What percent of a weak base (pK_a = 7.5) and weak acid (pK_a = 3.5) will be respectively ionized in urine of pH 5.5?

a. 1% and 1%
b. 9% and 91% 50% and 50%
c. 91% and 9%
d. 99% and 99%

\[
\text{pH} - \text{pK}_a = \log \text{Base/Acid} \\
\text{[Acid]} \; 5.5 - 3.5 = 2 \log 100 = 2 \; \text{A} / \text{HA} = 100/1 \]
\[
\text{[Base]} \; 5.5 - 7.5 = -2 \log .01 = -2 \; \text{B} / \text{BH}^+ = 1/100
\]

Select the route of administration that will produce the slowest onset of drug action, most rapid onset of action and a first-pass liver effect

a. oral  Major first pass effect
b. intravascular  Most rapid onset
c. rectal  Slowest onset  Slight first pass effect
d. intramuscular

e. subcutaneous

Select the statements that are not true about the advantages and disadvantages of parenteral and enteral routes of drug administration.

a. enteral advantages: safe, economical, high bioavailability, rapid onset of action
b. enteral disadvantages: slow onset of action, low bioavailability, first pass liver effect, patient compliance
c. parenteral advantages: high bioavailability, fast onset of action, patient compliance safe economical
d. parenteral disadvantages: expensive, more dangerous, patient compliance first pass liver effect

Select the mechanism by which small water soluble agents, most lipophilic drugs and large molecular weight hormones cross membranes.

a. filtration  Small water solubles
b. active transport
c. facilitated transport
d. passive diffusion  Most lipophilic drugs [major mechanism]
e. receptor mediated endocytosis  Large MW hormones
Which of the following statements is not true about sublingual drug administration?

a. by-pass portal circulation  

b. rapid onset of drug action  

c. excellent method of administering nitroglycerin and epinephrine  

d. good method for administering many drugs  

e. difficult to hold drugs here for significant periods of time

Select the body water compartments that represent 60%, 40%, 20%, 16% and 4% of an individual's total body weight.

a. total body water 60%  

b. extracellular water 20%  

c. intracellular water 40%  

d. plasma water 4%  

e. interstitial water 16%

Thiopental has a ____ duration of action because this agent is _____.

a. short, rapidly excreted  

b. long, slowly excreted  

c. long, slowly metabolized  

d. short, rapidly redistributed  

e. short, rapidly metabolized  

f. long, slowly redistributed

Phenobarbital poisoning is treated with _____ to increase the extracellular pH and increase the clearance of phenobarbital.

a. ammonium chloride decrease  

b. ammonium chloride increase  

c. sodium bicarbonate increase  

d. sodium bicarbonate decrease  

e. sodium hydroxide decrease

The distribution of drugs to the brain is limited as a result of _______.

a. blood-brain barrier  

b. blood-CSF barrier  

c. blood-extracellular barrier  

d. brain-CSF barrier  

e. blood-intracellular barrier

Select the agent that can produce fetal abortion, malformation, retardation, withdrawal and vaginal cancer later in life.

a. cocaine  

b. ethanol  

c. thalidomide  

d. morphine  

e. diethylstilbesterol  

Fetal abortion  

Malformation  

Retardation  

Withdrawal  

Vaginal adenocarcinoma in late life
Which of the following statements is not true about the interaction between chronic alcohol intake and acetaminophen (Tylenol).

a. Alcohol induces the hepatic metabolism of acetaminophen. True
b. Alcohol potentiates the hepatotoxicity of acetaminophen. True
c. Therapeutic levels of acetaminophen can produce liver damage in alcoholics. True
d. Liver damage can be reduced with the administration of N-acetylcysteine. True
e. The combination of alcohol and acetaminophen is not toxic in most alcoholics. False

All of the following drugs or conditions induce drug metabolism except ________?

a. phenobarbital 

b. smoking 

c. chronic alcohol intake 

d. phenytoin 

e. cimetidine 

f. rifampin 

g. chloramphenicol

All of the following drugs or conditions inhibit drug metabolism except ________?

a. aging 

b. liver disease 

c. cimetidine 

d. chloramphenical 

e. acute alcohol intake 

f. charcoal broiled food 

g. testosterone 

h. newborn 

From the list below select an agent that produces liver injury in slow acetylators and one that produces respiratory depression in patients with decreased plasma cholinesterase activity.

a. chloramphenicol 

b. cimetidine 

c. succinylcholine Plasma cholinesterase activity 

d. aspirin 

e. phenobarbital 

None of these produce liver injury in slow acetylators (the antitubercular drug isoniazid produces liver injury in slow acetylators)

Select the P450 induced by ethanol, smoking, phenobarbital, isoniazid and rifampin.

a. 2E1 Induced by ethanol and isoniazid

b. 1A2 Induced by smoking and charbroiled foods

c. 2B6 Induced by phenobarbital and rifampin

d. 3A4 Induced by phenobarbital and rifampin

Select the one agent that is not found in the urine after the administration of aspirin.

a. salicylic acid 

b. salicyluric acid 

c. ether glucuronide of salicylic acid 

d. ester glucuronide of salicylic acid 

e. salicylacetic acid
Drug clearance is decreased by all of the following except _______.

