Balancing Equations

The idea of balancing equations comes from the conservation of mass. When a chemical reaction occurs, no atoms are created or just destroyed (they are just rearranged). Thus, the amount of each element on the left side (reactants) must equal the amount of the same element on the right side (products)

Steps:

1. Write the proper unbalanced equation
   - Ionic – charges must add to zero
   - Covalent – follow prefixes
   - Add phase if information given (write as subscript)
     - Solid = (s)
     - Gas = (g)
     - Liquid = (l)
     - Aqueous (dissolved in water or solution) = (aq)

Balancing Equations

2. Put in coefficients in front of each substance to get the quantities on the left side to equal the quantities on the right side. Do this for each element.

3. The coefficients must be the smallest whole number coefficients possible. (you can temporarily use fractions as long as you multiply through to get rid of them at the end)

Balancing Equations

Hints:

1. Save "singletons" for last (elements that are not bonded with other elements)
2. Save oxygen for last (assuming no singletons)
3. Save hydrogen for 2nd to last

For the rest of the elements you need to systematically work through each one to get it balanced.

PS – Don't forget the HOFBrINCl elements – these elements need a "2" subscript when they are by themselves (not part of a compound).
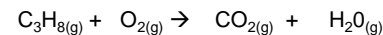Examples = H_2 or Cl_2

Balancing Equations

Example Problem:

Propane (C_3H_8) gas + Oxygen gas → Carbon dioxide gas + water vapor

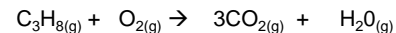Write the equation in terms of formulas:

$$C_3H_{8(g)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}$$

Inventory

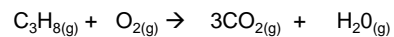| Reactants	Products
C = 3	C = 1
H = 8	H = 2
O = 2	O = 3

Nothing is currently balanced!

Start the balancing by placing a 3 on the carbon on the right side (remember the hint – save hydrogen and oxygen til the end)
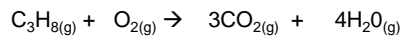
$$C_3H_{8(g)} + O_{2(g)} \rightarrow 3CO_{2(g)} + H_2O_{(g)}$$

Now the carbons are balanced.

Balancing Equations

Example Problem continued:

$$C_3H_{8(g)} + O_{2(g)} \rightarrow 3CO_{2(g)} + H_2O_{(g)}$$

Now the carbons are balanced.

Let's fix the hydrogens next (currently there are 8 on left, 2 on right) – let's multiply the hydrogen on the right by 4 to equal things out.

$$C_3H_{8(g)} + O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$$
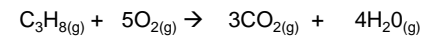
Now the hydrogens are balanced.

Finally, we need to fix the oxygens. There are currently 2 on the left and 10 on the right. We need to multiply the oxygen on the left by 5.

$$C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$$
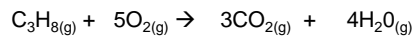
Are you sure it's balanced? Let's do another inventory to double check.

Balancing Equations

$$C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$$

Inventory

Reactants	Products
C = 3	C = 3
H = 8	H = 8
O = 10	O = 10

IT'S BALANCED!!!!!!!