using scientific instruments. The term may also refer to any data itself collected during this activity. Collecting observations is an important step in the scientific method. |
| Conclusion: | The results of your experiment and how they relate to your hypothesis. |
| Logbook or notebook: | A scientist's primary record of research. Researchers use a lab notebook to document their hypotheses, experiments, and initial analysis or interpretation of these experiments. It serves primarily as an organizational tool, a memory aid, but can have a role in protecting any intellectual property that comes from the research. |

**Materials**

- 1 notebook per student (to be used as a scientific logbook for the Scientist in Residence Program lessons)
- short demo YouTube video “Colour changing card trick”
- http://www.youtube.com/watch?v=voAntzB7EwE
- activity sheet *Questions about the colour changing card trick*

## In the Classroom

The teacher should participate in the discussion and write down the steps to the scientific method as the scientist discusses them.

**Introductory Discussion**

1. Begin by having the students brainstorm over the following questions: What is science? What does a scientist do? Why do science at all? Do you use science? Be sure to emphasize that we are all scientists.

2. Shift the discussion to the science which is around us. Draw examples from everyday life (e.g., medicine, technology, construction/architecture, nutrition, etc.).

3. Introduce “thinking like a scientist” as using the scientific method, which is the best method people know about for understanding the real and objective world around them. This kind of thinking is not always easy, but does become more natural with practice. Using the scientific method includes many (or all) of the following steps.

1. Start with a **problem** or ask a **question** – what is it that you are curious about?

2. Define your **variables** – this will help you to understand your results.

3. Make a **hypothesis** – predict what you think will be the outcome of your experiment and, importantly, why you think this will be the outcome.

4. Do your **experiment** – to test your hypothesis (determine whether or not it is correct or not). Be careful that your experiment only tests one variable, while the others are “controlled” (held constant). Your experiment might also require replication (to be done again), to be certain that the same observations result.

5. Collect your **data** and/or make your **observations**. This step should *always* involve written documentation.

6. **Summarize** your results – use a graph or table to communicate what you have learned. It also helps to write down one or two important sentences that summarize what you have learned from your experiment.

7. State your **conclusions** – how do your results relate to your hypothesis? Does your hypothesis remain a possible explanation to what you have observed or do you need to think of a new hypothesis to test.

**Science Activity**

Activity Title: The colour changing card trick

Purpose of Activity: While the introductory discussion part of the lesson reviewed the scientific method, the focus of the activity is to practice recording our observations. People quite naturally tend to believe that their brains accurately sense the world as it is and remember it as it was. But our brains often lie to us – it's true! Science has uncovered the fallibility of the human mind, as well as several clever ways to work around these inherent weaknesses.

One very effective way in which to learn about the world without having to rely solely on our memories is to record events in written form and then refer back to them when required. This is one of the reasons a scientist keeps a logbook.

A great way to convince a person that their brain can deceive them is to confront that person with such a deception. The video used in the activity does an excellent job of deceiving the audience (and, subsequently, revealing the deception).

Methods and Instructions:
Set-up prior to activity: Have the YouTube video completely downloaded and paused at the beginning.

Students will collect their observations individually, as the video plays. The worksheets will be distributed after they have seen the video, and are to be completed in groups of 2-4.

1. Explain to the students that they will be watching a video of a magician's trick. Explain that in order to uncover the trick, students must collect observations (which they will share with the class after the video has played). Students will use their scientific logbooks to record all of their observations.

2. Play the “colour changing card trick” video until 1:15 and then pause the video. Students should be recording their observations as the video plays – this will be particularly difficult for them, in part because they will not know what information is actually important.

3. Provide the questions from the activity sheet (*Questions about the colour changing card trick*) to the students. Have them attempt to answer all ten questions, as best they can. Request that students record their answers to these questions in their logbook.

4. Call on students for answers to the questions on the activity sheet. All students should be able to provide answers easily to some of the first five questions. The remaining five questions are likely to be left blank, or may reveal inconsistent answers between groups. Use the former point to emphasize how much information can be missed even when we are paying attention (why didn't you notice the colour of the table?). Use the latter point to emphasize how new questions can arise in answering others (how could two groups watching the same thing record different observations?).

5. Play the remainder of the video.

**Closure Discussion**

1. Review the scientific method (e.g., ask questions, collect evidence, draw conclusions, and always be willing to change your mind) with the students. Get them to identify the steps of the scientific method as they were just performed in the observational experiment.

2. Emphasize that the scientist does not trust their senses.

3. Introduce the upcoming unit on the particle model of matter.

**References**

1. <http://scientistinresidence.ca> See Science Lesson Plans, Earth Science, The Earth Around Us: Air Water & Soil, Introductory Activity - Thinking Like a Scientist, and Lesson 7 - The Scientific Method.

2. <http://en.wikipedia.org/wiki/Scientific_method> 'Scientific Method' entry on Wikipedia [Detailed explanation of the scientific method, with many examples.]

3. <http://www.youtube.com/watch?v=voAntzB7EwE> Richard Wiseman. Colour changing card trick. [YouTube video.] Accessed 9 January 2012.

# Questions about the colour changing card trick

What was the man's name?

What was the woman's name?

What card did the woman select?

What colour was the back of the original deck of cards?

What new colour appeared in the deck?

What colour was the man's shirt?

What colour was the woman's shirt?

What colour was the table?

What colour was the background?

What is the trick?