1. The mol and compounds
	1. molar mass: the mass of one mole of a substance
		1. Example: Water's molar mass is 18g / 1 mol
	2. **Steps to find molar mass:**
		1. Write out atomic symbols for each element
		2. Put how many atoms of each element you have
		3. Put the atomic mass of the elements
		4. Multiply step ii by iii
		5. Add all of the products together
	3. Percent Composition - the mass percentage of each element in a compound
		1. % of element = (mass of element/molar mass of compound) x 100
	4. **Empirical Formulas** - the smallest ratio of elements that are in a compound
		1. Example: C6H6 --> CH (empirical formula)
		2. C2H2 --> CH (empirical formula)
		3. How to find an Empirical Formula from Experimental Data
			1. Find the number of grams of each element
			2. Convert each number of grams to mols
			3. Divide each "number of mols" by the smallest "number of mols"
			4. Use ratio to find formula
				1. the number you come up with tells you how many atoms of each element you have
			5. Example: A compound is 45.5% yttrium and 54.5% chlorine. Find its empirical formula.
	5. **Molecular Formulas** - the actual ratio of elements that are in a compound
		1. Example: C6H6 (molecular formula) --> CH (empirical formula)
		2. C2H2 (molecular formula) --> CH (empirical formula)
		3. How to find Molecular Formula from Experimental Data
			1. Find empirical formula
			2. Find molar mass of empirical formula
			3. Find n = mm molecular / mm empirical
			4. Multiply all parts of empirical formula by n
			5. Example: A carbon/hydrogen compound is 7.7% hydrogen and has a molar mass of 78g. Find its molecular formula.
	6. **Hydrates and Anhydrous Salts**
		1. **anhydrous salt**: an ionic compound (a salt) that attracts water molecules and forms loose chemical bonds with them; symbolized by "MN" (metal-nonmetal)
			1. "**anhydrous**" means without water
			2. Uses: desiccants in leather goods, electronics, and vitamins (to keep leather dry)
		2. **hydrate**: an anhydrous salt with the water attached
			1. symbolized by MN . ? H2O
			2. Examples: CuSO4 . 5 H2O, BaCl2 . 2 H2O, FeCl3 . 6 H2O
		3. **Finding the Formula of Hydrate**
			1. Find the number of grams of MN and number of grams of H2O
			2. Convert grams to mols
			3. Divide each number of mols by the smallest number of mols.
			4. Use the ratio to find the hydrate's formula.
			5. Examples: Find the formula of the hydrate from the following information:
				1. sample's mass before heating = 4.38g (MN . H2O)
				2. sample's mass after heating = 1.93g (MN)
				3. molar mass of anhydrous salt = 85g
2. **Stoichiometry** involves finding the amounts of reactants and/or products in a chemical reaction.
	1. Why is Stoichiometry important? Consider the following examples:
		1. Internal Combustion Engine:
			1. Balance the following equations:
				1. \_\_\_\_C8H18 + \_\_\_\_O2 -----> \_\_\_\_CO2 + \_\_\_\_H2O
				2. \_\_\_\_C8H18 + \_\_\_\_O2 -----> \_\_\_\_C + \_\_\_\_H2O
				3. What is the difference?
	2. Basic Chemical Equation: RA + RB ---> P1 + P2
		1. If we know the: One can find the...
			1. Amount of RA (or RB): The amount of the other reactant needed to react
			2. Amount of RA or RB : Amount of P1 or P2 that will be produced
			3. Amount of P1 or P2 : Amount of RA and/or RB you need to produce must use
	3. Calculations in Stoichiometry - Mol Island
		1. There are four conversion you will need to know
			1. molar mass (g/mol)
			2. Avogadro's Number (6.02 x 1023 particles/mol)
			3. Volume (22.4 L/mol @ STP)
			4. Mol-Mol Ratio (between reactants and/or products)
				1. This comes from the balanced chemical equation



* + 1. Examples: \_\_\_ Cu + \_\_\_ AgNO3 --> \_\_\_ Ag + \_\_\_ Cu(NO3)2
			1. If you have 300g of AgNO3, how many grams of copper nitrate would be produced?
		2. \_\_\_ TiO2 + \_\_\_ Cl2 + \_\_\_ C --> \_\_\_ CO2 + \_\_\_ CO + \_\_\_TiCl4
			1. If you have 115 grams of titanium oxide, how many particles of titanium chloride would be produced?
			2. If you have 4.55 mols of carbon, how many mols of chlorine gas will be needed?
	1. Limiting Reactant (LR): the reactant that runs out first.
		1. the amount of product is based on the LR
		2. Any reactant you don't run out of is an excess reactant (ER).
		3. How do we find the limiting reactant?
			1. For the generic reaction, Ra + RB --> P1
			2. Assume that the amount of Ra or Rb are given
			3. Should you use Ra or Rb in your calculations?
			4. Calculate the number of mols of Ra and Rb you have.
			5. Divide by the respective coefficients in balanced chemical equation.
			6. Reactant having the smaller result is the LR.
			7. Example: If 125g of aluminum reacts with 125g of chlorine, how many grams of aluminum chloride is made?
	2. **Percent Yield**
		1. Let's consider the following reaction: molten sodium reacts with solid aluminum oxide to produce molten aluminum and solid sodium oxide
			1. Find mass of aluminum produced if you start with 575g of Na and 357g of aluminum oxide.
		2. The amount of product is the theoretical yield.
			1. amount of product if reaction is perfect
			2. found by calculation
		3. Now supposed that we perform this reaction in the lab and only got 172 grams of aluminum.
			1. Why did this happen?
				1. couldn't collect all Al
				2. not all Na and Al2O3 reacted
				3. some reactant or product spilled and was lost
		4. **Percent Yield** - percentage of product that was produced
			1. % yield = (actual yield / theoretical yield) x 100
			2. % yield cannot be larger than 100%
			3. Example: B2H6 + 3 O2 --> B2O3 + 3 H2O
				1. If you have 10g of B2H6 and 30g of oxygen, how many grams of B2O3 would be produced?
				2. If only 19.7g of B2O3 was produced, what was the percent yield?

