HW 7.4 p. 358 29-32, 47, 49-51

Sunday, March 1, 2015 1:09 PM

(29) $y = y_0 e^{-kt}$ $\quad t = \frac{3}{k}$

$y = y_0 e^{-k(\frac{3}{k})}$

$y = y_0 e^{-3}$

$\frac{y}{y_0} = e^{-3} \approx .0498 < 5\%$

(30) $T_s = 65^\circ$ $\quad t = 10$ min $T_{10} = 35^\circ$ $\quad t = 20$ min $T_{20} = 50^\circ$

$\frac{50-65 = (T_0-65)e^{-k(20)}}{35-65 = (T_0-65)e^{-k(10)}}$

$\frac{1}{2} = e^{-10k}$

$\ln\frac{1}{2} = -10k$

$k = -\frac{1}{10}\ln\frac{1}{2}$

$35-65 = (T_0-65)e^{-\frac{1}{10}\ln\frac{1}{2}(10)}$

$-30 = (T_0-65)e^{\ln\frac{1}{2}}$

$T_0 = 5^\circ$F

(31) $T_0 = 90^\circ$C $\quad t = 10$ min $T_{10} = 60^\circ$C

$T_s = 20^\circ$C

$60-20 = (90-20)e^{-k(10)}$

$\frac{4}{7} = e^{-k(10)}$

$k = \frac{\ln\frac{4}{7}}{-10}$

$T = 70e^{\frac{1}{10}\ln\frac{4}{7}t} + 20$ $\quad Y_1$

(a) $T = 35$? $\quad Y_2$ Intersect

$t = 27.527$ min

-10

17.527 min longer

(b) $T_s = -15^\circ$ (use same value for k) why?

$T = 35^\circ$

$T-(-15) = (90-(-15))e^{\frac{1}{10}\ln\frac{4}{7}t}$

$50 = 105e^{\frac{1}{10}\ln\frac{4}{7}t}$

$t = 13.258$ minutes

(32) $T_{20} = 60 + T_s$ $\quad T_0 = 70 + T_s$

$T_{20} - T_s = (T_0 - T_s)e^{-kt}$

$60 + T_s - T_s = (70 + T_s - T_s)e^{-k(20)}$

$60 = 70e^{-20k}$

$k = \frac{-1}{20}\ln\left(\frac{6}{7}\right)$

(a) $T = 70e^{\frac{1}{20}\ln\frac{6}{7}(35)} = 53.449^\circ$ above Room Temp

(b) $T = 70e^{\frac{1}{20}\ln\frac{6}{7}(140)} = 23.794^\circ$ above Room Temp

(c) $10 = 70e^{\frac{1}{20}\ln\frac{6}{7}t}$

$t = 252.469$ min

-20

$t = 252.469$ min

-20

232.469 min (after now)

(47) False $y = Ce^{kx}$

(49) $2 = 1e^{r(7)}$

$r = .099$

$3 = e^{.099t}$

$t = 11.095$ years

D

(50) $.01 = \left(\frac{1}{2}\right)^{\frac{199}{HL}}$

$\ln .01 = \frac{199}{HL} \ln \frac{1}{2}$

$HL = 29.95$ hrs C

(51) II and III

D

(52) $T_0 = 425°F$

$T_S = 68°F$

$T_{30} = 195°F$

$195 - 68 = (425 - 68)e^{-k(30)}$

$k = \frac{-1}{30} \ln \frac{127}{357}$

$T = 100°$ $t = ?$

$100 - 68 = (425 - 68)e^{\frac{1}{30} \ln \frac{127}{357} t}$

$t = 70.011$ min

-30

40 min E