

The Scientific Method: How Do Scientists Solve Problems?



Lesson 2 of 3

**Can be used in conjunction with the following lesson plans:*

Lesson 1: Steps to Creating a Science Research Project

Lesson 3: What is the effect of light on ice?

Purpose

The following lesson will allow students to name and explain the steps of the scientific method and use the scientific method to solve a problem.

Georgia Performance Standards

Characteristics of Science:

Habits of Mind:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science

- a. Exhibit the above traits in their own scientific activities
- b. Recognize that different explanations often can be given for the same evidence

SCSh3. Students will identify and investigate problems scientifically

- a. Suggest reasonable hypotheses for identified problems
- b. Develop procedures for solving scientific problems
- e. Develop reasonable conclusions based on data collected

SCSh4. Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials

- a. Develop and use systematic procedures for recording and organizing information

SCSh6. Students will communicate scientific investigations and information clearly

- a. Write clear, coherent laboratory reports related to scientific investigations
- c. Use data as evidence to support scientific arguments and claims in written or oral presentations
- d. Participate in group discussions of scientific investigation and current scientific issues

Nature of Mind:

SCSh7. Students will analyze how scientific knowledge is developed. Students recognize that:

- e. Testing, revising, and occasionally rejecting new and old theories never ends

SCSh9. Students will enhance reading in all curriculum areas by:

- c. Building vocabulary knowledge

Materials

- Shoe boxes, numbered and sealed. Each box is to have a flap, large enough for students to use senses other than sight to determine the contents of the box.

- 4 – 5 items for each box, including aromatic herbs (mint, etc), marbles, salt or sugar, pieces of wood, balls (e.g., ping-pong, rubber, golf), paperclips, glass rods
- answer key for the contents of each box

Procedure

- Introduce the scientific method by brainstorming how a problem is solved. Formulate student's ideas into a chart of steps in the scientific method. Determine with the students how a scientist solves problems.
- Arrange students in working groups of 3 or 4. Students are to attempt to discover what is in their mystery box.
- The group must decide on a procedure to determine the contents of their box and formulate a hypothesis as to the contents.
- Students are to design an experiment (series of steps) that they will use to test their hypothesis.
- Students will carry out experiment and record their results on the worksheet.
- Students will draw conclusions based on what they did, then appoint a reporter from their group to share their results with the class.

Key Questions

- What are the steps involved in the scientific method?
- How do you raise a testable question from your observation?

Explanations

There is no single process or set of steps that all scientists use. The scientist must always be prepared to go backward, change directions and be flexible. Although the exact steps may vary, a good scientific investigation must have certain features. Every investigation begins with an observation.

- Observation – the use of senses to study something. Scientists may use tools such as a microscope or a scale. Observations are followed by a question
- Researching – reading literature to give you a background of information that already exists concerning your question
- Hypothesizing – a possible explanation for an observation
- Designing an experiment – experimentation supports or rejects your hypothesis
- (Variables) – a variable is any factor that affects the outcome of an experiment. Each experiment must contain a control and an independent variable.
- Collecting, organizing, and analyzing data
- Reporting the results so that other scientists may test your conclusions

Student Sheet

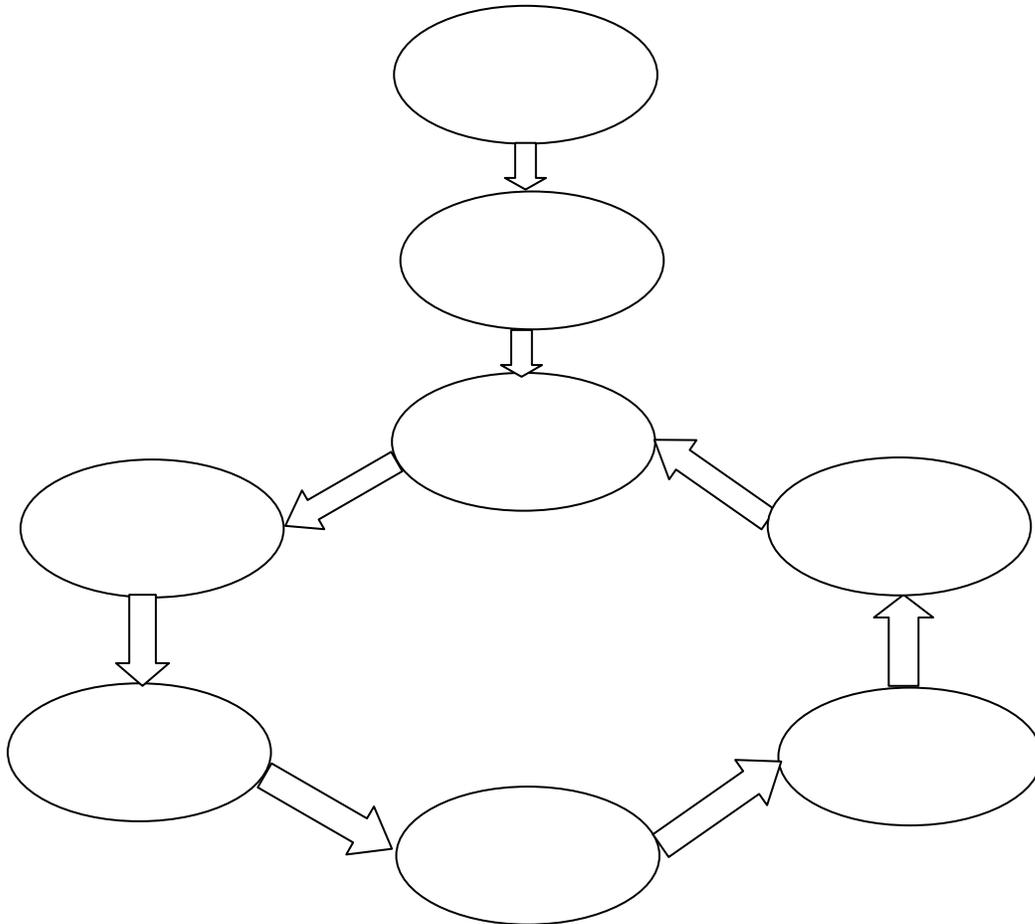
Name _____

Date _____

To be completed in class.

How do scientists solve problems?

- I- Fill in each oval of the flowchart below with a step of the scientific method.
Steps of the scientific method include:



Define the following processes:

1. Observation
2. Hypothesis
3. Prediction
4. Experimentation
5. Analysis

How do scientists solve a problem?

II – Worksheet 1

Name _____ Group # _____ Mystery Box # _____

Problem:

Hypothesis:

What We Did:

- | | |
|----------|---------------|
| 1- _____ | Result: _____ |
| 2- _____ | Result: _____ |
| 3- _____ | Result: _____ |
| 4- _____ | Result: _____ |
| 5- _____ | Result: _____ |

Our Conclusions:

Why we came to these conclusions:

What can we do to improve our results?
