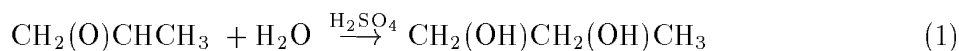


Compound	C_p (Btu/lbmole-°F)	H_f^{518} (Btu/lbmole)
propylene oxide	35	-66,600
water	18	-123,000
propylene glycol	46	-226,000
methanol	19.5	-

Problem 1

The propylene glycol synthesis reaction is to be conducted in a nonadiabatic CSTR.



$$r = \left(16.96 \times 10^{12} \times \exp\left(\frac{-32,400 \text{ Btu/lbmole}}{RT}\right) \text{ hr}^{-1} \right) \times c_{\text{propylene oxide}}$$

The reactor volume is 40.1 ft³. The total feed rate is 326.34 ft³/hr and consists of 43.03 lbmole/hr of propylene oxide, 71.78 lbmole/hr of methanol and 802.8 lbmole/hr of water. The inlet stream is at 75 °F. A cooling coil with 40 ft² of area is used and the coolant in the coil is maintained at a constant wall temperature of 85 °F. The overall heat-transfer coefficient for the coil is 100 Btu/hr-ft²-°F. Thermodynamic data are tabulated. You will need to assume the heat capacity does not change with temperature.

- (a) Under the conditions listed above only one stable operating condition is possible. Determine the reactor temperature.