CE 329 Fall 2015

Assignment 5

This problem will help you determine whether you have mastered the learning objectives for this unit.

Problem Statement

Suppose that for a quick preliminary calculation you need an approximate value for the rate of reaction (1) below for a mixture containing 22 % CO, 46 % H_2, 1 % CH_3OH and 31 % CO_2 at a total pressure of 49.3 atm and a temperature of 327 ℃. Suppose further, that you have obtained an old company report which says that the rate expression given in equation (2) below was shown to fit experimental data from reaction (1) at similar compositions and pressure, but at the temperatures given in the table below. Using the data in that table, what is your best estimate for the rate of reaction (1) at the conditions of interest to you. (Note: the rate expression used in this example is made-up and should not be used for any purpose other than answering this question.)

$$CO + 2\,H_2 \rightleftarrows CH_3OH \tag{1}$$

$$r_1 = k_1 P_{CO}^{0.46} P_{H_2}^{1.37} \tag{2}$$

Temperature (degrees C)	k (mol min^{-1} L^{-1} atm$^{-1.83}$)
80	0.024
110	0.138
140	0.606
170	2.180