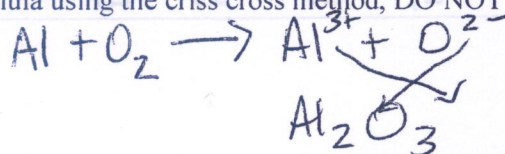


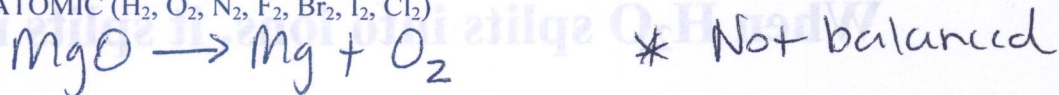
Guidelines for balancing reactions:

1. Determine the type of reaction (synthesis, decomposition, single replacement, double replacement, or combustion)
2. Predict the products for the reaction based on the TYPE of reaction.

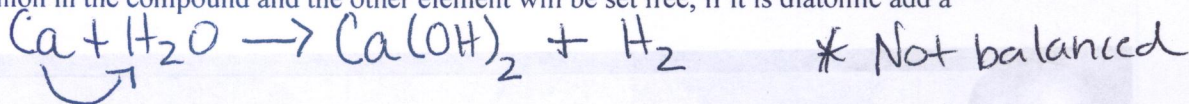
If synthesis: Write the chemical formula using the criss cross method, DO NOT USE THE SUBSCRIPTS FROM THE REACTANTS!!!!



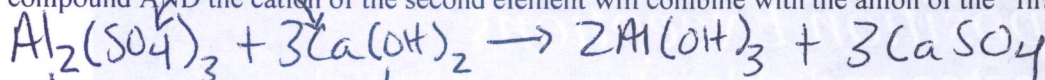
If decomposition: Write the elements that make up the compound WITHOUT subscripts UNLESS the element is DIATOMIC (H₂, O₂, N₂, F₂, Br₂, I₂, Cl₂)



If single replacement: The single element will replace another element in the compound that is most similar to it. So if the single element is a cation it will replace the cation in the compound. If it is an anion it will replace the anion in the compound and the other element will be set free, if it is diatomic add a subscript



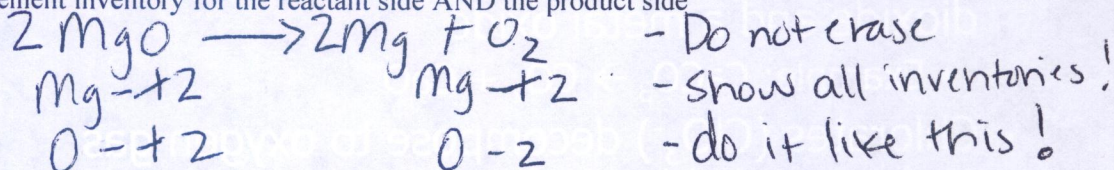
If double replacement: The cation of the first compound will combine with the anion of the second compound AND the cation of the second element will combine with the anion of the first element.



If combustion: the products will be carbon dioxide and water

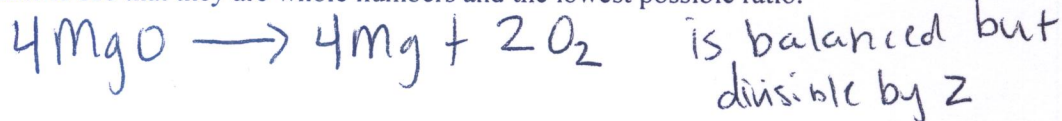
3. Balance the reaction: FROM THIS POINT ON DO NOT TOUCH SUBSCRIPTS OR ADD SUBSCRIPTS OR ELEMENTS TO THE REACTION!!!

a. take an element inventory for the reactant side AND the product side



b. If atoms are unbalanced find the least common factor and PLACE COEFFICIENTS (ONLY WHOLE NUMBERS) IN FRONT OF THE CHEMICAL FORMULAS OR ELEMENTS (NOT THE MIDDLE) to balance the numbers of atoms on either side of the reaction. It is helpful to start with greatest numbers of atoms and leave hydrogen and oxygen for last. EVERY TIME YOU PLACE A COEFFICIENT YOU NEED TO TAKE AN ELEMENT INVENTORY. IT IS OKAY TO CHANGE COEFFICIENTS

c. Check all coefficients to see that they are whole numbers and the lowest possible ratio.

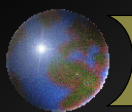


Seven Diatomic Elements

$H_2, O_2, N_2, F_2, Br_2, I_2, Cl_2$

When H_2O splits into ions, it splits into

H^+ and OH^- (not H^+ and O^{2-} !!)



Decomposition Exceptions

- Carbonates and chlorates are special case decomposition reactions that do not go to the elements.
 - Carbonates (CO_3^{2-}) decompose to carbon dioxide and a metal oxide
 - Example: $CaCO_3 \rightarrow CO_2 + CaO$
 - Chlorates (ClO_3^-) decompose to oxygen gas and a metal chloride
 - Example: $2 Al(ClO_3)_3 \rightarrow 2 AlCl_3 + 9 O_2$
- There are other special cases, but we will not explore those

Guidelines for balancing reactions:

1. Determine the type of reaction (synthesis, decomposition, single replacement, double replacement, or combustion)
2. Predict the products for the reaction based on the TYPE of reaction.

If synthesis: Write the chemical formula using the criss cross method, DO NOT USE THE SUBSCRIPTS FROM THE REACTANTS!!!!

If decomposition: Write the elements that make up the compound WITHOUT subscripts UNLESS the element is DIATOMIC (H₂, O₂, N₂, F₂, Br₂, I₂, Cl₂)

If single replacement: The single element will replace another element in the compound that is most similar to it. So if the single element is a cation it will replace the cation in the compound. If it is an anion it will replace the anion in the compound and the other element will be set free, if it is diatomic add a subscript

If double replacement: The cation of the first compound will combine with the anion of the second compound AND the cation of the second element will combine with the anion of the first element.

If combustion: the products will be carbon dioxide and water

3. Balance the reaction: **FROM THIS POINT ON DO NOT TOUCH SUBSCRIPTS OR ADD SUBSCRIPTS OR ELEMENTS TO THE REACTION!!!**

a. take an element inventory for the reactant side AND the product side

b. If atoms are unbalanced find the least common factor and **PLACE COEFFICIENTS (ONLY WHOLE NUMBERS) IN FRONT OF THE CHEMICAL FORMULAS OR ELEMENTS (NOT THE MIDDLE)** to balance the numbers of atoms on either side of the reaction. It is helpful to start with greatest numbers of atoms and leave hydrogen and oxygen for last. **EVERY TIME YOU PLACE A COEFFICIENT YOU NEED TO TAKE AN ELEMENT INVENTORY. IT IS OKAY TO CHANGE COEFFICIENTS**

c. Check all coefficients to see that they are whole numbers and the lowest possible ratio.