**AFCoKaRE Practice Problem 23.1**

**Purpose:** This problem will allow you to practice the quantitative analysis of a transient CSTR.

**Problem Statement:** A 150 °C solution containing 2 mol L⁻¹ of A is being to a 500 L CSTR at a rate of 250 L h⁻¹. A jacket surrounding the CSTR contains a fluid at a constant temperature of 180 °C. The contact area between the CSTR contents and the jacket is 2 m² and the overall heat transfer coefficient is equal to 500 kcal m⁻² h⁻¹ K⁻¹. Within the reactor reaction (1) occurs at a rate given by equation (2). The pre-exponential factor for the rate coefficient in equation (2) is $1.14 \times 10^9$ L mol⁻¹ h⁻¹ and the activation energy is 16.2 kcal mol⁻¹. The reacting solution has a constant density and a constant heat capacity of 1.17 cal mL⁻¹ K⁻¹. The heat of reaction is 18.2 kcal mol⁻¹ and is independent of temperature. At steady state at these conditions, the outlet temperature is 167 °C and the conversion of A is 86%. Suppose that the temperature of the fluid in the jacket suddenly dropped to 160 °C. Calculate the temperature and conversion versus time until a new steady state is attained.

A → B

\[ r_1 = k_1 C_A^2 \]