

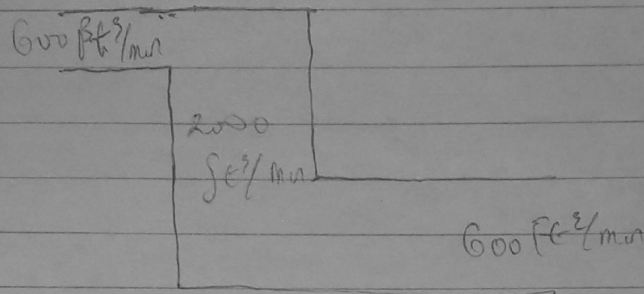
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C ENA 282

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Question and Answer



$$\frac{dy}{dt} = Y_{in} - Y_{out}$$

$$Y_{in} = 600$$

$$Y_{out} = \frac{600}{2000} = 0.03y$$

$$\frac{dy}{dt} = 600 - 0.03y$$

$$\frac{dy}{dt} = -0.03(y - 20,000)$$

$$\int \frac{dy}{(y - 20,000)} = \int -0.03 dt$$

$$\ln(y - 20,000) = -0.03t + C$$

$$y - 20,000 = e^{-0.03t + C}$$

$$y - 20,000 = y_0 e^{-0.03t}$$

$$y = y_0 e^{-0.03t} + 20,000$$

a) At $t = 0$; $y = 0$

$$y = y_0 e^{-0.03t} + 20,000$$

$$0 = y_0 e^{-0.03(0)} + 20,000$$

$$y_0 = -20,000$$

$$y = 20,000 e^{-0.03t} + 20,000$$

b) $90\% \times 20,000 = 18,000$

$$y = 18,000$$

$$18,000 = 20,000 e^{-0.03t} + 20,000$$

$$18,000 - 20,000 = -20,000 e^{-0.03t}$$

$$0.1 = e^{-0.03t}$$

$$\ln(0.1) = -0.03t, t = 2.30/0.03, t = 76.8 \text{ min.}$$