Section 3.9 - Molec/ Stoichiometry

→ We know how to get # of moles from MW, FW

\[
\text{mass subst} \div \text{MW} = \text{moles subst}
\]

\[
100.0 \text{ g H}_2\text{O} \div \left(\frac{1 \text{ mol}}{18.015 \text{ g}}\right) = \text{ mol H}_2\text{O}
\]

→ We know how to balance equations

\[
2\text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(l)
\]

→ Stoichiometry is calculating amount of reagent needed to produce x y Product

• amount of products formed by x y reagents
• other story problems

→ mole method (only)

- A balanced eqn, what we need

Recall that our arrow is “=”

\[
2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O} \quad \text{balance/chems}
\]

\[
2\text{C}_2\text{H}_6 + 7\text{O}_2 = 4\text{CO}_2 + 6\text{H}_2\text{O}
\]

→ 2 \text{C}_2\text{H}_6 produces 4 \text{CO}_2 (w/enough \text{O}_2, \text{f} also makes \text{H}_2\text{O})

\[
2 \text{C}_2\text{H}_6 = 4 \text{CO}_2
\]

\[
\frac{2 \text{mol C}_2\text{H}_6}{4 \text{mol CO}_2} = \frac{1}{2} \quad \text{a factor}
\]

Note: instead of 1 \text{mol} \text{C}_2\text{H}_6, let's use a m ole:

\[
\frac{2 \text{mol C}_2\text{H}_6}{4 \text{mol CO}_2} = \frac{1}{2}
\]
this allows us to compare apples to oranges:

\[ \text{C}_2\text{H}_6 \text{ to } \text{CO}_2 \]

Mole Super-highway

\[ \text{onramp} \quad \rightarrow \quad \text{offramp} \]

→ in England they drive backwards, their onramps are our onramps

→ "ramps go both ways"

Onramps:
- molecular weight
- molecular mass
- concentration (mole/L)
Steps:
1. Write balanced eqn
2. Figure out plan
3. Write factors
4. Calculate, verify answer

Chlorine gas can be made by HCl react w/ \( \text{MnO}_2 \):
\[
2 \text{HCl} + \text{MnO}_2 \rightarrow \text{MnCl}_2 + 2 \text{H}_2\text{O} + \text{Cl}_2
\]
when 1.52 mol of HCl react w/ x \( \text{MnO}_2 \).

- how much \( \text{Cl}_2 \) is found? \( \text{moles} \)? \( \text{g} \)?

Bismuth oxide reacts w/ carbon to make metal
\[
\text{Bi}_2 \text{O}_3(s) + 3 \text{C}(s) \rightarrow 2 \text{Bi}(l) + 3 \text{CO}(g)
\]

\( \text{CO}(g) \) = "coke"

when 352 g \( \text{Bi}_2 \text{O}_3 \) reacts w/ x \( \text{C} \) carbon what do we get?

Elemental phosphorus (P\(_4\)) reacts w/ Cl gas what mass of Cl gas do we need to consume 353 g P to form Phosphorus pentachloride?

When 0.100 mol of carbon reacts w/ 8.00 g \( \text{O}_2 \), what happens?