

1. Consider the Reaction $2\text{NOBr}(g) \rightleftharpoons 2\text{NO}(g) + \text{Br}_2(g)$. Which way will the equilibrium shift if the volume is decreased by half?

right

b. If ΔH is 40. Which way will the reaction shift if temperature is increased?

right

2. A reaction is 5 times faster at 50 C than at 25 C. Find the E_a of the reaction? Note R is 8.314 J/mol K.

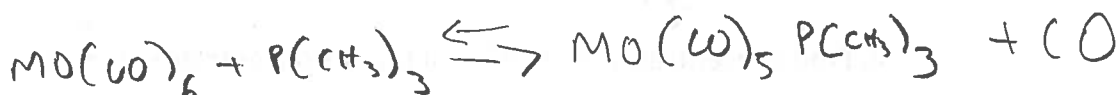
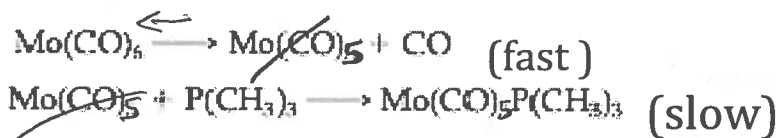
$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

Solve for $E_a \rightarrow \ln\left(\frac{5}{1}\right) = \frac{E_a}{8.314} \left(\frac{1}{273+25} - \frac{1}{273+50}\right)$

$\ln\left(\frac{1}{5}\right) = \frac{E_a}{8.314} (0.00369 - 0.00335)$
 $\ln\left(\frac{1}{5}\right) = -0.000306 E_a$

3. Write the overall reaction eq. for the following reaction. Identify the reactants

$E_a = 52675.4$



b. Write the Rate Law expression for the reaction.

$\text{Rate} = k_1 [\text{Mo(CO)}_6]$ $\text{Rate} = k_{-1} [\text{CO}] [\text{Mo(CO)}_5]$

$\text{Rate} = k_2 [\text{Mo(CO)}_5] [\text{P(CH}_3)_3]$

$$\frac{k_1 [\text{Mo(CO)}_6]}{k_{-1} [\text{CO}]} = \frac{k_{-1} [\text{CO}] [\text{Mo(CO)}_5]}{k_{-1} [\text{CO}]}$$

$$\text{Rate} = \left[k_2 \frac{k_1 [\text{Mo(CO)}_6]}{k_{-1} [\text{CO}]} \right] [\text{P(CH}_3)_3]$$

c. If ΔH is -60, how would increasing the temperature effect rate? Which direction would the reaction shift?

Increasing temp increases rate
Reaction will shift to the left

4. 5. The half-life for decomposition of cyclopentene at 825 K is 25s. How long would it take for a sample of cyclopentene to decompose to 4% of the original amount?

$t_{1/2} = \frac{0.693}{k}$

$25 = \frac{0.693}{k}$

$k = 0.0277$

this is first order since it has a half-life

$\ln(A) = -kt + \ln(A)_0$

$\ln(4) = -(0.0277)(t) + \ln(100)$

$1.386 = -0.0277t + 4.605$

$t = 116.2 \text{ s}$

skip
b

5. 3. Use the Data from the table to determine the rate law expression.



Experiment	[A]	[B]	Initial Rate (M/s)
1	.4	.2	2×10^{-2}
2	.4	.4	2×10^{-2}
3	.6	1.0	3×10^{-2}
4	.8	.2	8×10^{-2}

$$\left(\frac{.8}{.4}\right)^x = \frac{(8 \times 10^{-2})}{(2 \times 10^{-2})}$$

$$2^x = 4 \quad x = 2$$

$$[B] = \left(\frac{.4}{.2}\right)^x = \frac{2 \times 10^{-2}}{2 \times 10^{-2}}$$

$$x = 0$$

$$\text{Rate} = k[A]^2$$

b. Using experiment 1, find k.

$$2 \times 10^{-2} = k [0.4]^2$$

$$k = .125 \text{ s}^{-1}$$

d. Find concentration of A at t=6 if initial concentration of ^A is 9.

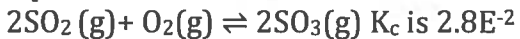
$$\frac{1}{A} = kt + \frac{1}{A_0}$$

$$\frac{1}{A} = .125(6) + \frac{1}{9}$$

$$A = 1.16 \text{ M}$$

Skip unless you have finishing calc.

6. Suppose you poured 1 M of SO_2 with 1M of O_2 in a 2L container. What would the equilibrium concentration of all reactant and product be?



1	1	0
-2x	-x	+2x
1-2x	1-x	2x

$$\frac{(2x)^2}{(1-2x)^2 (1-x)} = 2.8 \times 10^{-2}$$

$$1-2(.092) \quad 1-.092$$

$$.816 \quad .908 \quad .184$$

Solve for x

$$x = .092$$