

## Announcements – Lecture II – Tuesday, May 19<sup>th</sup>

1. Class Web Site: [www.chem.umass.edu/genchem](http://www.chem.umass.edu/genchem)
2. Daily Quizzes: Start, Wednesday, May 20<sup>th</sup>  
*(No make-ups ... 2 scores dropped)*
3. Add/Drop: Friday, May 22<sup>th</sup>
4. No Class: Monday, May 25<sup>th</sup> , Memorial Day
5. First Lab: Tuesday, May 26<sup>th</sup> , ISB 155



## 1.4 Unit Conversions

### a) Dimensional Analysis

#### 1.4a Example\_1

Prior to the metric system, the common unit of weight was the pound (lb). Under the S.I. System,  $1 \text{ lb} = 453.5 \text{ g}$ . If an old recipe calls for **9 ounces** of flour ( $16 \text{ oz} = 1 \text{ lb}$ ), how many grams of flour is this equivalent to?

$$\frac{9 \text{ ounces}}{16 \text{ ounces}} \times \frac{1 \text{ lb}}{16 \text{ ounces}} \quad \times \quad \text{Cannot do ... NO CONVERSION factor given ... and NO web access!}$$

$$\frac{9 \text{ ounces}}{16 \text{ ounces}} \times \frac{1 \text{ lb}}{16 \text{ ounces}} = 0.5625 \text{ lb}$$

$$\frac{0.5625 \text{ lb}}{1 \text{ lb}} \times \frac{453.5 \text{ g}}{1 \text{ lb}} = 255 \text{ g}$$

? What about significant figures?

## 1.4 Unit Conversions

### a) Dimensional Analysis

- a)  $4.5 \times 10^5$  X      b)  $4.5 \times 10^7$  ✓  
c) 45                      d) 0.45  
e) Oops ... I made a mistake

### 1.4a Example\_2

A field is 100m long by 45m wide. What is the area in  $\text{cm}^2$ ? ( $1\text{m} = 100\text{cm}$ )

*To illustrate the power of dimensional analysis, first find the area in  $\text{m}^2$  and then do the conversion to  $\text{cm}^2$ .*

$$A_{\text{area}} = 100\text{m} \times 45\text{m} = 4.5 \times 10^3 \text{m}^2$$

$$4.5 \times 10^3 \text{m}^2 = \frac{4.5 \times 10^3 \text{m} \cdot \text{m}}{1 \text{m}} \times \frac{100 \text{cm}}{1 \text{m}} = 4.5 \times 10^5 \text{cm} \cdot \text{m}$$

$$\frac{4.5 \times 10^5 \text{cm} \cdot \text{m}}{1 \text{m}} \times \frac{100 \text{cm}}{1 \text{m}} = 4.5 \times 10^7 \text{cm} \cdot \text{cm} = 4.5 \times 10^7 \text{cm}^2$$

## 1.4 Unit Conversions

### b) Unit Conversions Using Density

#### 1.4b Example\_1

The density of whole blood at 37°C is  $1.06 \text{ g}\cdot\text{cm}^{-3}$ .

What is the mass, in grams of a  $15.0 \text{ cm}^3$  sample of blood?

a) 15.9g ✓  
c) Neither a or b

b) 14.2g  
d) Tom I am clueless!

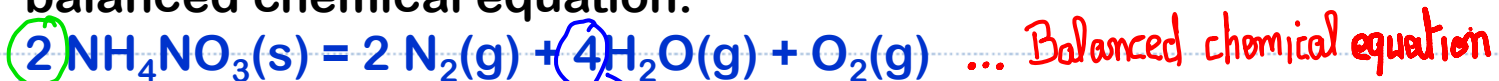
$$1.06 \text{ g}\cdot\text{cm}^{-3} = \frac{1.06 \text{ g}}{1 \text{ cm}^3}$$

$$\frac{15.0 \text{ cm}^3}{1} \times \frac{1.06 \text{ g}}{1 \text{ cm}^3} = 15.9 \text{ g}$$

