Experiment # 1
The Iodine "Clock" Reaction
Sample Exam Questions

1. **Write the balanced chemical equation whose rate of reaction is analyzed in Experiment # 1: "The Iodine Clock Reaction" . Include state designations.**

2. **The following experimental data are available:**
   10.0 ml of 0.200 M KI are mixed **10.0 mL of 0.00500 M $Na_2S_2O_3$** and **10.0 mL of 0.200 M KCl** in a **250 ml Reaction Flask**. A few drops of soluble starch are added to this mixture.
   20.0 mL of 0.100 M $(NH_4)_2S_2O_8$ are added to a **50 mL flask**.
   When the contents of the two flasks are mixed a deep blue color forms after **63 seconds**

   (a) Enter the relevant data in the table below:

250 mL REACTION FLASK				50 mL FLASK
KI	$Na_2S_2O_3$	KCl	Soluble Starch	$(NH_4)_2S_2O_8$
M	M	M		M
mL	mL	mL	A few drops	mL

   (b) Write the chemical formula of Reactant 1: _____

   (c) Calculate the molarity of Reactant 1 after mixing the contents of the two flasks. Show calculations and include units.

   (d) Write the chemical formula of Reactant 2: _____

   (e) Calculate the molarity of Reactant 2 after mixing the contents of the two flasks. Show calculations and include units.

   (f) Calculate the molarity of the $Na_2S_2O_3$ after mixing the contents of the two flasks Show calculations and include units.

(g) Calculate the Rate of Reaction based on your data above, and express it in the proper units.

(h) Calculate the Rate Constant, k, based on your data above and express it in the proper units. (The reaction is of the first order with respect to both reactants)

3. **In this experiment, the effect of three factors on the Rate of Reaction (shown above) has been analyzed. List these <u>factors</u>:**

(a) Factor: _____

Experimental Data from <u>which Reaction Runs</u> has been used to analyze the effect of the above listed factor on the Reaction Rate?

Runs: _____ (indicate runs by numbers)

(b) Factor: _____
Experimental Data from <u>which Reaction Runs</u> has been used to analyze the effect of the above listed factor on the Reaction Rate?

Runs: _____ (indicate runs by numbers)

(c) Factor: _____
Experimental Data <u>from which Reaction Runs</u> has been used to analyze the effect of the above listed factor on the Reaction Rate?

Runs: _____ (indicate runs by numbers)

4.   (a) **What is the purpose of adding 10.0 mL of 0.00500 M $Na_2S_2O_3$ $(S_2O_3{}^{2-})$ to the reaction mixture in each run?**

(b) **Write an equation that illustrates the chemical reaction in which the thiosulfate ion $(S_2O_3{}^{2-})$ is involved:**

(c) **Is the $(S_2O_3{}^{2-})$ ion a reactant in the reaction whose rate is being analyzed?** _____

5.   **What is the numerical relationship between the concentration of $[I_2]$ produced and the concentration of the $(S_2O_3{}^{2-})$ used up at the time (t_{color}) the blue color appears**

EXPERIMENT 2
The Hydrolysis of t-Butyl Chloride
Sample Exam Questions

1. What was the purpose of this experiment?

2. Write the **overall** equation that illustrates this reaction. An abbreviated form is acceptable.

3. A plot of **log n_{RCl} versus time (seconds)** yields a straight line.
The slope of the graph is = **m = - 5.25 x 10^{-4} s^{-1}**
      (a) Calculate the **Rate Constant**, **k.**
            Show calculations and include units.

      (b) Calculate the Half- Life ($t_{1/2}$) for the Hydrolysis of t-Butyl Chloride
           Show calculations and include units.

4.   Assume that $k = 9.52 \times 10^{-4}\ s^{-1}$.
Calculate the time in hours which would have been required for 99.5 % of the t-butyl chloride to
hydrolyze, if the reaction had been allowed to proceed without the addition of extra water or heating.

5. Was the purpose of this experiment achieved? (See your answer to Question 1 above)
If YES, please explain how was the purpose achieved.
If NO, please explain why the purpose was not achieved.

_____ (**YES** or **NO**)

Your explanation: