Show your work on numerical problems to receive credit. This homework is due on Monday, February 5, 2007 at class time.

(6) 1. For the following reactions, relate how the disappearance of other reactants and the appearance of products is related to the disappearance of the bold-faced reactant. For example, in the first one what are the expressions for the changes in concentration of \( O_2 \) and \( SO_3 \) in terms of \( \frac{\Delta[SO_3]}{\Delta t} \)?

\[
2 \text{SO}_2 (g) + O_2 (g) \rightarrow 2 \text{SO}_3 (g)
\]

\[
\text{N}_2 (g) + 3 \text{H}_2 (g) \rightarrow 2 \text{NH}_3 (g)
\]

\[
2 \text{H}_2 (g) + O_2 (g) \rightarrow 2 \text{H}_2\text{O} (g)
\]

(6) 2. Given the following initial rate information, find the rate law and rate constant (including units) for the reaction \( A + B \rightarrow \) products.

<table>
<thead>
<tr>
<th>Experiment #</th>
<th>[A] (/M)</th>
<th>[B] (/M)</th>
<th>Rate (M/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.20</td>
<td>0.20</td>
<td>0.10</td>
</tr>
<tr>
<td>2</td>
<td>0.10</td>
<td>0.20</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>0.40</td>
<td>0.40</td>
<td>0.80</td>
</tr>
</tbody>
</table>
3. A particular reaction is first-order in A and first-order overall with a rate constant of $1.45 \times 10^{-3} \text{ s}^{-1}$ and has the stoichiometry:

$$\text{A} \rightarrow \text{Products}$$

a. Find the concentration of reactant A 300 s into a reaction in which the initial concentration of A was 0.15 M.

b. What is the half-life of the reaction?

4. A reaction is second-order in A and second-order overall. It has a rate constant of $4.2 \times 10^{-1} \text{ M}^{-1} \text{ min}^{-1}$ at a particular temperature and the stoichiometry:

$$\text{A} \rightarrow \text{Products}$$

a. If the starting concentration of A is 0.25 M, how much A will remain after 10 minutes of reaction?

b. What is the half-life of the reaction if the starting concentration is 0.25M?

c. OMIT How would your answer change to part a, if at all, if the stoichiometry was 2 A $\rightarrow$ Products? Explain your reasoning. A qualitative answer would be to say more A would be consumed. The quantitative answer is a little more involved. Basically it uses an equation you have not seen but which is similar to the second order.

$$\frac{1}{[A]} - \frac{1}{[A]_o} = 2kt$$