Balancing Equations

Chemical Reactions
Chemical Equations

- A chemical equation describes what happens in a chemical reaction.
- Within an equation, there are reactants (starting materials) and products (resulting substance), the formulas of the participating constituents and the phases of the participants (solid, liquid, gas, aqueous) and the amount of each substance.
Balancing of Equations

• To balance a chemical equation, you have to establish a mathematical relationship between the quantity of reactants and products.
• These quantities are expressed as grams or moles.
• You begin by writing the unbalanced equation out.
• Chemical formulas of reactants appear on the left and products appear on the right.
• Reactants and products are separated by putting an arrow between them to show direction of reaction.
Balancing of Equations (cont.)

• An unbalanced equation

\[ \text{SnO}_2 + \text{H}_2 \rightarrow \text{Sn} + \text{H}_2\text{O} \]

• Look at the equation and see which elements are not balanced.
• There are two oxygen atoms on the reactant side and one on the product side.
• Correct this by adding a coefficient of 2 in front of water:

\[ \text{SnO}_2 + \text{H}_2 \rightarrow \text{Sn} + 2\text{H}_2\text{O} \]

• This puts the hydrogen atoms out of balance
Balancing of Equations (cont.)

• Now there are four hydrogen atoms on the product side but only two hydrogen atoms on the reactant side.
• Correct this by adding a coefficient of 2 for the hydrogen gas on the reactant side.

\[ \text{SnO}_2 + 2\text{H}_2 \rightarrow \text{Sn} + 2\text{H}_2\text{O} \]

• And just like that the equation is balanced.
• Be sure to double-check your math!
• Each side of the equation has 1 atom of Sn, 2 atoms of O\(_2\), and 4 atoms of H
Chemical equations to balance

1. \( \text{Fe} + \text{Cl}_2 \rightarrow \text{FeCl}_3 \)
2. \( \text{KMnO}_4 + \text{HCl} \rightarrow \text{KCl} + \text{MnCl}_2 + \text{H}_2\text{O} + \text{Cl}_2 \)
3. \( \text{K}_4\text{Fe(CN)}_6 + \text{H}_2\text{SO}_4 + \text{H}_2\text{O} \rightarrow \text{K}_2\text{SO}_4 + \text{FeSO}_4 + (\text{NH}_4)_2\text{SO}_4 + \text{CO} \)
4. \( \text{C}_6\text{H}_5\text{COOH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} \)
5. \( \text{K}_4\text{Fe(CN)}_6 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{KHSO}_4 + \text{Fe}_2(\text{SO}_4)_3 + \text{MnSO}_4 + \text{HNO}_3 + \text{CO}_2 + \text{H}_2\text{O} \)
6. \( \text{PhCH}_3 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{PhCOOH} + \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{O} \)
7. \( \text{CuSO}_4*5\text{H}_2\text{O} \rightarrow \text{CuSO}_4 + \text{H}_2\text{O} \)
Solving Problem 1

Fe + Cl2 → FeCl3

• Look at the equation and see which elements are not balanced
• There are 2 chlorine atoms on the reactant side and 3 on the product side
• Correct this by adding a coefficient of 3 for the chlorine molecule on the reactant side, a 2 in front of the FeCl3 compound on the product side and a 2 in front of the Iron atom on the reactant side

2Fe + 3Cl2 → 2FeCl3

• The equation is balanced!
The Key is...

PRACTICE!