Stoichiometry

Quantitative study of chemical reactions

The basic question - how much? - is the object of stoichiometry.

It's like baking a cake…or two.

Basic cupcake recipe:

- 2 ¼ cups all purpose flour
- 1 1/3 cups sugar
- 3 teaspoons baking powder
- ½ teaspoon salt
- ½ cup shortening
- 1 cup milk
- 1 teaspoon vanilla
- 2 large eggs

- Makes 12 cupcakes

- What if you wanted 24?
- What if 8?
- What if you only have 2 cups of flour/
- No measuring cup?
- (48tsp = 1 cup)

Basic Stoichiometry

- Always starts with a balanced equation (the recipe).

$$2Al_2O_3 \downarrow \rightarrow 4\,Al + 3\,O_2$$

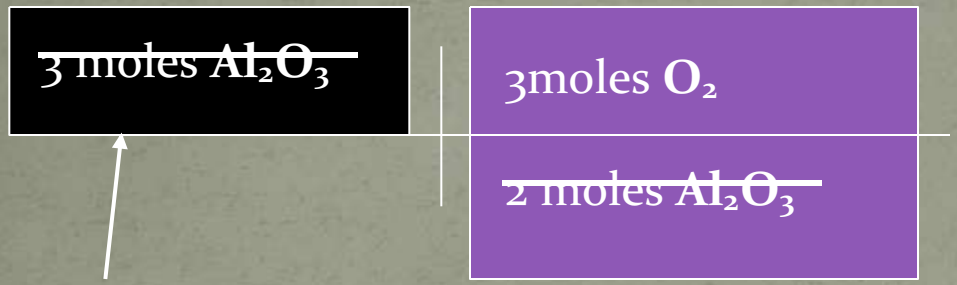
- From the balanced equation we can determine the *molar ratios.*
- Remember that the coefficients refer to the number of *moles* of each reactant or product there are in the balanced equation.
- So in this equation 2 moles of aluminum oxide decompose to form 4 moles of aluminum metal and 3 moles of oxygen gas.

Basic Stoichiometry

$2Al_2O_3 \rightarrow 4Al + 3O_2$

- What if I only had one mole of aluminum oxide. How many moles of aluminum metal could I produce then?
- How many moles of oxygen gas?
- What if I had three moles of aluminum oxide…?
- Note, you always need the molar ratio to determine the number of moles produced from or required….

Basic Stoichiometry



This is your "given"

Molar ratio

$$= \frac{3 \times 3}{2} = 4.5 \text{mols of } O_2$$

Try some

$$2Al_2O_3 \rightarrow 4Al + 3O_2$$

- If you had 1 mole of aluminum oxide, how many moles of oxygen would you yield?
- 1.5 moles
- How many moles of aluminum oxide would you need to produce 17.25 moles of aluminum?
- 8.625 moles.

Basic Stoichiometry

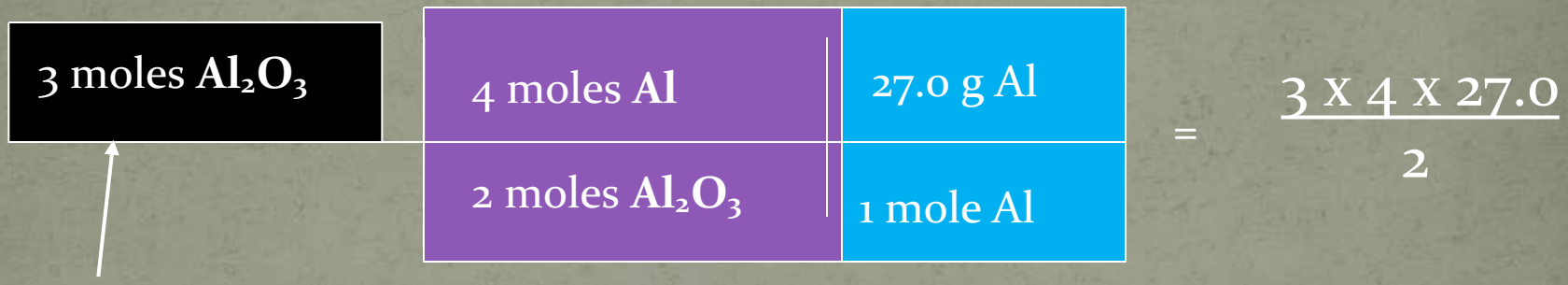
$$2Al_2O_3 \downarrow 4Al + 3O_2$$

- Remember that one mole can be converted to a substance's mass in grams.
- What is the mass in grams of one mole of aluminum?
- So, what would be the mass of four moles of aluminum?
- What if you had three moles of aluminum oxide?

Basic Stoichiometry

$$2Al_2O_3 \rightarrow 4Al + 3O_2$$

- Now the bridge looks like this:



Practice

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