**Ideal Batch Reactor**

1. Constant volume
2. Homogeneous mixture
3. Isothermic

**Measure of Reaction Rate of Component**

-r = -1/V \* dN/dt = -d(N/V)/dt = -dC/dt (but for an ideal gas, you would measure pressure)

PV =nRT

P = n/V RT

P = CRT

dC= dP/RT

t = 0, NA0

t = t, NA

X = NA0 - NA / NA0 = (NA0 - NA)/V / NA0/V (if constant volume)

X = CA0-CA/CA0

CA = CA0(1-XA)

dCA = -CAdXA

**Irreversible Unimolecular-Type First-Order Reactions**

A --> products

-rA = -dCA/dt = kCA

Integrate and derive CA ~ t

∫CA0CA -dCA/CA = ∫0t kdt

-ln(CA/CA0) = kt

**Irreversible Second Order, Bimolecular Elementary Reaction**

2A --> products

-r = ∫CA0CA-dCA/CA2 = ∫0t kdt

1/CA - 1/CA0 = kt

**Second Order, Bimolecular Elementary Reaction**

A + B --> products

-r = -dCA/dt = -dCB/dt = kCACB

CA = CA0 (1-XA)

CB = CB0 - CA0XA

-CA0dXA/dt = kCA0(1-XA)(CB0-CA0XA)

dXA/dt = k(1-XA)(CB0-CA0XA) = k(CB0 + CA0XA - CB0XA + CA0XA2)

M = CB0/CA0

∫dXA/(1-XA)(M-XA) = ∫kCA0dt

(M-1)kCA0t = ln(CBCA0)/(CB0CA)