FLAME CHEMISTRY DEMONSTRATION

- (High Temperature) Reaction Chemistry
- Flame Chemistry
- Excitation of metal atoms (Na, Ca, Ba)
STOICHIOMETRY

• Determine Reactants and Products
• Balance numbers of atoms on both sides of equation
FLAME CHEMISTRY REACTIONS

• Propane + Air

\[ \text{C}_3\text{H}_8 + 4\text{O}_2 \rightarrow 2\text{CO} + \text{CO}_2 + 4\text{H}_2\text{O} \]

• LHS: 3xC, 8xH, 8xO
• RHS: 3xC, 8xO, 8xH
• BALANCED REACTION
COMMON FLAMES

- **METHANE**: Gas Stove, Bunsen Burner
- **PROPANE**: Gas Grill
- **BUTANE**: Cigarette lighter, Gas Match
- **ACETYLENE**: Welding (Oxy/Acetylene)
FLAME STRUCTURE

• Primary Reaction Zone (main combustion) – Pre-Mixed Flame
• Secondary Reaction Zone (Excess Fuel burns) – Diffusion Flame
NITROUS OXIDE/PROPANE

• Higher Temp than Air/Propane
• Air/Propane – 2500K
• Nitrous Oxide/Propane – 3000K
EXCITATION OF METAL ATOMS

NaCl (solid) (3000 K) → NaCl (vapor)
NaCl (vapor) → Na (vapor) + Cl (vapor)
Na (3000K) → Na* (excited state atom)
Na* → Na + Photon (yellow)
Excitation Mechanism

- Na outer (valence) electron lifted to higher (quantized) energy level
- Electron drops back to lower level
- Emits Photon of light
- Wavelength of Photon Characteristic of each atom (no two atoms exactly the same)