Chem 111

Lecture 2

Announcements

- Supplementary Instructors

- Has anyone sent a question and not heard back after a long time?

- Spark Discussion

- Problems with your computer, take it to the PC software support in LGRC -> Use campus computer centers.

- Slow pitched soft ball

Homework

- Finish Reading Chapter 1
- Read “Let’s Review”
- OWL online homework.

Recap

- Chemistry
- Matter
- Classification of Matter

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Classification of Matter

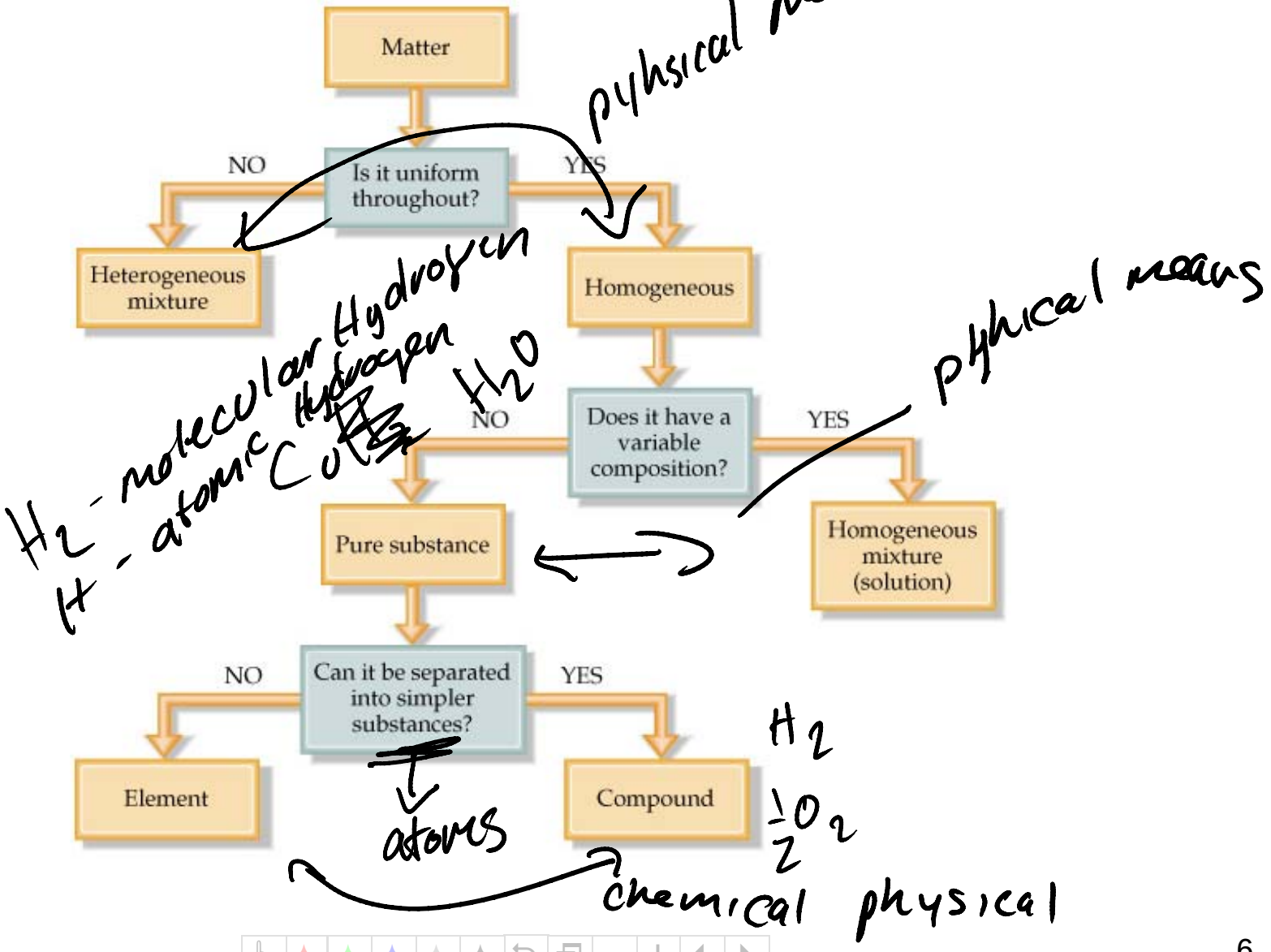
Pure substance - matter that has fixed composition and distinct properties. *eg* Table Salt, Water, Copper…

