Introduction to Metric Measurement Curriculum

The following activities are designed to introduce basic components of the metric system using tools from the Metric Stations Kit. Each station promotes problem solving, measurement skills, and drawing on prior knowledge. Healthcare connections link these measurement skills with industry related tasks. The pacing and timing of this curriculum can be adapted to student ability level.

Kit Materials:

Electronic Balance
Metric/Customary Rulers
1000 mL Graduated Cylinder set
Base 10 Block Set with 1000 Cubic Centimeter Container
Thermometers
Measuring Cup
Measuring Spoons
Modeling Clay
Balloon
Plastic Kit Container
Scissors
Paper
Water
Computer access
Meter Stick (optional)
Calculators (as needed)

Station: Understanding Weight and Mass

Weight and mass are related, but are different properties of matter. Mass is a measure of the amount of matter in an object. Weight is the impact of gravity on an object. An object's weight changes as gravity changes, but mass stays the same regardless of gravitational pull. Because of this, mass is a more accurate and useful measurement for most areas of science.

Activity Requirements

- Calculator

In this activity, students calculate the weight of a soda can on each planet or celestial object. The goal is to investigate the relationship between mass and weight. While the mass of the can stays constant, the weight changes as a result of gravity.

Student will:

- Use previous knowledge to analyze the data and make inferences
- Determine the weight of an object by multiplying the object's weight on Earth times the gravitational factor
- Convert ounces to pounds as needed. 1 lb = 16 oz

Prior Knowledge Requirements

Science

Vocabulary

- ❏ Celestial Body
- ❏ Gravitational Factor

- Basic understanding of our Solar System including the planets.
    - planets and other celestial bodies vary in size and mass
    - planets and other celestial bodies vary in composition
- Basic concepts of gravity
    - all matter has a gravitational pull
    - the more massive the object the stronger the gravitational pull

Mathematics

- Converting between units specifically ounces and pounds
- Using one step formulas

Measurement Tips	Units	Tool
Mass - the amount of matter in an object	grams (g)	balance
Weight- the force of gravity on an object	Pounds (lbs) Ounces (oz) 16 oz = 1 lb	scale

Further extensions

- Discuss various experiments conducted in the International Space Station and how they relate to gravity, weight and mass.
  https://www.youtube.com/playlist?list=PLCE-SVF9BSTe9AhV2g-0TqsYfNHjTzZei
- Graph data in a variety of ways to visualize data
- Replicate the activity with a 12 oz bottle of water. Use sand or other material to fill bottles to simulate the calculated weights.

Healthcare Industry Connection

Monitoring Weight Loss/Gain

What are common reasons for sudden weight gain/loss in a patient? When monitoring a patient what is considered a healthy amount of weight fluctuation?

Practice conversions

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters.

Determine the BMI of the following individuals by converting pounds to kilograms and feet/inches to meters.

$$BMI = \frac{\text{weight (lb)} * 703}{\text{height}^2\ (\text{in}^2)}$$

OR

$$BMI = \frac{\text{weight (kg)}}{\text{height}^2\ (\text{m}^2)} \quad \text{(metric)}$$

Station: Investigating Mass

For those who don't use grams in their daily lives, understanding and quantifying this measurement can be a challenge. One ounce is about 28 grams. Grams are measured with a balance and use the metric prefixes.

Activity Requirements

- electronic balance
- random classroom objects

The goal is for students to construct a concept of a gram through inquiry with minimal pre-teaching. Students will gather object around the room and record their predictions before measuring the object on the balance. The second part of the activity asks students to gather objects around the room that have specific masses.

Student will:

- Use trial-and-error to construct a concept of a gram
- Practice precise measurement using an electronic balance

Prior Knowledge Requirements

Science

Vocabulary

- ❏ mass
- ❏ gram

- Proper use of an electronic balance

Mathematics

- Reading decimals to the tenths place

Further extensions

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Healthcare Connections

Mass in Healthcare

Investigate the following common units of mass used in the healthcare field. Find the abbreviation for each unit and examples when these units would be used.

Microgram

Milligram

Gram

Kilogram

Station: Investigating Length I

Converting between units of length in the customary system requires memorization of random factors. Metric conversions use a base ten system.

