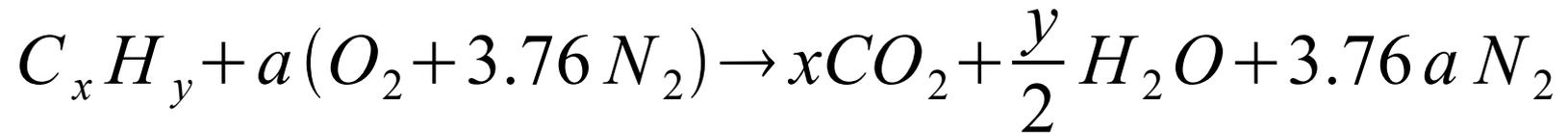


# Reactant & Product Mixtures

- **Stoichiometry** – Mixture of oxidizer & fuel that contains *just enough* oxidizer for complete combustion of the fuel
- **Lean** – excess of air (more air than needed by fuel)
- **Rich** – excess of fuel (less air than needed by fuel)

# Stoichiometric relation

- For hydrocarbon (  $C_xH_y$  ) in air (21%  $O_2$ , 79%  $N_2$ )



$$a = x + \frac{y}{4}$$

# Air-Fuel Ratio

- Stoichiometric A/F ratio

$$\left(\frac{A}{F}\right)_{stoic} = \left(\frac{m_{air}}{m_{fuel}}\right)_{stoic} = \frac{4.76a}{1} \frac{M_{air}}{M_{fuel}}$$

- Equivalence Ratio  $\Phi$

$$\Phi = \frac{(A/F)_{stoic}}{(A/F)} = \frac{(F/A)}{(F/A)_{stoic}}$$

$\Phi = 1$  *stoichiometric*

$\Phi < 1$  *lean*

$\Phi > 1$  *rich*

# Air-Fuel Ratio

- Relative air-fuel ratio  $\lambda$

$$\lambda = \phi^{-1}$$

$\lambda = 1$  *stoichiometric*

$\lambda < 1$  *rich*

$\lambda > 1$  *lean*

- Percent stoichiometric air

$$x\% = \frac{100\%}{\phi}$$

- Percent excess air

$$x\% \text{ excess air} = \frac{(1 - \phi)}{\phi} 100\%$$