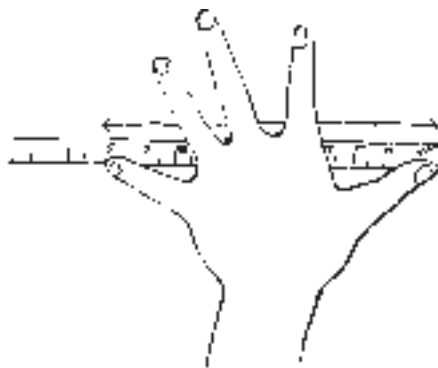


OVERVIEW

MEASUREMENT



GOALS

Measurement, the process of quantifying observations, is one of the cornerstones of science. Measurement compares nature—the unknown—to a standard unit—the known. Through such comparison, the organization of the world becomes more comprehensive. The FOSS Measurement Module consists of four investigations, each designed to emphasize a particular type of metric measurement—length, mass, temperature, and volume.

FOSS EXPECTS STUDENTS TO

- Understand the necessity for standard units of measurement.
- Develop an understanding and intuitive feel for the metric system.
- Measure length and distance in meters and centimeters with a meter tape.
- Measure mass in grams with a balance and mass pieces.
- Measure liquid volume and capacity of containers in liters and milliliters with 50-ml syringes and graduated cylinders.
- Measure temperature of liquids and air in degrees Celsius with a thermometer.
- Acquire the vocabulary associated with metric measurement.
- Exercise language and math skills in the context of metric measurement.
- Apply appropriate measuring skills in everyday situations.
- Develop and refine the manipulative skills required for making and using measuring tools.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, and organizing.

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MEASUREMENT MODULE MATRIX

SYNOPSIS

SCIENCE CONTENT

THINKING PROCESSES

THE FIRST STRAW

Students learn the need for standard units of linear measurement. They measure objects with nonstandard units, straws, and then use a meter tape to measure objects in meters and centimeters. Students measure and compare body dimensions in the metric system.

- The meter (m) is the standard metric unit of linear measurement; the centimeter (cm) is 0.01 m.
- Length is how far it is from one point to another.

- Observe and measure length in meters and centimeters.
- Organize information on a record sheet.
- Compare the results of several linear measurements.
- Communicate findings.

WEIGHT WATCHING

Students learn the need for standard units for measuring mass and use the FOSS balance and mass pieces to weigh objects. Students prepare 100-g bags of gravel and cooperate to make a kilogram mass piece. They discover that a sponge can soak up many times its own mass in water.

- The gram (g) is the standard metric unit of mass; the kilogram (kg) is 1000 g.
- Mass is the amount of matter in an object.

- Observe and measure mass in grams.
- Organize information on a record sheet.
- Compare the results of several weighings.
- Communicate findings.

TAKE ME TO YOUR LITER

Students learn the need for standard units of volume. They use syringes and graduated cylinders calibrated in milliliters to measure fluids accurately. After learning how to use the FOSS volume measuring tools, students measure the capacity (maximum volume) of several common containers.

- The liter (L) is the standard metric unit of fluid measurement; the milliliter (ml) is 0.001 liter.
- Volume is the three-dimensional space occupied by something.
- Capacity is the maximum amount (or volume) of fluid a container can hold.

- Observe and measure fluid capacity in milliliters.
- Organize information on a record sheet.
- Compare measured capacity results to given values.
- Communicate findings.

THE THIRD DEGREE

Students compare the temperatures of 3 cups of water using their fingers, which leads to the need for a measuring tool and a standard unit. Students use alcohol thermometers and measure in degrees Celsius. They measure the temperatures of warm and cold water and find out how cold a mixture of ice and water gets in 10 minutes. The module ends with a Metric Field Day as students compete and officiate in events designed by the class.

- The degree Celsius ($^{\circ}\text{C}$) is the standard metric unit of temperature.
- Temperature is a measure of how hot or cold something is.

- Make sensory comparisons of temperature.
- Observe and measure temperature in degrees Celsius.
- Organize information on a record sheet.
- Compare temperatures of cooling ice water over time.
- Communicate findings.
- Apply metric measurement in a game format.

Language Extensions

- Research measuring units in other countries and from history.
- Discuss metric prefixes.

Math Extensions

- Problem of the week.
- Review multiplication by tens.

Science and Art Extensions

- Create a measurement museum.
- Make desk covers.
- Draw a picture on a larger scale.
- Make a trundle wheel.

See the Science Stories folio.

- *A Royal Measurement Mess*
- *The Metric System*
- *Measure This!*

www.fossweb.com Check the FOSS website for interactive simulations, to communicate with a scientist, for teaching tips, and to talk with other classes using FOSS.

Home/School Connection: Students and families measure objects around the house (using hands, feet, etc., as measuring units) to reinforce the need for a standard.

Language Extensions

- Describe the procedure for weighing an object.
- Discuss nonstandard units.

Math Extensions

- Problem of the week.
- Weigh lunch items.
- Determine tare weight of packages.

Science Extensions

- Monitor evaporation rates.
- Test products for absorbancy.
- Make homemade balances.
- Investigate labels on food packages.

See the Science Stories folio.

- *The Metric System in the United States*
- *Mind-Boggling Measurements*
- *Measurements through Time*
- *Ancient Measurements Used Today*
- *The Metric System at Work*

Home/School Connection: Students keep a journal listing all the times someone in the family needed to measure something exactly or approximately. They describe in writing two of these situations.

Language Extensions

- Write letters to companies about product volume.

Math Extensions

- Problem of the week.
- Estimate capacity of other containers.

Science Extensions

- Seriate containers by a measurement other than capacity.
- Determine the volume of solid objects using a displacement apparatus.

See the Science Stories folio.

- *Water Everywhere*
- *Measurements in the Marketplace*
- *Angela Amato, School Reporter*

Home/School Connection: Students check labels of a variety of products at home. They determine what kind of products are labeled by volume and by mass.

Language Extensions

- Write stories about characters from extreme temperature climates.
- Compare temperatures around the world.

Math Extensions

- Problem of the week.
- Estimate temperatures of common things.

Science Extensions

- Hunt for high and low temperatures in class.
- Check body temperature.
- Practice taking temperatures.

See the Science Stories folio.

- *Fahrenheit and Celsius*
- *Thermometers*
- *Careers You Can Count On*
- *Vacation Aggravation*
- *Everything Is Made of Atoms*

Home/School Connection: Students monitor highs and lows in their own city for 5 days, then graph the highs and lows on a grid.

FOSS AND NATIONAL STANDARDS

The **Measurement Module** emphasizes the development of observation and description skills and building explanations based on experience. This module supports the following National Science Education Standards.

SCIENCE AS INQUIRY

Develop students' abilities to do and understand scientific inquiry.

- Ask and answer questions.
- Plan and conduct simple investigations.
- Employ tools to gather data.
- Use data to construct reasonable explanations.
- Communicate investigations and explanations.
- Understand that scientists use different kinds of investigations and tools to develop explanations using evidence and knowledge.
- Understand that scientists review and ask questions about the results of other scientists' work.

SCIENCE AND TECHNOLOGY

Develop students' abilities in technological design.

- Identify a simple problem and propose a solution.
- Evaluate a product or design.
- Communicate a problem, design, and solution.

Develop students' understandings about science and technology.

- People have always had problems and invented tools and techniques to solve problems.
- Scientists work collaboratively in teams and use tools and scientific techniques to make better observations.

HISTORY OF SCIENCE

Develop an understanding of science as a human endeavor.

- Science and technology have been practiced by people for a long time.
- Men and women have made a variety of contributions through the history of science and technology.