CH104 Assigned Problems Chapter 13

Section	Problems
13.1	Chang: 3, 6, 7. SP: 1
13.2	Chang: 10, 17-19, 25. SP: 2
13.3	Chang: 23, 26, 30-32. SP: 3, 4
13.4	Chang: 34, 35, 38, 42, 43, 45. SP: 5
13.5	Chang: 47, 48, 52, 55, 56, 60
13.6	Chang: 61, 62, 64, 65, 68. SP: 6

CH104 Supplementary Problems: Chapter 13

Data and equations:

$\ln [A] = \ln[A]_0 - kt$ $\quad\quad$ $1/[A] = 1/[A]_0 + kt$

$t_{1/2} = 0.693/k$ $\quad\quad$ $t_{1/2} = 1/(k[A]_0)$

$k = Ae^{(-Ea/RT)}$ $\quad\quad$ $\ln k = (-E_a/R)\,(1/T) + \ln A$

$\ln (k_1/k_2) = E_a/R\,(1/T_2 - 1/T_1)$

1. For the reaction $2H_2O_2 \rightarrow 2H_2O + O_2$, write the rate of appearance of H_2O and O_2 in terms of the rate of disappearance of H_2O_2.

2. The reaction

$$2A + 3B \rightarrow C + 4D$$

was studied at 30 °C. The initial rate was measured as a function of initial concentrations of reactants, and the following results were obtained:

$[A]_0$ (M)	$[B]_0$ (M)	Rate (M/s)
0.10	0.10	2.42×10^{-3}
0.20	0.20	1.92×10^{-2}
0.20	0.60	1.73×10^{-1}
0.20	0.10	4.84×10^{-3}

Write the rate law for this reaction and find the rate constant.

3. The dimerization of butadiene was studied at 500 K:

$$2C_4H_6(g) \rightarrow C_8H_{12}(g)$$

A graph of $1/[C_4H_6]$ versus t gave a straight line with a slope of 1.4×10^{-2}/M s, and a graph of $\ln[C_4H_6]$ versus t gave a curved line. What was the rate constant? Write the rate law for this reaction. If the initial concentration of C_4H_6 was 5.00 M, how long would it take for the

concentration of C_4H_6 to fall to 0.01 M? For the same initial concentration, what would the concentration of C_4H_6 be after 6 minutes?

4. The first-order rate constant for the reaction A $\rightarrow$ C is 2.12/s. Calculate the half-life of the reaction if the starting concentration of A is 2.0 M.

5. For a reaction R $\rightarrow$ P, the rate constants were measured at several different temperatures. A graph of ln k versus 1/T gave a straight line with a slope of -1.2×10^4 K. What is the activation energy of the reaction in kJ/mol? The rate constant at 20.0 °C was found to be 2.0×10^{-5}/s. What will the rate constant be at 60.0 °C? What is the frequency factor, A?

6. Write the overall reactions and rate laws that correspond to the following reaction mechanisms. Identify any intermediates or catalysts.

(a) $2A + B \rightleftharpoons D$ (fast equilibrium)

$D + B \rightarrow E + F$ (slow)

$F \rightarrow G$ (fast)

(b) $A + B \rightleftharpoons C$ (fast equilibrium)

$C + D \rightleftharpoons F$ (fast equilibrium)

$F \rightarrow G + D$ (slow)