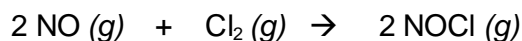


The problems given here are a guide. When studying you also need to work similar problems from the text.

Kinetics. Know the difference between zero, first and second order reactions. Be able to determine a reaction order from initial rates. Know about first order decay. Be able to write a rate law when given a mechanism. Know the relations between energy of activation, temperature and rates.

1. The following reaction was studied:



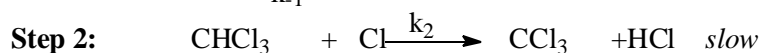
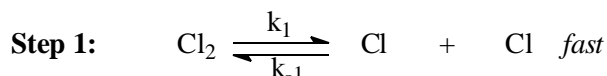
The following data was obtained:

	[NO] mol/L	[Cl ₂] mol/L	Initial Rate M/sec
1	.040	.040	1.05 x 10 ⁻⁴
2	.040	.080	2.08 x 10 ⁻⁴
3	.060	.040	2.36 x 10 ⁻⁴

Write the rate law for this reaction.

2. An archeologist discovers the remains of an ancient campsite. A stick of wood is was subjected to ¹⁴C dating to determine its age (¹⁴C half life is 5730 years) . A sample containing one gram of carbon gave 6500 counts over a 20 hour period. A similar modern sample gave 18400 counts.
- How old is the sample?
 - If the sample was 20,000 years old how many counts would you anticipate?

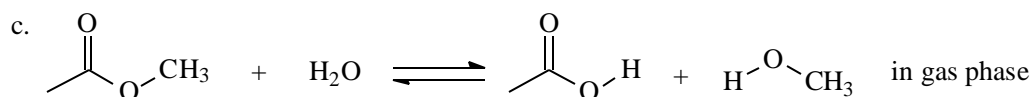
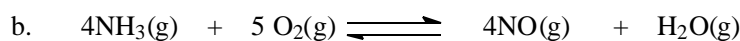
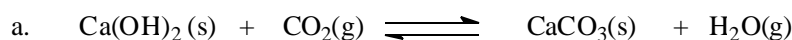
3. The following mechanism has been proposed for the reaction of chlorine with CHCl₃ to give CCl₄. Write the rate law implied by this mechanism.



4. A reaction was studied at 25°C and found to have an initial rate of 0.0024M/sec. Under similar conditions at 35°C the reaction was found to have a rate of .0055M/sec.
- What is the energy of activation of the reaction?
 - What rate would you predict for this reaction at 50°C?

Equilibrium. Know all about equilibrium constants, the reaction quotient, the meaning of Q (not the one from Star Trek, the one from chapter 14). Be able to determine equilibrium constants given equilibrium concentrations. Be able to determine equilibrium concentrations give the equilibrium constant. Know Le Chatelier's principle and how to apply it.

6. Write the equilibrium expression for the following reactions.



d. Same reaction as c, but in water solution.

7. You add .0040 mol of PCl_5 to a one liter flask and establish equilibrium. You find that the flask contains 0.0038 mol of Cl_2 at equilibrium. The following reaction has taken place. What is K_c ?



8. Iodine will react with H_2S to give HI plus sulfur. If you add 50.0g grams of I_2 to a 500 mL flask containing H_2S at .95 atm what will be the pressure of HI at equilibrium?



9. 1 mol each of Cl_2 and CO are added to a 3.0 liter flask at 668 K and the following equilibrium is established .



What is the final pressure of each of the three compounds in the flask?

10. Consider the equilibrium established in question 9. Using Know Le Chatelier's principle as a guide predict if whether the equilibrium will shift to the left or the right under each of the following changes of condition.

- More Cl_2 is added to the flask.
- COCl_2 is added to the flask.
- CO is removed from the flask.
- The volume of the flask is doubled.
- The temperature is decreased to 400 K. (the reaction is exothermic)
- The pressure of all three components is doubled.

Acid Base: Know various qualitative concepts in regards to acids and bases. What is the conjugate acid of a give base, what is the conjugate base of a given acid? What is K_w ? In a given list which acid or base is stronger? How do you get a K_b from a K_a ? Know how to calculate the pH or pOH of an acid or base solution (strong or weak). Know how to calculate the pH of a salt solution. Have some chemical idea what makes an acid or base stronger or weaker.

11. What is the pH and pOH of each of the following solutions.

- 10^{-3} M HCl
- 3.5×10^{-5} M NaOH
- 7.1×10^{-9} HNO_3
- 1.5 M HF ($K_a = 3.5 \times 10^{-4}$)
- 0.85 M NaF
- .50 M NH_3 ($K_b = 1.8 \times 10^{-5}$)
- .10 M NH_4Cl
- 0.010 M H_2SO_4 ($K_{a2} = 1.2 \times 10^{-2}$)

12. For each of the following predict which is the stronger answer and explain.

- H_2SO_4 or H_2SO_3
- trichloroacetic acid or acetic acid
- HCl or HBr
- HClO or HBrO
- ethane or acetylene

The exam is Tuesday, October 23, 2000 8:30-10:00pm

Room assignments:

Ying Li's Sections (1, 3, 4) Javits 102

Section 1 (Mon 12:40) Section 3 (Tues 12:50) Section 4 (Th 12:50)

Wonsuk Chang's Sections (2, 5, 6) Javits 110

Section 2 (Fri 12:40) Section 5 (Tu 9:50) Section 4 (Tu 11:20)