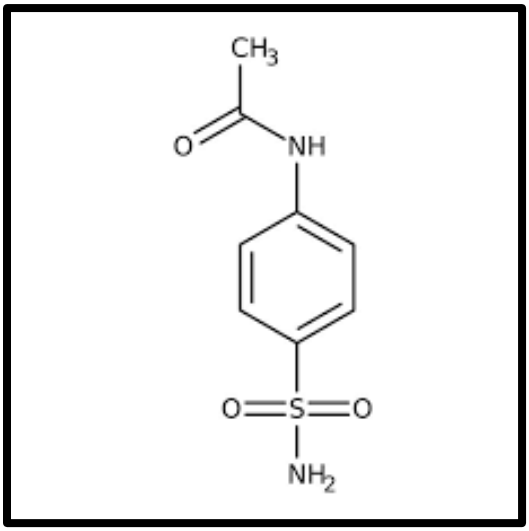
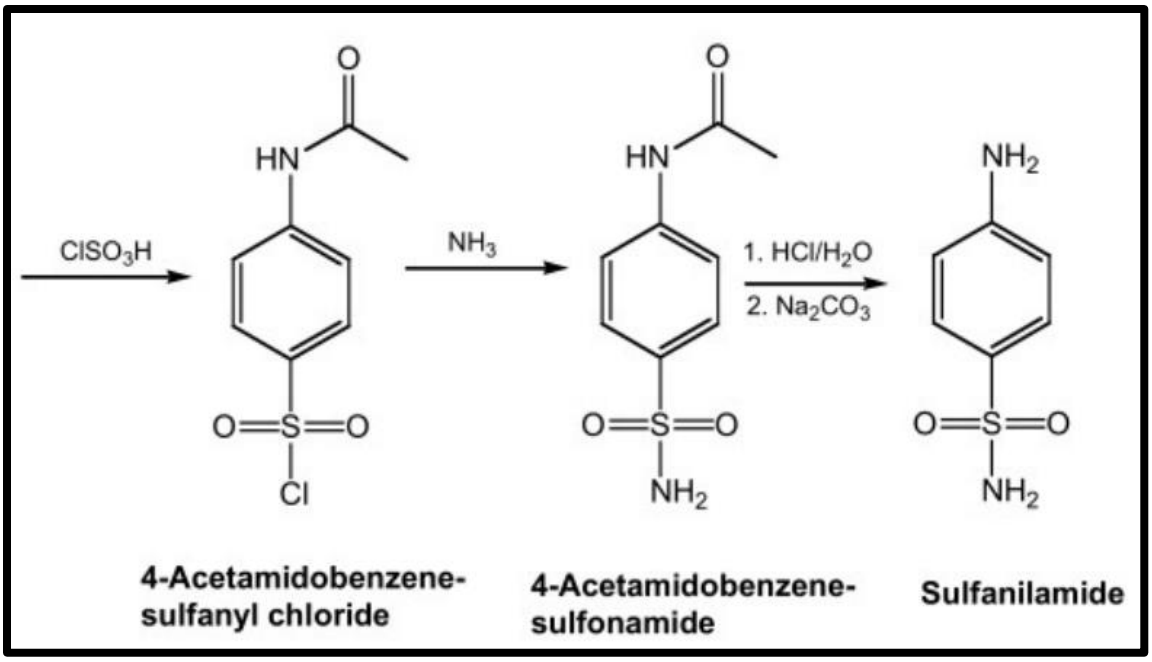
Lab.9

