

# 1. Problem 3.15

## 2. Problem 3.16

### 3. Problem 3.17

4. Problem 3.18

(a)

$$\begin{aligned}
 \text{A in S1} &= 200 \\
 \text{P production} &= 0.8 \cdot 200 - 2 \cdot (375 - 370)^2 = 110 \\
 \text{Total fresh input} &= 200 + 100 = 300 \\
 \text{ME} &= \frac{0.8 \cdot 110}{300} \\
 \boxed{\text{ME} = 29.3\%}
 \end{aligned}$$

(b)

Find the maximum of this equation:

$$\begin{aligned}
 \text{P production} &= 0.8 \cdot 200 - 2 \cdot (375 - T)^2 \\
 \boxed{T = 375 \text{ K}}
 \end{aligned}$$

(c)

From maximum solver in the last part

$$\begin{aligned}
 \text{P production} &= 160 \text{ kg/h} \\
 \text{P in S7} &= 160 \cdot 0.8 \\
 \boxed{\text{P in S7} = 128 \text{ kg/h}}
 \end{aligned}$$

(d)

Recover all P in S2

$$\boxed{\text{P in S7} = 160 \text{ kg/h}}$$

(e)

Recover A in S3 and B in S6

$$\begin{aligned}
 \text{Recovered A} &= 40 \text{ kg/h} \\
 \text{Recovered B} &= 95 \text{ kg/h} \\
 \text{Total recovered inputs} &= 135 \text{ kg/h}
 \end{aligned}$$

Decrease input by 135 kg/hr

$$\begin{aligned}
 \text{Required input} &= 300 - 135 = 165 \text{ kg/h} \\
 \text{P in S7} &= 160 \text{ kg/h} \\
 \text{ME} &= \frac{160}{165} \\
 \boxed{\text{ME} = 97.7\%}
 \end{aligned}$$