THREE FUNDAMENTAL CHEMICAL LAWS

THREE FUNDAMENTAL CHEMICAL LAWS

1. Law of Conservation of Mass
2. Law of Definite Proportions
3. Law of Multiple Proportions

#1 – LAW OF CONSERVATION OF MASS

Mass cannot be created or destroyed, it can only be rearranged or converted from one form to another

https://www.youtube.com/watch?v=2S6e11NBwiw

#1 – LAW OF CONSERVATION OF MASS

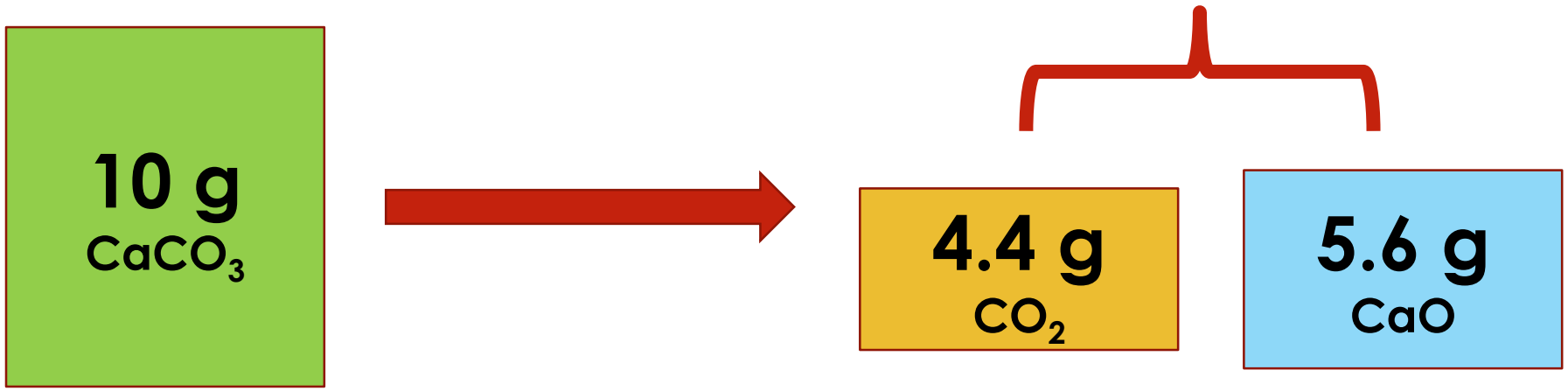
- We convert mass into energy during *nuclear chemical reactions*.

- In *normal chemical reactions* we simply rearrange the atoms to bond in different combinations to make new molecules.

#1 – LAW OF CONSERVATION OF MASS

If heating 10 grams of $CaCO_3$ produces 4.4 g of CO_2 and 5.6 g of CaO, show that these observations are in agreement with the law of conservation of mass.

