Florida Benchmarks

- **SC.6.N.1.1** Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observation or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

- **SC.6.N.1.2** Explain why scientific investigation should be replicable.
Florida Benchmarks

• **SC.6.N.1.3** Explain the difference between an experiment and other types of scientific investigation, and explain the relative benefits and limitations of each.

• **SC.6.N.1.4** Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.
Florida Benchmarks

- **LA.6.4.2.2** The student will record information (e.g., observations, notes, lists, charts, legends) related to a topic, including visual aids to organize and record information and include a list of sources used.
Scientists at Work!

What are some types of scientific investigations?

• Two main types of scientific investigations are *experiments* and *observations*.

• An *experiment* is an organized procedure to study something under controlled conditions.

• Experiments are often done in the laboratory to control factors that can influence a result.
What are some types of scientific investigations?

- **Observation** is the process of obtaining information by using the senses.

- Observation also can refer to the information obtained through the senses.

- Observations cannot always be made under controlled conditions.
What are some types of scientific investigations?

• Observations can be made anywhere and may give a better description of what is actually happening in nature.

• The creation of models is another type of investigation used to study small, large, or complex things.
Why Ask Why?

What are some parts that make up scientific investigations?

• A **hypothesis** is a testable idea or explanation that leads to scientific investigation.

• A hypothesis can be tested by experiment or observation.
What are some parts that make up scientific investigations?

• A **variable** is any factor that can change in an experiment, observation, or model.

• Scientists try to change only one variable in an experiment and keep the other variables constant, or unchanged.
What are some parts that make up scientific investigations?

- **Data** are information gathered by observation or experimentation that can be used in calculating or reasoning.

- All observations, experimental setup, and procedures must be recorded so details are not forgotten.
Many Methods

What are some scientific methods?

• Scientific methods are the ways in which scientists answer questions and solve problems.

• Scientists do not all use the same steps in every investigation or use steps in the same order.
What are some scientific methods?

- After making observations or reading scientific reports, a scientist might state a problem.
- The problem must be well defined, or precisely stated, so it can be investigated.
What are some scientific methods?

• When scientists form a hypothesis, they are making an educated guess about a problem.

• Before testing a hypothesis, scientists will often make predictions about what will happen in an investigation.
What are some scientific methods?

• Scientific investigations must be carefully planned.

• Scientists must decide where to conduct an investigation.

• Scientists must determine the equipment and technology required for the investigation.
What are some scientific methods?

- Scientists must identify all the variables that can affect the results before conducting a controlled experiment.

- Scientists must decide which variables should change and which variables should stay constant.
What are some scientific methods?

- The data collected in an investigation must be recorded and properly organized.
- Data is often organized into tables, spreadsheets, or graphs.
What are some scientific methods?

- Scientists must analyze the data collected during an investigation.
- The analysis of data helps scientists to draw conclusions about the results.
What are some scientific methods?

- Scientists conclude whether the results of an investigation support the hypothesis.

- If the hypothesis is not supported, scientists will think about the problem some more and try to come up with a new hypothesis.

- Scientists must be able to defend their conclusions.
How are scientific methods used?

- Different situations require different methods of testing a hypothesis.
- Even when an investigation does not support a hypothesis, the information can lead to new investigations.
- Even after several unsupported hypotheses, scientists continue to test problems until a supported hypothesis is found.
What are some ways to confirm an investigation is valid?

- Peer reviewers evaluate the methods used in a study and the conclusions reached by its authors.
- Even after a study is published, scientists must answer questions raised by other scientists.
What are some ways to confirm that an investigation is valid?

- Replicating an investigation is an important way to confirm the findings of an investigation.

- Scientists disclose the methods and materials used in a study when they publish their findings.

- Investigations that cannot be supported or repeated will not be accepted by the scientific community.
How can you evaluate the quality of scientific information?

- The most reliable scientific information is published in science journals.

- Government or academic web sites are the most reliable information on the Internet.

- Lab reports in school need to meet the same standards as published studies.