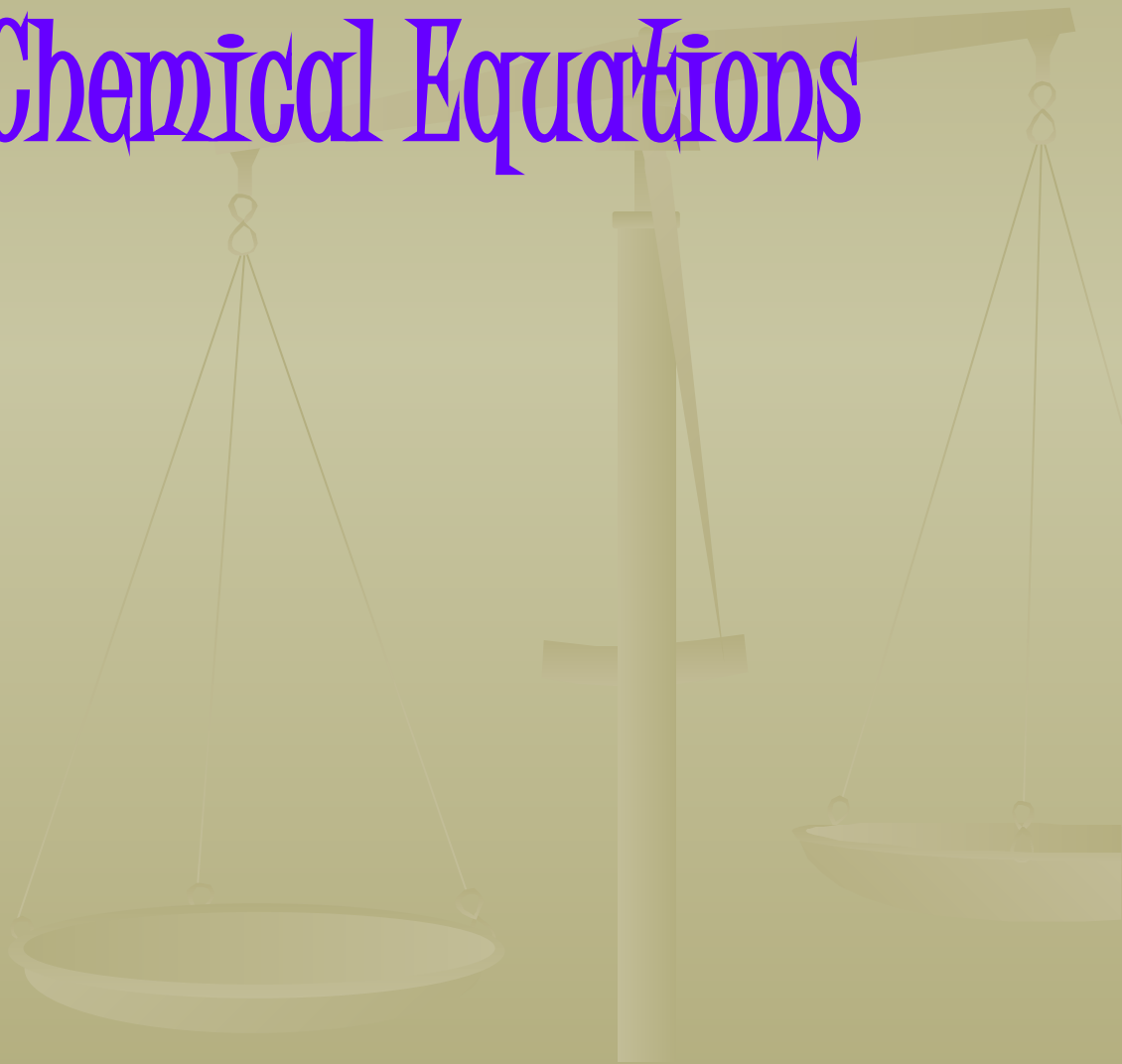
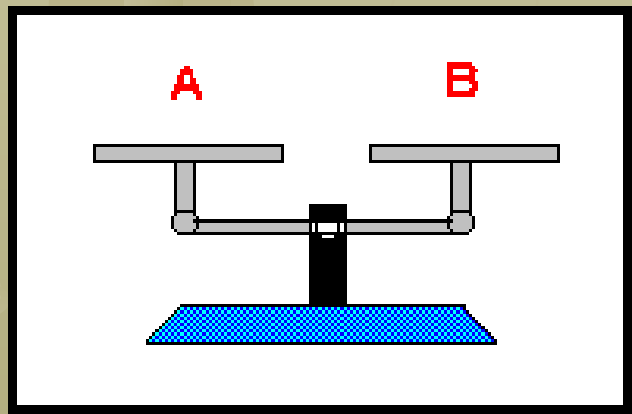
Balancing Chemical Equations



What Do You See?

