

PS #6 Kinetics

1. For these definitions, see your book and notes!

2. a.) Rate = $k [\text{NO}]^m [\text{H}_2]^n$ where m, n are the orders of reaction

for m compare #3 } $[\text{H}_2]$ constant, $[\text{NO}] \times 2$, Rate $\times 4$
#4 } $\therefore m = 2$

for n compare #2 } $[\text{NO}]$ constant, $[\text{H}_2] \times 2$, Rate $\times 2$
#3 } $\therefore n = 1$

$\therefore \text{Rate} = k [\text{NO}]^2 [\text{H}_2]^1$ or just $\text{Rate} = k [\text{NO}]^2 [\text{H}_2]$

b.) Pick an experiment (I chose #2; it really doesn't matter!)

$$k = \frac{\text{Rate}}{[\text{NO}]^2 [\text{H}_2]} = \frac{0.15 \text{ M/s}}{[0.60 \text{ M}]^2 [0.30 \text{ M}]} = 1.39 \text{ M}^{-2} \text{ s}^{-1}$$

c.) Rate Law $\Rightarrow \text{Rate} = 1.39 \text{ M}^{-2} \text{ s}^{-1} [\text{NO}]^2 [\text{H}_2]$

d.) Rate given as $\frac{\Delta [\text{N}_2]}{\Delta t} = 0.15 \text{ M/s}$

from stoichiometry $-\frac{1}{2} \frac{\Delta [\text{H}_2]}{\Delta t} = \frac{\Delta [\text{N}_2]}{\Delta t} \therefore \frac{\Delta [\text{H}_2]}{\Delta t} = -0.30 \text{ M/s}$

means loss!!

e.) Rate of formation

$$\begin{aligned} \text{Rate} = \frac{\Delta [\text{N}_2]}{\Delta t} &= 1.39 \text{ M}^{-2} \text{ s}^{-1} [\text{NO}]^2 [\text{H}_2] \\ &= 1.39 \text{ M}^{-2} \text{ s}^{-1} [0.10 \text{ M}]^2 [0.50 \text{ M}] \end{aligned}$$

$$= 6.95 \times 10^{-3} \text{ M/s}$$