Chapter 1

vocab

chemistry: the science that tries to understand how matter behaves by studying how and molecules behave
experiment: highly controlled observations designed validate or invalidate hypothesis
hypothesis: a tentative interpretation or explaination of the observation
scientific method: a way of learning that emphasizes observation and expirimentation
scientific law: a brief statement that summerizes past observations
scientific theory: a broader and deeper explaination for observations and laws

questions

what is the difference between scientific laws and theories?
scientific law has been proved many times and no exceptions
scientific theory has a broad explaination and lots of evidence
what are the steps of the scientific method?
1. observation
2. hypothesis
3. experiment
4. form laws / theories
what is the law of conservation of mass? by Antoine Lavoisier
matter is neither created nor destroyed
what is Atomic theory?
all matter are composed of small, indistructable particals called atoms
studying chemistry requires curiosity, calculations, + commitment

Chapter 2

questions

what is a derived unit?
represent the precision of a measured quality
why are units important?
so we know what the numbers mean / represent

sigfigs

why are sig figs important?
so we dont loose or gain precision during mathematical operation
- what are the 6 rules?
  1. all non-zero digits are significant
  2. zeros between two numbers are significant
  3. trailing zeros that fall after a decimal point are signifigant
  4. trailing zeros before a decimal point are significant
  5. leading zeros are not significant
  6. trailing zeros at the end of a number, but before an implied decimal point, are ambiguous and should be avoided
- practice (how many sig-figs?)
  a. 28.6g =
  b. 3440. cm =
  c. 0.046041 L =
  d. 450,781 cm =
- answer key:
  a. = 3
  b. = 4
  c. = 4
  d. = 6

density

what is density? equation?
mass / volume
- practice
  a. what is the density of a block of marble that occupies 205cm^3 and a mass of 762g?

conversions

what is a conversion factor?
the relationship between units that is used to change the units of a measured quantity without changing the value
- use feet to inches to help understand easier (1:12)
- practice
  a. 22.5 in to feet =
  b. 825 yd to kilometers=

reminder: scientific notation is the $y \times 10^x$

Chapter 5

do the properties change of an element change when combined with another?
each compound has its own properties
the law of constant composition (discovered by Proust) is all samples of a given compound have the same proportions of their elements
in a chemical formula, the most metallic goes first.
molecular formula: the ACTUAL number of atoms of each element in a molecule of the compound ($C_6H_{12}O_6$)
empirical formula: the simplist whole-number ratio of atoms of each element in a compound (CH_2O)
atomic elements have single atoms as their basic units
molecular element do not normally exist with single atoms
- diatomic molecules - two atoms of that element bonded together
  a. $H_2, I_2, N_2, Cl_2, Br_2, O_2, F_2$

common name
systematic name
naming ionic compounds:
- metal and one or more nonmetals
- with binary ionic compounds (metal + nonmetal), you add "ide" to the end
  - when forming cations, use roman numerals to show the charge

naming molecular compounds
- two (or more) nonmetals
  - prefix, name + prefix, name, - ide

Chapter 3

matter

what is matter?
anything that occupies space and has mass
- what are the three states of matter? (and their properties)
  1. solid - atoms + molecules are packed close + have fixed locations
     a. crystalline - atoms + molecules arranged in geometric patterns
     b. amorphous - atoms + molecules dont have longrange order
  2. liquid - atoms + molecules are close, move freely, fixed volume but not shape
  3. gas - atoms + molecules are seperated and move freely

what is a mixture?
composed of 2+ different types of atoms or molecules combined
- what are the two types? (and properties)
  a. heterogeneous: different compositions
  b. homogeneous: same composition throughout (uniform)

what is a pure substance? element? compound?
- pure substance: composed of only one type of atom or molecule
- element: a substance that cannot brake down
- compound: a substance composed of 2+ elements in fixed proportions

what is the difference between a mixture and a compound?
know this! look at definitions
physical property: a property displayed without changing its composition
chemical property: a property displayed only through a composition change
physical change: a change when the composition does not change
chemical change: a change when the composition does change
energy: the capasity to do work
kinetic energy: energy associated with motion
potential energy: energy associated with its position or composition
what are the three common units for energy?
joules, cal, Cal
exothermic: releases energy
endothermic: absorbs energy
what is heat capacity?
the number of heat units needed to raise the temperature
classifying matter is important
find your own practice problems if needed
temperature ≠ heat

Chapter 4

people

Democritus
- what he did: first person to record the idea of atoms
  a. matter is composed of small, indivisible particles

Thomson
- discovered the electron

Rutherford
- gold foil experiment
- the plumpudding experiment
  a. proved it wrong (by Thomson)