- Look closely!
- When the pans are both at the same height, what does that mean if you have masses on both pans?
- Keep this in mind as we continue



What Does the Law State

- The law of conservation of matter states that matter (mass) can neither be created nor destroyed. It can, however, can be rearranged.
- In a chemical reaction, the mass of the reactants must equal the mass of the products.
  - HUH?

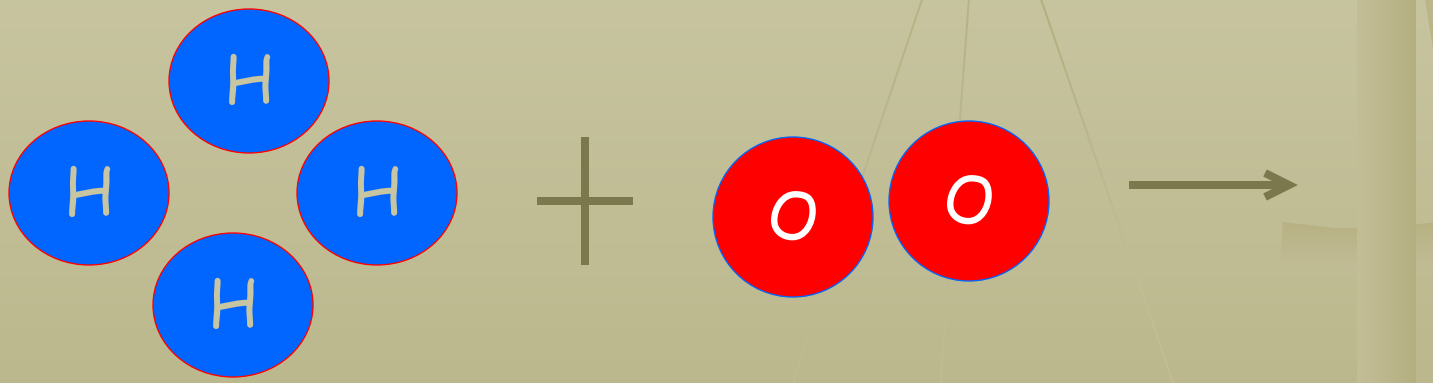
Thinking of the balance?

- Everything must be equal!
- When matter goes through a physical or chemical change, the amount (or mass) of the substances that you begin with must equal the amount (or mass) of the substances that you end with.
- The before and after must balance
  - Why, you ask?
  - It's the Law!!!!

- <u>The Law of Conservation of Matter</u> (Mass)
- <u>Matter can neither be created, nor destroyed.</u>

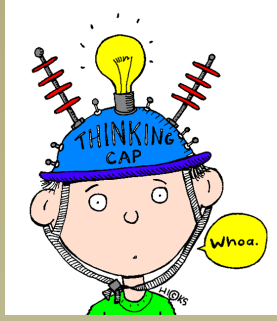
However in a chemical reaction

The atoms in the reactants are rearranged to form new compounds, but none of the atoms disappear, and no new atoms are formed.



Reactants

Products



What are Chemical Equations

- A chemical change is represented by a chemical reaction.
- A chemical equation identifies the starting and ending chemicals as reactants and products:
- reactants→ products

