The Measures of Science

By Trista L. Pollard

1 Imagine a world where we did not know the boiling point of water. What if we could not record growth of plants and animals? How would you know the weekend had begun if you could not keep count of days, weeks, and months? **Measurement** has been an important part of our lives for centuries, and it is the reason that scientists are able to compare objects and events **quantitatively**. Scientists rely on measuring to describe comparisons numerically by using standard tools, models, scaling, sampling, and estimating.

2 Before standard tools like rulers, clocks, and scales, people used everyday objects to help find measurements or quantities of other objects. A simple example would be using an average adult foot to represent one foot in English or customary units of measurement. Large stones may have been used in simple balances to help measure the weight of objects. Even the sundial, the earliest form the clock, used the shadows from the sun to help keep track of time. Today scientists use various tools like rulers, graduated cylinders, and scales to measure in English units (i.e., inches, feet, etc.) and metric units (i.e. centimeters, millimeters, etc. Graduated cylinders are used to measure the volume of small objects in milliliters. Scales can be used to measure the weight of objects in grams and milligrams. Scientists also use thermometers and barometers to measure changes in the earth's temperature and changes in its air humidity over time.

3 Scientists build **models** and use **scaling** to represent objects that are far too large to show at their true size. Models are smaller objects that are built to represent the detail of larger objects. Scientists use smaller measurements that are in proportion or scaled to the measurements of the larger object the model represents. Scaling is also done to represent extremely large distances between objects, such as the planets in our solar system. Another example would be when architects build models of buildings. These models may have a scale where every inch of height stands for a certain amount of feet in height for the real buildings. When scientists build models, they are providing a visual image that helps others to understand scientific concepts (such as planetary motion) and objects (such as high speed trains).

4 There are times when scientists need to study populations of beings or sets of objects that are extremely large. **Sampling and estimating** are good methods for accomplishing this goal. When scientists sample populations or sets, they are looking at a small part of that population or set. After they have studied that small part, they use it to make **generalizations** or judgments about the whole population or set. Scientists who study events, like weather patterns, may need to estimate or form opinions about numerical data. An example would be when a meteorologist estimates the amount of inches of snow your town will receive that evening. Based on past records of similar weather patterns, he or she is able to predict a range of snowfall.

5 Measurement is an important part of scientific investigating and our daily lives. When scientists measure objects and events, they are communicating comparisons that help us to better understand our world.

Name _____ Science Pd: _____

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1. Scientists use measurement to _____.
   - (A) Record the procedures in their experiments
   - (B) Communicate comparisons numerically about objects or events
   - (C) Estimate the amount of hours an experiment will take
   - (D) None of the above

2. Scaling is a method for building models of very small objects.
   - (A) False
   - (B) True

3. Before there were standard tools to use for measurement, people used _____.
   - (A) Estimation to determine measurements of objects
   - (B) Everyday objects to measure and compare with other objects
   - (C) Scaling to determine measurements of objects
   - (D) Folktales to determine measurements of objects

4. What would be the best method for measuring the number of geese that appear every spring in a state?

5. How does scaling help scientists to represent models of our solar system?

6. When scientists estimate, they use past patterns of events to make numerical judgments about future events.
   - (A) False
   - (B) True

7. Graduated cylinders are used to measure the _____.
   - (A) Weight of small objects
   - (B) Length of small objects
   - (C) Volume of small objects
   - (D) Width of small objects

8. Look around your classroom. Locate several small items (about ten) that you can measure. Imagine you did not have standard tools to measure these items. What could you use to help measure these items? List the items you chose and the non-standard tools you used to measure them.

The Measures of Science Reading Questions

1. Scientists use measurement to _____.	2. Scaling is a method for building models of very small objects.
3. Before there were standard tools to use for measurement, people used _____.	4. What would be the best method for measuring the number of geese that appear every spring in a state?
5. How does scaling help scientists to represent models of our solar system?	6. When scientists estimate, they use past patterns of events to make numerical judgments about future events.
7. Graduated cylinders are used to measure the _____.	8. Look around your classroom. Locate several small items (about ten) that you can measure. Imagine you did not have standard tools to measure these items. What could you use to help measure these items? List the items you chose and the non-standard tools you used to measure them.