

Directions: Select the **SINGLE** best choice

4. For patients spontaneously breathing inhalational anesthetic agents, which statement is **FALSE**?

- halothane*
- A. Desflurane causes dose-dependent elevation of PaCO₂. *?*
 - B. Isoflurane causes reduced systemic vascular resistance. *T*
 - C. The sympathomimetic effects of nitrous oxide can obscure myocardial depression. *T*
 - D. Halothane is associated with an increased incidence of ventricular arrhythmias. *T*
 - E. Decreased minute ventilation occurs primarily due to decreased respiratory rate.

5. Which anesthetic agent listed below has rapid recovery, can be used for both general anesthesia and long-term sedation, and has an anti-emetic effect?

- Rapid Recovery*
- A. etomidate
 - B. propofol
 - C. thiopental
 - D. midazolam
 - E. ketamine

6. Which reaction(s) is/are **NOT** considered a phase II or synthetic reaction?

- A. glucuronidation
- B. sulfation
- C. acetylation
- D. hydroxylation
- E. None of the above (all are phase II or synthetic reactions)

7. Drug metabolic pathways

- ?*
- A. always lead to inactive metabolites. *F*
 - B. are only contained in the liver. *F*
 - C. always involve the cytochrome P450 oxidase enzymes. *F*
 - D. are irrelevant when considering therapeutic options. *F*
 - E. are also used to metabolize certain endogenous compounds.

8. A 55 year-old man has recently suffered a heart attack. You advise him to stop drinking grapefruit juice because you have begun which medication?

- A. aspirin (acetylsalicylic acid)
- B. lovastatin (an Hmg-CoA reductase inhibitor or statin)
- C. timolol (a beta blocker)
- D. fluoxetine (Prozac[®], a selective serotonin reuptake inhibitor or SSRI)
- E. procainamide (an antiarrhythmic agent)

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9. Lopinavir, a protease inhibitor used in treating patients with HIV infection, is metabolized by CYP3A4 in the liver. Which of the following drugs is **MOST LIKELY** to raise circulating lopinavir levels if co-administered?

inhibit 3A4

⊙

7

0

- A. rifampin (an antimycobacterial) *Induces*
- B. ethanol
- C. itraconazole (a triazole antifungal) ✓
- D. phenytoin (Dilantin[®], an antiepileptic) *Strongly induces*
- E. ciprofloxacin (a fluoroquinolone antibiotic)

10. Genetic polymorphisms in CYP2D6 and CYP2C19 (two cytochrome P450 oxidases) have been identified in human populations. Which of the following enzyme-drug pairs is **MOST LIKELY** to demonstrate a clinically significant interaction, especially in an Asian population?

2D6

2C19

- A. CYP2D6 and dextromethorphan (a cough suppressant)
- B. CYP2C19 and isoniazid (an antimycobacterial)
- C. CYP2C19 and omeprazole (a proton pump inhibitor)
- D. CYP2D6 and warfarin (Coumadin[®], coumarin, an anticoagulant)
- E. CYP2C19 and acetaminophen (Tylenol[®], an analgesic)

A
C
D
F
H
T

D
O
P

11. A 4 year-old child presents to your clinic with microcytic anemia, developmental delay, and abdominal pain. You suspect metal poisoning. Which of the following diagnostic-therapeutic combinations is **MOST** appropriate? *4-6 yr.*

- A. Chronic lead toxicity. Obtain blood lead levels and, if elevated, administer chelation therapy with BAL (dimercaprol), EDTA, or DMSA (succimer).
- B. Acute iron poisoning. Obtain an abdominal x-ray and, if pills are visualized, immediately administer chelation therapy with deferoxamine.
- C. Chronic iron overload. Obtain iron levels and, if elevated, begin weekly phlebotomy.
- D. Chronic mercury poisoning with an organic salt. Obtain mercury levels and, if elevated, administer chelation therapy with BAL (dimercaprol).
- E. Depleted uranium poisoning. Obtain uranium levels and, if elevated, alkalinize the urine.

12. Carbon monoxide

- A. interacts with and inactivates cytochrome oxidases throughout the body. F
- B. toxicity can be reversed by administration of sodium nitrite and sodium thiosulfate. F CN
- C. causes a "milk and roses" cyanosis on prolonged exposure. T?
- D. is treated primarily by generation of methemoglobin. F
- E. binds with much greater affinity to hemoglobin than does oxygen.

Milk
Rose?

