(18.7) A sodium iodide solution contains some radioactive ^{131}I. An ethanol solution was prepared containing 0.135 M of this sodium iodide and 0.910 M inactive C_2H_5I. In the exchange reaction

$$C_2H_5I + {}^{129}I^- \underset{k_r}{\overset{k_f}{=}} C_2H_5{}^{129}I + I^-$$

the reaction rate constant is assume to be the same in both directions: k_f=k_r. One part (a) of the solution was removed and heated to high temperature so that equilibrium was rapidly reached. Another part (B) was kept in a thermostated bath at 30^{o}C. After 50 min ethyl iodide was separated from both solutions. The concentration of radioactive iodine in C_2H_5I in B was found to be only 64.7% of that in A. Calculate k (k_r=k a b in §9.4.2).

Page 260.

a=(AX)+(AX*)

b=(BX)+(BX*)

x=(AX*)

y=(BX*)

F=x_t/x_{inf}

ln(1-F)=-k_r*t*(a+b)/(a*b)

$F := \frac{64.7}{100}$ $\quad lf := ln(1 - F)$ $\quad a := 0.910$ $\quad b := 0.135$ $\quad t := 50 \cdot 60$ s

$k_r := -\frac{lf}{t \cdot \frac{a+b}{a \cdot b}}$ $\quad k := \frac{k_r}{a \cdot b}$ $\quad k = 3.321 \cdot 10^{-4}$ s^{-1} M^{-1}