Chemistry SOL Study Sheet Name: _____

Strategies:
- Identify what unit is given and what is asked for. Be on the lookout for extra information!
- You don't have to know all big words in a question. (They do this on purpose.) Apply what you know.
- If an option is *not* something we talked about in class, it's probably not the answer!
- Write down equations you need to use, like PV=nRT, before plugging in numbers.
- If all else fails, plug in answers to see which one works
- Look at axes on graphs!

Independent Variable – variable that the experimenter manipulates
Dependent Variable – variable that changes in response to the independent variable; the results that are measured
Control – a standard for comparison
All other possible variables are made "**constants**"

Significant Figures Rules (1) all digits are significant (2) zeros in a "sandwich" (3) zeros after digit & decimal
Addition/Subtraction of measurements = round to least number of ***decimal places***
Multiplication/Division of measurements = round to least number of ***significant figures***

Percent error: $\frac{\text{experimental} - \text{true}}{\text{true}} \times 100$

precision: numbers close to each other
accuracy: numbers close to true value

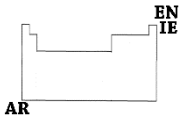
Density = $\frac{mass}{volume}$ "displacement" = change in volume; add object to graduated cylinder; volume goes up

Atomic number = protons **Mass number** = protons + neutrons **Electrons** = same as protons *if neutral*
Cation = positive charge, lost electrons **Anion** = negative charge, gained electrons
Isotope = different versions of an element; same # protons, different # neutrons
calculate number of neutrons = mass number – atomic number

Nitrogen-14 ← mass number
N-14 ← mass number
$mass\# \rightarrow 14$ N^{-3} ← *charge*
$atomic\# \rightarrow 7$

$$\frac{Atomic}{Mass} = (mass\ number\ A \times abundance\ A) + (mass\ number\ B \times abundance\ B) + \cdots$$

Electronegativity – ability of an atom to attract electrons to itself
Ionization energy – energy required to remove an electron



electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ Noble gas notation: (ex) Cl = [Ne] $3s^2 3p^5$
- Electrons fill lowest energy orbitals first (Aufbau Principle); singly before pairing (Hund's Rule)

Ionic bond = cation + anion; electrons transferred; always cross charges, never use prefixes
Covalent bond = nonmetal + nonmetal; electrons shared; always use prefixes (except mono on first element)

Molecular shapes: **linear** (two atoms; 2 bonds, 0 lone pairs) **trigonal planar** (3 bonds, no lone pairs, boron)
trigonal pyramidal (3 bonds, 1 lone pair) **tetrahedral** (4 bonds) **bent** (2 bonds, 2 lone pairs)

polar: unequal sharing of electrons; *lone pair* on the central atom; NO lone pairs or two atoms with *different* elements
nonpolar: equal sharing of electrons; NO lone pairs or two atoms with the *same* element
Intermolecular forces: think of magnets! hydrogen bonding > dipole-dipole > London dispersion forces

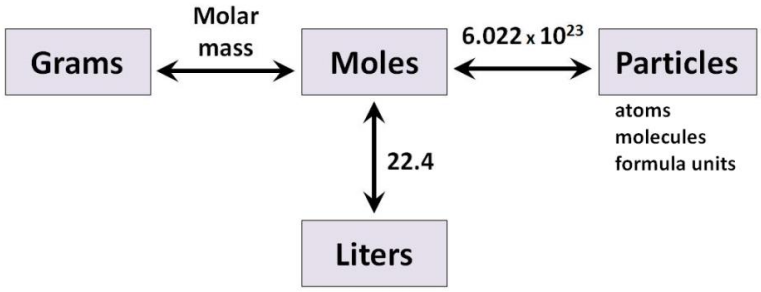
Polymer: made of many small repeating subunits called monomers
Saturated: all single bonds to carbon
Unsaturated: double or triple bond to carbon

Balancing equations: Write down equations on paper before balancing! Don't try to do it in your head!

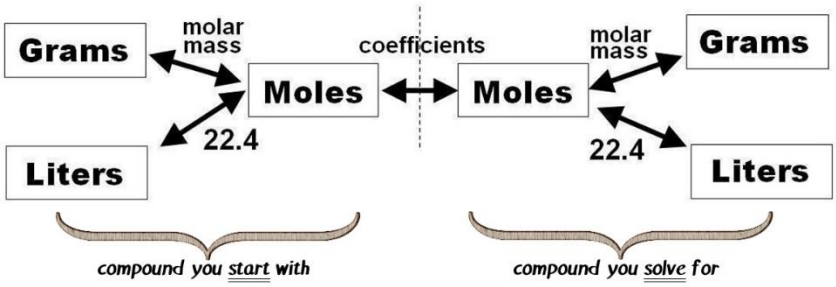
Synthesis: $A + B \rightarrow AB$
Decomposition: $AB \rightarrow A + B$
Combustion: $C_xH_y + O_2 \rightarrow CO_2 + H_2O$
Single Replacement: $A + BC \rightarrow AC + B$
Double Replacement: $AB + CD \rightarrow AD + CB$
Neutralization: Acid + Base → Water + Salt

molar mass = "mass of one mole" = formula mass = molecular mass
Avagadro's number: 6.022 x 10^{23} particles
22.4 L = molar volume of a gas at STP (standard temperature and pressure)
mole ratio = coefficients

Molar Conversions
*conversions of the **same** compound*



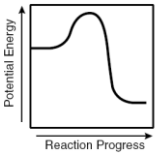
Stoichiometry
*convert one compound to a **different** compound; must be given balanced equation*



Heat = m · c · ΔT (*mass x specific heat x change in temperature*) $H_{vaporization}$ (liq-gas) H_{fusion} (solid-liq)

Endothermic- absorb E
ΔH = ⊕

Exothermic- release E
ΔH = ⊖



- **Catalysts** speed up a reaction by decreasing activation energy
- Increasing temperature increases kinetic energy, speed of molecules, number of collisions
- **enthalpy** – "heat content" (H) **entropy** – the amount of disorder

Gas Laws *Always use Kelvin for temperature* **K = °C+ 273**

Boyle's Law	$P_1V_1 = P_2V_2$	Inverse relationship
Charles's Law	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$	Direct relationship
Combined Gas Law	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$	
Dalton's Law of Partial Pressures	$P_{Total} = P_1 + P_2 + P_3 + \ldots$ or $\frac{\%}{100} \times TOTAL = Partial\ Pressure$	
Ideal Gas Law	$PV = nRT$	n = moles

Molarity: $M=\frac{mol}{L}$ **Dilution**: $M_1V_1 = M_2V_2$

- Electrolyte: ionic compounds dissociate in water, conduct electricity
- Colligative properties: Boiling point elevation; Freezing point depression. (ex) Salt makes boiling point ↑ freezing point ↓

Acids begin with –H **Bases** end in –OH

pH = hydrogen ion concentration 0 ---------- 7 ----------14 **pH + pOH = 14**
pH = -log[H^{+1}] acid neutral base

Equilibrium: rate of forward reaction = rate of reverse reaction; shift away from increase & towards a decrease

Polyatomic Ions: OH^{-1} hydroxide NO_3^{-1} nitrate SO_4^{-2} sulfate
PO_4^{-3} phosphate NH_4^{+1} ammonium CO_3^{-2} carbonate