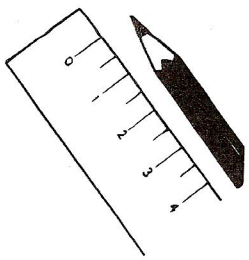
MSZTC Physical Science Summer Work Packet

Name _____ Date _____

# Table of Basic Metric Prefixes and Quantities



A quantitative measurement system has been developed that is used in most of the world. It is called the International System or, more commonly, the metric system. The metric system was designed to relate mass, distance, and volume for one substance—pure water. This is how it works. Imagine a small box that is exactly one centimeter long, one centimeter wide, and one centimeter high. Its volume is one cubic centimeter (cc). If water is added to this container until it is full, that amount of water would be one milliliter and have a mass of one gram. This assumes that water is at a standard (normal) temperature and a standard (normal) air pressure.

The metric system is based on multiples of ten. This makes it very easy to change from one unit to another and it makes it easier to use very large or small numbers.

The basic units of the metric system are the liter, a measure of volume; the meter, a measure of distance; the gram, a measure of mass; and degrees Celsius, a measure of temperature.

| Prefix | Quantity | Symbol | Example |
|---|---|---|---|
| kilo | 1000 | k | 1 kilogram = 1000 grams<br>1 kg = 1000 g |
| hecto | 100 | h | 1 hectogram = 100 grams<br>1 hg =100 g |
| deca | 10 | dk | 1 decagram = 10 grams<br>1 dkg = 10 g |
| base unit | 1 | g, l, m, | 1 gram = 1 g<br>1 liter = 1L<br>1 meter = 1 m |
| deci | 0.1 (1/10) | d | 1 decigram = 0.1 grams<br>1 dg = 0.1 grams |
| centi | 0.01 (1/100) | c | 1 centigram = 0.01 grams<br>1cg = 0.01 g |
| milli | 0.001 (1/1000) | m | 1 milligram = 0.001 grams<br>1 mg = 0.001 g |

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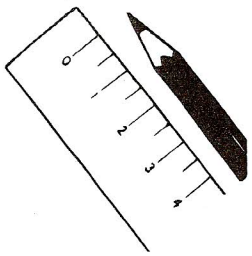
# The Metric System



Change the following numbers to the appropriate units of measurements.

6.2 kilograms = _____ grams

78.36 liters = _____ milliliters

12.3 meters = _____ centimeters

3.2 meters = _____ kilometers

76.3 millimeters = _____ centimeters

143.2 meters = _____ millimeters

312 milligrams = _____ grams

15.3 milliliters = _____ liters

7.5 grams = _____ milligrams

62.1 meters = _____ centimeters

53.5 liters = _____ milliliters

12.3 kilometers = _____ meters

79.4 milliliters = _____ liters

43.9 milligrams = _____ kilograms

67.2 meters = _____ kilometers

Write the names of the basic metric units used to measure each of the following numbered items. Then, next to each lettered item, tell which subunit of these measurements would be most practical to use.

**Distance** _____

a. From home to school _____

b. Length of the classroom _____

c. Width of this page _____

**Volume** _____

a. Volume of a large jug _____

b. Liquid medicine _____

**Mass** _____

a. Your mass _____

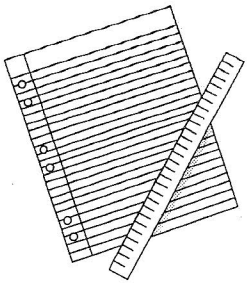
b. Mass of a pin _____

# Measurement of Length

Teacher Notes

## Materials (per student)

- metric ruler
- meter stick
- notebook paper
- tape
- book
- scissors
- worksheet on page 19



*In this activity, students will practice making careful, quantitative observations of length.*

## Active Engagement Before the Task

Actively engage students' minds in preparation for the process skill activity by asking the following questions.

- What situations or professions can you think of in which it is important to be extremely accurate in measurements of distance?
- Explain the wisdom of the carpenter's motto, "Measure twice, cut once."

## Process Skill Activity

Have students work in groups to complete the worksheet; however, encourage students to come up with answers individually before comparing them with the rest of the group.

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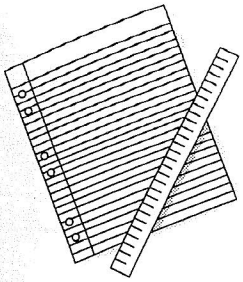
# Measurement of Length



In this and the following three activities, you will have the opportunity to practice making careful, quantitative observations. You will be using specific equipment to make metric measurements of length, mass, volume, and temperature. Make sure your work is accurate and be sure to label each measurement with its correct unit. Metric length is measured in meters, centimeters, and millimeters with a meter stick or metric ruler.