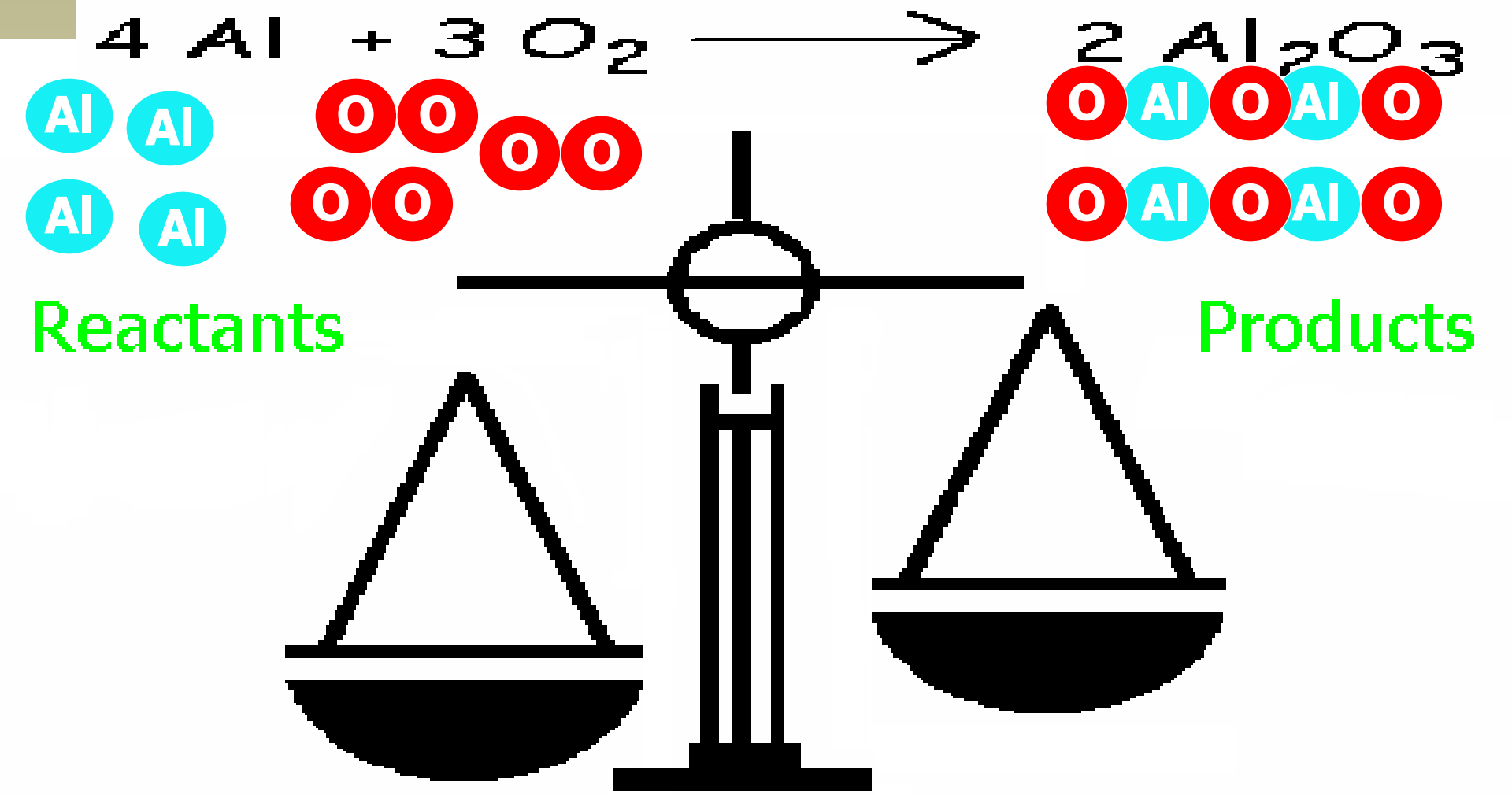
reactants → products

$2H_2 + O_2 \rightarrow 2H_2O$

A chemical equation is balanced when it reflects the conservation of mass.

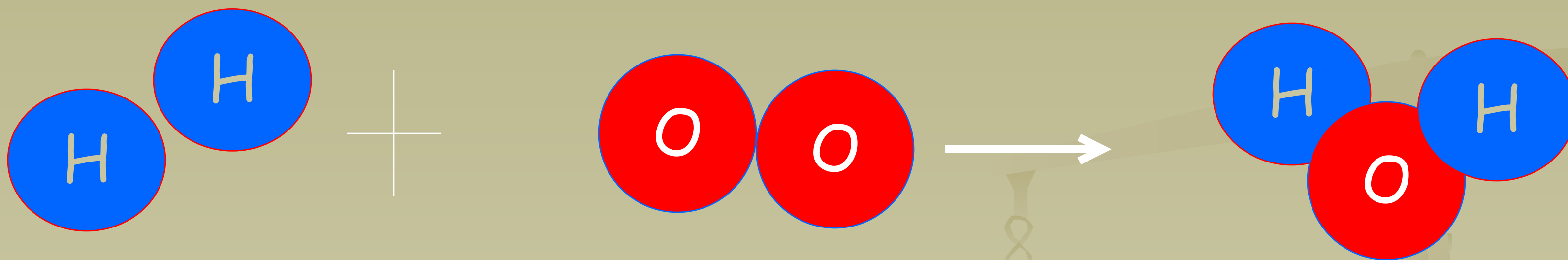
Graphic: http://www.chemistry.ohio-state.edu/betha/nealChemBal/

The same number of each kind of atom must be on the left side of the arrow as are on the right side when an equation is balanced.



Balancing an equation:

$2\ H_2 + O_2 \rightarrow 2\ H_2O$



Second: Inventory the atoms on both sides of the yield arrow.

First: Determine which atoms are not equal and add coefficients to balance these atoms.