- **Elements** – substances that can not be decomposed into a simpler substance. Each element is composed of only one kind of atom.
- **Compounds** – are composed of two or more elements, and thus composed of two or more kinds of atoms.

Mixtures – are combinations of two or more substances in which each substance retains its own chemical identity. They have variable composition. *eg air, chocolate chip cookie…*

- **Homogenous mixtures** – mixtures that are uniform throughout, sometime called solutions.
- **Heterogeneous mixtures -** do not have the same properties, composition and appearance throughout the mixture.

Classification of Matter



Properties of Matter

Physical Properties – are properties that we can measure without changing the identity and composition of the substance.
eg color, odor, density, melting point, boiling point

Density = mass/volume

Chemical Properties – describe the way the substance may react to form another substance. *eg flammability*

Changes in Matter

Physical changes – a substance changes it physical appearance but not its composition.

Chemical changes – a substance is transformed into a chemically different substance. **Chemical reactions**

$H_2O(solid) \xrightarrow{\Delta} H_2O(liquid) \xrightarrow{\Delta} H_2O(gas)$

$H_2 + \frac{1}{2}O_2 \xrightarrow{\Delta} H_2O$

Measurement

Quantities are important.

Mem:

Let's Review, Table 2, p. 26

TABLE 2 Selected Prefixes Used in the Metric System

GB
pre measurement

Prefix	Abbreviation	Meaning	Example
giga-	G	10^9 (billion)	1 gigahertz = 1×10^9 Hz
mega-	M	10^6 (million)	1 megaton = 1×10^6 tons
kilo-	k	10^3 (thousand)	1 kilogram (kg) = 1×10^3 g
deci-	d	10^{-1} (tenth)	1 decimeter (dm) = 1×10^{-1} m
centi-	c	10^{-2} (one hundredth)	1 centimeter (cm) = 1×10^{-2} m
milli-	m	10^{-3} (one thousandth)	1 millimeter (mm) = 1×10^{-3} m
micro-	μ	10^{-6} (one millionth)	1 micrometer (μm) = 1×10^{-6} m
nano-	n	10^{-9} (one billionth)	1 nanometer (nm) = 1×10^{-9} m
pico-	p	10^{-12}	1 picometer (pm) = 1×10^{-12} m
femto-	f	10^{-15}	1 femtometer (fm) = 1×10^{-15} m

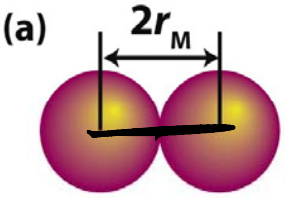
Molarity

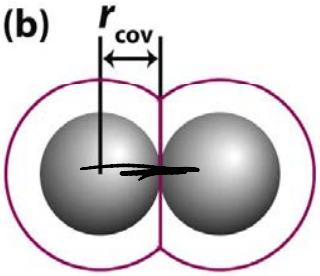
μm

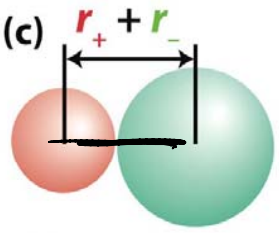
nm

Measurement

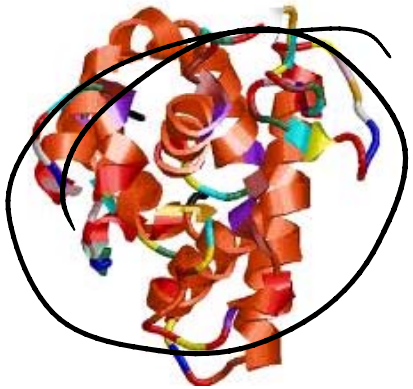
Quantities are important.



