1. A 75 kg patient is to be treated p.o. with sodium phenytoin capsules. Assuming a phenytoin volume of distribution of 0.7 L/kg, Km of 4 mg/L and Vmax of 7 mg/kg/day, calculate the following:
   a. The loading dose to produce an initial concentration of 18 mg/L. How would you administer this dose? (1 pt)
   b. The daily maintenance dose to produce an average steady state concentration of 15 mg/L. (1 pt)

   a. 
   \[ V_d = 0.7 \text{L/kg} \cdot 75 \text{kg} = 52.5 \text{L} \]
   \[ LD = \frac{C_p \cdot V_d}{S \cdot F} = \frac{18 \text{mg/L} \cdot 52.5 \text{L}}{0.92 \cdot 1} = 1027.17 \text{mg} \approx 1000 \text{mg} \]

   The dose is given as a 400mg dose, followed by two 300mg doses at two-hour intervals to decrease the possibility of nausea and vomiting which may be associated with a single large dose. (note: if student approximate salt factor to 1 is ok too, the answer would be slightly different)

   b. 
   \[ MD = \frac{V_m \cdot C_{pss} \cdot \tau}{(K_m + C_{pss}) \cdot S \cdot F} = \frac{7 \text{mg/kg/day} \cdot 15 \text{mg/L}}{(4 \text{mg/L} + 15 \text{mg/L}) \cdot 0.92 \cdot 1} = 450.51 \text{mg} \approx 450 \text{mg} \]

2. A phenytoin patient has a plasma concentration of 10mg/L at 300mg/day and 25mg/L at 400mg/day. Using graph paper, determine the Km and Vmax as well as the dose needed to produce a concentration of 15mg/L. (2 pts)
Dose needed to produce a concentration of 15mg/L ⇒ 350mg/day

3. A patient (35 years old, 65 kg) is to be started on intravenous phenobarbital sodium. The therapeutic range is 10-30 mg/L. A loading dose is given so as to yield a $C_p_0$ of 30 mg/L. Calculate this loading dose and the daily maintenance dose to produce an average steady state concentration of 20 mg/L. (2 pts)

$$LD = \frac{C_p \cdot V_d}{S \cdot F} = \frac{30 \text{mg/L} \cdot 0.7 \text{L/kg} \cdot 65 \text{kg}}{0.9 \cdot 1} = 1517 \text{mg} \approx 1.5 \text{g}$$

$$MD = \frac{C_p \cdot C_l \cdot \tau}{S \cdot F} = \frac{20 \text{mg/L} \cdot 0.1 \text{L/kg/day} \cdot 65 \text{kg} \cdot 1 \text{day}}{0.9 \cdot 1} = 144 \text{mg}$$

(Note: if student approximate salt factor to 1 is ok too, the answer would be slightly different)

4. C.S., a 10-year-old, 28 kg female, is receiving valproic acid sprinkles 250 mg (2x125mg) po Q 8 hr for her seizure disorder. Calculate her valproic acid level at steady state. (2 pts)

$$C_l = (13 \text{mL/kg/hr})(28 \text{kg}) = 364 \text{mL/hr} \text{ or } 0.364 \text{L/hr}$$

$$C_{pss \text{ ave}} = (1)(1)(250 \text{mg/8hr})/(0.364 \text{L/hr}) = 85.85 \text{ mg/L}$$

5. M.W. is a 50-year-old, 70kg male with glomerular nephritis. His creatinine clearance is reasonably good, but he has a serum albumin concentration of 2.2g/dL. M.W. is receiving 350mg/day of phenytoin and has a steady-state
phenytoin concentration of 6mg/L. What would be his phenytoin concentration be if his serum albumin concentration were normal? (normal serum albumin=4.4g/dL). (2 pts)

\[ C_{p_{normal}} = \frac{C_p'}{(1-\alpha) \cdot \frac{\text{Patient's Albumin}}{\text{Normal Albumin}}} + 0.1 = \frac{6 \text{mg/L}}{(1-0.1) \cdot \frac{2.2 \text{g/dL}}{4.4 \text{g/dL}}} + 0.1 = 10.9 \text{mg/L} \]