ChE 7033 **Reaction Kinetics** **Due Nov. 9, 2011**

Homework #5

The reversible reaction A → R has the following coefficient parameters:

$A_1 = 7\ s^{-1}$ $E_1 = 41{,}868$ kJ/kmol
$A_2 = 5000\ s^{-1}$ $E_2 = 83{,}736$ kJ/kmol

The reaction is to be carried out in a batch reactor with a maximum allowed temperature of T_{max} = 800K. For a conversion of $x_{af} = 0.8$:

(a) Determine the optimum isothermal operating temperature, and the resulting batch holding time. Also determine the heat exchange rate required.

(b) Determine optimum temperature profile as a function of conversion and a function of processing time.

(c) Determine the heat exchange rates required for part (b).

Additional data:
Density of liquid = 1000 kg/m^3
Heat capacity = 4.187 kJ/kg C.
Initial mole fraction of reactant A = 0.5
Molecular weights: = 100 for A
= 20 for solvent