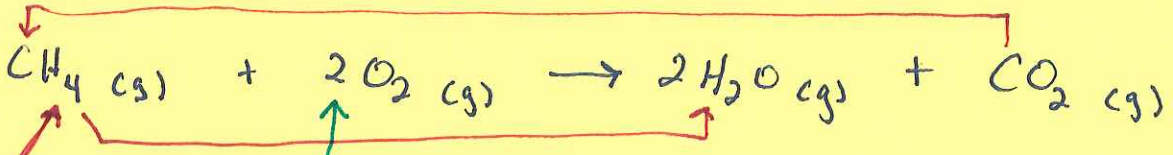
# Law of Conservation - Quantitative

Intro: The law of conservation states that matter cannot be created or destroyed. We can use this to quantify chemical processes and relate the amount of products produced to the amount of reactants that were present. Another part of this basis is that each element has a known average atomic mass so we are now able to relate the mass of products formed to the mass of reactants needed to form them. Mass analysis can be done in the form of gravimetric analysis or titrations.




**Subscripts:**
# of each type of atom present in a molecule

**Coefficient:**
relative # of particles consumed/created in a process

↳ Could be moles or literal atoms

1 molecule of $CH_4$ reacts with 2 molecules of oxygen to produce 2 molecules of water and 1 molecule of carbon dioxide

OR

1 mole of $CH_4$ reacts with 2 moles of oxygen to produce 2 moles of water and 1 mole of carbon dioxide

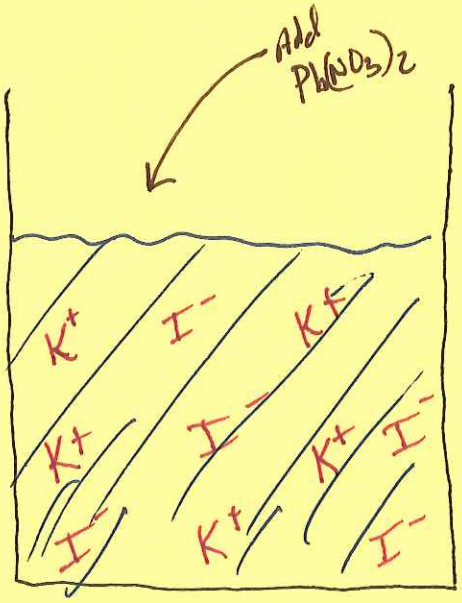
**From Equation above:**

Know mass of $CO_2$ produced...

↳ notice only source of Carbon is $CH_4$ so I can relate $CO_2$ to $CH_4$

Think about this for Water...

Gravimetric Analysis: quantitative determination of amount of analyte originally present based on mass of a solid produced




Analyte: chemical species (element or molecule) that is the target of analysis

$KI_{(s)}$ → Know it is soluble based on Rules Below (6IA metal)

↳ so end up with $K^+$ and $I^-$ in solution

$$2KI + Pb(NO_3)_2 \rightarrow PbI_2 + 2KNO_3$$

$PbI_2$: Solid product (will precipitate)

↳ can filter out, dry it and use stoich to relate to original Amt of $I^-$ present

Add $Pb(NO_3)_2$ in excess!

↳ because want KI to be limiting

Mass $PbI_2$ → Related to $I^-$ in solution → Related to original amount of KI in tablet

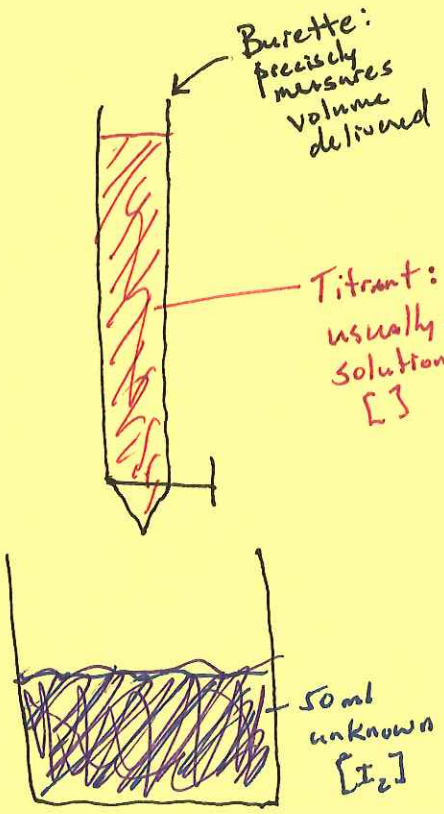
Solubility Rules to Memorize!!!

- Group IA metals soluble
- $NH_4^+$ compounds soluble
- $NO_3^-$ compounds soluble

Note: Be able to "connect the dots" that Link elements/compounds together

Drying to constant mass: once mass becomes constant we know all water has evaporated

# Titrations: Mix two ~~liquid~~ solutions together and use "clues" to determine an amount of an unknown analyte to that of a known solution




$$\underset{\text{purple}}{I_2} + \underset{\text{clear}}{K_2S_2O_3} \rightarrow \underset{\text{clear}}{K_2S_4O_6} + \underset{\text{clear}}{2KI}$$

Measured values:
1. Initial volume of Burette
2. Final volume of Burette

End point: indicated by observable change in property (macroscopic)
- color change
- change in conductivity
- drastic change in pH

end point signals equivalence point

equivalence point: It's a Stoichiometric point!

↳ point at which analyte is totally consumed and converted to products

Usually Know: Molarity of titrant & volume of titrant delivered

$M \times L = \text{moles}$ ∴

∴ if know moles of $K_2S_2O_3$ then can stoichiometrically relate it to amount of KI