## CHEMICAL REACTIONS

- a chemical change produces one or more new substances
- there is a change in the composition of one or more substances
- old bonds are broken and new bonds formed
- atoms in the reactants are rearranged to form one or more different substances

REACTANT ATOMS = PRODUCT ATOMS

## BALANCING CHEMICAL EQUATIONS

- mass conversion law has to be fulfilled
- ATOMS CANNOT BE CREATED OR DESTROYED during a chemical reaction
- instead, they combine in different ways to make a chemical compound
- Chemical equations can be used to describe what is going on during reactions
- represents both the atomic level picture, and a "big scale" molar picture
- describes how many formula units of different chemicals react
- a Formula Unit is the smallest unit of a substance
- could be an atom, ion, ionic formula, or molecule^

## BALANCING CHEMICAL EQUATIONS - STRATEGY

1. write unbalanced equation using correct chemical formula of all reactants and products
2. find suitable coefficients (numbers placed before each number)
3. if necessary, reduce numbers to smallest whole number values
4. check your answer by counting how many atoms of each kind are on both sides of the equation

EX: THESE ARE CURRENTLY UNBALANCED

$H_2 + O_2 = H_2O$

$Na + Cl_2 = NaCl$

$CH_4 + O_2 = CO_2 + H_2O$

## REPRESENTING CHEMISTRY ON DIFFERENT LEVELS

- microscopic: 2 molecules of hydrogen gas react with 1 molecules of oxygen to yield 2 molecules of liquid water
- macroscopic: 2 mole of hydrogen gas react with 1 mole of oxygen gas to yield 2 moles of liquid water

## CHEMICAL ARITHMETIC: STOICHIOMETRY

- ratio is given by coefficients in balanced equation
- stoichiometry tells us in what ratios chemicals react
- however, we cannot "weigh" chemicals by number of moles
  - need to use mass instead
  - convert using molecular mass or molar mass
  - being able to convert between moles and grams is CRUCIAL!!!

MOLECULAR MASS: sum of all atomic masses of all atoms in a molecule
FORMULA MASS: sum of all atomic masses of all atoms in a formula unit of any compound, whether molecular or ionic

REMEMBER: ONE MOLE OF A SUBSTANCE IS THE AMOUNT WHOSE MASS IN GRAMS IS NUMERICALLY EQUAL TO THE SUBSTANCE'S MOLECULAR OR FORMULA MASS

EX:

HCl: 1.0 amu + 35.5 amu = 36.5 amu

C2H4: 2(12.0)amu + 4(1.0)amu= 28.0 amu

HCl: 1 mole = 36.5 grams

6.022 x 10^23 molecules = 36.5g

Grams of compound >>> Moles of compound >>> Mole Ratio >>>> Grams of product compound

YIELD OF CHEMICAL REACTIONS

- so far, we have assumed that every atom or molecule undergoes the chemical reactions we wrote down
- would be an ideal case scenario
- this is called a "reaction goes to completion"
- in real life, most reactions do not only form the desired products
- unreacted material
- side products
- the amount of product formed is called the YIELD of a reaction