A First Course on Kinetics and Reaction Engineering

Practice Problem 4.4

Problem Purpose

This problem introduces an alternative to the Arrhenius expression for the temperature dependence of a rate coefficient. In addition, it will help you determine whether you have mastered the learning objectives for this unit.

Problem Statement

Suppose that the rate coefficient for the isomerization of α-glucose to β-glucose was measured at several temperatures with the results given in the table below. Determine the Arrhenius parameters, k_0 and E, corresponding to the rate coefficient. Then determine the parameters, k_0, a and E, in equation (1), which is an alternative to the Arrhenius expression for the temperature dependence of a rate coefficient. Discuss the accuracy of the two models.

Table 1. Data for Practice Problem 4.4

T (°C)	10^5 x k (s^{-1})
10	3.20
17	6.72
23	12.07
28	19.27
35	36.38
42	66.51
46	92.59
50	127.52

$$k = k_0 T^a \exp\left(\frac{-E}{RT}\right) \tag{1}$$