PHARMACY 324

PHARMACOKINETICS

EXAMINATION FORMULA SHEET

BUDGET YOUR TIME! WATCH THE VALUE OF THE QUESTIONS!

PLEASE PLACE YOUR NAME ON EACH PAGE

Please read the ensuing examination questions and data provided carefully before attempting any calculations. **Show all your calculations**. All mathematical calculations should be written and organized in a logical, neat order. Double check all your answers where possible. If necessary, graph paper can be found at the back of this examination.

NOTE: 1. This exam is worth **35% of the final overall grade** in PHM 324.

2. The allotment of marks for each question is indicated beside each question.

3. Potential equations needed to answer the questions are found on the next pages. Graph paper, if needed, is found either in the body of the exam or at the back.

4. *This exam is designed to test your knowledge of pharmacokinetics and possibly even teach you about its use in problem situations. Some issues may be presented which were not specifically dealt with in lectures, but the context of the question should make their meaning clear.*

FACTS AND FIGURES:

Cardiac output (CO) = 85 mL/min/kg ideal body weight (IBW)
Normal hematocrit (H) = 0.45
Hepatic blood flow (Q_H) = 25% of cardiac output
Renal blood flow (Q_R) = 25% of cardiac output
Ideal body weight (kg) = X + (2.3 x inches over 5.0 ft) Males: X = 50 kg Females: X = 45.5 kg
Blood volume (L) = 8% of ideal body weight (IBW)
Body water (L) = 60% of ideal body weight (IBW)
BSA (m^2) = $\sqrt{[(W) \times (H) / (3600)]}$ [W = kg; H = cm]
% Fat = 90 - 2 (Height - Girth) [Height = inches; Girth = inches]
Lean body mass (LBM) = Total weight - Fat weight
Urine production rate = 0.0143 mL/min/kg ideal body weight [for normal kidneys]
1 in = 2.54 cm

WHERE IT APPEARS NECESSARY,
STATE YOUR ASSUMPTIONS WHEN ANSWERING A QUESTION.
IF SUCH ASSUMPTIONS ARE VALID THEY WILL BE CONSIDERED IN THE GRADING.

Last revised: December 2007

Potential equations for this examination:

$$ER_h = \frac{Cl\,int_h}{Cl\,int_h + Q_h}$$

$$C = \frac{R^o}{Cl_t}\left[1 - e^{-k*t}\right]$$

$$C\max_{ss} = \frac{C\max^1}{\left(1 - e^{-k*\tau}\right)}$$

$$C = \frac{ka * F * Dose}{V * (ka - k)}\left[e^{-k*t} - e^{-ka*t}\right]$$

$$AUC = \frac{A}{\alpha} + \frac{B}{\beta}$$

$$Cm = \frac{km * Dose}{Vm * (kme - k)}\left[e^{-k*t} - e^{-kme*t}\right]$$

$$E = \frac{E\max * C^n}{EC_{50}{}^n + C^n}$$

$$E = E^o - \frac{s * k * t}{2.303}$$

$$Ae^t = Dose * \left[\frac{ke}{k}\left(1 - e^{-k*t}\right)\right]$$

$$MRT = \frac{AUMC}{AUC}$$

$$AUMC_{o-\infty} = AUMC_{o-t} + \frac{t * C_{last}}{x} + \frac{C_{last}}{x^2}$$

$$\frac{dAe}{dt} = ke * A_1 = ke * V_1 * C_1$$

$$A = \frac{Dose * (k_{21} - \alpha)}{V_1 * (\beta - \alpha)}$$

$$k_{10} = \frac{\alpha * \beta}{k_{21}}$$

$$t_{max} = \frac{\ln\left[\frac{ka}{k}\right]}{ka - k}$$

$$V = \frac{R^o}{k}\left[\frac{\left(1 - e^{-k*t'}\right)}{C\max^1 - C\min^1 * e^{-k*t'}}\right]$$

