SCHOLARS BIOLOGY METRIC LAB

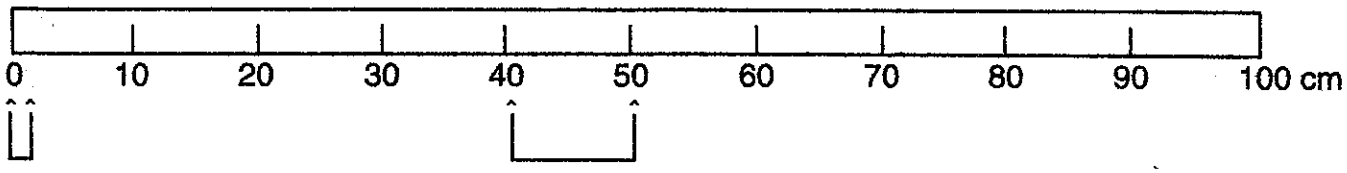
Date: _____ Names: _____

METRIC MEASUREMENT (LENGTH)

INTRODUCTION: If your hand is 3 inches wide, how many centimeters wide is it? Which metric unit is closest to the length of 1 yard?

OBJECTIVE: In this activity, we will review metric units for measuring distance or length—the meter, decimeter, centimeter, and millimeter. We will also use these units to estimate and then measure the sizes of various objects around the room.

Meterstick: 1 meter (m) = 10 decimeters (dm) OR 100 centimeters (cm) OR 1,000 millimeters (mm)
Here is a visual representation of a meterstick.



0–1 is 1 centimeter

1 decimeter

** 1 millimeter is the distance between each tiny black mark on a meterstick.

PROCEDURE:

1. Use a meterstick to measure the objects listed in the chart below. Make sure you use the metric side of the meterstick (with numbers to 100 cm, not 36 inches).
2. Measure the objects in the units listed. Write the unit abbreviation after the measurement you get (example: instead of 47.5, write 47.5 cm).

OBJECT	MEASUREMENT	UNITS
Length of your table		Meters (m)
Width of your table		Decimeters (dm)
Length of a piece of paper		Centimeters (cm)
Width/thickness of a pencil		Millimeters (mm)

3. Which unit above is closest to the following size:
   a. the thickness of a fingernail? _____
   b. the width of a finger? _____
   c. the width of a hand? _____
   d. longer than your leg? _____

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4. Keep the sizes of each of the metric units in mind. For each object listed in the chart below:

a. Choose the most appropriate unit of measurement (m, dm, cm, mm) and record that unit in the chart in the "Unit Chosen" column.

b. Estimate the size of that object using the units you choose and the "body parts" in steps 3a–d above. You may actually lay fingers side-by-side along an object to see how many centimeters long it is. Record your estimates in the chart below under the "Estimate" column.

c. Get up and measure the objects listed using the units that you chose. Record your measurements in the chart below the "Measurement" column. You do not have to measure the items in the order listed.

OBJECT	UNIT CHOSEN	ESTIMATE (WITH UNITS)	MEASUREMENT (WITH UNITS)
Height of table	METERS		
Length of cabinet	DECIMETERS		
Height of classroom door	METERS		
Thickness of tabletop	MILLIMETERS		
Width of cabinet	CENTIMETERS		
Height of cabinet	DECIMETERS		
Width of your table leg	MILLIMETERS		
Width of piece of paper	CENTIMETERS		

1. Which unit might be best used to measure:
   a. shoe length? _____
   b. thickness of hair strands? _____
   c. a bus length? _____
   d. width of a door? _____
   e. length of a hallway? _____
   f. height of the letter "E"? _____
   g. length of a pencil? _____

2. How is the metric system simpler to use than English units (like inches, feet, and yards)?

_____

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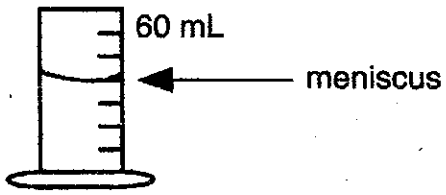
METRIC MEASUREMENT (VOLUME)

INTRODUCTION: The volume of a cube can be calculated by multiplying its length times its width times its height. How could you figure out the volume of a rock that has broken and chipped edges? How could you figure out the volume of a bag of marbles without doing a lot of math?