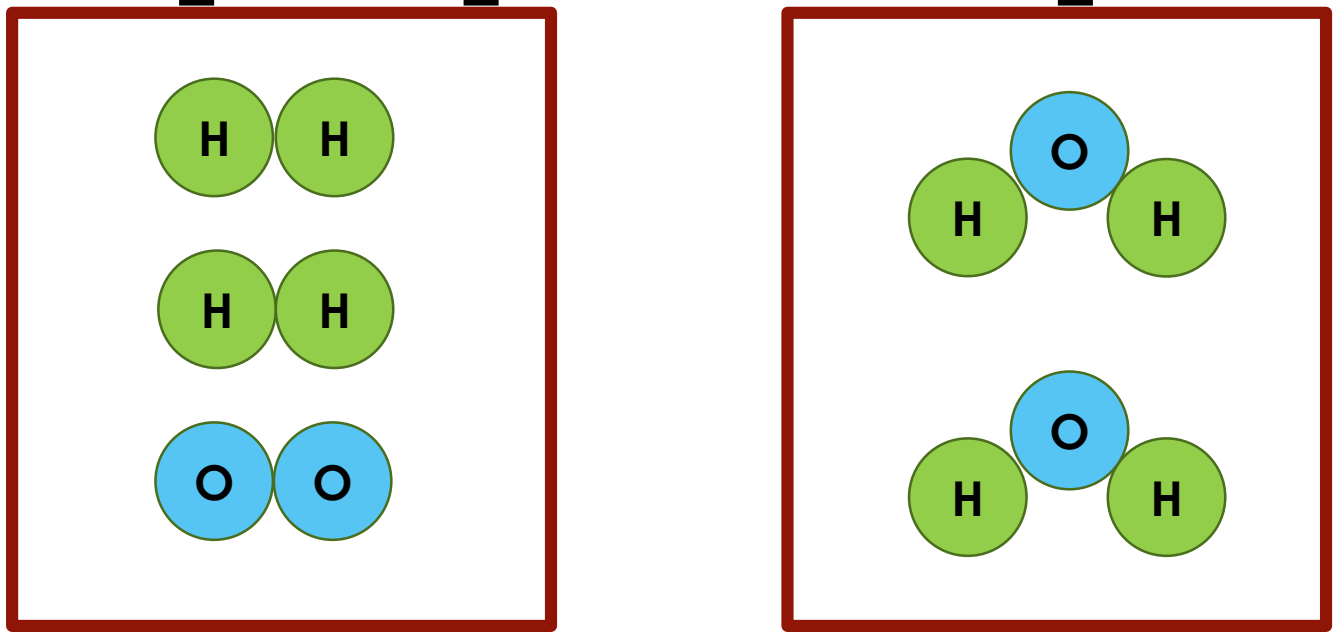
4.4 g + 5.6 g = 10 g



#1 – LAW OF CONSERVATION OF MASS

$2H_2 + O_2 \rightarrow 2H_2O$

4 H
2 O



4 H
2 O

#2 – LAW OF DEFINITE PROPORTIONS

- No matter how a molecule is made, it will always have the same elements in the same ratios.
- *Example*: No matter how you make it, H_2O will always be 2 hydrogen:1 oxygen

#2 – LAW OF DEFINITE PROPORTIONS

10.000 g of water gives 1.119 g of hydrogen gas and 8.881 g of oxygen gas. Also 27.000 g of water produces 3.021 g hydrogen and 23.979 g oxygen. Show that this follows the law of definite proportions.

Show that each sample has the same ratios!

Sample #1:

$\frac{1.119 \text{ g } H_2 \text{ gas}}{10.000 \text{ g } H_2O}$ = 0.1119 x 100 = **11.19% H**

$\frac{8.881 \text{ g } O_2 \text{ gas}}{10.000 \text{ g } H_2O}$ = 0.8881 x 100 = **88.81% O**

Sample #2:

$\frac{3.021 \text{ g } H_2 \text{ gas}}{27.000 \text{ g } H_2O}$ = 0.1119 x 100 = **11.19% H**

$\frac{23.979 \text{ g } O_2 \text{ gas}}{27.000 \text{ g } H_2O}$ = 0.8881 x 100 = **88.81% O**

Same ratios! So it is water!

#3 – LAW OF MULTIPLE PROPORTIONS

- Elements can combine in different ratios, but they must always be whole number ratios! We cannot have ½ an atom! Or ¼ of an atom! Etc.
  - *Example*: NO, NO_2, N_2O
  - *Not* $NO_{1.5}$

#3 – LAW OF MULTIPLE PROPORTIONS

Which of the following pairs of compounds can be used to illustrate the "law of multiple proportions"?

a) CH_4 & CO_2

b) NH_4 & NH_4Cl

c) SO_2 & SO_3

d) H_2O & HCl

e) ZnO_2 & $ZnCl_2$

f) CO & CO_2

A LITTLE HISTORY BEHIND ALL THIS!

https://www.youtube.com/watch?v=QiiyvzZBKT8