CHM152 Quiz 1 25 Pts Fall 2010 Name: Key

Show all work where possible.

1. The kinetic data shown below was collected for the reaction:

$S_2O_8^{2-}(aq) + 3I^-(aq) \rightarrow 2SO_4^{2-}(aq) + I_3^-(aq)$

Experiment	$[S_2O_8^{2-}]$	$[I^-]$	Initial rate (M/min)
1	0.0200	0.0155	1.15×10^{-4}
2	0.0250	0.0200	1.85×10^{-4}
3	0.0300	0.0200	2.22×10^{-4}
4	0.0300	0.0275	3.06×10^{-4}

a. (8 Pts) Determine the order of the reaction with respect to $[S_2O_8^{2-}]$ and $[I^-]$. Be sure to show setups for each.

The general rate law is: $rate = k[S_2O_8^{2-}]^x[I^-]^y$

for $S_2O_8^{2-}$ use Exp 3 ÷ Exp 2 : $\dfrac{2.22\times10^{-4}}{1.85\times10^{-4}} = \dfrac{\cancel{k}[0.0300]^x \cancel{[0.0200]^y}}{\cancel{k}[0.0250]^x \cancel{[0.0200]^y}}$

$1.2 = (1.2)^x$ so $x = 1$

for I^- use Exp 4 ÷ Exp 3 : $\dfrac{3.06\times10^{-4}}{2.22\times10^{-4}} = \dfrac{\cancel{k}\cancel{[0.0300]^1}[0.0275]^y}{\cancel{k}\cancel{[0.0300]^1}[0.0200]^y}$

$1.38 = (1.38)^y$ so $y = 1$

and : $rate = k[S_2O_4^{2-}][I^-]$

b. (4 Pts) Calculate to value of the rate constant and determine its units.

$k = \dfrac{rate}{[S_2O_4^{2-}][I^-]} = \dfrac{1.15\times10^{-4}\,\cancel{M}}{min} \Big/ 0.0200\,M \Big/ 0.0155\,\cancel{M} = 0.37\ min^{-1}\cdot M^{-1}$

2. Given the reaction: $6I^-(aq) + BrO_3^-(aq) + 6H^+(aq) \rightarrow 3I_2(aq) + Br^-(aq) + 3H_2O(l)$.

a. (4 Pts) Write a general rate law.

$rate = k[I^-]^x[BrO_3^-]^y[H^+]^z$

b. (3 Pts) What can be said about the order of the reaction with respect to $[BrO_3^-]$?

Order can only be experimentally determined

3. (3 Pts) Determine the units of the rate constant for the rate law: $rate = k[A][B]^2$ if rate is measured in M/s.

$k = \dfrac{rate}{[A][B]^2} = \dfrac{\cancel{M}}{s \cdot \cancel{M} \cdot M^2} = s^{-1} \cdot M^{-2}$

4. (3 Pts) Given the rate law: $rate = k[A][B]^2$

What would be the effect on the observed rate if the concentration of A is tripled and the concentration of B is doubled?

$rate = k[3][2]^2 = 12$

a 12-fold increase in rate