MASS OLYMPICS

Teacher Notes

FOURTH GRADE BACKGROUND

- Students are familiar with centimeters and inches, but should not be asked to convert between them
- Students have not yet seen the scientific method
- Students will need help making their first estimations in the Olympic events

PREVIOUS LESSON REVIEW

- What did you learn last month about classification?
- What is a property (color, shape, texture, smell, taste, etc.)?
- How did we classify objects into different groups (such as beans/buttons)?

INTRODUCTION

This lesson begins our unit on measurement by allowing the students to make estimates and measurements of mass using metric units (grams and kilograms). The mass of an object is the amount of matter it contains. The weight of an object is the pull of gravity on that object. Discuss which tool should be used for our measurements (i.e., balance for mass and scale for weight); we will use a balance. Explain the difference, but focus on mass for this lesson. Estimation can be presented in the context of the scientific method, as students will be making hypotheses involving mass in various Mass Olympics activities.

The scientific method is how scientists investigate a **(1) question** they have. Sometimes scientists make discoveries by accident, but more often they develop a plan to test a theory or **(2) hypothesis** they have. This plan is called a **(3) procedure**. During the procedure, a scientist will **(4) collect the results or data** from his or her experiments. After thinking about the data, the scientist will then **(5) make a conclusion** and **(6) share the results** with others.

To form a hypothesis, scientists choose a problem they would like to explore. Often the problem starts off with a question, such as "How much water do plants need to grow?" Once a question is formulated, it is restated in the form of a hypothesis. For example, "If I water the plants once a day, then they will grow." The hypothesis should be very clear so that it can be tested. The procedure should describe what the scientist plans to do during the experiment. All the necessary materials and the different steps to perform the experiment are reported in the procedure. Other scientists should be able to repeat the experiment by reading the recorded procedure. As the steps described in the procedure are performed, observations are written down. These are the data and should be reported honestly. What is actually seen should be reported and not what is thought should have happened. Data is then typically organized into a table or graph. When forming conclusions, the data must be carefully analyzed to determine what it tells the scientist about the hypothesis. Sometimes the hypothesis is then revised and further experiments are conducted. Other times, the scientist decides to communicate the results with others via a scientific article. This is how scientists let others know of their work.

DISCUSSION THOUGHTS

Why is it important to make a guess about our questions before we find out the answers? What happens if we don't guess correctly?

VOCABULARY

- **Mass:** The amount of matter an object contains (measured using grams and kilograms)
- **Balance**: A tool used to measure the mass of an object
- **Estimation:** A guess about the size or value of a measurement
- **Scientific Method:** A method scientists use to answer difficult questions. Based on observations, a hypothesis is created and then checked using an experiment
- **Hypothesis**: A guess temporarily describing an observation until it can be verified with an experiment

ACTIVITIES

For these activities, set up four stations (one for each event). Each volunteer is assigned to a different station; the teacher manages the Worksheet station. Pass out the Mass Olympics Scorecards before breaking the students into four teams (Red, Blue, Green, Yellow Teams, etc). Rotate groups every ~10 minutes by using the bell to announce when students should change groups. At the end, save ~5 minutes to tally the average team scores. The team with the total score closest to 100 points wins!

- **Mass Olympics Worksheet (25 points)**
  - Hand each student a Mass Olympics worksheet. The student earns **25** points if the worksheet is completed successfully and **0** points if it is not.
  - Materials:
    - 25 Measurement Olympics Worksheets

- **Block Weight Lifting (25 points)**
  - Help each student set up a wooden arm and fulcrum. Explain that the wooden arm sits on the fulcrum and can be used like a pan balance to compare the masses of two objects. Now hand each student a set of silver, white, and black blocks. Have students hypothesize about the relative block masses by drawing lines to match the block color to its relative mass on the scorecard Then determine the actual order (white < silver < black). *Note: Due to irregularities, some of the blocks may not be in this order. Check those students' experiments individually and award points if they measure correctly for their set of blocks.* The student receives **5** points for making their hypothesis, **5** points for running the experiment, **10** points for writing their observations, and **5** points for a correct hypothesis.
  - Objective: Understand relative masses and gain exposure to the upcoming concept of density
  - Materials:
    - 4-5 Wooden arms and fulcrums
    - 4-5 Sets of different-sized blocks (white, silver, and black)

- **Right-Handed Bean Grab (25 points)**
  - Each student grabs a fistful of beans from the container (using the right hand) and adds it to the balance. The student makes a hypothesis for the mass of beans on the scale (in grams). Students measure the mass of beans with the balance. The student receives **5** points for making their hypothesis, **5** points for running the experiment, **10** points for writing their observations (with units), and **5** points for a correct hypothesis (for example, within 10 grams).
  - Objective: Students hypothesize about the mass of beans and check their accuracy
  - Materials:
    - 1 Container of beans
    - 1 Balance (teachers will have balances in the classrooms)

- **Water Works (25 points)**
  - Using a graduated cylinder, measure different amounts of water into the three different-shaped cups (use the same volumes for all groups). Have the team make a hypothesis about which cup has the greatest mass of water. The Olympians weigh each cup on the balance. The student receives **5** points for making their hypothesis, **5** points for running the experiment, **10** points for writing their observations (with units), and **5** points for a correct hypothesis.
  - Objective: Students hypothesize about the mass of water and to check their accuracy
  - Materials:
    - 3 Cups for holding water, labeled A, B, and C
    - 1 Graduated cylinder
    - 1 Balance (teachers will have balances in the classrooms)

CONCLUDING THOUGHT

Can you make a hypothesis about your mass in grams?