CHAPTER 6
INTRO TO CHEMICAL REACTIONS

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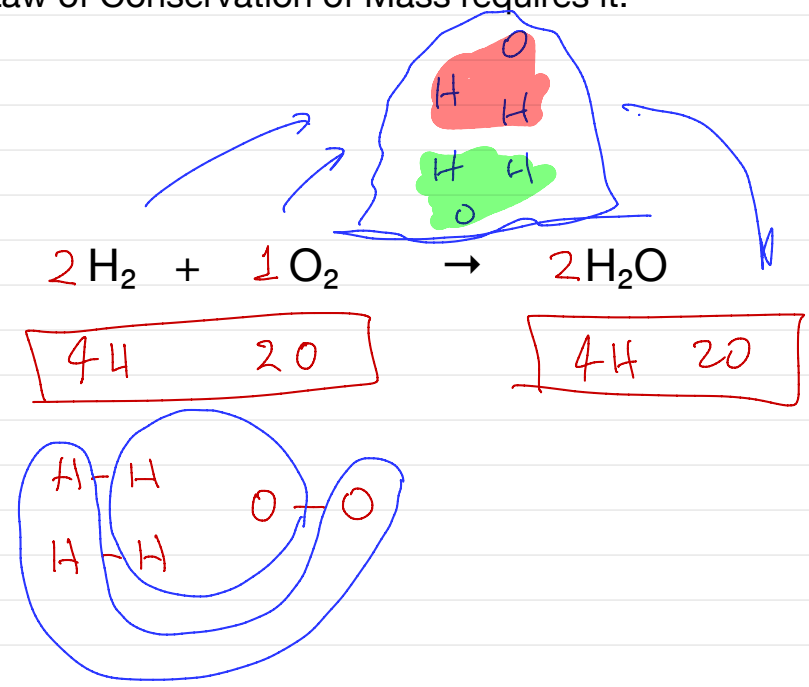
Q: Why balance chemical equations?

A: The Law of Conservation of Mass requires it.



HOW TO BALANCE CHEMICAL EQUATIONS
THE TWIN ELEMENTS METHOD

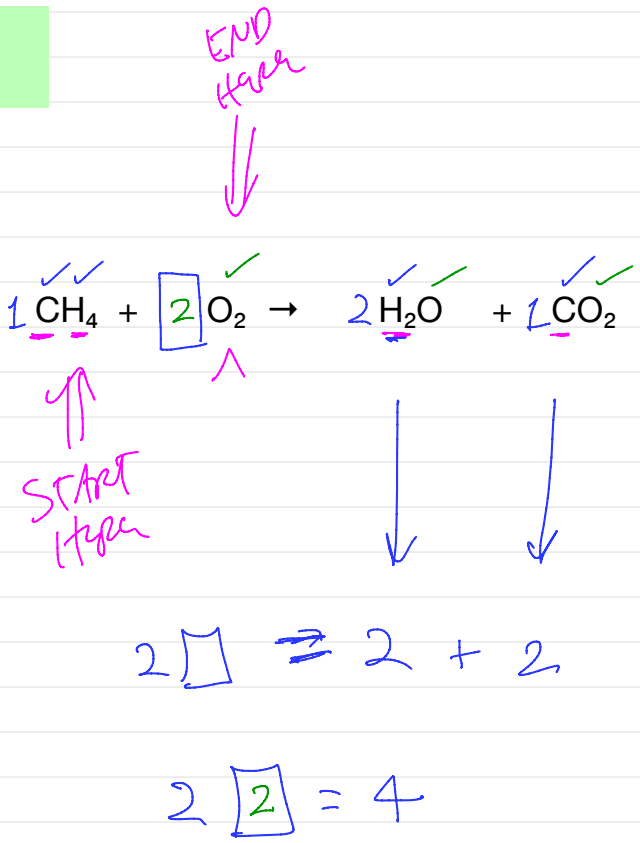
1. ID "lone" elements
   (pure elements that are all "alone")

2. ID "twin" elements "paired"
   (element whose symbol appears once-and-only-once on each side of the equation. One of the twins lives on the reactant-side, the other on the product-side)

3a. START with the Twin Element with the largest subscript.

3b. END by determining the coefficient of a Lone Element, if present.