- a. aging
- b. newborn
- c. liver disease
- d. kidney disease
- e. heart disease
- f. smoking
- g. phenobarbital

Kidney function can be assessed by determining the glomerular filtration rate (GFR) and the renal plasma flow (RPF) by measuring the clearance of _______.

- a. creatinine and inulin
- b. para-aminophenyl acid (PAH) and probenecid
- c. inulin and PAH
- d. creatinine and probenecid
- e. inulin and probenecid
- f. creatinine and PAH

GFR = creatinine or inulin

Renal plasma flow = PAH

When renal drug clearance is greater than the GFR the drug is primarily _______ by the nephron.

- a. secreted
- b. reabsorbed
- c. filtered
- d. filtered, secreted and reabsorbed

Which of the following drugs are readily cleared as they pass through the liver?

- a. propranolol
- b. lidocaine
- c. morphine
- d. tolbutamide
- e. phenobarbital

These drugs are all high extraction, high intrinsic clearance, subject to high first pass effect, flow-limited

Select the agent that can be used to reduce the enterohepatic cycling of drugs.

- a. propranolol
- b. cholestyramine
- c. morphine
- d. steroids
- e. phenobarbital

Bile acid binding resin (sequestrant), binds tightly to bile acid and carries it out in feces, reduced enterohepatic cycling of bile acids, drugs, lipid soluble vitamins, common source of drug interaction

Nitrous oxide has a _______ λ, a _______ duration of action and a _______ rate of clearance.

- a. high, long, low
- b. low, short, rapid
- c. high, short, rapid
- d. low, long, low
- e. high, long, high
Select the agents that would be useful in reducing the high plasma uric acid levels associated with gout.

- a. probenecid
- b. aspirin
- c. cimetidine
- d. phenobarbital
- e. sodium bicarbonate

Both these agents block the carrier-mediated reabsorption of uric acid from glomerular filtrate in the proximal tubules of the kidney.

If a drug has a half-life of 6 hours how long will it take to clear 100% of this drug and how many doses given at half-life intervals will be needed to reach 94% of the Css?

- a. 42 h 4
- b. 30 h 6
- c. 48 h 5
- d. 24 h 7
- e. 36 h 3

\[ 7 \times \frac{1}{2} \times 6 \text{ hrs} = 42 \text{ hrs} \]

4 \times \frac{1}{2} = 94\% \text{ of } \text{Css}

42 \times 4 = 94\% \text{ of } \text{Css}

The time course of a drug's plasma plateau (Css) is altered by all of the following factors except ?

- a. liver disease
- b. kidney disease
- c. a loading dose followed by a maintenance dose at constant intervals
- d. induction of hepatic drug metabolism
- e. inhibition of hepatic drug metabolism
- f. change in dose interval
- g. change in dose level
- h. aging
- i. heart disease

Any factor that affects half life will affect the time course including

\[ t \frac{1}{2} = \frac{0.693 \times \text{Vd}}{\text{CL}} \]

The magnitude of a drug's plasma plateau (Css) is altered by all of the following factors except _?_

- a. change in dose interval
- b. change in dose level
- c. change in drug clearance
- d. change in drug bioavailability
- e. liver disease
- f. kidney disease
- g. aging
- h. heart disease
- i. route of drug administration

The dose of drug should be reduced in all of the following except _?_

- a. elderly patients
- b. infants
- c. liver disease
- d. kidney disease
- e. smokers
- f. alcoholics (without liver damage)

Possibly (can act as an inhibitor but it is also an inducer)
What drug dose must be given at half-life intervals to obtain a $C_{ss}$ of 300 mg?

- a. 50 mg
- b. 100 mg
- c. 150 mg
- d. 200 mg
- e. 300 mg

When $T = T_{1/2}$, accumulation factor is 2 such that at steady state, peak amount in body will be 2D, trough amount in body will be 1D and the average in the body will be 1.5D.

For $D = 200$ mg,

<table>
<thead>
<tr>
<th>Dose</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>100</td>
<td>150</td>
<td>350</td>
<td>400</td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>

The desired $C_{ss}$ of drug X is 300 mg. Eight hours after administering a single 300 mg dose of drug X there is only 75 mg of drug X remaining in the patient. What loading dose (LD), maintenance dose (MD) and dose interval (DI) would you recommend to reach and maintain the 300 mg $C_{ss}$ as quickly as possible?