Activity Requirements

- meter stick (optional)

This activity works best if students are familiar with some of the most common length conversions in the customary system, and the prefixes associated with the metric system. The goal is to conclude that the metric system is simpler to convert within than the customary system.

Student will:

- Students will use prior knowledge of length to convert between various lengths

Prior Knowledge Requirements

Mathematics

- converting between units in the same system

Further extensions

Station: Investigating Length II

When measuring, the metric system uses decimals, whereas the customary system typically uses fractions. Adding fractions can be much more time consuming than adding decimals, especially when the denominators are not common. This activity investigates adding lengths with both of these systems.

Activity Requirements

- Post-It Notes or Small Paper
- Scissors
- Ruler- Metric & Customary

Students cut the small paper into three different shapes, then measure the perimeter by adding the the sides together in both metric and customary units. After the activity, students will explain which system they prefered and why.

Student will:

- Measure length in order to calculate perimeter
- Add fractions and decimals

Prior Knowledge Requirements

Mathematics

Vocabulary

- ❏ Polygon
- ❏ Perimeter

- Adding fractions
- Adding decimals

Further extensions

- Have students check each other's work for accuracy

Healthcare Industry Connection

An essential part of weekly wound assessment is measuring the wound. It's vitally important to use a consistent technique every time you measure. The most common type of measurement is linear measurement, also known as the "clock" method. In this technique, you measure the longest length, greatest width, and greatest depth of the wound, using the body as the face of an imaginary clock. Document the longest length using the face of the clock over the wound bed, and then measure the greatest width. On the feet, the heels are always at 12 o'clock and the toes are always 6 o'clock. Document all measurements in centimeters, as L x W x D. Remember—sometimes length is smaller than width.

When measuring length, keep in mind that:

- the head is always at 12 o'clock
- the feet are always at 6 o'clock

- your ruler should be placed over the wound on the longest length using the clock face.

When measuring width:

- measure perpendicular to the length, using the widest width
- place your ruler over the widest aspect of the wound and measure from 3 o'clock to 9 o'clock.

When measuring depth:

- Place a cotton-tip applicator into the deepest part of the wound bed.
- Grasp the applicator by the wound margin and place it against the ruler.

Activity-

Use clay to create a "wound". Compare measurements to each person in the class.

Station: Investigating Volume

There is not a pattern to convert between measurements of volume in the customary system, but there is a one to one conversion between milliliters and cubic centimeters in the metric system. This relationship makes converting between various measurements much simpler.

Activity Requirements

- 1000 ml graduated cylinder
- 1000 cubic centimeter block and container
- measuring cup
- tablespoon
- water

This activity draws on prior knowledge and inquiry to find missing values. Students use various measuring tools to find equivalent values.

Student will:

- Measure volume using a variety of tools
- Investigate the relationship between various units of volume

Prior Knowledge Requirements

Mathematics

Vocabulary

- ❑ Volume- the amount of space that a substance or object occupies, or that is enclosed within a container

Key	
Tablespoons in a Cup	**16**
Tablespoons in a Fluid Ounce	**2**
Cubic Centimeter in a Liter	**1000**
Cubic Centimeters in a milliliter	**1**

Further extensions

- Students can convert between more units or between systems
- Fill the 1000 ml graduated cylinder and pour it into the 1000 cubic centimeter cube to show the 1:1 ratio

Healthcare Industry Connection

Lung Capacity Activity

http://www.biologycorner.com/worksheets/lungcapacity.html

Station: Investigating Temperature

This activity investigates the customary and metric units for temperature and converting between them. The metric system uses logical values of 0 and 100 for freezing point and boiling point for water compared to 32 and 212 in the customary system.

Activity Requirements

- Thermometer
- Calculator
- Magnifying glasses as needed

Students will use thermometers to compare temperatures in both systems.

Student will:

- Read a thermometer
- Use formulas to convert temperatures

Prior Knowledge Requirements

Mathematics

- Using formulas

Further extensions

Healthcare Industry Connection

Additional materials: alcohol wipes to clean thermometers.

What are the different ways to measure temperature body temperature?
Take your axillary temperature before and after light exercise (ex: jumping jacks) Convert your temperature between customary and metric.