Homework 5

1. Given the following equation give the portion which represents (1.5 pts)

$$C\min = \frac{Dose}{Vd} * \left(\frac{1}{1 - e^{-ke*tau}} \right) * e^{-ke*t}$$

A. The Cmax
B. The accumulation factor
C. Elimination

A=Dose/Vd
B=1/(1-e^(-ke*tau))
C=e^(-ke*t)

2. Drug X was given via IV bolus. The pharmacokinetics of Drug X can be described by linear one-compartment model. Volume of distribution of this drug is 18 L, and its half-life is 4 hr. If AB was administrated this drug twice a day (BID).

A. Calculate the accumulation factor at steady state (1pt).

ke= 0.693/T1/2=0.693/4= 0.173/hr
Rss=1/(1-e^(-ke*12)=1/(1-e^(-0.173*12))=1.14

B. Calculate the average concentration for a dose of 500 mg (1pt).

Cpss=D/(CL*τ)=D/(ke*Vd*τ)=500mg/(0.173hr^{-1}*18L*12hr)=13.36mg/L

C. Calculate the maximum and minimum plasma concentrations (C_{max}, C_{min}) in the body at steady state if dose of 500mg (2pts).

Cmax=D/Vd*Rss=500/18*1.14=24.37 mg/L
Cmin=Cmax*e^(-ke*τ)=24.37mg/L*exp(-0.173*12)=3.06 mg/L

3. A 60-kg patient is to be started on a continuous intravenous infusion. To achieve an immediate effect, a loading dose is administered as an IV bolus. The continuous infusion is started immediately after the loading dose. The desired average steady state concentration is 15mg/L. The volume of distribution 30L and the clearance is 7 L/hr.

A. Calculate the loading dose (1pt).

Loading dose=Concentration*Vd=15mg/L*30L=450mg

B. Calculate the maintance dose (infusion rate) (1pt).

R0=Concentration*CL=15mg/L*7L/hr=105mg/hr

C. How long until steady state is reached? (0.5pt)

Steady state=5 half-lives=5*(0.693/(Cl/Vd))=5*(0.693/(7L/hr/30L))=14.85hr

D. The patient remains on the constant infusion for 5 days and it is then stopped. Predict the concentration 5 hours after the infusion is stopped (1pt).

Once the infusion has stopped, the concentration at any given time can be calculated using the iv bolus equation.

Css=R0/CL=105mg/hr/7L/hr=15mg/L
C=C0*e^(-ke*t)=15mg/L*e(-7L/hr/30L*5hr)=4.67mg/L

E. It is decided that the infusion should be restarted when the concentration equals 2mg/L. How long after the stop of the infusion should it be restarted (1pt)?

C=C0*e^(-ke*t)= Ln(C/C0)=-ke*t Ln(C/C0)/-ke=t
Ln(2mg/L/15mg/L)/-(7L/hr/30L)=8.63hr