Directions: Select the **SINGLE** best choice

13. Ethanol increases the likelihood of sensitivity to acetaminophen (Tylenol®) toxicity primarily by which of the following mechanisms?
- A. depletion of glutathione stores and direct toxicity
 - B. acute synergistic interactions altering brainstem function
 - C. induction of CYP2E1 and production of a toxic metabolite
 - D. activation of alcohol dehydrogenase and production of formaldehyde
 - E. induction of CYP3A4 leading to increased toxic glucuronide metabolites
14. Chemical pneumonitis is the most feared complication following ingestion of
- A. kerosene. ^{CO}
 - B. arsenic.
 - C. methanol.
 - D. ethylene glycol.
 - E. *Amanita muscaria*.
15. Which of the following drugs, used to treat certain pediatric leukemias, can show marked variation in toxicity because of an easily identifiable defect in metabolism?
- A. benzene ✗
 - B. arsenic trioxide
 - C. 6-mercaptopurine or azathioprine
 - D. paraquat or diquat ✗
 - E. sparteine

16. In a 62 year-old woman with type I diabetes and hypertension, propranolol would reduce her blood pressure but may cause each of the following adverse reactions **EXCEPT**
- A. exacerbation of insulin-induced hypoglycemia. ^{True β → α₂}
 - B. slowing of A-V nodal conduction and A-V block. ^{β₁}
 - C. exacerbation of exercise-induced tachycardia. ^{β₂}
 - D. bronchoconstriction. ^{β₂}
 - E. decreased exercise performance. ^{β₂}

β Antagonist

Liver → α / β₂
 FAT → β₁ / β₃
 Pancreas → α₂
 Kidney → β₁

17. A 72 year-old woman with angina pectoris and glaucoma is treated with propranolol. In this patient propranolol is exerting its therapeutic effects by each of the following mechanisms **EXCEPT**

- A. reducing the production of aqueous humor. ^τ
- B. non-selectively blocking β-adrenergic receptors. ^τ
- C. reducing myocardial contractility. ^τ
- D. increasing the release of plasma renin and the level of plasma angiotensin. ^τ
- E. decreasing myocardial oxygen demand.

β₁ ← Block
 β₂
 β₃
Blocker

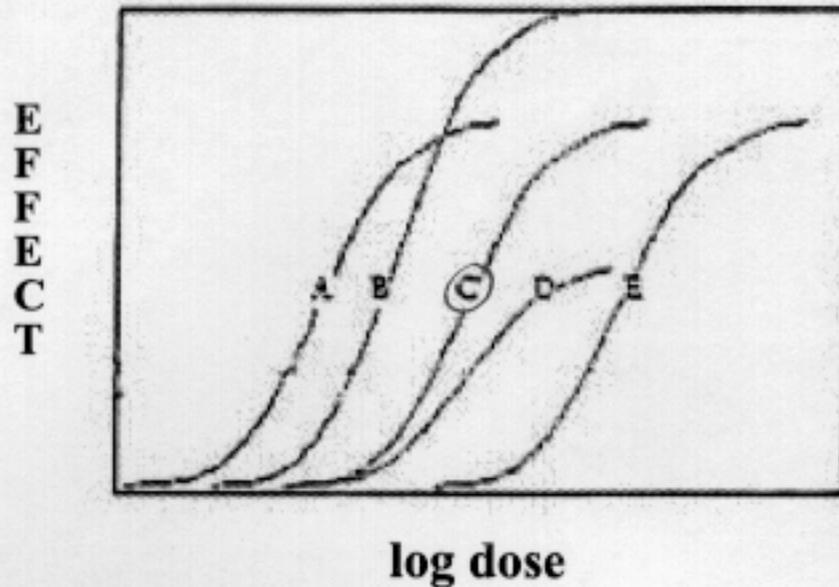
Glaucoma

Angina Pectoris

Directions: Select the **SINGLE** best choice

Examination #1
5 February 2001
Page 5

THE FOLLOWING 2 QUESTIONS PERTAIN TO THE FIGURE BELOW:



18. If curve C represents the vasoconstriction after norepinephrine was given alone, which curve represents the effect of norepinephrine in an isolated vascular smooth muscle preparation pre-treated with cocaine?

- A. curve A ✓
- B. curve B
- C. curve C ✓
- D. curve D
- E. none of the above

NE vasoconstrict
Cocaine → NE
∅ spare receptors!

19. If curve C represents contraction of an isolated blood vessel after phenylephrine was administered alone, which curve represents the effect of phenylephrine in a preparation pretreated with phenoxybenzamine?

- A. curve A
- B. curve B
- C. curve C
- D. curve D
- E. curve E

phenylephrin → agonist α_1, α_2
phenoxybenz → phnylep'
 α_1, α_2 Irrev

α_1 Block \leq ↓ vasoconstrict
↑ GI motil

20. Prazosin is a useful therapeutic agent for each of the following reasons **EXCEPT**

- A. it competitively blocks α_1 adrenergic receptors. T
- B. it causes decongestion of mucous membranes. ⊗
- C. it reduces resistance to outflow in benign prostatic hyperplasia. T
- D. it reduces vascular resistance and mean arterial blood pressure. T
- E. it causes less reflex cardiac stimulation than non-selective alpha receptor antagonists.

Directions: Select the **SINGLE** best choice

D

21. Which statement about drugs and dopamine receptors in the peripheral vasculature is **CORRECT**?

- A. Dobutamine increases myocardial contractile force by stimulating D_1 receptors in the myocardium. F
- B. Fenoldopam is a D_1 receptor antagonist that may elevate blood pressure. F
- C. Dopamine is a selective D_1 receptor agonist without effects on heart rate or rhythm. F D_1, β, α
- D. Activation of D_1 receptors causes dilation of the renal vasculature. T
- E. In the kidney, D_1 receptors are primarily located presynaptically on noradrenergic nerve terminals. ?

