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+p j-ku,#dqg#wkh#|hdvw#glh#zlwk#d#vhfrqg#rughu#udwh#frqvwdqw#ri#5@3B334#p O2+p j-ku,1#Suhglfw#wkh#
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wkh#ioorz #udwh#ri#z dwhu#dv#d#ixqfwlrq#ri#p h#lq#O2p lq#dqg#wkh#whp shudwxuh#ri#wkh#z dwhu#dv#lw#ohdyhv#wkh#
frroblqj#v|vwhp 1

Dvvhp edn=

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dqg#wkh#Whp shudwxuh#ri#wkh#z dwhu#dv#lw#ohdyhv#wkh#frroblqj#v|vwhp

Gldjudp #

Dqdo|}h=
Dvvxph h#rshq/#vwhdg|#Mwdwh/#qrq#hdfwlyh
Edvlv=
DEFG@63;9

$$ry := \frac{0.03}{hr} \qquad rb := \frac{0.02}{hr} \qquad re := .008 \left(\frac{mg}{hr}\right) \qquad rl := .0006 \left(\frac{mg}{hr}\right)$$

$$Ky := 10^7 \qquad Kb := 10^6$$

$$E := 0.008 \; \frac{mg}{hr}$$

$$mwe := 46.07 \left(\frac{g}{mol}\right) \qquad mwl := 90.08 \left(\frac{g}{mol}\right)$$

$$L := 0.006 \; \frac{mg}{hr}$$

$$mL$$

$$K1 := 0.0003 \ \frac{mL}{mg \cdot hr}$$

$$K2 := 0.0001 \ \frac{mL}{mg \cdot hr}$$

$$pka := 3.86$$

$$Tw := 4 \ °C \qquad Tb := 5 \ °C$$

$$A := 5 \ m^2$$

$$V := 10 \ L$$

$$Ti := 4 \ °C$$

$$Y(0) = 1 \cdot 10^5$$

$$\frac{d}{dt} Y(t) = ry \cdot Y(t) \cdot \left(1 - \frac{Y(t)}{(K1)}\right) - K1 \cdot Y(t) \cdot E(t)$$

$$B(0) = 1 \cdot 10^3$$

$$\frac{d}{dt} B(t) = rb \cdot B(t) \cdot \left(1 - \frac{B(t)}{K2}\right) - K2 \cdot B(t) \cdot E(t)$$

$$L(0) = 0 \ \frac{mg}{mL}$$

$$\frac{d}{dt} L(t) = \frac{(B(t) \cdot rb)}{V}$$

$$E(0) = 0 \ \frac{mg}{mL}$$

$$\frac{d}{dt} E(t) = \frac{(Y(t) \cdot re)}{V}$$

$$Q(0) = 0 \ J$$

$$Q(t) = \frac{(E(t) \cdot V)}{mwe} \cdot \frac{(1000 \ J)}{1 \ mol}$$

$$V(0) = 0.00001 \ gm$$

$$V(t) = \frac{Q(t) \cdot 1 \left(\frac{gm}{mL}\right)}{A \cdot 100 \cdot 10^3 \left(\frac{J}{m^5 \ K}\right) (Tb - Ti)}$$

$$Tf(0) = 4 \ °C$$

$$Tf(t) = \frac{\left(Q(t) - V(t) \ 4.184 \left(\frac{J}{gm \cdot °C}\right)\right) \cdot Ti}{V(t) \cdot 4.184 \left(\frac{J}{gm \cdot °C}\right)}$$

$$
\begin{bmatrix} Y \\ B \\ L \\ E \\ Q \\ V \\ Tf \end{bmatrix} := \textbf{odesolve} \left(\begin{bmatrix} Y(t) \\ B(t) \\ L(t) \\ E(t) \\ Q(t) \\ V(t) \\ Tf(t) \end{bmatrix}, 100000 \right)
$$