Discuss Group Presentations.

Def: **unit** - a known base to which we compare the object we are measuring.

The measurement process:
- Choose the property (length, area, volume, etc.) of an object that is to be measured.
- Select an appropriate unit of measure.
- Use a device to compare the object with the unit.
- Express the measurement as the number of units used.

Figure 12.1 - Examples of Traditional units of length based on the human body:
- yard - length from center of body down outstretched arm
- foot - length of a foot
- hand - width of a hand
- span - width of outstretched fingers
- cubit - length of arm from elbow to fingertips
- inch - width of the thumb

The U.S. Customary or 'English' System of Measures - arose from various traditional informal units of measurement. Although they have since been standardized, the ratios are the result of accident, not planning.

Unit	Abbrev	in other units
*Inch	in	1/12 ft
*Foot	ft	12 in
*Yard	yd	3 ft
Mile	mi	5280 ft

Area is a measure of the region bounded by a closed plane curve. We could choose any shape as a unit, but square is most common.

Unit	Abbrev	in other units
Square Inch	in^2	$1/144 \ ft^2$
*Square Foot	ft^2	$144 \ in^2$ or $1/9 \ yd^2$
*Square Yard	yd^2	$9 \ ft^2$
Acre	acre	$1/640 \ mi^2$ or $43560 \ ft^2$
Square Mile	mi^2	640 acres

Figure 12.2 - Comparing units of area measure (*When computing with dimensioned quantities, it is essential to retain the units in all equations and expressions.*)

Volume is the measure of space taken up by a solid. We use the volume of a cube whose side length is one of the standard units.

Unit	Abbrev	in other units
Cubic Inch	in^3	$1/1728 \ ft^3$
Cubic Foot	ft^3	$1728 \ in^3$ or $1/27 \ yd^3$
*Cubic Yard	yd^3	$27 \ ft^3$

Figure 12.3 - Comparing units of volume measure.

Capacity is the volume that can be held in a container. Thus capacity units are also units of volume.

Unit	Abbrev	in other units
Teaspoon	tsp	1/3 tbl
Tablespoon	T or tbl	2 fl. oz.
Fluid Ounce	fl. oz.	1/8 cup
Cup	C	1/4 qt
Quart	qt	1/4 gal
Gallon	gal	$231 \ in^3$
Bushel	bu	$2150.42 \ in^3$

Metric Units (The SI System):

Prefix	Factor	Symbol
*kilo	10^3	k
hecto	10^2	h
deka	10^1	da
*-	$1 = 10^0$	(none)
deci	10^{-1}	d
*centi	10^{-2}	c
*milli	10^{-3}	m
micro	10^{-6}	μ

The fundamental unit of length in SI is the meter. (1 m = 39 in)

Figure 12.4 - Examples of metric lengths.

Example 12.3 - Changing Metric Units:

- 1495 mm = _____ m $\qquad$ (1.495 m)
- 29.4 cm = _____ mm $\qquad$ (294 mm)
- 38741 m = _____ km $\qquad$ (38.741 km)

Metric Units of Area:

Unit	Abbrev	in m^2
1 square centimeter	1 cm^2	0.0001 m^2
1 square meter	1 m^2	1 m^2
1 are (1 square dekameter)	1 a	100 m^2
1 hectare (1 square hectometer)	1 ha	10000 m^2
1 square kilometer	1 km^2	1000000 m^2

Volume and Capacity: A liter is the volume of a cube each of whose sides is 10 cm ($1L = 1000 \text{ cm}^3$).

The weight of an object is the force exerted on the object by gravity. A kilogram is the weight of one liter of water (about 2.2 lbs).

Example 12.4 - Estimating Weights in the Metric System:
Match the sizes: 2 mg, 2 kg, 100 g, 1200 kg, 9 kg, 5 g with
We have a nickel (5g), a small car (1200kg), 2L of soda(2kg), the RDA of vitamin B6 (2mg), a size D battery (100g) and a large watermelon (9kg).

Common measures of temperature:
Fahrenheit Scale: 32°F is the freezing point of water, 212°F is the boiling point.
Celsius Scale: 0°C is the freezing point of water, 100°C is the boiling point.

They are linear, so we have:
$C = (F - 32)(100/180)$ or $F = (180/100)C + 32$.

Unit Analysis - converting from a measurement in one unit to a measurement in an equivalent unit.
Recall that 5280 ft = 1 mi. So 1 = 5280 ft / 1 mi.

3.75 mi = 3.75 mi × 5280 ft/1mi × 1 yd / 3ft = 3.75×5280/3 yd = 6600 yd

Example 12.5 - Computing Speed and Capacity with Unit Analysis:
A cheetah can run 60 miles per hour. What is the speed in feet per second?
60mph = 60mi / 1 hr × 5280 ft / 1 mi × 1 hr / 60 min × 1 min / 60 sec = 88 ft/sec

A fish tank at the aquarium has the shape of a rectangular prism 2m deep by 3m wide by 3m high. What is the capacity in liters (remember $1L = 1 \text{ dm}^3$)?
(2m)×(3m)×(3m) = 18m^3 = 18m^3 × (10dm/1m)^3 = 18000 L

Homework 6 (due 3/30/10):
- Section 12.1 #7, 8, 9, 11, 18, 22, 26
- Section 12.2 #6, 8, 13, 14, 16, 17, 23, 53, 54