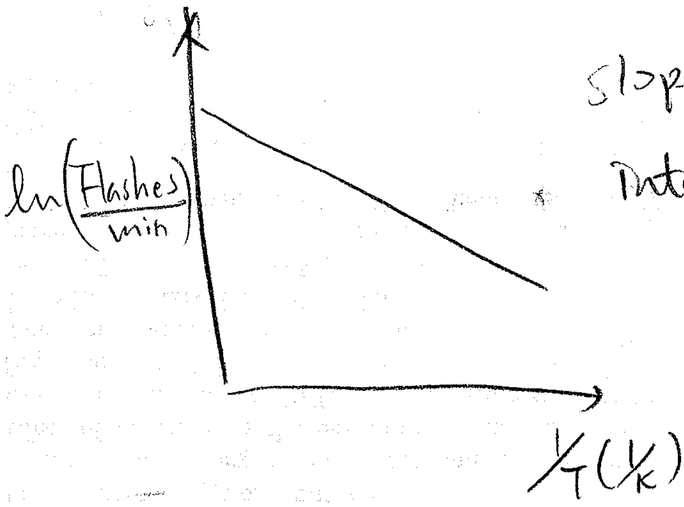
#3

P3-4.

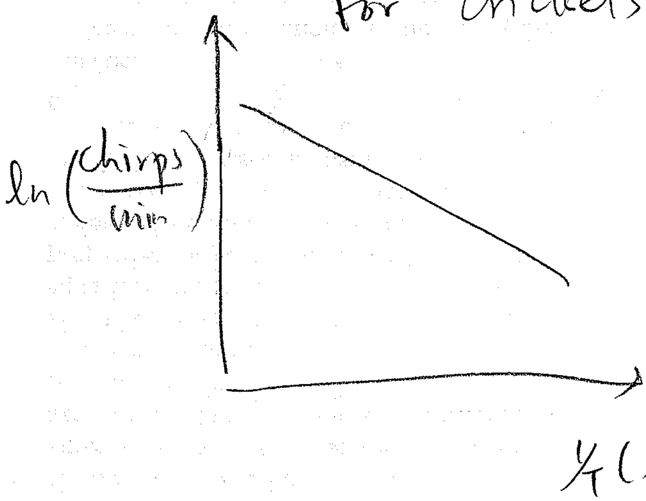
For fireflies



Slope = −5795.6

Intercept = 21.929

For crickets



Slope = −6166.9

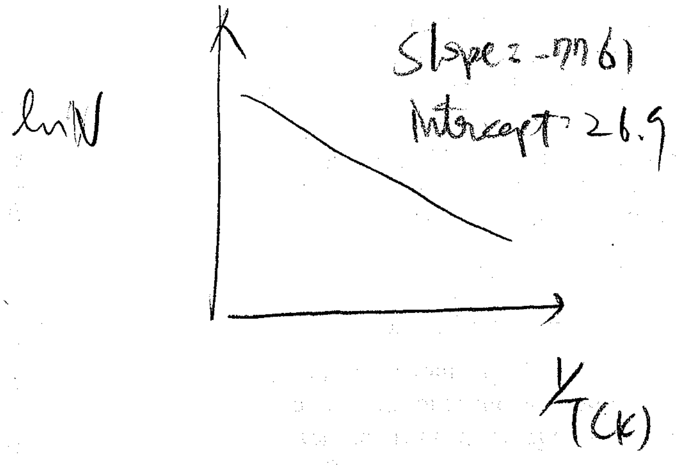
Intercept = 25

a) as temperature increases flash rate and chirps rate increase; however, the increasing rates due to temperature increase are different.
the temperature dependence is stronger for cricket case due to it high activation energy.

b)

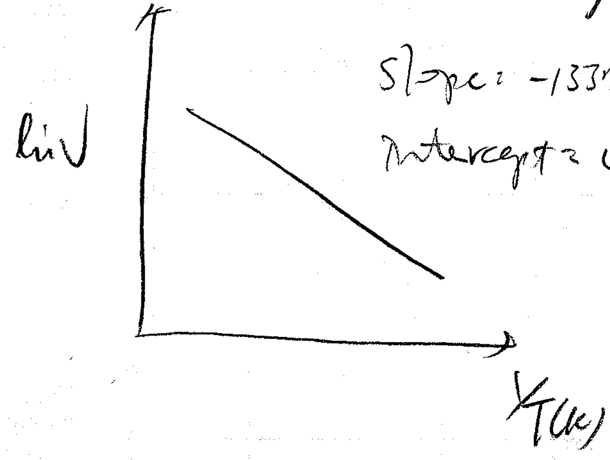
For ant

Slope = -7761
Intercept = 26.9



For honey bee

Slope = -13378
Intercept = 44.6



at 40°C: $\ln V = 44.6 - 13378 \cdot \frac{1}{313}$

$V = 6.4\ cm/s$

at -5°C: $\ln V = 44.6 - 13378 \cdot \frac{1}{268}$

$V = 0.005\ cm/s$

c) can be modeled by Arrhenius equation

d) For different insect the behavior of interest activates at different temperature range. more temperature experiment will help to clearify the activity region for each case.