$$B = \frac{Dose * (k_{21} - \beta)}{V_1 * (\alpha - \beta)}$$

$$Vss = \frac{Dose * AUMC}{AUC^2} = V_1 * \left(1 + \frac{k_{12}}{k_{21}}\right)$$

$$Clr = \left[fu * GFR + \frac{Q_r * fu * Cl\,int_{u,r}}{Q_r + fu * Cl\,int_{u,r}}\right] * [1 - FR]$$

$$E = s * [\log_{10} - constant]$$

$$C = \frac{ka * F * Dose}{V * (ka - k)} * \left[\frac{\left(1 - e^{-n*k*\tau}\right)}{\left(1 - e^{-k*\tau}\right)} * e^{-k*t} - \frac{\left(1 - e^{-n*ka*\tau}\right)}{\left(1 - e^{-ka*\tau}\right)} * e^{-ka*t}\right]$$

$$\alpha + \beta = k_{12} + k_{21} + k_{10}$$

$$V_{ss} = V_1(1 + (k_{12}/k_{21}))$$

$$k_{12} = \alpha + \beta - k_{21} - k_{10}$$

$$\mathbf{k}_{21} = \frac{\mathbf{A} * \beta + \mathbf{B} * \alpha}{\mathbf{A} + \mathbf{B}}$$

$$\tau = -\frac{1}{\mathbf{k}} * \ln\left[\frac{\mathbf{C}\min_{\mathbf{ss}}}{\mathbf{C}\max_{\mathbf{ss}}}\right] + \mathbf{t'}$$

$$\mathbf{C}_{\min} = \mathbf{C}_{\mathbf{initial}} * \mathbf{e}^{-\mathbf{k}*\mathbf{tdur}}$$

$$\mathbf{R^o} = \mathbf{k} * \mathbf{V} * \mathbf{C}\max_{\mathbf{ss}} * \left[\frac{\left(1 - \mathbf{e}^{-\mathbf{k}*\tau}\right)}{\left(1 - \mathbf{e}^{-\mathbf{k}*\mathbf{t'}}\right)}\right]$$

$$\mathbf{Vd} = 7.2 + 7.8 * \mathbf{fu} + 30 * \left[\frac{\mathbf{fu}}{\mathbf{ft}}\right]$$

$$C = \frac{Dose}{V} e^{-k*t}$$

$$C = \frac{Dose}{V} \frac{\left(1-e^{-n*k*\tau}\right)}{\left(1-e^{-k*\tau}\right)} e^{-k*t}$$

$$C = \frac{Dose}{V} \frac{1}{\left(1-e^{-k*\tau}\right)} e^{-k*t}$$

$$C = \frac{ka*F*Dose}{V*(ka-k)} \left[e^{-k*t} - e^{-ka*t}\right]$$

$$C = \frac{ka*F*Dose}{V*(ka-k)} \left[\frac{\left[1-e^{-n*k*\tau}\right]}{\left[1-e^{-k*\tau}\right]} e^{-k*t} - \frac{\left[1-e^{-n*ka*\tau}\right]}{\left[1-e^{-ka*\tau}\right]} e^{-ka*t}\right]$$

$$C = \frac{ka*F*Dose}{V*(ka-k)} \left[\frac{1}{\left[1-e^{-k*\tau}\right]} e^{-k*t} - \frac{1}{\left[1-e^{-ka*\tau}\right]} e^{-ka*t}\right]$$

$$C = A*e^{-\alpha*t} + B*e^{-\beta*t}$$

$$C = \frac{Dose * (k_{21} - \alpha)}{V_1 * (\beta - \alpha)} * e^{-\alpha * t} + \frac{Dose * (k_{21} - \beta)}{V_1 * (\alpha - \beta)} * e^{-\beta * t}$$

$$C = \frac{Dose * (k_{21} - \alpha)}{V_1 * (\beta - \alpha)} * \frac{[1 - e^{-n * \alpha * \tau}]}{[1 - e^{-\alpha * \tau}]} e^{-\alpha * t} + \frac{Dose * (k_{21} - \beta)}{V_1 * (\alpha - \beta)} * \frac{[1 - e^{-n * \beta * \tau}]}{[1 - e^{-\beta * \tau}]} e^{-\beta * t}$$

