

Name: _____

Building Physical Intuition – Measurement 1Groups: form groups of threeEquipment: each group should have a one-meterstick, a two-meterstick, and a tape measure**Lengths**Objectives: Estimates of human body dimensions. Developing familiarity with metric units

1. We will start by estimating and then measuring three body dimensions to get a feel for the units. Estimate each quantity in the following table to the nearest 10 cm. After making your estimates, use the one or two meter stick to measure each quantity and compare to your estimates. It is okay if these initial estimates differ from the measured values.

Partner 1's name _____ Partner 2's name _____

	Estimates to the nearest 10 cm	Measurements in centimeters
Your height		
Partner 1's height		
Partner 2's height		
Your palm width		
Partner 1's		
Partner 2's		
Your hand length		
Partner 1's		
Partner 2's		

2. Now that you have developed a feel for measurements in centimeters, complete the estimates of the quantities in the next table. After making your estimates, use the one or two meter stick to measure each quantity and compare to your estimates. Hopefully, your estimates show an improvement over the first set of estimates.

	Estimates to the nearest 10 cm	Measurements in centimeters
Your shoulder width		
Partner 1's		
Partner 2's		
Your nose to out-stretched finger tip		
Partner 1's		
Partner 2's		
Your leg length		
Partner 1's		
Partner 2's		
Your head height		
Partner 1's		
Partner 2's		
Your head width		
Partner 1's		
Partner 2's		

3. *Estimates of classroom dimensions.* Estimate each quantity to the nearest 1 m. Then use a tape measure to measure the length and the width of the classroom and two two-metersticks to measure the height of the classroom.

	Estimates to the nearest 1 m	Measurements in meters
Classroom width		
Classroom length		
Classroom height		

Units and Unit Conversions

Metric prefixes and some basic conversion factors are given in the Introduction.

The basic conversion between the metric system and the British system for lengths is the definition of the inch: 1 inch \equiv 2.54 cm. The conversion factor $\left(\frac{2.54 \text{ cm}}{1 \text{ in}}\right)$ is equal to one so that multiplication by this conversion factor will change the units but not the value of the length being converted. (Note: the symbol \equiv means that this is a definition and therefore an exact relationship between the two values. Use of this conversion factor does not affect the number of significant figures in the length being converted. Conversions using the metric prefixes also do not affect the number of significant figures.)

4. *Units of Length*: There are ____ centimeters in a meter, ____ millimeters in a centimeter, ____ millimeters in a meter, ____ meters in a kilometer.

In order to convert from one set of units to another multiply by the appropriate conversion factors. Example: Calculate the number of millimeters in one foot:

$$1 \text{ ft} = 1 \text{ ft} \left(\frac{12 \text{ in}}{1 \text{ ft}}\right) \left(\frac{2.54 \text{ cm}}{1 \text{ in}}\right) \left(\frac{10 \text{ mm}}{1 \text{ cm}}\right) = 304.8 \text{ mm}$$

You may use a calculator for the remaining problems on this worksheet.

5. Showing all conversion factors used, calculate the number of

a. miles in a kilometer

b. kilometers in a mile

c. yards in a meter

d. meters in a yard

6. *Conversion from one set of units to another.* Using the above conversion factors (once they have been verified), perform the following conversions.

- a. Convert your height to inches.

- b. Convert your head width to millimeters.

- c. Convert your leg length to meters.

- d. Convert the classroom width, length, and height to yards.

Time

1. *Units of Time*: There are ____ seconds in a minute, ____ minutes in an hour, ____ hours in a day, ____ days in a year.

2. Showing all conversion factors used, calculate the number of

seconds in an hour:

seconds in a week:

minutes in a day:

seconds in a year:

Speed

The concept of speed (how fast an object is moving) will be discussed in more detail in later exercises. Speed is found by dividing a distance by a time interval to find the rate of motion. Therefore, common units for speed are mi/hr and m/s.

1. Convert a speed of 1 m/s to mi/hr. As usual, show all conversion factors used.

2. Convert a speed of 30 mi/hr to a speed given in km/hr and in m/s.