

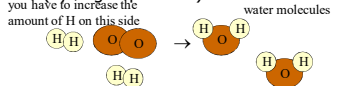
Balancing Equations

What is balancing an equation?

- Balancing an equation is changing the ratios of molecules/atoms to make the lowest possible same whole number and type of atoms on each side of the equation.
- $2 \text{ Na} + \text{Cl}_2 \rightarrow 2 \text{ NaCl}$
- Note $4 \text{ Na} + 2 \text{Cl}_2 \rightarrow 4 \text{ NaCl}$; would also have the same number but not the **lowest possible ratio**. It could be reduced!!

What you can not do!

- You can NOT change the formula of the molecules I give you.
- $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$ If the number is one, you don't have to write it!
- you cannot change water to H_2O_2 (hydrogen peroxide) and this will make 2 water molecules



What you are allowed to do

- change the coefficient in front of any molecule/atom (changing the ratio of atoms)
- $\underline{2} \text{ Ag} + \underline{\quad} \text{Cl}_2 \rightarrow \underline{2} \text{ AgCl}$
- you can only write on those lines

Problem solving strategies

- It helps to make a list of all atoms present
- $\text{HCl} + \text{Ba(OH)}_2 \rightarrow \text{BaCl}_2 + \text{H}_2\text{O}$

Problem solving strategies

- It helps to make a list of all atoms present
- $2 \text{HCl} + \text{Ba(OH)}_2 \rightarrow \text{BaCl}_2 + 2 \text{H}_2\text{O}$

Ba - 1	Start making the numbers agree one at a time	Ba - 1	
H - 3		H - 2	Now going to O
Cl - 1	(pick something, that occurs in only one molecule 1st)	Cl - 2	
O - 2		O - 1	Now everything is balanced!

starting w/
Cl
~not H in this case

Another to try

- $\text{CH}_4 + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$

Another to try

- $\text{CH}_4 + 2 \text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{CO}_2$

C- 1	C- 1
H- 4	H- 2 4
O- 2 4	O- 3 4

Everything is balanced now!
This takes a lot of trial and error.

Start with H
now O

More Practice

- $\text{NH}_4\text{ClO}_3 + \text{CaSO}_4 \rightarrow \text{Ca(ClO}_3)_2 + (\text{NH}_4)_2\text{SO}_4$
- If and ONLY IF a polyatomic ion is on both sides of an equation, you can treat it like it is one thing!

More Practice

- $2\text{NH}_4\text{ClO}_3 + \text{CaSO}_4$
- $\rightarrow \text{Ca}(\text{ClO}_3)_2 + (\text{NH}_4)_2\text{SO}_4$

• If and ONLY IF a polyatomic ion is on both sides of an equation, you can treat it like it is one thing!

Polyatomic ions

- $\text{NH}_4\text{Cl} + \text{NaOH} \rightarrow \text{NH}_3 + \text{NaCl} + \text{H}_2\text{O}$
- Now you can't treat the polyatomic ions as though they are one thing because the same polyatomic ion isn't on both sides.
- This equation is already balanced with no coefficients.

Nitrogen Triiodide

- $\text{NI}_3 \rightarrow \text{N}_2 + \text{I}_2$
-

Nitrogen Triiodide

- $2\text{NI}_3 \rightarrow \text{N}_2 + 3\text{I}_2$
- N- 1 2 N- 2
- I- 3 6 I- 2 6

• Looking at Iodine, this brings in the concept of common multiples

A Big Problem

- $\text{C}_4\text{H}_{10} + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$

A Big Problem

- $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 10\text{H}_2\text{O} + 8\text{CO}_2$
- C- 4 8 C- 1 4 8
- H- 10 20 H- 2 10 20
- O- 2 26 O- 3 9 13 18 26

I can't increase by 6.5 only whole numbers, I have to make O even on the product side. And finally everything balances!!

More


- $(\text{NH}_4)_2\text{CO}_3 + \text{Al}(\text{NO}_3)_3$
- $\rightarrow \text{Al}_2(\text{CO}_3)_3 + \text{NH}_4\text{NO}_3$

More

- $3(\text{NH}_4)_2\text{CO}_3 + 2\text{Al}(\text{NO}_3)_3$
- $\rightarrow \text{Al}_2(\text{CO}_3)_3 + 6\text{NH}_4\text{NO}_3$

One More

- $\text{C}_6\text{H}_{14} + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$



One More

$$2 \text{C}_6\text{H}_{14} + 19\text{O}_2 \rightarrow 14 \text{H}_2\text{O} + 12\text{CO}_2$$