ChE 43200: Chemical Reaction Engineering

Exam #1 Equation Sheet

R = 8.314 J/(mol*K)= 1.98 kcal/(mol*K)

PV=nRT

Pressure Conversion

Temperature

1 atm = 760 torr = 1 bar = 14 psi

K = °C + 273.15

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $C_i = \frac{N_i}{V}$

Base Kinetics

general mole balance applicable to all reactors

$$\frac{dN_j}{dt} = F_{j,0} - F_j + \sum \nu_j r_j V$$

Stoichiometric coefficient.

$$k(T) = k_0 \exp\left(-\frac{E_a}{RT}\right)$$

$$X = \frac{C_{i0} - C_i}{C_{i0}}$$

$$\Delta T_{Adiabatic} = T_2 - T_1 = -\frac{\Delta H_R}{NC_{p,products}}$$

$$\ln(K_{298}) = -\frac{\Delta G_{298}}{RT}$$

$$\ln(K_{eq}) = \ln(K_{298}) - \frac{\Delta H_{R,298}}{R}\left(\frac{1}{T} - \frac{1}{298K}\right)$$

$$K_{eq} = \prod K_i, \quad i = P, \gamma, y$$ $\Rightarrow K_{eq} = K_p \cdot K_\gamma \cdot K_y$

Flow Material Balances

$$\tau = \frac{V}{\nu}$$ ← volumetric flowrate ($m^3/s$) or ($m^3/min$)

For equations of variable density for CSTR & PFR refer slide no. 51 & 53 from chp. 3.

$$CSTR: C_{i0} - C_i = \tau r_i$$

$$PFR: \frac{dC_i}{d\tau} = r_i$$

These equations are valid for constant density systems

Batch

$\frac{dC_i}{dt} = r_i$ → Const. density system

$\frac{1}{V} \cdot \frac{dN_i}{dt} = r_i$ → variable density system.