Problem 1:

Consider an infinitesimal volume dv in the trough such that dv = L.X.dy = L.f(Y).dy

We know that dy = β.dt

so we get dv = L.f(Y). β.dt

Also given that dv/dt = $\alpha y^{1/2}$

=> L.f(Y). β.dt = $\alpha y^{1/2}$ .dt

=> L.f(Y). β = $\alpha y^{1/2}$

=> f(Y) = $\alpha y^{1/2}$ /L. β

Problem 2:

a) Mixer #1: DOF = 4 unknowns (m_1, m_2, m_5, x_{A5}) – 2 balances = 2

Separator #1: DOF = 4 unknowns (m_2, m_3, m_4, x_{A5}) - 2 balances = 2

Splitter: DOF = 3 unknowns (m_4, m_5, x_{A5}) - 1 balance = 2

Separator #2: DOF = 3 unknowns (m_7, m_8, x_{A5}) - 2 balances - 1 efficiency = 0

Mixer #2: DOF = 3 unknowns (m_3, m_7, m_9) - 1 balance = 2

Overall: DOF = 3 unknowns (m_1, m_8, m_9) - 2 balances = 1

b) Separator #2 Balance:

A balance: $x_{A5}(175)=m_7+0.15m_8$

B balance: $(1-x_{A5})(175)=0.85m_8$

Efficiency: $0.5*x_{A5}(175)=m_7$

Solve 3 equations for 3 unknowns: m_7=22.8kg/hr, m_8=152.2kg/hr, x_{A5}=0.26

Overall Balance:

A balance: $0.30m_1=0.15(152.2)+m_9$

Overall mass balance: $m_1=152.2+m_9$

Solve 2 equations for 2 unknowns: **m_1=184.8kg/hr**, **m_9=32.6kg/hr**

Mixer #1 Balance:

A balance: $0.30(184.8)+0.26m_5=0.29m_2$

Overall mass balance: $184.8+m_5=m_2$

Solve 2 equations for 2 unknowns: m_2=246.4kg/hr, **m_5=61.6kg/hr**

Problem 3:

a.

EMBED Equation.3

	In	Change	Out
N_2	EMBED Equation.3	EMBED Equation.3	EMBED Equation.3
H_2	EMBED Equation.3	EMBED Equation.3	EMBED Equation.3
NH_3	EMBED Equation.3	EMBED Equation.3	EMBED Equation.3
Total			EMBED Equation.3

EMBED Equation.3

b. Reactor Ammonia Balance

EMBED Equation.3

Separator Ammonia Balance

EMBED Equation.3