Take notes while watching the following video tutorials to prepare for the "The Mole & Balancing Chemical Reactions Activity".

Compounds Part 3: The Mole

Mole: amount of a substance

	Average Atomic Mass	Molar Mass
^{12}C and ^{13}C (99% and 1%)		
^{107}Ag and ^{109}Ag (56.5% and 43.5%)		

$$6.02 \times 10^{23} \quad = \quad 1 \text{ mole} \quad = \quad X \text{ grams}$$

where

Avogadro's number:	defined as 6.02×10^{23}
Molar Mass:	determined from the chemical formula and atomic masses of the atoms that form the compound

Which sample contains more atoms: 21 g of carbon or 21 g of silver?

The "Mole" is the bridge between the individual atoms and compounds we imagine when we discuss the theories of chemistry and the grams of atoms and compounds we weigh and measure when perform experiments in the lab to test these theories.

Compounds and the Mole

The chemical formula is the ______________________________ of the atoms that form 1 mole of the compound.

Let's compare calcium chloride ($CaCl_2$) and glucose ($C_6H_{12}O_6$).

	calcium chloride	glucose
type of cpd		
structure when dissolved in H_2O		

How many moles of the compound are present in a 21 g sample?

a) calcium chloride

b) glucose

How many moles of chloride ions are present in 21 g of calcium chloride?

How many moles of carbon atoms are present in 21 g of glucose?

Molecules and Moles can be used interchangeably because they are linked by Avogadro's number.

We can NOT compare grams of samples directly. We need to adjust for the different atomic masses of the elements involved.

Example:
Glucose reacts with oxygen to produce carbon dioxide and water according to the balanced reaction shown below.

$$C_6H_{12}O_6 \quad + \quad 6\ O_2 \quad \rightarrow \quad 6\ CO_2 \quad + \quad 6\ H_2O$$

molecules

moles

molar mass

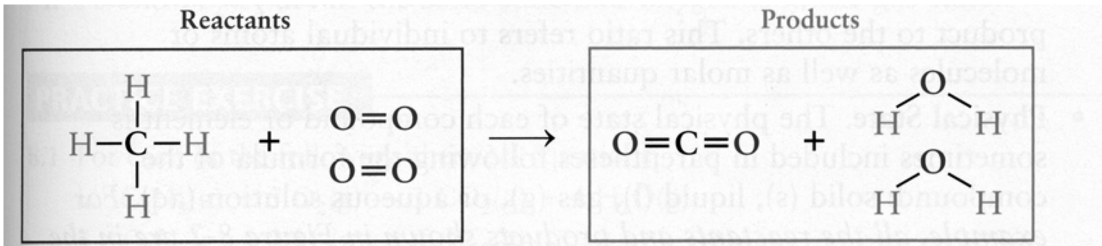
grams for
the mole ratio
above

Chemical Reactions Part 1 – Balancing Reactions

Chemical reactions obey the law of conservation of mass.

Chemical equations describe chemical reactions.

Methane reacts with oxygen to produce carbon dioxide, water & heat.



$$CH_4(g) \;+\; 2\,O_2(g) \longrightarrow CO_2(g) \;+\; 2\,H_2O(g) \;+\; \text{heat energy}$$

Coefficient: number placed in front of a chemical formula to indicate the ratios of each reactant and product – see above.

Optional subscripts can be used to indicate the physical state of the reactants & products.

(s) = solid (g) = gas (l) = liquid (aq) = aqueous solution (substance dissolved in H_2O)

Correct Chemical Equations are

1) Consistent with experimental facts
    - list only reactants & products involved in the reaction
    - use correct chemical formulas
2) Balanced – coefficients indicate ratios that obey conservation of mass

Balancing Chemical Equations

1) Assess the equation. Determine the number of atoms for each element on the reactant and product side. If the two numbers do not match, the equation is not balanced.

2) Balance the equation one element at a time by inserting coefficients.
   a) Never change the chemical formulas.
   b) A coefficient applies to every element in the formula.
   c) Save single element reactants and products for last.

3) Coefficients are always the smallest set of whole numbers. Check to make sure that the coefficients cannot be divided by a common factor.

Balance the following reactions.

$$Al + O_2 \rightarrow Al_2O_3$$

$$PCl_5 + H_2O \rightarrow H_3PO_4 + HCl$$

$$BaO_2 \rightarrow BaO + O_2$$

$$C_5H_{10} + O_2 \rightarrow CO_2 + H_2O$$

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