Mandeleev
- was able to find the pattern in the elements

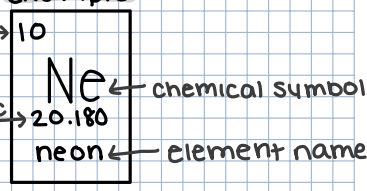
Dalton
- Atomic theory
  a. each element is composed of tiny indestructable particles (atoms)
  b. atoms of each element have the same mass + other properties
  c. atoms combine in simple, whole number ratios

questions

what are the main ideas in the nuclear theory of an atom?
protons in the nucleous, packed in the middle, open space + electrons around nucleous
subatomic particles-
1. electron - negative charge
2. proton - positive charge
3. nuetron - nuetral charge

electrical charge is a fundimental property
and matter is usually nuetral
periodic law is when elements are arranged in order of increasing mass
the table is organized by increasing atomic #

example:



elements

metals
- properties: good conductors, malleable, shiny
- where: left side of the periodic table

nonmetals
- properties: solid or gas, poor conductors
- where: upper right side, negative charge

metalloids
- properties: mixed properties, semiconductors
- where: zigzag line thing

what is a family or group?
a thing of elements with similar properties
know where (alkali metals, alkaline earth metals, halogens, noble gases) are on the periodic table
ion: atoms that loose or gain electrons
cation: positive charge
anion: negative charge
isotopes:
- percent natural abundance: how much an element appears in nature
- mass number: protons + nuetrons

the number of electrons changes

Chapter 6

questions

why is chemical composition important?
- lets us determine how much of an element is in a compound

there are 6.022×10^{23} atoms in one mole of atoms
the mass of 1 mole of atoms for an element is the same as the elements atomic mass
be able to use mass percent composition as a conversion factor between grams of an element and grams of a compound
water is 11.19% hydrogen by mass

practice
- how many mercury atoms are in 5.8 mols of mercury? _____

be able to do problems like this ↑ and get to moles from grams conversions!

example problem: (for empirical formula)
a. you decompose a compound containing nitrogen and oxygen in the labratory and produce 24.5g of nitrogen and 70.0g of oxygen. (calculate the empirical formula)

1. g → mol 2. devide by smallest number 3. multiply to get whole #

$$24.5\text{g N} \times \frac{1\text{ mol N}}{14.01\text{g N}} = \frac{1.75\text{ mol N}}{1.75} = 1\text{ mol N} \times 2 = 2\text{N}$$

$$70.0\text{g O} \times \frac{1\text{ mol O}}{16.00\text{g O}} = \frac{4.38\text{ mol O}}{1.75} = 2.5\text{ mol O} \times 2 = 5\text{O}$$

N_2O_5

Chapter 7

a chemical reaction
- when one occures:
  - change in color
  - formation of a solid + gas
  - heat absorbtion and emission

in a chemical equation:
- g = gas
- l = liquid
- s = solid
- aq = aqueous

balancing equations!

$Ag_2O + C \rightarrow CO_2 + Ag \rightsquigarrow 2Ag_2O + C \rightarrow CO_2 + 4Ag$

soluble: dissolves in said liquid
insoluble: does not dissolve
soluble rules- use the solubility chart but...
- always soluble:
  - Nitrate
  - Acetate
  - Group I
  - Sulfate → insoluble with Ca^{2+}, Sr^{2+}, Ba^{2+}, and Pb^{2+} (castrobear + peanutbutter)
  - Ammonium
  - Group 17 → insoluble with Pb^{2+}, Hg^{2+}, Ag^{+} (P M S)

types of reactions:

precipitation - aq + aq → s + aq
acid base - aq + aq → l + aq
gas evolution - aq + aq → g + aq
redox - m + O_2 & metal → O_2 and transfer electrons
- combustion - $C_xH_y + O_2 \rightarrow H_2O + CO_2$ (?)

synthesis - A + B = AB
decomposition - AB = A + B
single - displacement - AB + C = AC + B
double - displacement - AB + CD = AD + BC

Chapter 8

stoichiometry allows us to predict the amounts of products that form in a chemical reaction
limiting reactant: the reactant that makes the least amount of product
theoretical yeild: the amount of product that can be made
actual yeild: the amount of product ACTUALLY produced
percent yeild: actual yield (devided by) theoretical yeild
ΔH_{rxn} (positive or negative) shows thermal energy flow when the reaction occurs
g → mols → moles → grams
we just had a test on this so I'm not gonna write too much, sorry

Polyatomic ions

ammonium	NH_4^+
acetate	$C_2H_3O_2^-$
carbonate	CO_3^{2-}
perchlorate	ClO_4^-
chlorate	ClO_3^-
chlorite	ClO_2^-
phosphate	PO_4^{3-}
oxalate	$C_2O_4^{2-}$
nitrate	NO_3^-
nitrite	NO_2^-
sulfate	SO_4^{2-}
sulfite	SO_3^{2-}
permaganate	MnO_4^-
cyanide	CN^-
chromate	CrO_4^{2-}
hydroxide	OH^-