4 H atoms	Hydrogen atoms are =	4 H atoms
2 O atoms	Oxygen atoms are =	2 O atoms

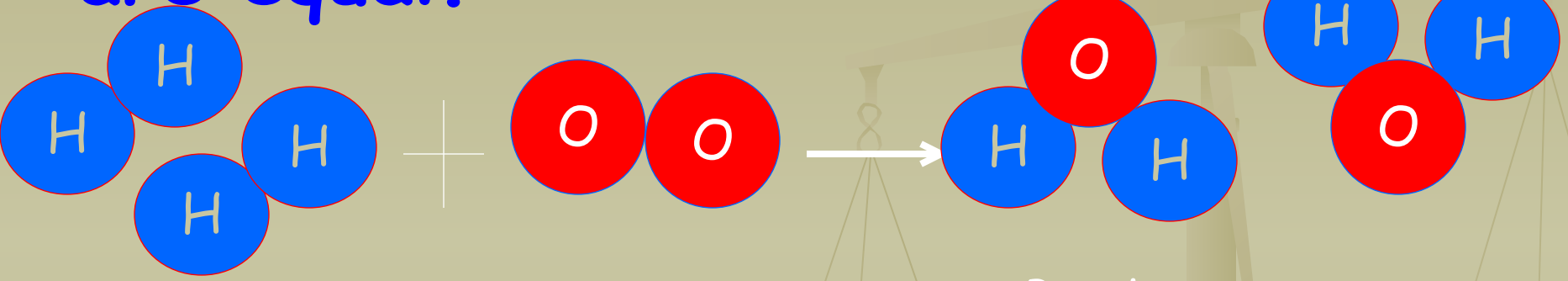
When a coefficient is added you must multiply all atoms in the compound by this number.

Redo the inventory.

After redoing the inventory add coefficients to balanced other atoms. With each additional coefficient the inventory must be updated.

This is now a balanced equation

So: Chemical equations are *balanced*, when the numbers and kinds of atoms on each side of the reaction arrow are equal.



Reactants

4 Hydrogen

2 Oxygen

Products

4 Hydrogen

2 Oxygen

Because atoms are conserved, the mass of the reactants in the chemical reaction is equal to the mass of the products.

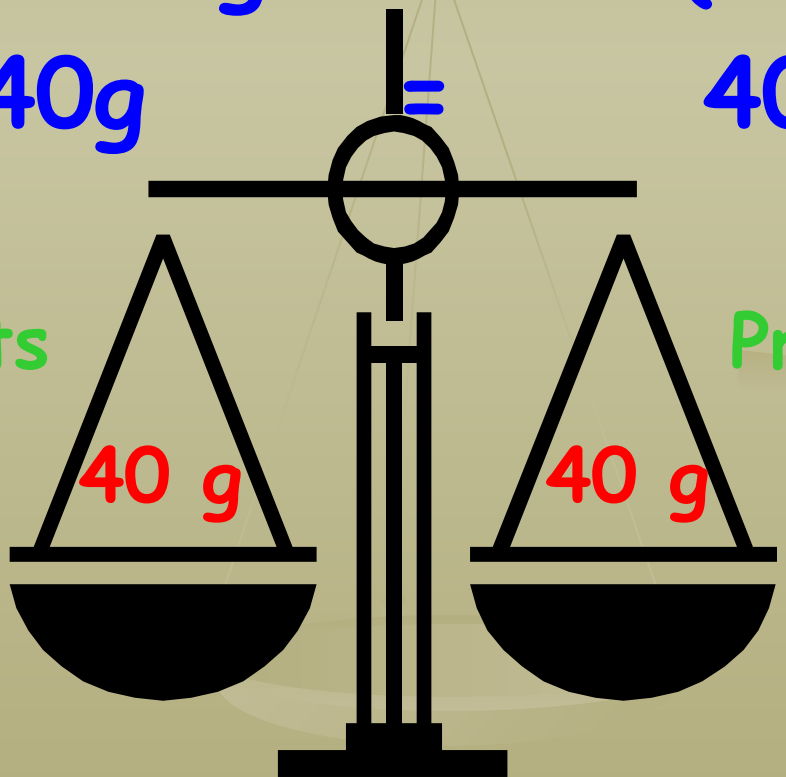
$H_2 + F_2 \rightarrow 2\,HF$

2g + 38g = 2(20g)

40g = 40g

Reactants

Products



Law of Conservation of Matter (Mass)

- If the amount of matter (mass) was not the same before and after the change

  (remember, it is the law),

  you must offer an explanation as to why.

Just because you cannot see it...

Sometimes in chemical reactions mass is converted to a gas and/or energy that it is released as a product.