The rate law for the Br—- catalyzed reaction

Br-

C6H5NH2 + HNO2 + H+ C6H5N2+ + 2H2O

is observed to be rate =  = k [H+][HNO2][Br -].

A proposed mechanism is

k1

(1) H+ + HNO2 H2NO2+ (rapid equilibrium)

k-1

k2

(2) H2NO2+ + Br- NOBr + H2O (slow)

k3

(3) NOBr + C6H5NH2 C6H5N2+  + H2O + Br- (fast)

Deduce the rate law for this mechanism and relate the *observed* rate constant k to the rate constants appearing in the assumed mechanism.

**Notes:**

1. Step (1) is a rapid equilibrium, meaning k1 and k-1 are much faster than k2.

2. The forward and reverse rates are equal for step (1) since it is an equilibrium; this fact can

be used to get an expression for the concentration of the intermediate H2NO2+.

3. Recall, the reaction orders for elementary reactions are determined by the reaction

stoichiometry.

4. Step (2) is sufficiently slow that it can be considered rate-determining.