Kelvin Tsao

Lab 2 Notes

Lab Focus:

- Reaction orders and rates
- S_N1 and S_N2

Report Format

- 6 pages max
- Paragraph text: 12 font – Times New Roman
- Caption text: 10 font – Times New Roman
    - Scheme's and figures have captions under the picture
    - Tables have captions on top of the table
- 2 cm borders
- Single spaced
- **Paragraph form for introduction and discussion and anywhere else specifically noted**

Introduction (Technically no more than a page, ideally ¾ of a page) (6 points)

1. How are reaction kinetics defined by? (**Hint: formula) (1 point)**
2. What reaction orders are studied in this experiment? **(1 point)**
3. What does the k value represent? **(1 point)**

4. What reactions are studied in this experiment? **(1 point)**
5. What happens in an S_N2 reaction? **(1 point)**
    a. Under what conditions does this substitution occur? (steric hindrance, leaving group capability, nucleophile strength). **(1 point)**
6. What happens in an S_N1 reaction **(1 point)**
    a. Under what conditions does this substitution occur? (steric hindrance, leaving group capability, nucleophile strength). **(1 point)**

7. What is the purpose of the first part of the experiment? **(1 point)**
    a. Very briefly describe how (how are you monitoring the reactions progression?) **(1 point)**
8. What is the purpose of the second part of the experiment? **(1 point)**
    a. Very briefly describe how (how are you monitoring the reactions progression?) **(1 point)**

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Mechanism (6 points)

- Draw as a figure and label as a "Scheme".
- Large enough to be seen but doesn't have to be any bigger.
- 3 points for each reaction (ie: the reaction in Part A and the reaction in Part B)

Table of Reactants (2 points)

- On a separate page (not counted towards page limit)
- Table with appropriate caption
- The table should have the following layout:

Reagent	**Mass or volume**	**Moles**	**Equivalents**	**Molecular weight and density (if liquid)**
Limiting reagent				
reagent				

Experimental Procedure (2 point)

- Write experimental as in Lab 1 (though this time it would be Lab 2 and a different date)

Observations and Results (4 points)

- Paragraph form
- What was observed when you started the reaction in Part A?
- What was observed when the reaction finished in Part A (at the end of 60 min)
- What was observed when you began a titration in Part A?
- What was observed when a titration finished in Part A?
- What was observed when you started the reaction in Part B?
- What was observed the reaction finished in Part B?
- **Do not show any data sets**
- 2 points for each part

Sample Calculation (6 points)

- Sample calculation of how to calculate [KOH] from the titration
    - Doesn't matter if it's the chloro or bromo variant
    - Use the average result for 1 time point of the group data.
- Sample calculation of how to [*t*-BuCl]
    - Doesn't matter which solvent system you use
    - Use the average result for 1 conversion % of the group data
- 3 points for each part

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Graphs (15 points)

- Big enough to be read
    - 3 graphs for Part A and 2 graphs for Part B
    - Part A graphs contain the plots of both bromo-butane and chloro-butane with the R^2 and line equation shown and labelled accordingly.
    - Part B graphs contain the plots of both solvent systems with the line equation and R^2 shown labelled accordingly
- 1 mark for having the graph (1 point x 5 graphs = 5 points)
- 1 mark/graph for proper axis (1 point x 5 graphs = 5 points)
- 1 mark/graph for showing Line equation and R^2 value (1 point x 5 graphs = 5 points)

Discussion (12 points) (Should be 2 pages at most) (1 point each)

1. After starting the reaction in Part A, what did you do at each time interval?
2. What was the purpose of doing this for the purposes of the experiment?
3. From the graphical analysis, what was the k value of the class' average for chlorobutane and bromobutane?
4. From the rate constants between the chloro- and bromo- substitution reactions, which one is faster? Does this agree with theory? Error analysis **if required (1 error only)**
5. How do you think the rate constant would change if the leaving group was iodine instead? What if it was fluorine?
6. From the graphical analysis, what is the reaction order of the substitution reactions involving chloro- and bromo-butane? From this reaction order, is the substitution reaction S_N1 or S_N2? Does this agree with theory (ie: Your hypothesis)? Error analysis **if required (1 error only)**

7. What did you do to study the progress of reaction B? How did this work? Why?
8. From the graphical analysis, what was the k value of the class' average for the reactions?
9. From the rate constants, in which solvent is the reaction slower? Does this agree with theory? Error analysis **if required (1 error only)**
10. Would the reaction constant be higher or lower if the reaction was run in methylene chloride?
11. How would the reaction constant change if the leaving group was instead iodine?
12. From the graphical analysis, what is the reaction order of the substitution reaction for Part B? From this reaction order, is the substitution reaction S_N1 or S_N2? Does this agree with theory (ie: Your hypothesis)? Error analysis **if required (1 error only)**

Questions

- Separate page
- 1 page max