



$\text{M} = \text{Ni}$ (catalyst?)



$$\Delta H^\circ = \sum \Delta H_{\text{prod}} - \sum \Delta H_{\text{react}}$$

$$\Delta S^\circ = \sum \Delta S_{\text{prod}} - \sum \Delta S_{\text{react}}$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

$$K = e^{-\frac{\Delta G^\circ}{RT}}$$

(298 K and 1000 K)
 $\Delta G < 0$ spontaneous
 react favored
 $K \ll 1$

$$k = A e^{-\frac{E_a}{RT}}$$

2nd order

$$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0} \rightarrow t = \frac{\frac{1}{[A]_t} - \frac{1}{[A]_0}}{k}$$

$$\text{rate} = k[\text{NO}_2]^2$$

1st order

$$\ln[A]_t = -kt + \ln[A]_0 \rightarrow t = \frac{\ln[A]_t - \ln[A]_0}{k}$$