## UNITS

| Variables | Units |
|---|---|
| temperature | kelvin |
| activation energy | joules |
| volume | 1 $dm^3$ = 1 liter |
| concentration | moles/liter |

## Design Equations (liquid phase)

| PBR | BR |
|---|---|
| dFj/dw=rj' | dNa/dt=raV |
| w=Fjo->Fj ∫ dFj/rj' | Na(t)=Nao(1--X(t)) |
| w=(Fjo-Fj)/-rj' | Nao(dX/dt)=-raV |
| | t=Nao*(0->X) ∫ dX/-raV |

## Random Shit I need to Know

| | |
|---|---|
| PV=nRT => n/V=Ct-o=P/RT | -ra=k($Ca^2$Cb-(Cc/Kc)) |
| Cjo = yjo*Cto | kc=Cc/($Ca^2$Cb) |
| Ca=(Cao(1-X)/(1+εX) | -ra=0 @ equili-brium |
| Cb=(Cao(θb-(b/a)X))/(1+εX) | |
| Cc=(Cao(θc+(c/a)X))/(1+εX) | |
| Ci=Cio/(1+εX) | |

## Design Equations (gas phase)

| CSTR | PFR |
|---|---|
| V=(Fao*X)/-ra | dFa/dV=ra |
| Fao=Cao*vo | Fa=Fao(1-X) |
| V=(Cao *vo*X)/-ra | dFa=d(-Fao(1-X))-=-Fao*-dX=>Fa-o(dX/d-V)=-ra- |
| Cao=Nao/v-=Pao/R *To=(yao*Po)/R*To | dV=Fao-(dX/-ra)=-->0->V ∫ dV=V |
| V=(yao*Povo X)/(R*To*-ra) | 0->X ∫ Fao(dX/-r-a)=-->V=Fao 0->X ∫ dX/-ra |
| | **PBR** |
| | Fao*(d-X/dw)=-ra' |
| | W=Fao 0->X ∫ dX/-ra' |

## Conversion

| |
|---|
| X=Xa=moles of A reacted/moles of A fed in=(Nao-Na)/Nao |
| Na=Nao(1-X) |
| Fa=Fao(1-X) |
| Ca=Cao(1-X) |

## Design Equations (liquid phase)

| CSTR | PFR |
|---|---|
| V=(Fjo-Fj)/-rj | rj=dFj/dV |
| V=(voCjo-vCj)/-rj | V=Fjo->Fj ∫ dFj/rj |
| $V^{isom}$=vo(Cao-Ca)/kCa | ra=dFa/dV , Fa=VCa |
| V=(FaoX)/-ra | ra=(d(vo*-Ca))/dV |
| V=(Cao *vo*X)/(k*Ca) | $V^{first\ order}$=Cao *vo 0->X ∫ 1/(k*Cao*(1-X)) dX |
| V=(vo*X)/(k(1-X)) | |

## Activation Energy

| |
|---|
| $k=Ae^{-Ea/RT}$ |
| ln k = ln A (-Ea/RT) |
| Ea = (Rln(k2/k1))/(1/T1-1/T2) |