CHM152 QUIZ 1 25 PTS SPRING 2006 NAME: Key

SHOW ALL WORK TO RECEIVE CREDIT.

1. a. (2 Pts) Write a general rate law for reaction:

$$H_2O_2(aq) + 3I^-(aq) + 2H^+(aq) \rightarrow I_3^-(aq) + 2H_2O(l)$$

rate = $k[H_2O_2]^x[I^-]^y[H^+]^z$

b. (9 Pts) Use the initial rate data below to determine the order of the reaction with respect to each reactant.

	$[H_2O_2]_o$	$[I^-]_o$	$[H^+]_o$	initial rate (M/s)
Exp. 1	0.010	0.010	0.00050	1.15×10^{-6}
Exp. 2	0.020	0.010	0.00050	2.30×10^{-6}
Exp. 3	0.010	0.020	0.00050	2.30×10^{-6}
Exp. 4	0.010	0.010	0.00100	1.15×10^{-6}

(1) for $[H_2O_2]$ use Exp. 1 + 2

Exp. 2 / Exp. 1:

$$\frac{rate_2}{rate_1} = \frac{k[H_2O_2]_2^x[I^-]_2^y[H^+]_2^z}{k[H_2O_2]_1^x[I^-]_1^y[H^+]_1^z}$$

$$\frac{2.30 \times 10^{-6}}{1.15 \times 10^{-6}} = \left[\frac{0.020}{0.010}\right]^x$$

$2 = (2)^x$ $x = 1$

(2) for $[I^-]$ use Exp. 3 & 1

$$\frac{2.30 \times 10^{-6}}{1.15 \times 10^{-6}} = \left[\frac{0.020}{0.010}\right]^y$$

$2 = (2)^y$ $y = 1$

(3) for $[H^+]$ use Exp. 4 & 1

$$\frac{1.15 \times 10^{-6}}{1.15 \times 10^{-6}} = \left(\frac{0.00100}{0.00050}\right)^z$$

$z = 0$

c. (3 Pts) Determine the value of the rate constant and its units.

rate = $k[H_2O_2]^1[I^-]^1[H^+]^0$

using Exp 1 (or any other): $k = \frac{rate}{[H_2O_2][I^-]} = \frac{1.15 \times 10^{-6}}{[0.010][0.010]} = 0.0115\ M^{-1}s^{-1}$

2. (4 Pts) Determine the units for each of the following rate laws:

a. rate = $k[A]^2[B]$ $M^{-2}t^{-1}$ or $\frac{1}{M^2 t}$

$\frac{M}{t} = \_\_ M^2 M$ $\quad \_\_ = \frac{1}{t M^3}$

b. rate = $k[A][B]$ $\frac{1}{M \cdot t}$ or $M^{-1}t^{-1}$

$\frac{M}{t} = \_\_ M M$ $\quad \_\_ = \frac{1}{M t}$

3. (3 Pts) Why and how does the rate of a reaction at constant temperature change as time proceeds?

The reaction slows down as the reactants are consumed and there are less collisions.

4. (4 Pts) Write a balanced equation for the following expression:

$$rate = \frac{-\Delta[N_2O_5]}{2\Delta t} = \frac{\Delta[NO_2]}{4\Delta t} = \frac{\Delta[O_2]}{\Delta t}$$

$2N_2O_5 \rightarrow 4NO_2 + O_2$