CH302 Worksheet 4: Real Kinetics. These questions aren't on the exams, but will really cement your understanding of how kinetics is done. You will need to make several rough graphs or you can use a graphing calculator.

Data Set 1. Find rates, C_0, k, $t_{1/2}$, A, E_a and reaction order at each temperature.

Time (s) **300K**	[C] **300K**	2^{nd} Order 1/[C]	1^{st} Order ln[C]	0^{th} Order [C]	Time (s) **310K**	[C] **310K**	2^{nd} Order 1/[C]	1^{st} Order ln[C]	0^{th} Order [C]
0	**Unknown C_0**				0	**Unknown C_0**			
1	.12				1	.074			
2	.074				2	.027			
3	.044				3	.009			
4	.027				4	.0036			
5	.016				5	.0013			
6	.009				6	.0005			
8	.0036				7	.000067			
10	.0013				10	.0000091			

(a) Solve for the instantaneous rate at 2 seconds. (Plot the concentration-time data for one of the temperatures. Draw a tangent line to the curve a 2 seconds and obtain the rate from the slope.)

(b) Find the order of the reaction. (Complete the empty columns in the chart above. The column that generates a straight line corresponds to the order of reaction.)

(c) Solve for the rate constant and the initial concentration. (From the data that produces a straight line, the slope yields the rate constant and the and y-intercept yields the initial concentration.)

(d) Solve for the half life. (Choose a concentration and half that concentration; the half life is the time associated with that concentration time.)

(e) Solve for the activation energy. (Use the two values of k at different temperatures to extract the activation energy from the slope of the combined Arrhenius equation.)

(f) Solve for the pre-exponential term, A. (Having found Ea, substitute k and a concentration time data point back into the Arrhenius equation to find A.)

Congratulations. If you have gotten this far you have done real kinetics calculations. Now do it again with the data sets on the back.

Perform steps a through f for data sets 2 and 3. Hint: You should get a different reaction order each time you perform the calculations.

Data Set 2. Data at 300 K **Data at 313 K**

Time (s)	[C]	2^{nd} Order 1/[C]	1^{st} Order ln[C]	0^{th} Order [C]	Time (s)	[C]	2^{nd} Order 1/[C]	1^{st} Order ln[C]	0^{th} Order [C]
0	**Unknown C_0**				0	**Unknown C_0**			
1	.182				1	.166			
2	.166				2	.142			
3	.153				3	.125			
4	.142				4	.111			
5	.133				5	.1			
6	.125				6	.09			
8	.11				8	.076			
10	.1				10	.066			

Data set 3. Data at 300 K **Data at 305 K**

Time (s)	[C]	2^{nd} Order 1/[C]	1^{st} Order ln[C]	0^{th} Order [C]	Time (s)	[C]	2^{nd} Order 1/[C]	1^{st} Order ln[C]	0^{th} Order [C]
0	**Unknown C_0**				0	**Unknown C_0**			
.05	.1875				.05	.175			
.1	.175				.1	.15			
.15	.1625				.15	.125			
.2	.15				.2	.1			
.25	.1375				.25	.075			
.3	.125				.3	.05			
.35	.1125				.35	.025			
.4	.1				.4	0			