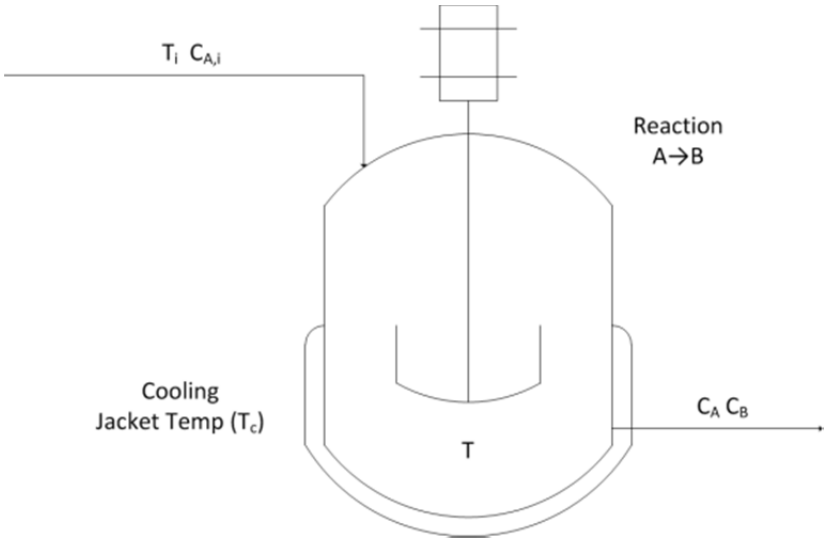
Part a) Using the Species for *A* and Energy Balance, derive a model of the CSTR response of $C_a$ and *T* to changes in the inputs $C_{a,i}$, $T_i$, and $T_c$.

```
Tc = 270                % Temperature of cooling jacket (K)
q = 100                 % Volumetric Flowrate (m^3/sec)
V = 100                 % Volume of CSTR (m^3)
ρ = 1000                % Density of A-B Mixture (kg/m^3)
Cp = .239               % Heat capacity of A-B Mixture (J/kg-K)
ΔHr = 5e4               % Heat of reaction for A->B (J/mol)
E/R = 8750              % EoverR = E/R
k0 = 7.2e10             % Pre-exponential factor (1/sec)
UA = 5e4                % Overall heat transfer coefficient (U=W/m^2-K)
Ca,i = 1                % Feed Concentration (mol/m^3)
Ti = 350                % Feed Temperature (K)
Ca = 0.989              % Concentration of A in CSTR (mol/m^3)
T = 296.6               % Temperature in CSTR (K)

k = k0*exp(-EoverR/T)
rate = k * Ca
```



Part b) Linearize the model from Part A

Part c) Put the Model into State Space Form : $dx/dt = A * x + B * u$