###### Introduction Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*AP Chemistry Lecture Outline*

matter: anything having mass and volume

mass: the amount of matter in an object

weight: the pull of gravity on an object

volume: the space an object occupies

 units: conversions:

state of matter: solid, liquid, or gas

atom: a basic building block of matter

 --

Elements contain only one type of atom.

 (a) monatomic elements consist of “unbonded,” identical atoms

 e.g.,

 (b) polyatomic elements consist of several identical atoms bonded together

 -- diatomic elements:

 -- others:

(c) allotropes: different forms of the same element in the same state of matter

 molecule: a neutral group of bonded atoms

Elements may consist of...

*Chemical symbols for elements appear on the periodic table; only the first letter is capitalized.*

Compounds contain two or more different types of atoms.

-- have properties that differ from those of their constituent elements

 e.g., Na (sodium):

 Cl2 (chlorine):

***All samples of a given compound have the same composition by mass.***

EX. A 550. g sample of chromium(III) oxide (Cr2O3) has 376 g Cr. How many grams of Cr

 and O are in a 212 g sample of Cr2O3?

composition: what the matter is made of

 copper:

 water:

Properties describe the matter.

 e.g., what it looks like, smells like, how it behaves

**States of Matter**

 SOLID LIQUID GAS

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

( ( ) )

 vapor:

###### Changes in State

 Energy put into system:

 Energy removed from system:

**Classifying Matter**

(Pure) Substances have a fixed composition and fixed properties.

 --

ELEMENTS COMPOUNDS

 e.g., e.g.,

Mixtures contain two or more substances mixed together.

 -- have varying composition and varying properties

 -- The substances are NOT chemically bonded; they retain their individual properties.

Two types homogeneous: (or solution) heterogeneous:

 **of** sample has same different composition

**mixtures…** composition and properties and properties in the

 throughout; evenly mixed same sample;

 at the particle level unevenly mixed

 e.g., e.g.,

alloy: a homogeneous mixture of metals suspension: settles over time

 e.g., bronze (Cu + Sn) e.g.,

 pewter (Pb + Sn)

brass (Cu + Zn)

**Separating mixtures** involves physical means, or physical changes.

 -- No chemical reactions are needed because...

 1. sorting: by color, shape, texture, etc.

 2. filtration: by particle size

 3. magnetism: one substance must contain iron

 4. chromatography: some substances dissolve more easily than others

 5. density: “sink vs. float”; perhaps use a centrifuge

 -- decant: to pour off the liquid

 6. distillation: different boiling points

 Volatile substances evaporate easily.

**Properties of Matter**

CHEMICAL properties tell how a substance reacts with other substances.

ONE OF

THESE

 PHYSICAL properties can be observed without chemically changing the substance.

AND

 EXTENSIVE properties depend on the amount of substance present.

ONE OF

THESE

 INTENSIVE properties do NOT depend on the amount of substance.

Examples: electrical conductivity reactivity with water

 ductile: can be drawn (pulled) into wire brittleness

 malleable: can be hammered into shape magnetism

**Density** 🡪 how tightly packed the particles are

 \*\* Density of water =

*The density of a liquid or solid is* nearly *constant, no matter the sample’s temperature.*

EX. A student needs 15.0 g of ethanol, which has a density

of 0.789 g/mL. What volume of ethanol is needed?

**Significant Figures: *Is a digit significant?***

All non-zeroes are significant. Zeroes might or might not be.

|  |  |  |
| --- | --- | --- |
| **Prefix** | **Symbol** | **Meaning** |
| giga- | G | 109 |
| mega- | M | 106 |
| kilo- | k | 103 |
| deci- | d | 10–1 |
| centi- | c | 10–2 |
| milli- | m | 10–3 |
| micro- |  | 10–6 |
| nano- | n | 10–9 |
| pico- | p | 10–12 |
| femto- | f | 10–15 |

 Use the box-and-dot method to determine the sig figs in a

 given quantity.

 1. Identify the leftmost AND rightmost non-zeroes.

2. Draw a box around these AND everything in-between.

 3. Everything in the box is significant.

4. NOTHING on the box’s LEFT is significant.

5. If there is a decimal point ANYWHERE, the digits on the

 box’s RIGHT ARE significant. Otherwise, no.

In scientific notation, the exponent has no effect on the number of sig. figs.

***Rules: Significant Figures and Mathematical Operations***

 1. When multiplying or dividing, the answer must have the same number of sig. figs. as

does the quantity with the fewest sig. figs.

EX. 1.52 C  3.431 s =

 0.0251 N x 4.62 m  3.7 s =

2. When adding or subtracting, the answer must be rounded to the place value of the

 least precise quantity.

EX. 2.53 s + 117.4 s =

2.11 m + 104.056 m + 0.1205 m =

 3. Because conversion factors are exact numbers, they do NOT affect the # of sig. figs.

 Your answer should have the same # of sig. figs. as does the quantity you start with.

**Conversion Factors and Unit Cancellation**

EX. For the rectangular solid: L = 14.2 cm W = 8.6 cm H = 21.5 cm

 Find volume. Convert to mm3.