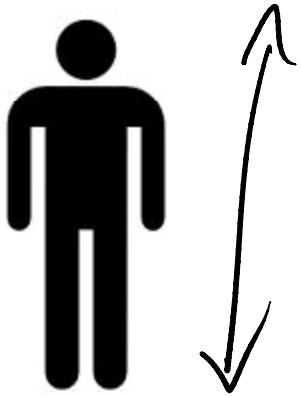




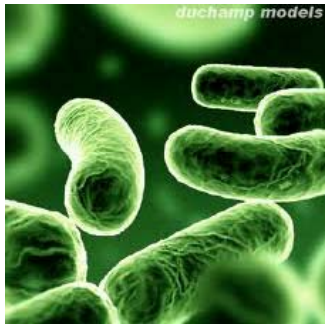
0.1 nm



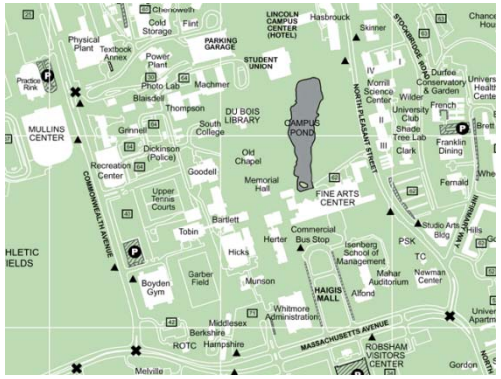
3 nm



1.8 m



1– 10 µm



1.5 km

Systeme International d'Unites GB

TABLE 1 Some SI Base Units

Measured Property	Name of Unit	Abbreviation
Mass	kilogram	kg
Length	meter	m
Time	second	s
Temperature	kelvin	K
Amount of substance	mole	mol
Electric current	ampere	A