OBJECTIVE: In this activity, we will learn how to read the volume of a liquid in a graduated cylinder measuring milliliters (mL) by reading the meniscus of the liquid (see diagram below). When most liquids are placed in tall, narrow containers, they tend to creep up the walls of the container a little due to capillary action. This results in the surface of the liquid appearing to be curved. The bottom of this curve is known as the MENISCUS, and it best represents the actual volume of liquid in the cylinder. We will also learn how to measure the volume of odd-shaped objects.

Graduated cylinder:



PROCEDURE:

1. Pour the colored liquid from the beaker at your lab station into the graduated cylinder.
2. Sit the graduated cylinder flat on the countertop.
3. Bend over so that the water level is at eye level and look for the meniscus.
4. Record the number of milliliters of liquid (to the nearest one-half mL) in the chart on the next page. This step will be done before each object is lowered into the liquid. Since this prepares us to measure the first object, record the liquid volume in the first box under "Beginning Volume" (second column).
5. Once a starting liquid volume has been measured, gently lower an object into the liquid. The amount that the water rises (amount of water displaced) is equal to the volume of the object.
6. Read the new volume at the meniscus and record it in the chart under "Volume of Liquid & Object" for that object (first column).
7. To calculate the volume of the object alone, subtract the "Beginning Volume" from the "Volume of Liquid & Object" (column 2 from column 1).
8. Repeat the above steps for each of the remaining objects.

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OBJECT	VOLUME OF LIQUID & OBJECT	–	BEGINNING VOLUME (LIQUID)	=	VOLUME OF OBJECT
Nail					
Screw					
Metal Nut					
Rock					

QUESTIONS:

1. Why is it necessary to recheck the starting volume of liquid before each object is put in?

_____

_____

_____

2. What kind of error would result if you read the liquid volume where the liquid touches the wall of the cylinder rather than at the meniscus?

_____

_____

_____

3. How does this "measuring volume by difference" method compare with measuring volume using math for these odd-shaped objects?

_____

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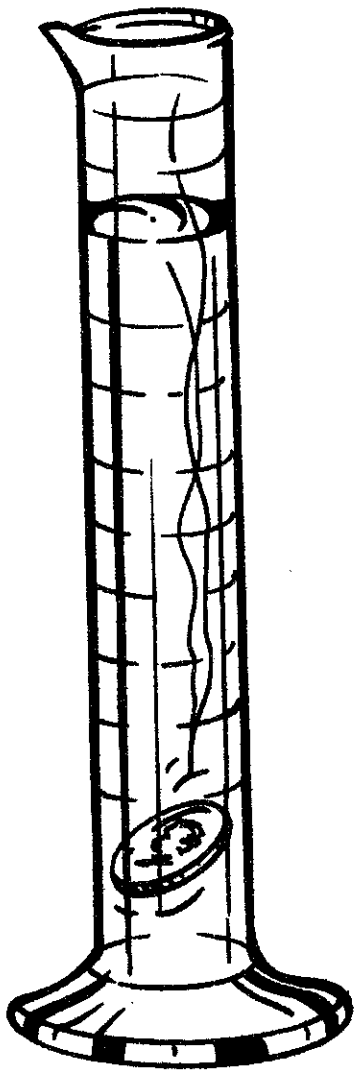

