

UNITS		Design Equations (gas phase)		Design Equations (liquid phase)	
Variables	Units	CSTR	PFR	CSTR	PFR
temperature	kelvin	$V=(F_{ao}X)/-r_a$	$dF_a/dV=r_a$	$V=(F_{jo}-F_j)/-r_j$	$r_j=dF_j/dV$
activation energy	joules	$F_{ao}=C_{ao}v_o$	$F_a=F_{ao}(1-X)$	$V=(v_oC_{jo}-vC_j)/-r_j$	$V=F_{jo}-\int_0^X dF_j/r_j$
volume	1 dm ³ = 1 liter	$V=(C_{ao}v_oX)/-r_a$	$dF_a=d(-F_{ao}(1-X))=-F_{ao}dX \Rightarrow F_{ao}(dX/dV)=-r_a$	$V^{isom}=v_o(C_{ao}-C_a)/kCa$	$r_a=dF_a/dV$, $F_a=VC_a$
concentration	moles/liter			$V=(F_{ao}X)/-r_a$	$r_a=(d(v_o^*C_a))/dV$
Design Equations (liquid phase)				$V=(C_{ao}v_oX)/(k^*Ca)$	$V^{first order}=C_{ao}v_o \int_0^X \frac{1}{kC_{ao}^*(1-X)} dX$
PBR	BR	$C_{ao}=N_{ao}/v_o$ $=P_{ao}/R T_o=(y_{ao}P_o)/R^*T_o$	$dV=F_{ao}-(dX/-r_a)=-\int_0^X dV=-\int_0^X \frac{F_{ao}dX}{-r_a}$		
$dF_j/dw=r_j'$	$dN_a/dt=r_aV$	$V=(y_{ao}P_o v_o X)/(RT_o^*-r_a)$	$V=\int_0^X \frac{F_{ao}dX}{-r_a}$		
$w=F_{jo}-\int_0^X dF_j/r_j'$	$N_a(t)=N_{ao}(1-X(t))$				
$w=(F_{jo}-F_j)/-r_j'$	$N_{ao}(dX/dt)=-r_aV$				
	$t=N_{ao} \int_0^X \frac{dX}{-r_aV}$				
Random Shit I need to Know					
$PV=nRT \Rightarrow n/V=C_t$ $C_o=P/RT$	$-r_a=k(C_a^2C_b-(C_c/K_c))$		PBR		
$C_{jo}=y_{jo}C_{to}$	$k_c=C_c/(C_a^2C_b)$		$F_{ao}(dX/dw)=-r_a'$		
$C_a=(C_{ao}(1-X))/(1+\epsilon X)$	$-r_a=0$ @ equilibrium		$W=F_{ao} \int_0^X \frac{dX}{-r_a'}$		
$C_b=(C_{ao}(\theta_b-(b/a)X))/(1+\epsilon X)$					
$C_c=(C_{ao}(\theta_c+(c/a)X))/(1+\epsilon X)$					
$C_i=C_{io}/(1+\epsilon X)$					
Conversion					
	$X=X_a$ =moles of A reacted/moles of A fed in= $(N_{ao}-N_a)/N_{ao}$				
	$N_a=N_{ao}(1-X)$				
	$F_a=F_{ao}(1-X)$				
	$C_a=C_{ao}(1-X)$				
Activation Energy					
	$k=Ae^{-E_a/RT}$				
	$\ln k = \ln A - (E_a/RT)$				
	$E_a = (R \ln(k_2/k_1))/(1/T_1 - 1/T_2)$				