Objective: Students will be able to:

- Define and complete the remaining steps of the Scientific Method.
- Create an experiment designed to test a hypothesis.
- Analyze data collected from an experiment.
- Report the results of an experiment.

Time Required: One class period

Materials Needed:
- Students’ Observation Worksheets from Lesson 1
- Scientific Method graphic (included)
- Experiment materials as dictated by your choice of experiment

Vocabulary:

**Scientist** - A person who is studying or has expert knowledge of one or more of the natural or physical sciences

**Experiment** - A test, conducted under controlled conditions, that is made to demonstrate a known truth or to examine the validity of a hypothesis

**Scientific Method** - A procedure for scientific discovery consisting of observation, research and experimentation for the purpose of testing a hypothesis

**Observation** - The action or process of observing something or someone carefully in order to gain information

**Hypothesis** - A testable, temporary prediction about how a scientific investigation or experiment will turn out.
Applicable Common Core State Standards:

**CCSS.ELA-Literacy.RI.3.3** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

**CCSS.ELA-Literacy.RI.3.4, RI.4.4, RI.5.4** Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade-appropriate topic or subject area*.

**CCSS.ELA-Literacy.RI.4.3, RI.5.3** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

**CCSS.ELA-Literacy.W.3.7** Conduct short research projects that build knowledge about a topic.

**CCSS.ELA-Literacy.W.3.8** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

**CCSS.ELA-Literacy.W.4.7** Conduct short research projects that build knowledge through investigation of different aspects of a topic.

**CCSS.ELA-Literacy.W.4.8** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

**CCSS.ELA-Literacy.W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**CCSS.ELA-Literacy.W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

Additional Relevant National Learning Standards:
(Based on Mid-continent Research for Education and Learning)

**Science. Standard 12. Level II [Grade 3-5].** Understands the nature of scientific inquiry
1. Review the first three steps of the **Scientific Method** that were covered in Lesson One of this unit.
   - Ask a question
   - Make observations and do background research
   - Form a hypothesis

2. Provide students with their Observation Worksheets from Lesson 1. Review the class question, and highlight some of the observations made while watching the baseball game. Select a few students to share their hypotheses.

3. As a class, brainstorm some ways that the hypotheses could be tested. Write down students’ ideas on the board or on a sheet of chart paper.

4. Explain that the next step of the scientific method is to conduct an **experiment** to test a hypothesis. An experiment is a scientific test to try out a theory or see the effect of something.

5. Tell students that in order to conduct an experiment, a procedure must be established. A procedure is a list of steps that a scientist takes to complete an experiment. It is a detailed list that has each step numbered. It might also include drawings of what each step should look like.

6. Review students’ experiment ideas written down earlier. Select one that has the potential to provide good information and is relatively easy to perform.

7. Help students plot out the procedure of the experiment. Explain that it is important to follow the steps as they are laid out. That way, the experiment can be repeated in the same way later to see if the results remain the same.

8. Discuss that when scientists design an experiment, they try to control almost all variables. Variables are things that might change and affect the outcome of an experiment. Ideally, almost all elements of the experiment should be controlled except for one variable that will help provide an answer to the question.
9. Perform your class experiment. The activity on the following page is one example of an experiment that can be done to compare wood and aluminum bats.

10. No matter what your class experiment looks like, make sure that students record the data for every step of the process. Repeat your experiment as many times as necessary.

11. Once the class has completed their experiment, discuss that the final piece of the scientific method is drawing conclusions. In this step, examine the data collected by the class. Ask students to look back at their hypotheses. Does the data support or refute their hypotheses?
This example experiment will compare the distance a ball can travel when hit with a wood bat and an aluminum bat.

1. Choose two or three students (or adults) that have experience hitting a baseball off a tee. The batters may warm up before the experiment.

2. Have the first batter hit a ball off a tee using an aluminum bat. After the ball is hit, the distance traveled should be measured using a measuring tape.

3. Have the batter hit the ball three times. Calculate the average distance the ball traveled.

4. Repeat steps 2 and 3 with the other two batters. Calculate the average distance the ball traveled for each batter.

5. Now have the three batters repeat the process using wooden bats. The distance traveled by the ball is again measured and the average distance calculated.

6. Have students compare the results of the experiment. The results should show that the ball traveled the furthest after being hit with the aluminum bat, compared to the distance traveled by the ball when hit with the wooden bat.

Conclusion:

To conclude this lesson and check for understanding, have each student write a lab report. The lab report should explain the entire process of the experiment by laying out the question, experiment procedure, and addressing the conclusion reached. Students may also address other experiments that could be performed to test their hypothesis, as well as any improvements that could be made if this experiment were conducted again.
The Scientific Method

1. Ask a question
2. Do background research
3. Construct a hypothesis
4. Test your hypothesis by doing an experiment
5. Analyze your data and draw a conclusion
6. Report your results (Was your hypothesis correct?)