

Unit 3: Stoichiometry

adapted from http://www.phschool.com/advanced/lesson_plans/chem_brown_2003/index.html

This unit presents the fundamental quantitative skills you will need for the rest of the course.

Objectives:

- Calculate the atomic weight (average atomic mass) of an element from the relative abundances and masses of its naturally occurring isotopes.
- Calculate the percentage composition of a compound from its formula.
- Calculate the molar mass of a substance from its chemical formula.
- Be able to interconvert between moles, mass, and number of particles of a substance.
- Calculate the empirical formula of a compound from either elemental percent composition or quantity of CO_2 and H_2O produced from its combustion.
- Calculate the molecular formula of a compound from the empirical formula and molecular weight.
- Find the mass of any substance in a chemical reaction from the mass of one substance.
- Determine the limiting reactant (limiting reagent) in a reaction and then calculate the amount of each product and the mass of the excess reactant left over.
- Calculate theoretical yield.
- Calculate moles of solute, volume of solution, or molarity of the solution from the other two.
- Recognize and solve dilution problems.
- Calculate the volume of a certain molarity solution required to react with another solution of known molarity.
- Calculate the mass of a substance that would be required to react with a given volume of a solution of known molarity.
- Calculate mass of solute or concentration of an unknown solution from titration data.

Lab Objectives:

- To become familiar with chemical formulas (empirical and molecular) and how they are obtained experimentally.
- Learn some basic lab procedures, the chemistry of copper, and the concept of percent yield.

Suggested Labs:

- Chemical Formulas
- Chemical Reactions of Copper and Percent Yield

Key Words:

formula weight
molecular weight
mole
Avogadro's number
molar mass
empirical formula

molecular formula
combustion analysis,
limiting reactant (limiting reagent)
theoretical yield
percent yield
concentration

molarity
dilution
titration
standard solution
equivalence point
indicators

Tips:

- Average mass of an atom is in *amu* and that the mass of a mole (Avogadro's number) of these atoms is the same number of *grams*.
- Electrons have negligible mass, therefore ions have essentially the same mass as their atoms.
- Reaction stoichiometry requires a correct, balanced chemical equation.