$$C = \frac{Dose * (k_{21} - \alpha)}{V_1 * (\beta - \alpha)} * \frac{1}{[1 - e^{-\alpha * \tau}]} e^{-\alpha * t} + \frac{Dose * (k_{21} - \beta)}{V_1 * (\alpha - \beta)} * \frac{1}{[1 - e^{-\beta * \tau}]} e^{-\beta * t}$$

$$C = \frac{ka * F * Dose * (k_{21} - ka)}{V_1 * (\alpha - ka) * (\beta - ka)} e^{-ka * t} + \frac{ka * F * Dose * (k_{21} - \alpha)}{V_1 * (ka - \alpha) * (\beta - \alpha)} e^{-\alpha * t} + \frac{ka * F * Dose * (k_{21} - \beta)}{V_1 * (ka - \beta) * (\alpha - \beta)} e^{-\beta * t}$$

$$C = \frac{ka * F * Dose * (k_{21} - ka)}{V_1 * (\alpha - ka) * (\beta - ka)} * \frac{[1 - e^{-n * ka * \tau}]}{[1 - e^{-ka * \tau}]} e^{-ka * t} + \frac{ka * F * Dose * (k_{21} - \alpha)}{V_1 * (ka - \alpha) * (\beta - \alpha)} * \frac{[1 - e^{-n * \alpha * \tau}]}{[1 - e^{-\alpha * \tau}]} e^{-\alpha * t} + \frac{ka * F * Dose * (k_{21} - \beta)}{V_1 * (ka - \beta) * (\alpha - \beta)} * \frac{[1 - e^{-n * \beta * \tau}]}{[1 - e^{-\beta * \tau}]} e^{-\beta * t}$$

$$C = \frac{ka * F * Dose * (k_{21} - ka)}{V_1 * (\alpha - ka) * (\beta - ka)} * \frac{1}{[1 - e^{-ka * \tau}]} e^{-ka * t} + \frac{ka * F * Dose * (k_{21} - \alpha)}{V_1 * (ka - \alpha) * (\beta - \alpha)} * \frac{1}{[1 - e^{-\alpha * \tau}]} e^{-\alpha * t} + \frac{ka * F * Dose * (k_{21} - \beta)}{V_1 * (ka - \beta) * (\alpha - \beta)} * \frac{1}{[1 - e^{-\beta * \tau}]} e^{-\beta * t}$$

$$CLcr = \frac{(140\text{-age}) \times IBW}{72 \times S_{CR}} \quad ; \quad \text{females} = * 0.85$$

$$\mathbf{fu} = 1 - \frac{n\,KA\,[P]}{1 + nKA[P] + KA[D]}$$

$$G = K_{uremic} / K_{normal} = 1 - fe\,\{1 - (CLcr_{uremic} / CLcr_{normal})\}$$

$$DOSE_{HI} = [(RL * \mathit{fm}) + \mathit{fe}\,)] * DOSE_{norm}$$

$$MD_{child} = 1.4 \times [S.A./\ 1.8\ m^2] \times MD_{adult}$$

$$CL = \frac{2K0}{C1 + C2} + \frac{2\,V\ \ (C1\text{-}C2)}{(C1 + C2)\,(t2 - t1)}$$

$$\frac{-\mathbf{dA_B}}{\mathbf{dt}} = \text{Rate In} = \frac{\mathbf{V}\max * \mathbf{Css}}{\mathbf{Km} + \mathbf{Css}}$$

$$\frac{\mathbf{R}}{\mathbf{Css}} = \frac{\mathbf{V}\max}{\mathbf{Km}} - \frac{\mathbf{R}}{\mathbf{Km}}$$

$$CL_H = \frac{Q_h * CL_{int}}{CL_{int} + Q_h}$$

$$CL_{int} = \frac{CL_H * Q_h}{(Q_h - CL_H)}$$