# CH 204 Post-lab 10 Help Sheet

**Problem 1**

**1a.** 2 A + 2 B → C + 3 D The rate law expression for this reaction looks like this: rate = $k[A]^a[B]^b$. In this part of the problem we need to solve for *a* and *b*.

When the concentration of A is doubled, the rate also doubles ("the amount of time required for the formation of one mole of C decreased by a factor of two"). That means the rate is linearly related to the concentration of [A], so *a* = ___. Tripling [A] and [B] at the same time makes the reaction go 27 times faster. We already know that doubling [A] doubles the rate, so tripling [A] will triple the rate. Tripling [B] therefore makes the rate go an additional 9 times faster. The rate is related to the square of [B], so *b* = ___.

**1b.** The easiest way to do rate comparison problems like this is to plug in [1] for each of your initial condition concentrations and calculate the rate. Then plug in the new concentrations you are given as multiples of 1 and calculate a new rate. So in this problem you are comparing **rate =** $\mathbf{k[1]^a[1]^b}$ with **rate =** $\mathbf{k[4]^a[\frac{1}{4}]^b}$**.**

**Problem 2**

**2a.** This is easy.

**2b.** This is easy, too.

**2c.** This is done just like problem 1b.

**2d.** Rate constants have different units depending on the order of the reaction. The overall units on rate are always M/sec, so the units on the rate constant *k* are whatever they have to be so that when *k* is multipled by the reactant concentrations raised to their exponents, it all comes out in units of M/sec.

**Problem 3**

All you have to do here is calculate the concentrations of the two reactants in moles per liter, then plug those values into the rate law expression. You should know the exponents from the information given, and you are given the rate law constant, so you just plug in the numbers to find the rate.

**Problem 4**

**4a**. To get the order of each reactant, you compare two experimental runs where the concentration of one reactant is held constant and the other is doubled, and see what the effect is on the rate. For example, [NO] is held constant in runs 2 and 3 while $[O_3]$ is doubled. What is the effect on the rate? What is the order of $[O_3]$?

**4b**. You can use any of the first three runs to calculate the rate law constant *k*, and then use this value of *k* with the concentration data from experiment 4 to calculate the rate.

**Problem 5**

**5a**. Just add up all the steps and cancel out the spectators.

**5b**. Intermediates are produced early and reacted away later.

**5c**. Catalysts are reacted away early and then produced later.

**5d**. The rate law depends only on the slow step of the mechanism, and for an elementary reaction, the order of each reactant in the rate law are just the coefficient in that step of the mechanism.