جامعة بيرزيت
BIRZEIT UNIVERSITY

Homework 4

Bio pharmaceutics & Pharmacokinetics/PHAR434

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Problem 1:-

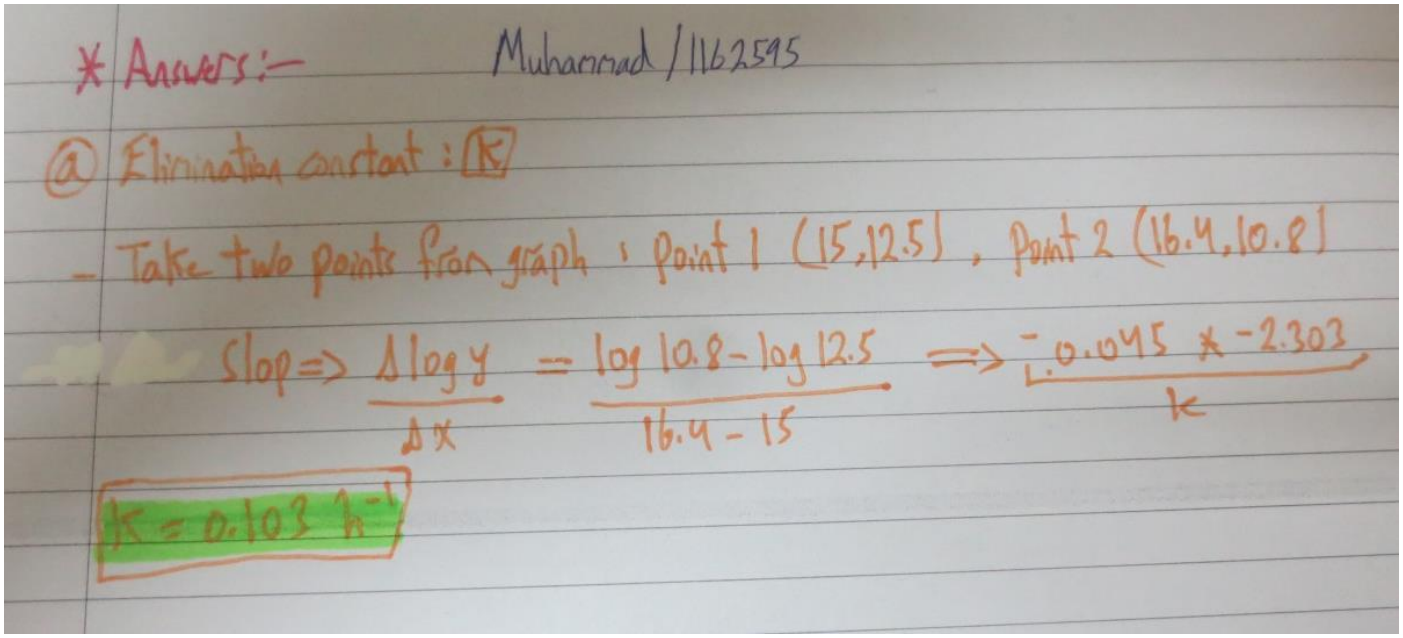
Plasma samples from a patient were collected after an oral bolus dose of 10 mg of a new benzodiazepine solution (F=1) as follows:

Table1: Data of benzodiazepine solution

Time (hr)	Concentration (ng/mL)
0.25	2.85
0.50	5.43
0.75	7.75
1.00	9.84
2.00	16.20
4.00	22.15
6.00	23.01
10.00	19.09
14.00	13.90
20.00	7.97

a. Determine the elimination constant of the drug.
b. Determine k_a by feathering.
c. Determine the equation that describes the plasma drug concentration of the new benzodiazepine.
d. the elimination half-life, $t_{1/2}$;
e. the t_{max}, or time of peak drug concentration.
f. the volume of distribution of the drug.

Figures: Solution



(b) From Residual line:

X_1' (0.4, 46) X_2' (0.8, 44) X_3' (1, 43)

X_1 (0.4, 7.4) X_2 (0.8, 8.5) X_3 (1, 9.5)

$\Delta X_1 = X_1' - X_1 \Rightarrow 41.6$ $\Delta X_2 = 35.5$ $\Delta X_3 = 33.5$ ΔX (For y)

- From Residual line (Take 2 points)

A (4.4, 8) B (5.8, 5)

Slope $* -2.303 = k_a$

$\frac{\log y_2 - \log y_1}{x_2 - x_1} \Rightarrow$ F 0.146 $* -2.303 = k_a$

$k_a = 0.34$

$\frac{\log y_2 - \log y_1}{x_2 - x_1}$

$k_a = 0.34$

$A = \frac{F k_a D_o}{V_D (k_a - k)}$

(c) Equation:- $A = 48$ mg/ml, $k = 0.103\ h^{-1}$, $k_a = 0.34\ h^{-1}$

$C_p = A(e^{-kt} - e^{-k_a t}) \Rightarrow C_p = 48\ (e^{-0.103t} - e^{-0.34t})$

(d) $t_{\frac{1}{2}} = \frac{0.693}{k} \Rightarrow \frac{0.693}{0.103\ h^{-1}}$

$t_{\frac{1}{2}} = 6.73$ h

(e) $t_{max} = \frac{\ln(k_a/k)}{k_a - k} \Rightarrow \frac{\ln(0.34/0.103)}{0.34 - 0.103} \Rightarrow \frac{1.19}{0.237}$

