Reading Equipment with Scales

Background

In an effort to fully understand our universe and to better prepare for future missions, scientists examine a wide range of measurements about our Solar System and beyond. Scientists use various units of measurement and different types of scales in order to ensure precise and uniform measurement.

Scientists use the International System of Measurement, which is a version of the metric system. In the metric system, a basic unit of measure is used for each type of measurement, and prefixes are affixed to this basic unit to make describing amounts easier.

The liter is the metric unit for measuring volume. Prefixes, added to "liter", are used to show fractional parts of the liter and multiples of liters, as follows.

Milliliter	1/1000 of a liter
Centiliter	1/100 of a liter
Deciliter	1/10 of a liter
Decaliter	10 liters
Hectoliter	100 liters
Kiloliter	1000 liters

Skills

- Measuring
- Collecting data
- Math
- Science

Measurement	Unit	Measured with
Length	Meter, Kilometer	Meter Stick
Volume	Liter, Milliliter	Graduated Cylinder
Weight or Mass	Gram, Milligram, Kilogram	Scale
Temperature	Degree (Celsius)	Thermometer
Speed	Kilometers/Hour	Speedometer
Electrical current	Amperes	Ammeter

Objectives

Students will:

- Apply the metric system to reading various forms of measuring devices.
- Use a meter stick to find the length, width, and height of several objects.
- Calculate volume, area, and density.

Overview

Students will practice reading an ammeter, a graduated cylinder, a meter stick, and a balance. Students will calculate area, volume, and density.

Key Question

How can instruments of measure assist us in scientific investigation?

Key Concepts

- Technology is essential to scientific investigation.
- Technology can assist us by providing tools for analysis.
- The more advanced technology becomes, the more precise the measurements, leading to greater accuracy and insight into phenomena in our Solar System.

Materials & Preparation

Per team:

- 5 different objects for students to weigh and measure
- 1 Triple beam balance
- 1 Meter stick
- 3 Graduated cylinders of various sizes
- 1 Ammeter

1. Obtain materials listed above.
2. Fill all three graduated cylinders with different amounts of water.
3. Assign students to teams with cooperative roles.

4. Discuss the metric system.
5. Review with the students the formulas for volume, area, and density.

Management

This lesson should take one class period. You can order ammeters from a science catalog.

Reflection & Discussion

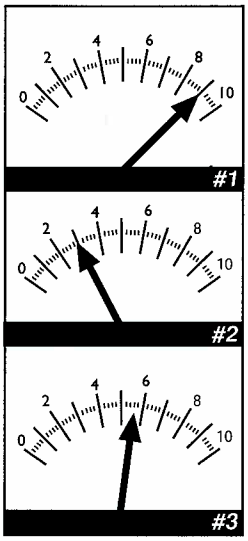
1. How can the use of measuring devices assist us in everyday life?
2. How can we create new measuring units or devices?
3. Why is it important to use the metric system?
4. Which is the largest unit of measure: milliliter, centiliter, or deciliter? When is it appropriate to use each?

Transfer & Extension

1. Convert recipes into metric measurements and have the students make the dishes based on the new units.
2. Interview an electrician to find out information about an ammeter. Why is it used? How is it used?
3. Use an ammeter to determine which materials are good and bad conductors of an electrical current.
4. Research and report on the National Institute of Standards and Technology.

STUDENT WORKSHEET

Reading Equipment with Scales



Student Procedures

1. For questions 1-6, use the graduated cylinders to practice reading and writing measurements of volume.
2. For questions 7 and 8 use the pictures of the ammeter dials (at right) to practice reading and writing measurements of electrical currents. Use milliamps (mA)
3. Use the balance and the meter stick to weigh and measure five objects provided by the teacher.
4. Use the following formulas to calculate the surface area, volume, and density of each object.

   (Volume= Length x Width x Height) (Area= Length x Width) (Density = $\frac{\text{Mass}}{\text{Volume}}$)
5. Record your data in the chart below.

Reflection & Discussion

1. The value of each line in cylinder #1 represents _____ ml.
2. _____ ml is the volume of the liquid in graduated cylinder #1.
3. The value of each line in cylinder #2 represents _____ ml.
4. _____ ml is the volume of the liquid in graduated cylinder #2.
5. The value of each line in cylinder #3 represents _____ ml.
6. _____ ml is the volume of the liquid in graduated cylinder #3.
7. _____ is the value of the long bold line between the 2 and 4 on each of the ammeters.
8. Each line on the ammeters is_____ mA more than the one before it. Read the ammeters and write the number of milliamps represented on each.

   Ammeter #1 _____ mA

   Ammeter #2 _____ mA

   Ammeter #3 _____ mA
9. Do all graduated cylinders look the same?
10. Even if they look different, are all graduated cylinders similar in they way they are used?

	Length	Width	Height	Area	Volume	Density
Object #1						
Object #2						
Object #3						
Object #4						
Object #5						