1. K.L., a 51-year-old, 70-kg man, was admitted to the coronary care unit with a diagnosis of heart failure, probable myocardial infarction. Calculate a bolus dose that achieves lidocaine plasma level of 4 mg/L which should achieve an immediate response.
(Note: Lidocaine is available as lidocaine hydrochloride).
Calculate a maintenance infusion rate of that will achieve a steady-state lidocaine concentration of 4 mg/L. (2 points)

\[
V_c = 0.3 \text{ L/kg} \times 70 \text{ kg} = 21 \text{ L}
\]

\[
LD = \frac{V_c \cdot C_{\text{max,desired}}}{S} = \frac{21 \text{ L} \times \frac{4 \text{ mg}}{L}}{0.87} = 96.6 \text{ mg}
\]

\[
MD = \frac{CL \cdot C_{\text{ss,average}}}{S} = \frac{(0.36 \frac{L}{h \cdot kg} \times 70 \text{ kg}) \times \frac{4 \text{ mg}}{L}}{0.87} = 115.9 \text{ mg/h}
\]
2. A 34 year old male patient weighing 68 kg, has been taking uncoated (rapidly absorbed) *theophylline* tablets, 200 mg q6h, with satisfactory response. Recently, steady-state theophylline plasma concentrations were determined to be 20.0 mg/L 30 minutes after administration (peak) and 10.0 mg/L 6 hours after administration (trough). Please estimate the average steady-state theophylline concentration with this regimen. (For this case, assume that F=1.) (2 points)

\[
\text{k_e} = \frac{\ln C_1 - \ln C_2}{t_2 - t_1} = \frac{\ln 20 - \ln 10}{6\ h - 0.5\ h} = \frac{0.693}{5.5\ h} = 0.126\ h^{-1}
\]

\[
C_1 = \frac{D}{V_d} \times \frac{1}{1 - \exp(-k_e \tau)} \times e^{k_e t_1}
\]

\[
20\ mg/L = \frac{200\ mg}{V_d} \times \frac{1}{1 - \exp(-0.126 \times 6)} \times e^{-0.126 \times 0.5}
\]

\[\Rightarrow V_d = 17.7\ L\]

\[
CL = k_e \times V_d = 0.126\ h^{-1} \times 17.7\ L = 2.23\ L/h
\]

\[
C_{ss} = \frac{D \times F}{\tau \times CL} = \frac{200\ mg \times 1}{6\ h \times 2.23\ L/h} = 14.9\ mg/L
\]
3. E.W. is a 72 years old, 69 kg male with serum creatinine of 1.2 mg/dL. He is treated with procainamide because of tachyarrhythmia. Calculate the half-life of procainamide in this patient. (Vd = 2 L/kg) (2.5 points)

\[ CL_{Cr} = \frac{(140 - \text{age}) \times \text{BW}}{\text{CpCr} \times 72} = \frac{(140 - 72) \times 69}{1.2 \times 72} = 54.3 \text{ mL/min} = 3.26 \text{ L/h} \]

\[ CL_{\text{renal}} = 3 \times CL_{Cr} = 3 \times 3.26 \text{ L/h} = 9.78 \text{ L/h} \]

\[ CL_{\text{acetylation}} = 0.13 \times \text{BW} = 0.13 \times 69 = 8.97 \text{ L/h} \]

\[ CL_{\text{other}} = 0.1 \times \text{BW} = 0.1 \times 69 = 6.9 \text{ L/h} \]

\[ CL_{\text{total}} = CL_{\text{renal}} + CL_{\text{acetylation}} + CL_{\text{other}} = 9.78 + 8.97 + 6.9 = 25.65 \text{ L/h} \]

\[ Vd = 2 \text{ L/kg} \times 69 \text{ kg} = 138 \text{ L} \]

\[ k_e = \frac{CL}{Vd} = \frac{25.65 \text{ L/h}}{138 \text{ L}} = 0.186 \text{ h}^{-1} \]

\[ t_{1/2} = \frac{\ln 2}{k_e} = \frac{0.693}{0.186 \text{ h}^{-1}} = 3.73 \text{ h} \]
4. A liver transplant patient at Shands hospital has been treated with IV infusion of 250 mg/day of **cyclosporine** for a certain time. His plasma concentration at steady state is 200 ng/mL. Since he is doing fine, the physician would like to change IV infusion to orally administration and decrease the desired steady state concentration by 10%. What is the reasonable dose for oral treatment? (The bioavailability of oral cyclosporine is 0.3) (1.5 points)

\[
Dose_{\text{new}} = \frac{C_{\text{ss,desired}}}{C_{\text{ss, current}}} \times \frac{F_{\text{current}}}{F_{\text{new}}} \times Dose_{\text{current}}
\]

\[
= \frac{200 \times 90\%}{200} \times \frac{1}{0.3} \times 250 \text{ mg/day}
\]

\[
= 750 \text{ mg/day}
\]
5. L.T. is a 27 years old, 51 kg female patient receiving aminophylline with maintenance infusion rate of 25 mg/h (S=0.8). Her theophylline level is 10 mg/L. However, she needs to take ciprofloxacin at the same time (Factor=0.7). What is the maintenance infusion rate to keep the same theophylline level? (2 points)

\[
\text{CL}_{\text{old}} = \frac{S \times F \times D}{C_{SS} \times \tau} = \frac{0.8 \times 1 \times 25 \text{ mg} \text{ h}^{-1}}{10 \text{ mg} \text{ L}^{-1}} = 2 \text{ L/h}
\]

\[
\text{CL}_{\text{new}} = \text{CL}_{\text{old}} \times 0.7 = 2 \text{ L/h} \times 0.7 = 1.4 \text{ L/h}
\]

\[
\text{MD} = \frac{D}{\tau} = \frac{\text{CL}_{\text{new}} \times C_{SS}}{S \times F} = \frac{1.4 \text{ L} \times 10 \text{ mg} \text{ L}^{-1}}{0.8 \times 1} = 17.5 \text{ mg/h}
\]