$t_{max} = 5.02$ h

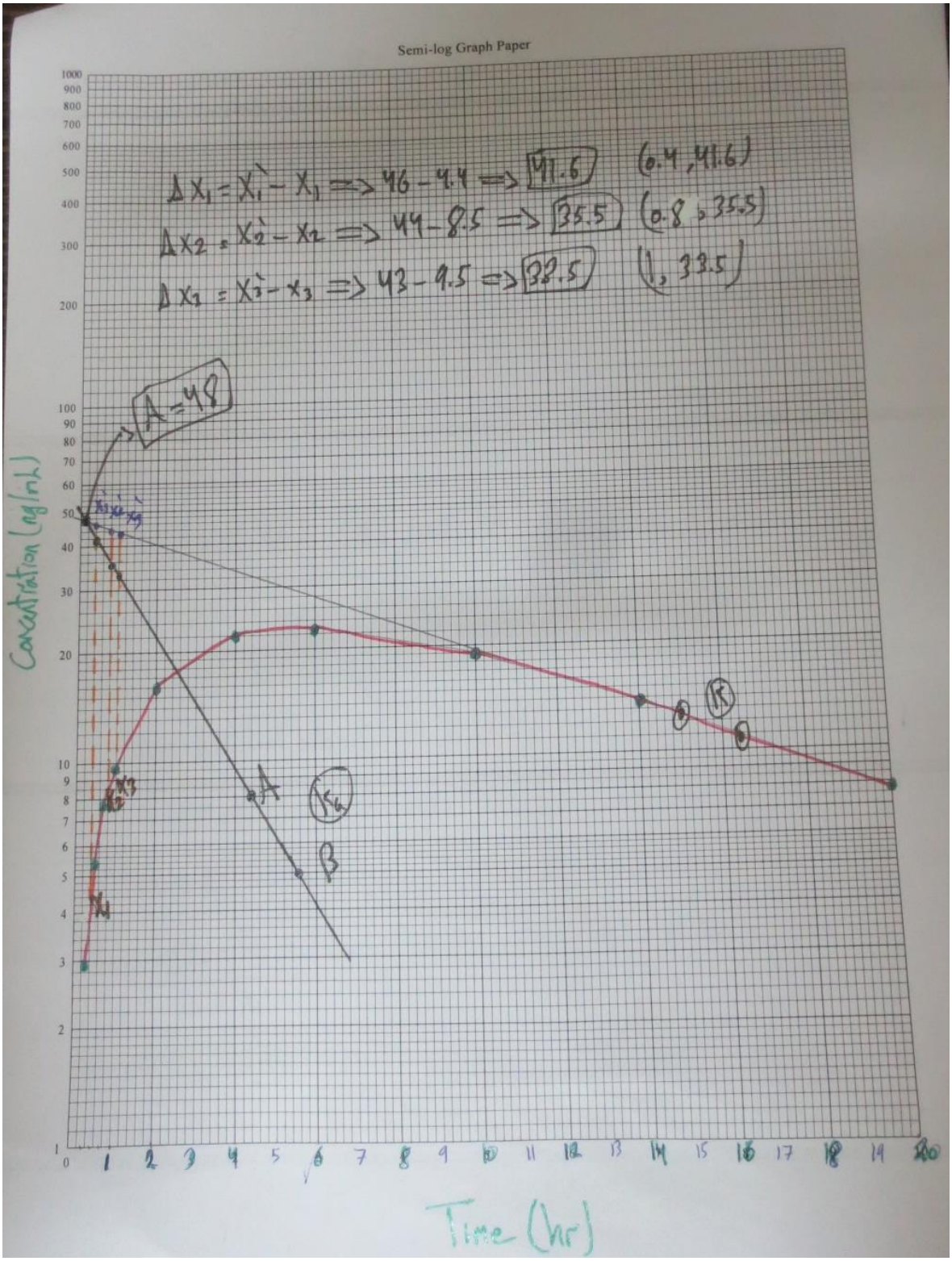
(f) $A = \frac{F k_a D_o}{V_D (k_a - k)}$, where $F = 1$, $k_a = 0.34\ h^{-1}$, $k = 0.103\ h^{-1}$, $D_o =$ 1 mg, $A = 48$ mg/ml

$V_D = \frac{F \times k_a \times D_o}{A (k_a - k)} \Rightarrow \frac{1 \times 0.34\ h^{-1} \times 10 \times 10^{-6}\ mg}{48\ mg/ml\ (0.34\ h^{-1} - 0.103\ h^{-1})} = \frac{3.4 \times 10^{-6}}{11.376}$

$\Rightarrow 0.298 \times 10^{-6}$ ml $\Rightarrow$ 299 l

1 l = 10^3 ml

$V_D = 299$ l


Semi-log Graph Paper
$\Delta X_1 = X_1' - X_1 \Rightarrow 46 - 4.4 \Rightarrow 41.6$ (0.4, 41.6)
$\Delta X_2 = X_2' - X_2 \Rightarrow 44 - 8.5 \Rightarrow 35.5$ (0.8, 35.5)
$\Delta X_3 = X_3' - X_3 \Rightarrow 43 - 9.5 \Rightarrow 33.5$ (1, 33.5)
A = 48
Concentration (ng/mL)
Time (hr)
A
B