**1.** Measure the length of the line below in cm and mm.

_____ _____ cm or _____ mm

**2.** Cut a piece of notebook paper that measures 50 mm wide and 250 mm long. Then cut a piece of notebook paper that is 25 cm long and 5 cm wide. Hint: Find a way to save work here.

**3.** Find the area (A = L x W) of the rectangle constructed in Step 2. _____

**4.** Cut a square of notebook paper that is 4.5 cm on each side.

**5.** Measure the length, width, and thickness of a book. Choose the best unit.

length = _____ width = _____ height = _____

**6.** Measure the length, width, and height of a desk or table in the room. Choose the best unit.

length = _____ width = _____ height = _____

**7.** Measure the perimeter of this sheet of paper (P = 2L +2W).

Choose an appropriate unit. _____

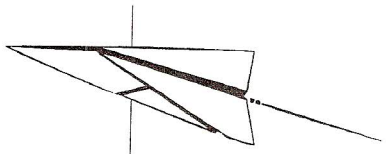
**8.** Draw a 98 mm line in the space below.

**9.** Measure the length of your pen or pencil. Choose the appropriate unit. _____

# Airplane Activity

## Teacher Notes

### Materials (per student)



- balance
- ruler
- paper
- area for plane flying
- worksheet on page 30

*In this activity, students will make quantitative observations and illustrations of paper airplanes they create.*

### Active Engagement Before the Task

Actively engage students' minds in preparation for the process skill activity by holding up a paper airplane you have made and asking the following questions.

- What are some qualitative observations you could make about this plane?
- What changes could I make that might increase the flying distance of this plane?
- What do you think is the single most important element in a successful paper plane?

### Process Skill Activity

Students will work individually on this activity. Remind them that they are making quantitative observations and that their work should be as accurate as possible. Once it has been determined which plane flies the farthest, you may want to analyze with the class why this is so. Students may want to modify their planes based on the discussion.

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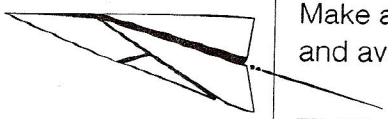
# Airplane Activity



Make a paper airplane. Record at least six measurements including mass, length, and average flying distance. Remember to include units of measurement.

**Mass** _____

**Length** _____

**Average flying distance** _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

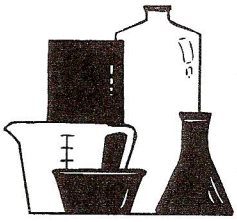
Draw your airplane.

# Measurement of Volume

Teacher Notes

## Materials (per group)

- various graduated cylinders
- four graduated cylinders with red, blue, green, and yellow water
- beaker of water
- one liter container
- measuring cup
- scissors
- tape
- container (can or bottle)
- box pattern sheet on page 21
- worksheet on page 22



*In this activity, students will practice making careful, quantitative measurements of volume.*

## Active Engagement Before the Task

Actively engage students' minds in preparation for the process skill activity by asking the following questions.

- Can you name a situation or profession in which it is important to be extremely accurate in measurements of volume?
- Do you think glass and plastic containers would have different effects on the liquids they contain? Why or why not?
- Can you think of any relationship between the U.S. customary system of volume measurement and the U.S. customary system of linear measurement?

## Process Skill Activity

Have students work in groups for this activity. Duplicate the box pattern to provide one small box for each student. Review the protocol for measuring with a graduated cylinder. Have groups present their answers individually when all have finished. Note that you will need to know the volume of water in the graduated cylinders beforehand, particularly if you choose to make amounts different for each group.

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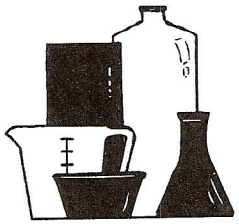
# Measurement of Volume



## Procedure or Protocol for Measuring with a Graduated Cylinder

- Place the graduated cylinder on a flat, solid surface.
- Your eyes must be at the level of the graduated cylinder. Do not pick it up.
- Pour the liquid to be measured into the graduated cylinder.
- The proper volume is the line that is touched by the bottom of the curve (or meniscus) of the liquid in a glass cylinder. In a plastic graduated cylinder, there will be no meniscus.

| | Volume |
|---|---|
| **1.** Record the volume of the graduated cylinder with red water. | _____ |
| **2.** Record the volume of the graduated cylinder with blue water. | _____ |
| **3.** Record the volume of the graduated cylinder with green water. | _____ |
| **4.** Record the volume of the graduated cylinder with yellow water. | _____ |
| **5.** Pour exactly 95 ml of water into a graduated cylinder. | |
| **6.** Pour exactly 52 ml of water into a graduated cylinder. | |
| **7.** How many ml in 1 L? | _____ |
| **8.** How many ml in 1 cup? | _____ |
| **9.** Find the volume of a container. | _____ |
| **10.** Using the pattern provided, construct a cubic centimeter. Use tape to hold the shape. | |

# Box Patterns