Announcements

- Turn on the Clicker (the red LED comes on).
- Push “Join” button followed by “20” followed by the “Send” button (switches to flashing green LED if successful).

- Next exam on Chapters 13 and 14 next lecture period.
- Wed. Disc. is review. Bring questions.

- Sample Exam 2, answer keys, etc have been posted on web site.
- Please contact me by e-mail if you did not get a bunch of e-mails related to this class sent out on Thursday. E-mail server was broken and needed to be reset.

Review

- Mechanism consists of sequence of elementary steps.
  - Rate limiting or rate determining steps (overall rate is determined by slow step)
  - Steady state approximation (an intermediate product concentration stays the same during the reaction)
  - Preequilibria (the concentration of the intermediate is primarily determined by a fast equilibrium, which is a reaction that goes both directions.

Effect of temperature on rates:

Arrhenius rate law: $k = A\exp\{-E_a/(RT)\}$

=> rate increase with T.

Looked at using slope of line

$\ln k = \ln A - (E_a/R)(1/T)$ to determine E_a.

Fig 14.18

Review

- Catalysis
  - Catalysts increase rate of reaction by lowering the energy barrier to reaction (providing a different pathway).
  - Homogeneous catalysis versus heterogeneous catalysis.

Fig 14.21

Chapter 15-Chemical Equilibria

Not on Exam 2

- Dynamic Equilibria/What is equilibrium?
- Equilibrium constants, mass action expressions
- Reaction quotient Q and direction of change
- K_p vs K_c
- K and ΔG
- Le Châtelier's principle (equilibrium response to change in conditions)
- Effect of catalysts
- Calculations of equilibrium concentrations/pressures
- Dependence of K on T
- Heterogeneous equilibria

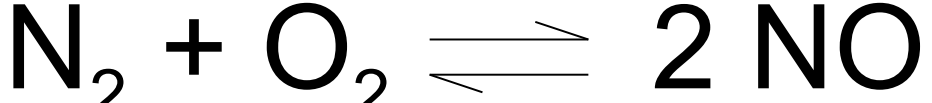

Figure 15.1

Partial Mechanism for Reverse Reaction: $2\ NO \longrightarrow N_2 + O_2$

$$2\ NO \xrightarrow{k_1} N_2O_2$$

$$O_2 \underset{k_{-2}}{\overset{k_2}{\rightleftharpoons}} 2\ O \text{ (fast equilibrium)}$$

$$N_2O_2 \xrightarrow{k_3} N_2 + O_2$$

$$N_2O_2 + O \xrightarrow{k_4} NO + NO_2$$

Overall Rate Law: $\Delta[N_2]/\Delta t = k_r[NO]^2[O_2]^{-1/2}$

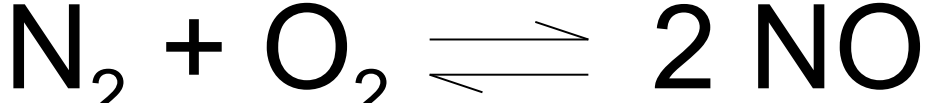

Figure 15.1