

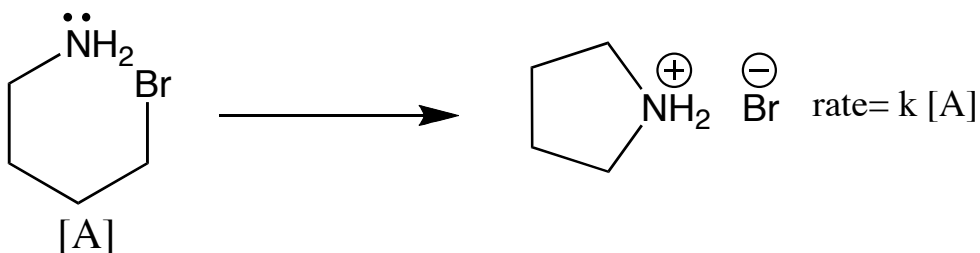
CHEM 3351 Quiz 6

NAME:

The reaction of butylamine, with 1-bromobutane in 60% aqueous ethanol follows the rate law:

$$\text{rate} = k [\text{butylamine}][1\text{-bromobutane}]$$

The product of the reaction is $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2)_2\text{NH}_2^+\text{Br}^-$. The following very similar reaction, however, has a first-order rate law:



Give a mechanism for each reaction that is consistent with its rate law and with the other facts about nucleophilic substitution reaction. Use the curved-arrow notation.

The reaction of butylamine with 1-bromobutane is a typical $\text{S}_{\text{N}}2$ reaction. (Bu— = the butyl group = $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2$):



This mechanism is consistent with the second-order rate law, because the rate law requires one molecule of amine and one molecule of alkyl halide in the transition state.

The second reaction is also a nucleophilic substitution reaction, but, because it is intramolecular (that is, the nucleophile and carbon at which it reacts are part of the same molecule), the reaction is first-order.