- a. 400 mg 200 mg 4 h
- b. 600 mg 300 mg 4 h
- c. 300 mg 300 mg 8 h
- d. 400 mg 200 mg 8 h
- e. 600 mg 300 mg 8 h

After 8 hr, 25% remains. 2 half lives have passed $T_{1/2} = 4$ hrs.

A 400 mg dose of drug X is administered to a 220 pound man. The peak plasma level ($C_p$) of drug X is 1 mg/L. The $V_d$ of drug X is _______.

- a. 4 L
- b. 40 L
- c. 400 L
- d. 25 L
- e. 250 L

$V_d = Q / C_p = (400 \text{ mg}) / (1 \text{ mg/L}) = 400 \text{ L}$

$V_d >> \text{ TBW} (0.6 \times 100 \text{ Kg}) = 60 \text{ L}$, much of drug outside blood compartment.

The pharmacokinetic characteristics of drug X are:

- Bioavailability (oral) 1
- % urinary excretion 100
- Clearance (L/h/Kg) $0.1 \times 100 \text{ Kg} = 10 \text{ L/h}$
- Volume of distribution (L/Kg) $1 \times 100 \text{ Kg} = 100 \text{ L}$
- MEC 1 mg/L
- MTC 5 mg/L

This drug is primarily cleared by the ______ and follows ______ kinetics.

- a. kidney zero-order
- b. liver zero-order
- c. kidney first-order
- d. liver first-order
- e. liver and kidney mixed kinetics

% urinary excretion 100% 
Clearance $0.1 \text{ L/h/Kg} \times 100 \text{ Kg} = 10 \text{ L/h}$

If it was zero order, clearance would not be stated as constant.

The patient that you are administering drug X to is a 220 pound male with normal kidney function. Answer the following 4 questions. [2.2 pounds = 1 Kg] 220 pounds $= 100 \text{ Kg}$

What would be an appropriate plasma target level ($C_{ss}$ and $C_p$) for drug X?

- a. 1 mg/L
- b. 2 mg/L
- c. 3 mg/L
- d. 4 mg/L
- e. 5 mg/L

- MEC 1 mg/L
- MTC 5 mg/L

If it was zero order, clearance would not be stated as constant.
Calculate a loading dose that would produce the appropriate Css.

a. 100 mg
b. 200 mg
c. 300 mg
d. 400 mg
e. 500 mg

\[ LD = V_d \times C_p \]
\[ LD = (100 \text{ L} \times 3 \text{ mg/L}) = 300 \text{ mg} \]

Calculate the 4 h maintenance dose that would maintain the appropriate Css.

a. 60 mg
b. 120 mg
c. 80 mg
d. 160 mg
e. 200 mg

\[ Css = \frac{F \times D}{CL \times T} \]
\[ MD = \frac{Css \times CL \times T}{F} \]
\[ MD = \frac{3 \text{ mg/L} \times 10 \text{ L/hr} \times 4 \text{ hr}}{1} = 120 \text{ mg} \]

The renal clearance of drugs that are weak acids and bases will be increased respectively by?

a. sodium bicarbonate and ammonium chloride
b. ammonium chloride and sodium bicarbonate
c. amphetamine and aspirin
d. antacids and phenobarbital
e. aspirin and antacids
f. probenecid and amphetamine

For weak acid, to ionize, alkalinize (promotes formation of A-)
For a weak base, to ionize, acidify (promotes formation of BH+)

The absorption of tetracyclines and quinolones is reduced by all of the following except?

a. antacids
b. milk
c. iron

d. sodium
e. magnesium

Divalent cation decrease the absorption of these two classes of antimicrobials

If one wants to maintain a higher plasma level of drugs such as methotrexate or penicillin that are readily secreted by the kidney then one should administer which of the following agents?

a. aspirin
b. probenecid
c. atropine
d. cimetidine
e. chloramphenicol
f. phenobarbital

Administer a drug that can compete for tubular secretion, same class as methotrexate or penicillin (acids), salicylic acid and probenecid are acids

Bilirubin [kernicterus], tolbutamide [hypoglycemia] and dicumarol [hemorrhage] are readily displaced from plasma albumin by all of the agents listed below except?

a. aspirin
b. phenobarbital
c. sulfonamide
d. salicylates
e. cimetidine
Which of the following statements are true about epinephrine?

a. prolongs the duration of action of local anesthetics
b. interacts with imipramine to increase blood pressure
c. increases capillary blood flow
d. decreases blood pressure
e. is a vasodilator