Chapter 11 – Rates

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- General Rate = Change in concentration per change in time.
- Rate is dependent on concentration – More collisions, more reactions, faster rate.
- Rate Law Formula = $k[A]^m$, where k is a constant, A is the reactant, and m is the order.
- If there are two reactants, then the rate = $k[A]^m[B]^n$, where B is the other reactant, and n is the order for the second reactant
- Order – Tells how rate changes when concentration changes $(0, 1, 2)$
- Example: Calculate k for $CH_3CHO \longrightarrow CH_4 + CO$

Concentration:	.1	.2	.3	.4
Rate:	.085	.34	.076	1.4

$$\begin{aligned} \frac{Rate_1}{Rate_2} &= \left(\frac{(CH_3CHO)_1}{(CH_3CHO)_2}\right)^m \\ \frac{.085}{.34} &= \left(\frac{.1}{.2}\right)^m \\ m &= 2 \\ .085 &= k(.1)^2 \\ k &= 8.5 \end{aligned} \tag{1}$$

- Example: Calculate k for $2\,NO + Cl_2 \longrightarrow 2\,NOCl$

Experiment	NO	Cl_2	Rate
1	.0125	.0255	$2.27 \cdot 10^{-5}$
2	.0125	.051	$4.55 \cdot 10^{-5}$
3	.025	.0255	$9.08 \cdot 10^{-5}$

$$
\begin{aligned}
\frac{Rate_1}{Rate_3} &= \left(\frac{(\mathrm{NO})_1}{(\mathrm{NO})_3}\right)^m \\
\frac{Rate_1}{Rate_2} &= \left(\frac{(\mathrm{Cl_2})_1}{(\mathrm{Cl_2})_2}\right)^n \\
\frac{2.27}{9.08} &= \left(\frac{.0125}{.025}\right)^m \\
m &= 2 \\
\frac{2.27}{4.5} &= \left(\frac{.0225}{.051}\right)^n \\
n &= 1 \\
2.27 \cdot 10^{-5} &= k[.0125]^2[.0255]^1 \\
k &= 5.7
\end{aligned}
\tag{2}
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