P 3-10.

a) 1) $-r_{C_2H_6} = k\, C_{C_2H_6}$

2) $A + B \rightarrow C$

$-r_A = k C_A \cdot C_B^{1/2}$

3) $A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} B + 2C$

$-r_A = k_1 \cdot C_A - k_2 C_B C_C^2$

4) $A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} B$

$-r_A = k_1 C_A - k_2 C_B$

5) $A + B \underset{k_2}{\overset{k_1}{\rightleftharpoons}} C + D$

$-r_A = k_1 C_A C_B - k_2 C_C C_D$

b)

(1) $-r_A = k C_B^2 C_A$

(2) $-r_A = k C_B$

(3) $-r_A = k\, C_A / C_B$

Actually, I personally don't think I could get any result from the information given from problem

c)

(1) $-r = \dfrac{k\, C_{H_2} C_{Br_2}^{1/2}}{k_2 + C_{HBr}/C_{Br_2}}$

(2) $-r = k\, C_{H_2} C_{I_2}$

P3-16

a) $K_c = \frac{C_{A0}(X_{Ae})}{C_{A0}^2(1-X_{Ae})^2}$ $\quad 10 = \frac{X_{Ae}}{2(1-X_{Ae})^2}$

$X_{Ae} = 0.8$

$C_{Ae} = C_{A0}(1-X_{Ae}) = 0.4 = C_{Be}$

$C_{Ce} = 1.6$ $\quad$ (in mol/l) #

b)

$C_A = C_{A0}\frac{1-X_A}{1+\varepsilon X_A}$ $\quad \varepsilon = (3-1) \cdot 1 = 2$

$C_C = C_{A0}\frac{3X_A}{1+\varepsilon X_A}$

$K_c = \frac{C_{Ce}^3}{C_{Ae}}$ $\quad X_{Ae} = 0.58$

$C_{Ae} = 0.0593$ mol/l #

$C_{Ce} = 0.246$ mol/l #

c) $N_A = N_{A0}(1 - X_A)$

$N_C = N_{A0} 3X_A$

$C_A = \frac{N_A}{V}$ $C_C = \frac{N_C}{V}$ $C_{A0} = \frac{P_0}{RT}$

$C_A = C_{A0}(1 - X_A)$

$C_C = C_{A0} 3X_A$

$K_C = \frac{C_C^3}{C_A}$

$X_{Ae} = 0.393$

$C_{Ae} = 0.183$

$C_{Ce} = 0.359$

d) Should be the same as part b.

4,

	Batch	CSTR
0	$\tau = \frac{C_{A0}}{\varepsilon k} \ln(1+\varepsilon X)$	$\tau = \frac{C_{A0}}{k} X$
1	$\tau = \frac{1}{k} \ln\left(\frac{1}{1-X}\right)$	$\tau = \frac{X(1+\varepsilon X)}{k(1-X)}$
1-R	$\tau = \frac{X_e}{k} \ln \frac{X_e}{X_e - X}$	$\tau = \frac{X(1+\varepsilon X)}{k(1-\frac{X}{X_e})}$
2	$\tau = \frac{1}{k C_{A0}} \left[\frac{(1+\varepsilon)X}{1-X} - \varepsilon \ln \frac{1}{1-X} \right]$	$\tau = \frac{X(1+\varepsilon X)^2}{k(1-X)^2}$

PFR

0 $\tau = \frac{C_{A0}}{\tau} X$

1 $\tau = \frac{1}{k}\left[(1-\varepsilon)\ln\frac{1}{1-X} - \varepsilon X\right]$

1-R $-\frac{X_e}{k}\left[\varepsilon X + X_e\left(\frac{1}{X_e} + \varepsilon\right)\ln\left(1-\frac{X}{X_e}\right)\right]$

2 $\tau = \frac{1}{k C_{A0}}\left[2\varepsilon(1+\varepsilon)\ln(1-X) + \varepsilon^2 X + \frac{(1+\varepsilon)^2 X}{1-X}\right]$