Amination of the p-acetaminobenzene sulfonyl chloride

Preparation of p-acetaminobenzene sulfonamide

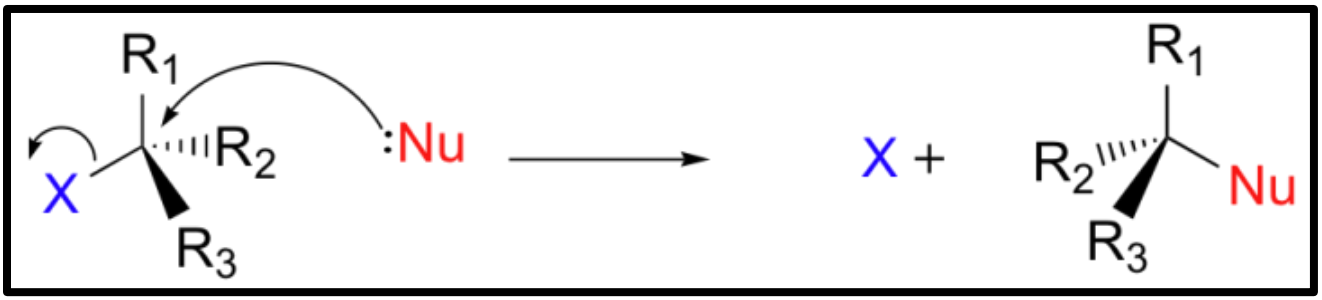


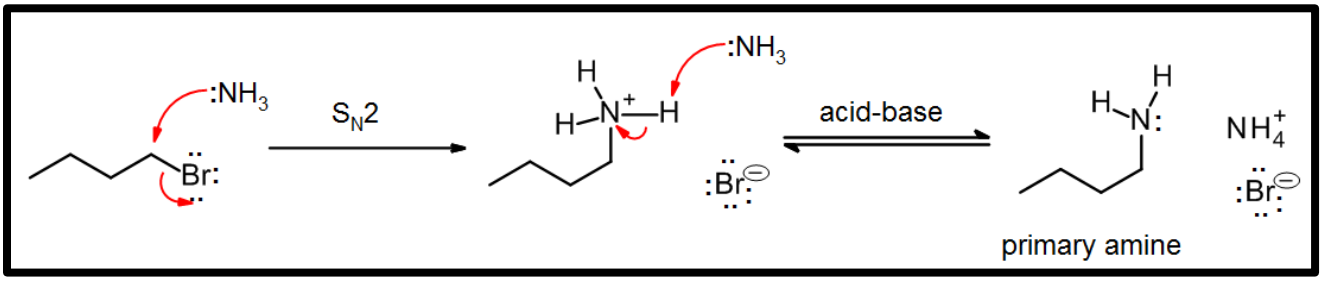
- Through an electrophilic aromatic substitution. The sulfonylchloride reacts readily with ammonia in a reaction that is mechanistically analogous to the nucleophilic acyl substitution reaction of carbonyl compounds.
- The resulting product of this step of the reaction is p-acetaminobenzenesulfonamide
- Selective acid-catalyzed hydrolysis of the amide (but not the sulfonamide) occurs to provide sulfanilamide
- (and acetic acid) through a nucleophilic acyl substitution reaction as shown in the figure bellow:



Mechanism of the reaction

- Nucleophilic substitution reaction (SN_2)





Procedure

1- Transfer the p-acetaminobenzene sulfonyl chloride to a clean 125 ml Erlenmeyer flask.
2- Add a magnetic stir bar to the flask.

3- Clamp the flask to a ring stand and set it in a water bath resting on a hot plate/stirrer.

4- Add 15ml of ammonia solution and 15 ml of distilled water to the flask.

5- Begin stirring the reaction mixture and heat the water bath to boiling for 5-10 minutes.

6- The consistency of the suspension will become more "pasty" as the reaction progresses

7- https://youtu.be/NQVDhj73Agg

8- Turn off the heat and remove the water bath. Place the flask in an ice bath and allow the reaction mixture to cool thoroughly (~5-7 minutes). Isolate the reaction product by vacuum filtration.

9- filter by Buchner funnel, collect the solid on top and wash the solid twice with ~20 ml of cold, distilled water. The solid is p-acetaminobenzenesulfonamide.

10- Transfer the p-acetaminobenzenesulfonamide to a clean 125 ml Erlenmeyer flask. Add a magnetic stir bar to the flask. and set it in a water bath resting on a hot plate/stirrer.

11- Add 15ml of 4M HCl.. Begin stirring the reaction mixture and heat in the water bath to boiling for 10-15 minutes.

12- Turn off the heat and remove the water bath. Place the flask in an ice bath and allow the reaction mixture to cool thoroughly (~5-7 minutes) , Remove the ice bath.

13- Stir the reaction mixture and add 4M NaOH, 2-3 ml at a time using a disposable glass pipette until the pH is ~7. It will require ~8-12 ml. To check the pH of the solution, insert a glass rod into the reaction mixture and touch the wet end to a strip of pH paper.

If a solid precipitates from the solution.....
The solid sulfanilamide may precipitate from the solution after the pH has been adjusted to 7. Filter the solid using vacuum filtration . Transfer the solid to a watch glass to dry. Save the filtrate until a melting point determination has been done to verify that the solid has the same melting point as commercial sulfanilamide.

If no solid precipitates from the solution.....
If no solid precipitates from the solution after the pH has been adjusted to ~7, heat the flask to boil off the water from the solution. Continue heating until approximately 20-30ml of water remains. Cool the flask in an ice bath to promote precipitation of the solid product from the solution. Filter the solid using vacuum filtration. Transfer the solid to a watch glass to dry. Save the filtrate until a melting point determination has been done to verify that the solid has the same melting point as commercial sulfanilamide.

Weight and Melting Point Determination of Sulfanilamide
Inspect your solid product and if it appears to be dry, weigh it and calculate the percent yield. Calibrate the thermometer of the melting point apparatus with benzoic acid (lit mp = 122°C). Record the melting point of the product.