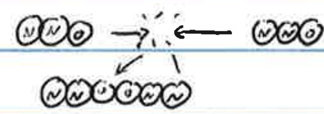
Today Feb 2: A bit more on mechanisms, sections 14.1-14.4

Monday: Sections 14.5-14.8

Overall: $2N_2O \rightarrow 2N_2 + O_2$

possible mechanism:



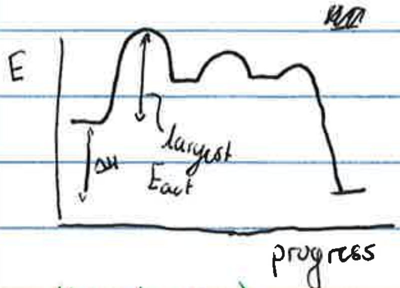
(bimolecular) step 1: $N_2O + N_2O \rightarrow N_4O_2$ (slow)

step 2: $N_4O_2 \rightarrow N_2 + N_2O_2$

step 3: $N_2O_2 \rightarrow N_2O_2$

$2N_2O \rightarrow 2N_2 + O_2$

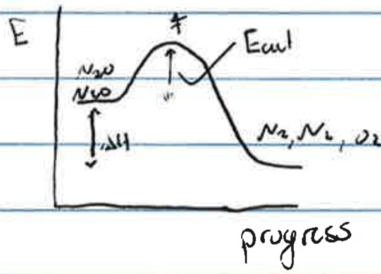
rate $= k[N_2O]^{2}$



both second order

(bimolecular)
1 step mechanism: $N_2O + N_2O \rightarrow N_2 + N_2 + O_2$

rate $= k[N_2O]^{2}$

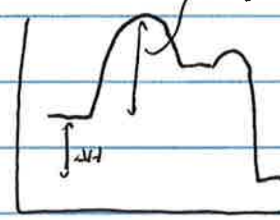


Mechanism 3:

(unimolecular) step 1: $N_2O \rightarrow N_2 + O$ (slow)

step 2: $N_2O + O \rightarrow N_2 + O_2$

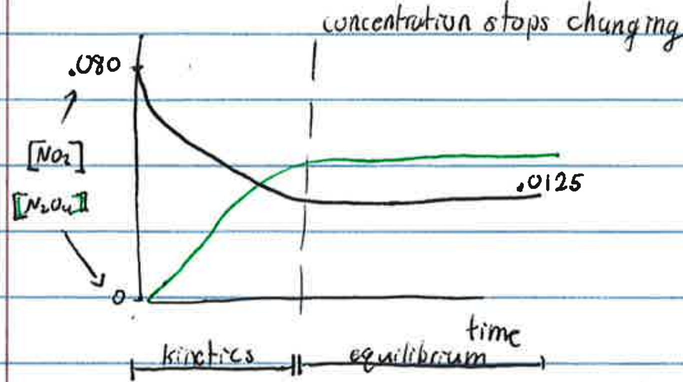
$2N_2O \rightarrow 2N_2 + O_2$



rate $= k[N_2O]^{1}$ ← first order

*Rate law determined by the slow step

$\overset{red}{2NO_{2(g)}} \longrightarrow \overset{colorless}{N_2O_{4(g)}}$



MICE table

(M = mol/L)

M	$2NO_2$	$\rightleftarrows$ N_2O_4
Initial	0.0800	0
Change	(−)2x	(+)x
Equilibrium	0.0125	0.03375

signs are opposite

write: $0.0800 - 2x = 0.0125$

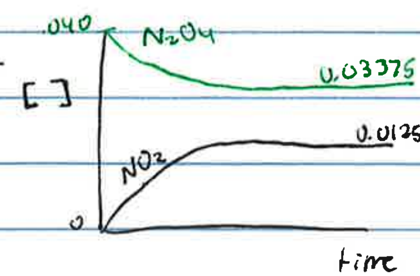
solve for x: $x = 0.03375$

use to find E for product: $0 + 0.03375 = 0.03375$

equilibrium constant: $K_c^{298k} = \frac{[N_2O_4]}{[NO_2]^2} = \frac{0.03375}{(0.0125)^2} = 216$ (unitless)

M	N_2O_4 $\rightleftarrows$	$2NO_2$
I	0.0400	0
C	−x	+2x
E	0.0400−x	2x

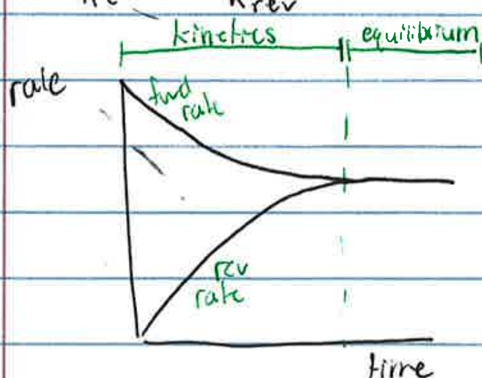
$K_c = \frac{[NO_2]^2}{[N_2O_4]}$



$K_c = \frac{(0.0125)^2}{0.03375} = .00463$ $\qquad \frac{1}{.00463} = 216$

at equilibrium, $rate_{fwd} = rate_{rev}$

$K_c = \frac{k_{fwd}}{k_{rev}}$



$K_p = \frac{P_{N_2O_4}}{(P_{NO_2})^2}$ (like K_c but with pressure)

$PV = nRT$

$P = \frac{n}{V} RT$

$P = [A] RT$

$K_p = \frac{[N_2O_4] RT}{[NO_2]^2 R^2 T^2}$

$$K_p = K_c (RT)^{\Delta n_g}$$

M	$2HI \rightleftharpoons$	H_2	+ I_2
I	0.50	0	0
C	$-2x$	$+x$	$+x$
E	0.032	0.234	0.234

$K_c^{700k} = \frac{[H_2][I_2]}{[HI]^2}$

$K_c^{700k} = \frac{(.234)(.234)}{(.032)^2} = \boxed{53.5}$

$0.50 - 2x = 0.032$

$x = 0.234$

M	$2HI \rightleftharpoons$	H_2	+ I_2
I	0.70	0	0
C	$-2x$	$+x$	$+x$
E	0.027	0.337	0.337

plug back in to K_c equation to check your math.

$K_c^{500k} = 160$

$\sqrt{160} = \sqrt{\frac{[x][x]}{(0.70-2x)^2}}$

~~$160 = \frac{x^2}{0.49 - 1.4x + 4x^2}$~~

$12.6 = \frac{x}{0.70-2x}$

$8.85 - 25.2x = x$

$8.85 = 26.2x$

$x = 0.337$