Kinetics lab sheet.
Equations:

1. $2I^- + H_2O_2 + 2H^+ \rightarrow I_2 + 2H_2O$

2. $2S_2O_3^{2-} + I_2 \rightarrow 2I^- + S_4O_6^{2-}$

3. I_2 + Starch → I_2—Starch Complex (Blue) *"Stop the Clock"*

$$rate = \frac{-\Delta[I^-]}{2\Delta t} = \frac{-\Delta[H_2O_2]}{\Delta t} = \frac{+\Delta[I_2]}{\Delta t} = k[I^-]^a[H_2O_2]^b[H^+]^c$$

With the use a buffer, the $[H^+]$ is constant. The equation then becomes:

$$rate = \frac{-\Delta[I^-]}{2\Delta t} = \frac{-\Delta[H_2O_2]}{\Delta t} = \frac{+\Delta[I_2]}{\Delta t} = k'[I^-]^a[H_2O_2]^b \quad \text{where } k' = k[H^+]^c$$

Take the ln of each side : $rate = k'[I^-]^a[H_2O_2]^b$

ln rate = ln k' + aln $[I^-]$ + bln$[H_2O_2]$ now rearrange into the form of y = mx + b

ln rate = a ln $[I^-]$ + [ln k' + bln$[H_2O_2]$] **(*this equation is used for data sets 1,2, and 3 with $[I^-]$ changing*)**
y = m x + b **(What does the value of m correspond to?________________)**

ln rate = b ln $[H_2O_2]$ + [ln k' + aln$[I^-]$] **(*this equation is used for data sets 3,4, and 5 with $[H_2O_2]$ changing*)**
y = m x + b **(What does the value of m correspond to?_______________)**

<u>Part 1 Trials:</u> Do Not Record Your Data on This Sheet. Use Your Laboratory Notebook.

Note: Be sure to use you use ***<u>your data</u>*** and the proper number of significant figures as dictated by the measuring device used, your data, and the calculations.

Solution number	Buffer (mL)	0.100 M KI (mL)	Starch (mL)	0.0200M $Na_2S_2O_3$ (mL)	D.I. Water (mL)	0.3 M H_2O_2 (mL)	Blue Time (s)	Total Volume (mL)
1	2.0	0.80	1.00	2.00	7.30	2.40		
2	2.0	1.60	1.00	2.00	7.00	2.40		
3	2.0	2.40	1.00	2.00	6.20	2.40		
4	2.0	2.40	1.00	2.00	4.60	4.00		
5	2.0	2.40	1.00	2.00	3.00	5.60		

Calculations:

Solution number	1. moles $S_2O_3^{2-}$ (1)	2. moles I_2 formed (2)	3. $[I_2]$ (3)	4. rate $\frac{\Delta[I_2]}{\Delta t}$ (4)	5. $[I^-]_o$ (5)	$\ln[I^-]_o$	6. $[H_2O_2]_o$ (6)	$\ln[H_2O_2]_o$	ln(rate)	k and its units?
1										
2										
3										
4										
5										
									k Average	

152LL Group Worksheet of Kinetics Part 1 Lab. Name:_____________________

Names:____

1. How many moles of $S_2O_3^{2-}$ are contained in 2.00 mL of 0.0200 M $Na_2S_2O_3$?

2. How many moles I_2 are required to completely react with the number of moles of $S_2O_3^{2-}$ formed in **problem number 1**? The net ionic equation for the reaction is

$$2S_2O_3^{2-}(aq) + I_2(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}(aq).$$

3. The moles of I_2 determined in **problem number 2** is equal to the number of moles formed in the chemical reaction: $2I^-(aq) + H_2O_2(aq) + 2H^+(aq) \rightarrow I_2(aq) + 2H_2O(l)$.
If the total volume of the solution was 16.00 mL, what was the concentration of the I_2 in moles per liter (M)?

4. Suppose 3 different experimental runs with varying concentrations of initial reactants were conducted. The time for each run to reach the concentration of I_2 determined in **problem number 3** was measured and recorded as follows: Run #1 8 minutes 45 seconds, Run #2 5 minutes 14 seconds, and Run #3 3 minutes 27 seconds. Determine the average rate of each experimental run in $[I_2]$/s.

5. A solution was prepared by taking 0.80 mL of 0.100 M KI and diluting it to a final volume of 16.00 mL. What was the resulting concentration of the I^- ion in units of M?

6. A solution was prepared by taking 2.40 mL of 0.30 M H_2O_2 and diluting it to a final volume of 16.00 mL. What was the resulting concentration of the H_2O_2 in units of M?

7. Now you will make Plots 1 and 2 to determine the order for each of the reactants and the rate law.

8. Once you have determined the orders you will use the rate law equation and each set of data to determine the value of the rate constant (k) for each run and then the average value of k. Be sure to include units for k values.