mks

cgs gram centi second

Let's Review, Table 1, p. 25

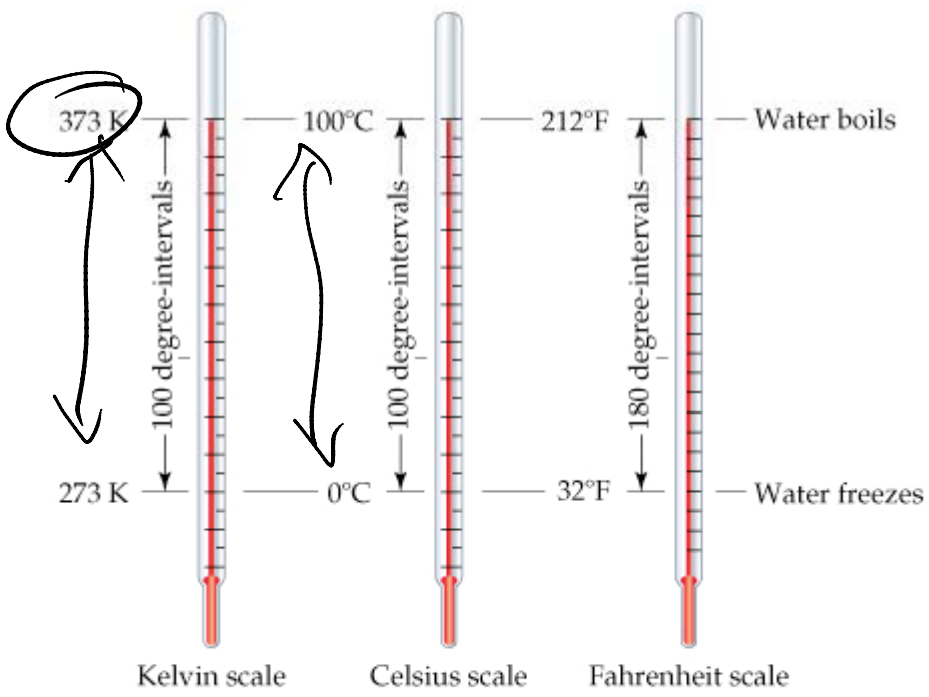
Volume = w x l x h = m x m x m = m^3

1 L = 1000 mL = 1000 cm^3 = 1 dm^3

Memorize

Density = $\frac{\text{mass}}{\text{volume}} = \frac{g}{L}$

Temperature



$\Delta K = \Delta C$

$2C > 2F$

$F = \frac{180\ F}{100\ C}(^\circ C) + 32$

100

✓ $K = {}^\circ C + 273.15$

$^\circ F = \frac{9}{5}(^\circ C) + 32$

$^\circ C = \frac{5}{9}(^\circ F - 32)$

Body Temperature

Body Temperature = 98.6 ^{o}F

37° C

310 K

K = ^{o}C + 273.15

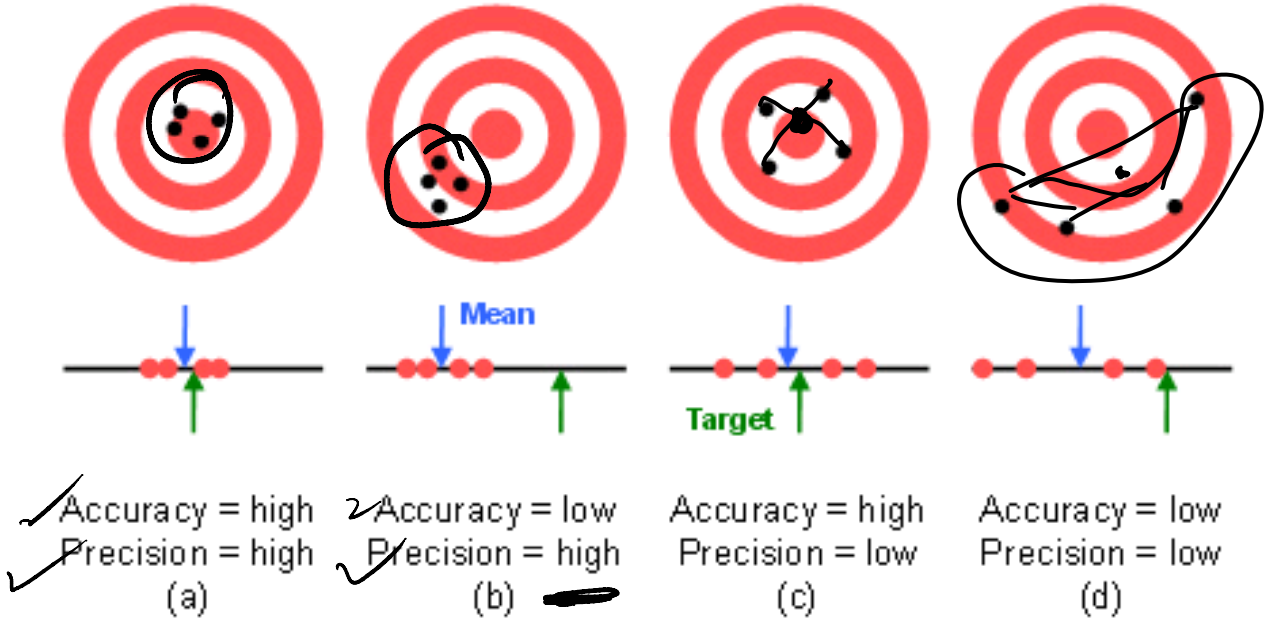
$$^{o}F = \frac{9}{5}(^{o}C) + 32$$

$$^{o}C = \frac{5}{9}(^{o}F - 32)$$

Precision v Accuracy

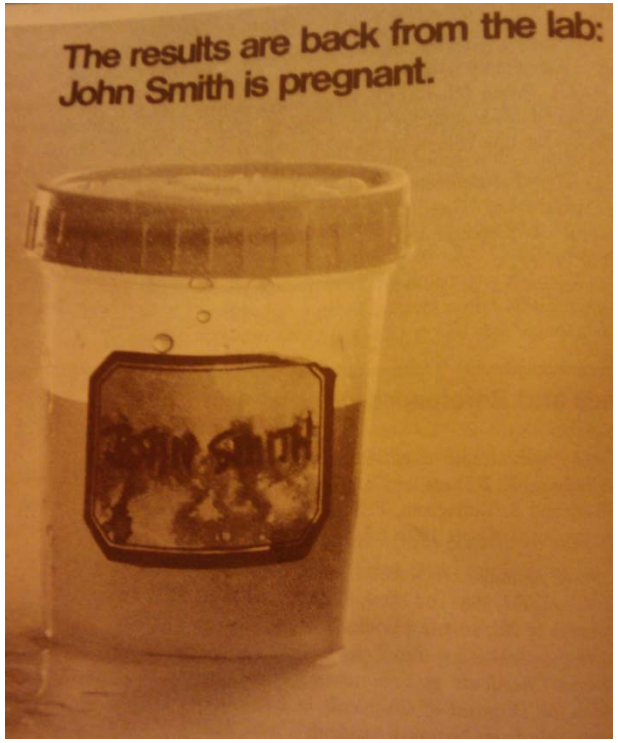
Precision gauges how closely individual measurements agree with one another.

Accuracy refers to how closely individual measurements agree with the correct, or “true” value.



Error

$$precent\ error = \frac{error\ in\ measurement}{accepted\ or\ 'true'\ value}\ x\ 100\%$$



Standard Deviation

$$s = \sqrt{\frac{\sum_i (x_i - \bar{x})^2}{n - 1}}$$

Scientific Notation

Sometimes called exponential notation, is a way of writing numbers that accommodates values too large or small to be conveniently written in decimal notation.