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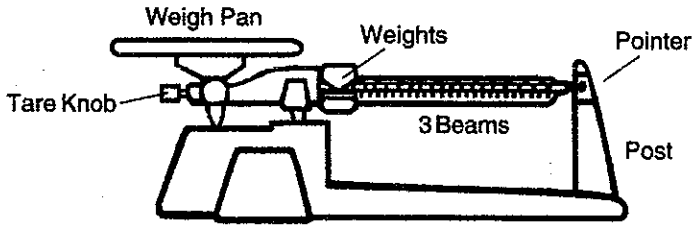
METRIC MEASUREMENT (MASS/WEIGHT)

INTRODUCTION: How can you figure out how much of your pencil gets "eaten" by a pencil sharpener each time you sharpen a pencil? How can you figure out how large a gulp of water is?

OBJECTIVE: In this activity, we will become familiar with the parts of a triple-beam balance that is used to measure mass, and we will practice measuring the mass of different objects. Following this, we will learn how to "weigh-by-difference" to find the mass of different objects.



PROCEDURE:

<u>To "ZERO A BALANCE"</u>

1. Check to make sure that the balance is clean. Wipe and clean it if necessary.

2. Move all weights to the left of the balance (next to the weigh pan).

3. Look to see if the pointer line is perfectly in line with the mark on the post. This indicates whether the balance is zeroed.

4. If the lines do not meet, adjust the tare knob, which is located underneath the weigh pan, by turning it a little and observing its effect. You should be able to zero the balance by repeating this procedure.

** If you cannot zero the balance, ASK FOR ASSISTANCE!

<u>To Weigh Objects</u>

1. Use the following steps to weigh each object listed in the chart (in grams), and record its weight in the chart.

2. Make sure the balance is zeroed and the weigh pan is clean.

3. Place an object on the weigh pan.

4. Move the weights on the beams until the pointer just balances at the white mark on the post. Do this by first moving the small weight to the right. If it is too light to balance the object, move it back to the left (to 0) and try the next larger weight. Continue this until one of the weights can be placed so that the pointer is both above and below the post line.

** Make sure that the two larger weights fall into notches as you move them on the beams.

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5. Weights can be measured as accurately as the nearest tenth of a gram by positioning the smallest weight.

6. Once the weights have been positioned so that the beam pointer aligns with the mark on the post, add each of the marked weights together to get a total. Remember, the smallest weight marks single grams, and the lines between the numbers on that beam mark tenths of grams. The medium-sized weight marks tens of grams, and the largest weight marks hundreds of grams.

7. Record the total mass in the chart below under "Weight." Write in units.

8. Store the balance clean and with all the weights on zero.

OBJECT	WEIGHT (IN GRAMS)
Small paper clip	
2 small paper clips	
Large paper clip	
2 large paper clips	
One penny	
Empty beaker	
Something you choose: _____	

<u>To Weigh By Difference</u>

1. When doing this, we will be weighing an **object**, taking away some of or adding to the object, and then reweighing **the object** to see how much was taken away or added.

2. First, weigh each of the objects listed in **the chart** on page 11. Record their weights under the column "Weight **Before.**"

3. For each object remove or add to it **by:**
   a. putting the sponge in water.
   b. drinking a swallow of water from the cup.
   c. sharpening the pencil.

4. Reweigh each item after step 3 **and record** its new weight under "Weight After."

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5. To find the amount of change (weight gained or lost), subtract the smaller number from the larger number. If the starting number is larger, the weight was lost. If the ending weight was larger, then the weight was gained.

6. Include the units as well as whether weight was gained or lost.

7. Store the balance clean and dry and with all weights on zero.

OBJECT	WEIGHT BEFORE	WEIGHT AFTER	WEIGHT CHANGE (GRAMS)
Dry sponge (put in water)			
Cup of water (take a sip)			
Pencil (sharpened)			

QUESTIONS:

1. Why is it important to make sure that the weigh pan is clean before weighing objects?

_____

_____

_____

2. How does "weighing by difference" compare to something like saving pencil shavings and weighing them to find out how much is sharpened off? _____

_____

_____

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