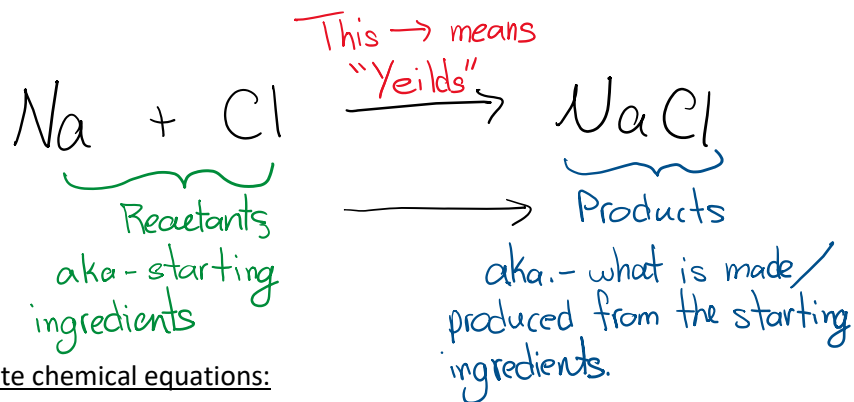


Conservation Law: Balancing Chemical Equations

Chemical Equations

- When two or more chemicals are combined, they may react to form new substances that have **properties** different from the original chemicals



Two ways to write chemical equations:

- Word Equations:** uses written chemical names for reactants and products
 - Example: sodium + oxygen $\rightarrow$ sodium oxide
- Symbolic/Formula Equations:** uses chemical formula for reactants and products
 - Example: $\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}$

Law of Conservation of Mass:

- States that mass is **conserved** in a chemical reaction
 - mass of **reactants** = mass of **products**
- Since matter cannot be **created** nor **destroyed**, then all of the atoms in the reactants must exist as atoms in the products

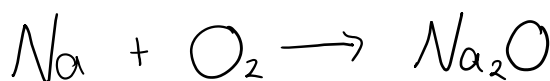
Balancing Chemical Equations

- Chemical equations are balanced to show that the total number of each type of atom is **equal** on both sides of the chemical equation.

Tips for Balancing Equations:

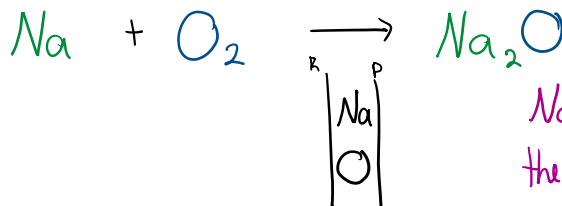
- Balance pure elements last.
- Double odd number of atoms if there is an even number on the other side.
- Balance complex ions by counting groups of that ion. e.g., how many groups of SO_4^{-2} on each side of the equation?
- When balancing compounds, balance any oxygen and hydrogen last.

- Write out the full formula equation (called a **skeleton** equation).



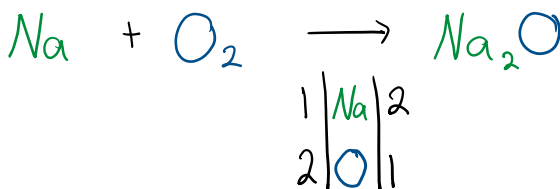
This is a skeleton eq. because it is NOT balanced.

- Draw a separating column or line under the "yields" sign of the reaction and write the unique atoms.

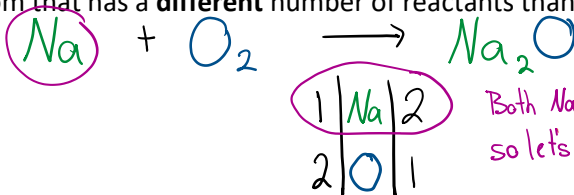


Na and "O" are the unique atoms (elements).

- Write the number of each unique atom for the reactant (left) side and for the product (right) side.



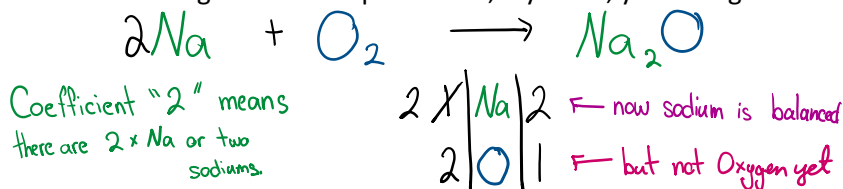
- Pick an atom that has a **different** number of reactants than products (an imbalance).



Both Na and "O" are not balanced so let's choose Na to start with.

- Use coefficients (numbers in **front** of each element or compound) to increase quantities of a particular element and mark the change by the separating column or line.

* DO NOT change the subscript number; if you do, you change the **substance**.

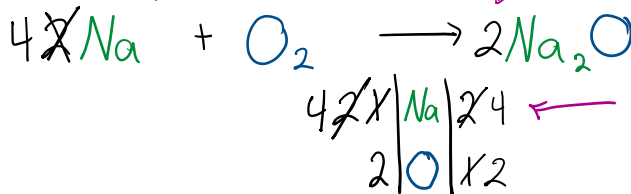


Coefficient "2" means there are 2 x Na or two sodiums.

← now sodium is balanced

← but not Oxygen yet

- Repeat steps 4-5 until complete



putting a "2" here means there now both $2 \times \text{Na}_2 = 4 \text{Na's}$ and $2 \times \text{O} = 2 \text{O's}$

← now unbalanced again so change reactant side again.

- Double check when finished.

