

Ch. 10.1 chemical equations

example: photosynthesis



- uses chemical formulas to identify the chemicals in a chemical reaction
- may identify the “state / phase” of the chemical using parenthesis
 - l = liquid
 - g = gas
 - s = solid
 - aq = aqueous = dissolved in water
- reactant(s) → product(s)
 - reactant(s) = chemical(s) at the “beginning” of a reaction
 - product(s) = chemical(s) at the “end” of a reaction
 - → = “to form”

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review: chemical formulas

- $\text{Mg}(\text{NO}_3)_2$ = Mg & NO_3 & NO_3 has 1-Mg, 2-N, and 6-O

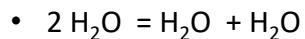
coefficients in a chemical equation

- number in front of chemical formula in a chemical equation
- represents the number of molecules in the chemical equation
- example: $3 \text{Ca}(\text{NO}_3)_2(\text{aq}) + 2 \text{Na}_3\text{PO}_4(\text{aq}) \rightarrow \text{Ca}_3(\text{PO}_4)_2(\text{s}) + 6 \text{NaNO}_3(\text{aq})$
 - if there's no number, then the value of the coefficient = 1
 - i.e. 3 molecules of $\text{Ca}(\text{NO}_3)_2$ reacts with 2 molecules of Na_3PO_4 to form 1 molecule of $\text{Ca}_3(\text{PO}_4)_2$ and 6 molecules of NaNO_3

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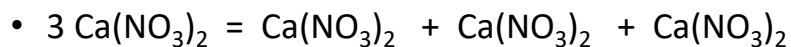
continue – coefficients in a chemical equation



where there are

4 atoms of hydrogen and

2 atoms of oxygen



where there are

3 atoms of Ca

6 atoms of N

18 atoms of O (oxygen)

since 1 molecule of $\text{Ca}(\text{NO}_3)_2$ has 1 – Ca, 2 – N, and 6 – O

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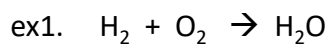
“balance” a chemical equation

- satisfies the conservation of mass
 - i.e. no atom is created nor destroyed in a chemical reaction
 - i.e. start and end with the same number of atoms in a reaction
- use the lowest ratio of integer coefficients to satisfy the conservation of mass

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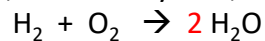
examples: balance the following chemical equations



H: 2 2

O: 2 1

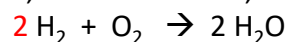
H is ok, but destroyed O, so need more O as a product



H: 2 4

O: 2 2

but now, the H is created, i.e. it's not balanced, so need more H



H: 4 4

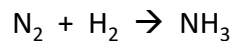
O: 2 2

ok; it's "balanced" and used the lowest ratio of integer coefficients

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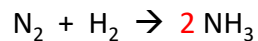
continue - ex 2



N: 2 1

H: 2 3

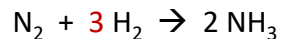
need more N as product and more H as reactant, so let's balance N, since its cleaner



N: 2 2

H: 2 6

now, let's balance H as reactant



N: 2 2

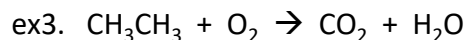
H: 6 6

ok; it's "balanced" and used the lowest ratio of integer coefficients

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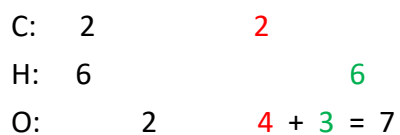
continue – ex. 3; balance X_2 last, since “easy” to balance



it's the same as: $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$



need more C on product, H on product, and O on reactant, so balance C & H



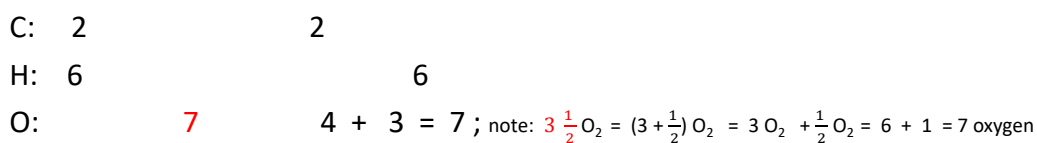
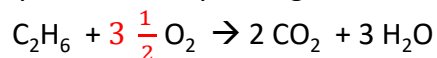
C and H are fine, but need more O on reactant side

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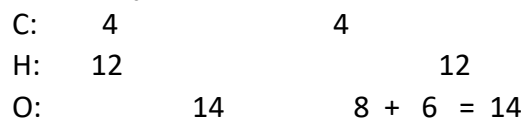
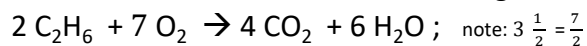
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finish-up – ex 3

lastly, balance O by having more O on reactant side



while it's balanced, want lowest ratio of integers, so double the coefficients

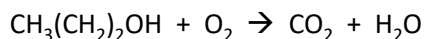


ok; it's “balanced” and used the lowest ratio of integer coefficients

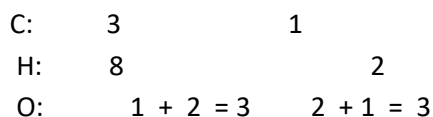
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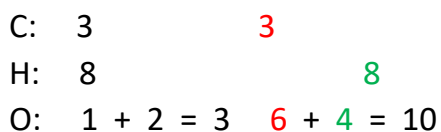
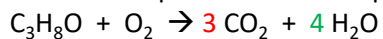
ex. 4



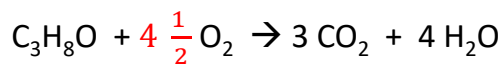
"simplify": $\text{C}_3\text{H}_8\text{O} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$



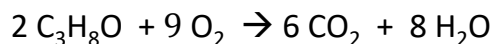
need more **C** on product and **H** on product



need more O on reactant,



double coefficients to get lowest ratio of integer coefficients

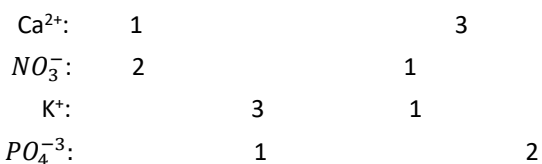
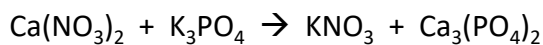


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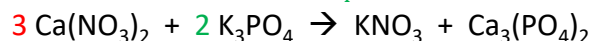
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ex 5. balance chem eqn with ionic compounds

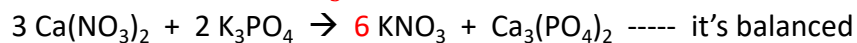
aside: don't balance atoms, balance ions



let's balance the Ca^{2+} and PO_4^{-3}



let's balance the K^+ and NO_3^-



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