Expressed as a product: $N \times 10^{y}$

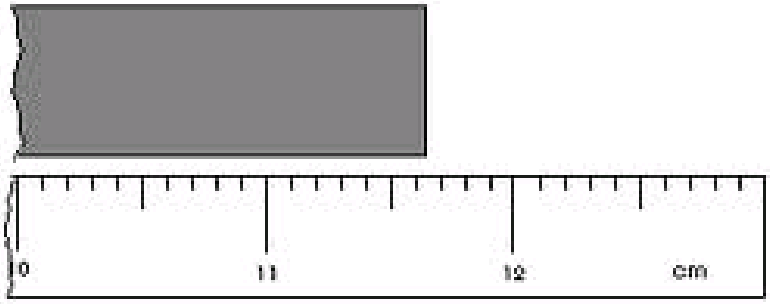
Decimal:

SN:

Calculators, Excel, OWL, Computer etc… PAGE 34

Significant Figures

Indicates the exactness of a measurement



The number of digits that can be justified by the data.

Guidelines

- Nonzero = significant. 963, 2.9
- Zeros between nonzeros = significant. 1006, 1.03
- Leading zeros not significant. 0.002, 0046
- Trailing zeros after decimal = significant 3.0, 0.0200
- Trailing zeros with no decimal are ambiguous →use scientific notation

- Exact numbers have infinite significant figures.

Sig Figs In Calculations

The precision of the result is the precision of the measurement.

Adding/Subtracting – the result cannot have more digits to the right of the decimal point than any of the original number.
Fewest Decimal Places

92.1
1.209
45
138.309

Sig. Figs. In Calculations

The precision of the result is the precision of the measurement.

Dividing/Multiplying – the result must be reported with the same number of significant figures as the measurement with the fewest significant figures.
Fewest Significant Figures.

7.273
1.20
1.5124421
13.19998967196 →13.2