

Ex 1 Turkey ^{at} ~~in room~~ 70°F
Put in 350°F oven.

$$\rightarrow h = 0.42$$

How long to cook until it is 200°F ?

$$\begin{cases} T' = -0.42(T - 350) \end{cases}$$

$$\begin{cases} T(0) = 70 \leftarrow T_0 \end{cases}$$

↓ soln from last time

$$T(t) = \underbrace{(70 - 350)}_{-280} e^{-0.42t} + 350$$

Q: At what time is temp = 200° ?

$$\begin{array}{c} t_{200} \rightarrow \\ 200 = T(t_{200}) = \underbrace{-280}_{\text{given}} e^{-0.42t_{200}} + 350 \\ \uparrow \\ \text{given} \end{array} \quad \underbrace{\hspace{10em}}_{\text{computed}}$$

$$\underline{1.486 \text{ hr}} \sim \frac{\ln\left(\frac{-150}{-280}\right)}{-0.42} = t_{200}$$



Ex : found at 11:00 AM
at 11:30 AM → 94.6°F
T_e = 70°

12:30 PM → 93.4°F

Estimate time of death.

Soln: T' = -h(T - T_e)

T(t) = (T₀ - T_e)e^{-ht} + T_e

Let t measure minutes since 11:00 AM.

So t = 0 corr to 11:00 AM.

t = 30 corr to 11:30 AM

t = 90 corr to 12:30 PM

T(30) = 94.6 T(90) = 93.4

94.6 = T(30) = (T₀ - 70)e^{-30h} + 70

↑ measured

↓ solve for T₀

24.6 = (T₀ - 70)e^{-30h}

24.6e^{30h} + 70 = T₀

T₀ ≈ 95.22

93.4 = T(90) = (T₀ - 70)e^{-90h} + 70

↑ measured

93.4 = (24.6e^{30h})e^{-60h} + 70

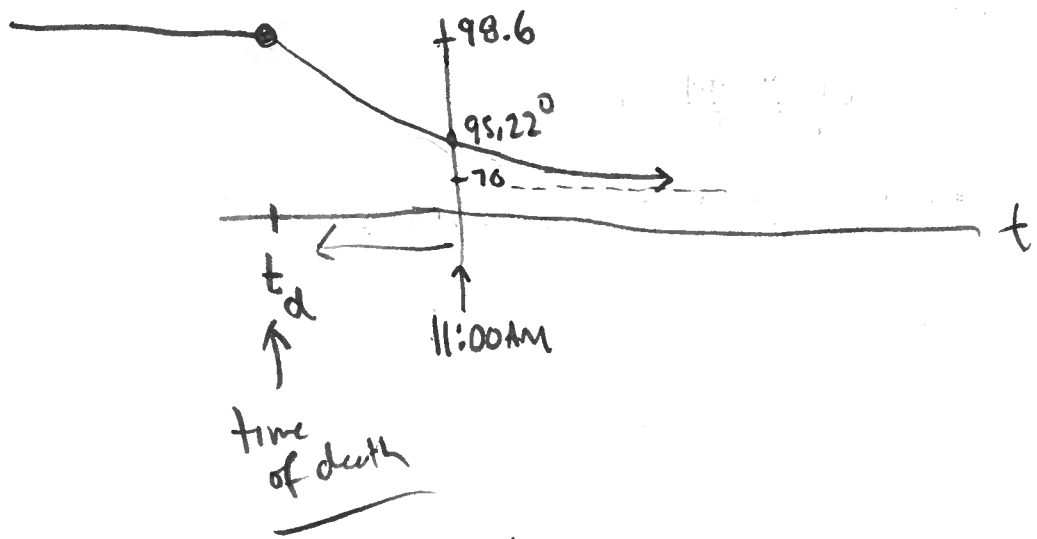
0.000833 ≈ ln(23.4/24.6) / -60 = h

⇒ our model is

$$T(t) = \underbrace{(95.22 - 70)}_{25.22} e^{-0.000833t} + 70$$

active once death occurred

Assume when living the body was 98.6° F



Find t_d

$$98.6 = T(t_d) = 25.22 e^{-0.000833t_d} + 70$$

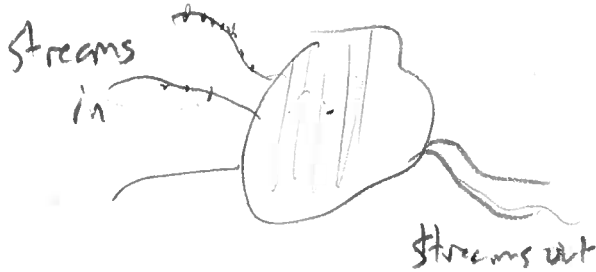
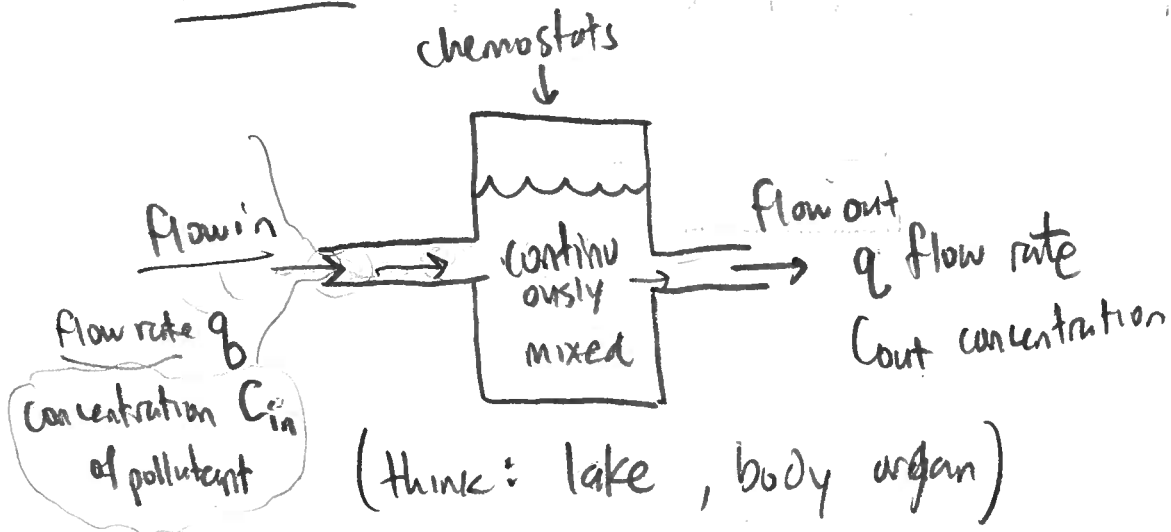
prior knowledge

$$t_d = \frac{\ln\left(\frac{28.6}{25.22}\right)}{-0.0008333} \approx -150.929$$

⇒ died 150 minutes before 11:00

⇒ died at about 9:30AM

§1.3.3 Chemical Reactors



Think: pond w/ volume $V \text{ m}^3$

polluted water concent. $C_{in} \left(\frac{\text{g}}{\text{m}^3} \right)$

dumped in at rate $q \frac{\text{m}^3}{\text{day}}$ (discharged at same rate)

initial concentration $\sim C_0$ in pond

Q: What is concentration of pollutant at time t ?