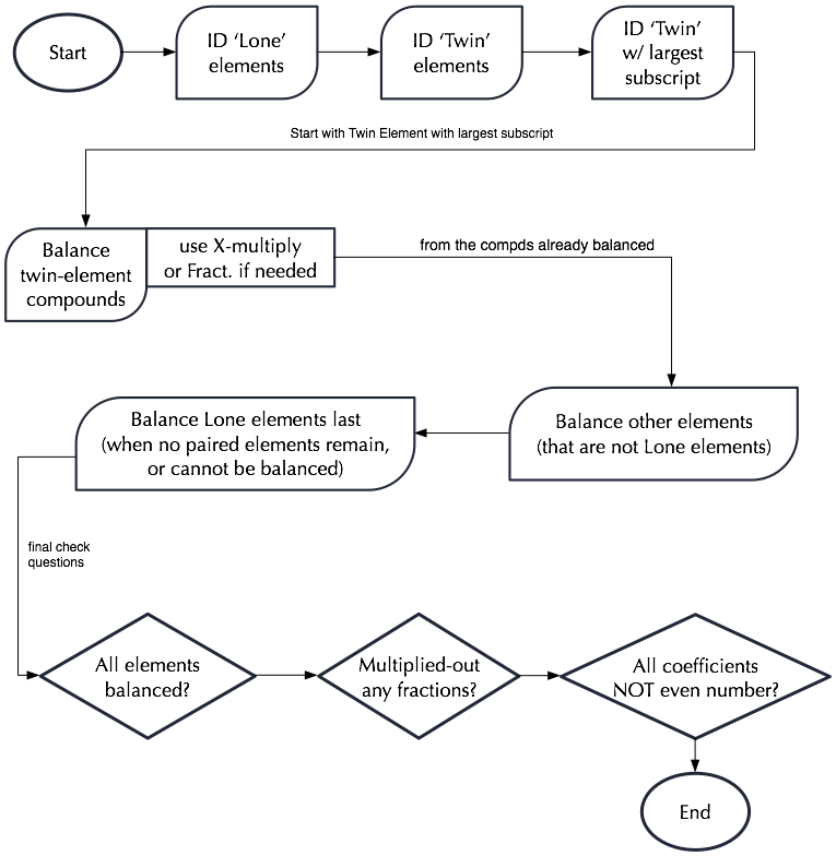
4. Exploit opportunities to employ two tricks of the trade:
   (i) cross-multiplication
   (ii) fractionations

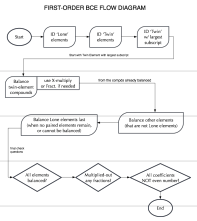


$2\square = 2 + 2$

$2 \boxed{2} = 4$

FIRST-ORDER BCE FLOW DIAGRAM





FRACTIONATION

$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

$1\,C_2H_6 + \frac{7}{2}O_2 \rightarrow 2\,CO_2 + 3\,H_2O$

$\frac{2}{1}$

OX

$2(-) = 4 + 6$

$\frac{2}{1}\left(\frac{7}{2}\right) = \frac{7}{1}$

$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

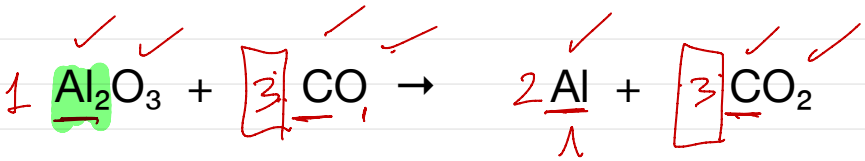
CROSS MULTIPLY

$2\,Sb + 3\,Cl_2 \rightarrow 2\,SbCl_3$

$Sb + Cl_2 \rightarrow SbCl_3$

$2Sb + 3Cl_2 \rightarrow 2SbCl_3$

TRIPLETS AND HIGHER (simple algebraic equation)



$3 + \square = \square 2$

$3 + x = 2x$

$3 = 2x - x$

$3 = x$

$$Al_2O_3 + 3CO \rightarrow 2Al + 3CO_2$$

(Practice Question)
Balance the following equation to proper form:

$$NaBH_4 + BF_3 \rightarrow NaBF_4 + B_2H_6$$

$$3\ NaBH_4 + 4\ BF_3 \longrightarrow 3\ NaBF_4 + 2\ B_2H_6$$

Mon. Sept 30

(Answer)