## 1.4 Unit Conversions

### Unit Conversions using Balanced Chemical Equations

Ammonium Nitrate decomposes explosively according to the following balanced chemical equation:



If 3.4 moles (the chemists unit of quantity) decomposes, how many moles of gaseous water are produced.

$$\frac{3.4 \text{ mol } \text{NH}_4\text{NO}_3}{2 \text{ NH}_4\text{NO}_3} \times \frac{4 \text{ H}_2\text{O}}{1} = 6.8 \text{ mol H}_2\text{O}$$

## 2.2 Elements and the Periodic Table Nomenclature ... Some Memorization

1A	2A	3B 4B 5B 6B 7B 8B 8B 8B 1B 2B										3A	4A	5A	6A	7A	8
H <sup>+</sup>																H <sup>-</sup>	
Li <sup>+</sup>														N <sup>3-</sup>	O <sup>2-</sup>	F <sup>-</sup>	
Na <sup>+</sup>	Mg <sup>2+</sup>											Al <sup>3+</sup>		P <sup>3-</sup>	S <sup>2-</sup>	Cl <sup>-</sup>	
K <sup>+</sup>	Ca <sup>2+</sup>														Se <sup>2-</sup>	Br <sup>-</sup>	
Rb <sup>+</sup>	Sr <sup>2+</sup>														Te <sup>2-</sup>	I <sup>-</sup>	
Cs <sup>+</sup>	Ba <sup>2+</sup>																

*No readily discernible charges!*

Monoatomic cations ... retain their parent name

Na : Sodium

Na<sup>+</sup> : Sodium

Monoatomic anions ... end in 'ide'

O : Oxygen

O<sup>2-</sup> : Oxide

## 2.1 The Structure of the Atom

### a) Components of an Atom

\* 2:  $1 \text{ amu} = 1.66054 \times 10^{-24} \text{ g}$

Name	Symbol	Mass (g)	Charge	Mass (amu) <sup>*2</sup>
PROTON	${}^1_1\text{p}$	$1.673 \times 10^{-24}$	+1	1.0073
NEUTRON	${}^1_0\text{n}$	$1.675 \times 10^{-24}$	0	1.0087
ELECTRON	${}^0_{-1}\text{e}$	$9.109 \times 10^{-28}$	-1	0.0005

a) Chemists tend to ignore the mass of the electron.

b) # PROTONS ... atom determinant ... **ATOMIC NUMBER** ...

$(Z)$

c) # NEUTRONS ... other mass contributor ... # PROTONS + # NEUTRONS = **MASS NUMBER** ...

$(A)$

d) # ELECTRONS ... determines the overall charge:

- # ELECTRONS = # PROTONS ; NEUTRAL
- # ELECTRONS > # PROTONS ; ANION
- # ELECTRONS < # PROTONS ; CATION

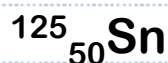
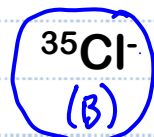
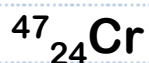
$\begin{matrix} A \\ Z \end{matrix} X \rightarrow$  assigned symbol ... carbon = C

## 2.1 The Structure of the Atom

### b) Atomic Number, Mass Number, and Atomic Symbols

#### 2.1b Example\_1

Which if any of the following species has the same number of Neutrons as it does Electrons?



(A)

(B)

(C)

(D)

		# Protons	# Neutrons	# Electrons
	${}^{47}_{24}\text{Cr}$	24	23	24
	${}^{24}\text{Mg}^{2+}$	12	12	10
A)	${}^{59}\text{Co}^{2+}$	27	32	25
B)	${}^{35}\text{Cl}^{-}$	17	18	18
C)	${}^{125}_{50}\text{Sn}$	50	75	50
D)	${}^{90}\text{Sr}$	38	52	38