22. Which statement about neurotransmission and post-ganglionic autonomic nerves is **TRUE**?

- F A. Norepinephrine and acetylcholine are coexisting neurotransmitters in these nerves.
- B. These nerves are stimulated by acetylcholine released from pre-ganglionic nerves and acting on N_N type nicotinic receptors. ~~or N_A~~
- F C. Transport of acetylcholine across the neuronal plasma membrane is blocked by cocaine.
- D. The primary mechanism of termination of released transmitter is the same in all post-ganglionic autonomic nerve terminals.
- ? E. Activation of presynaptic α_2 receptors ~~increases~~ the amount of neurotransmitter released with subsequent nerve impulses. \downarrow

23. Each of the following drugs is paired with a likely therapeutic use **EXCEPT**

- A. albuterol : asthma T \nearrow α_1, β
- B. labetalol : hypertension \nearrow α_1 & β block
- C. phenylephrine : rhinitis T
- D. atenolol : angina pectoris T
- E. ephedrine : hemorrhagic stroke ~~cause~~
 \hookrightarrow NE

24. In drug-receptor interactions, the K_D

- A. is the concentration of drug at which 50% of the maximum response is produced.
- B. is always higher for antagonists than for agonists.
- C. can be calculated most easily for drugs that bind irreversibly (covalently).
- D. is the concentration of drug at which 50% of receptors are occupied.
- E. is higher for drugs that bind the receptor faster.

25. Which of the following statements regarding sulfur mustard is **TRUE**?

- A. It binds and cross links DNA to produce necrosis and blisters.
- F B. It causes intense pain immediately upon contact with skin. 2-6 hr
- F C. It is a dense liquid that attacks skin, but does not enter the respiratory tract. F
- F D. It evaporates rapidly and does not persist on the battlefield after application. \rightarrow Eye
- E. Its effects can be prevented by Lewisite, which forms a complex with the mustard.

BAL

BAL

 \hookrightarrow Forms complex

26. Which statement concerning exposure to the organophosphate nerve agent, **sarin** is **TRUE**?

- A. Atropine is known to combine directly with sarin to inhibit further intoxication. **F**
- B. Atropine binds to acetylcholinesterase to prevent the inhibition of this enzyme by sarin. **F**
- C. Pyridostigmine is able to counteract the direct effect of sarin on both the muscarinic and nicotinic receptors. **F**
- D. Atropine is administered to reverse the muscarinic signs of sarin intoxication. **T**
- E. Atropine is similar to 2-PAM in its ability to reactivate sarin-inhibited acetylcholinesterase. **F**

27. In a smooth muscle preparation, brief exposure to a low dose of a drug shifted the log dose-response curve for acetylcholine to the right without affecting the maximum response to acetylcholine. But a higher dose of the drug decreased the maximum response to acetylcholine. The results are best explained if the drug

- A. is a competitive agonist, and there are spare receptors. **-**
- B. is a non-competitive antagonist, and there are spare receptors.
- C. is a competitive agonist, and there are no spare receptors.
- D. is a non-competitive antagonist, and there are no spare receptors.
- E. prevents hydrolysis of acetylcholine.

Comp. Inhib
of ACh

28. Thiopental, rather than pentobarbital, is used for induction of anesthesia because

- A. pentobarbital, but not thiopental, has active metabolites.
- B. thiopental does not induce cytochrome P450 liver enzymes, whereas pentobarbital does.
- C. thiopental is much more lipid soluble than pentobarbital.
- D. thiopental is more polar than pentobarbital.
- E. the pK_a for thiopental is more basic than is the pK_a for pentobarbital.

29. Intravenous injection of a given dose of an unknown drug X caused a decrease in diastolic blood pressure. After pretreatment with drug Y, injection of the same dose of drug X resulted in an increase in diastolic blood pressure. Drugs X and Y were **MOST LIKELY**

- A. isoproterenol and prazosine. β_1
- B. epinephrine and atropine. M
- C. acetylcholine and atropine. M
- D. norepinephrine and propranolol. β_{1-3}
- E. epinephrine and propranolol. β_{1-3}

X → α_1 inhibitor or $\beta_2 \uparrow$

↓ DBP

Y → X

↑ DBP

30. Cocaine

- A. can increase heart rate and blood pressure. **T**
- B. is metabolized entirely in the liver. **F** plasma/water
- C. does not enter the central nervous system. **F**
- D. is not an effective local anesthetic. **F**
- E. inhibits the action of sulfonamide antibiotics. Procaine

20

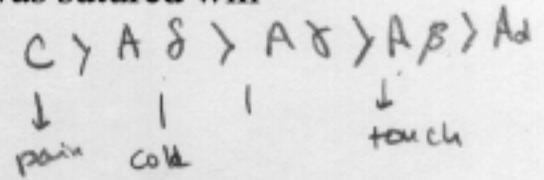
β_1/β_2
 $\alpha_1, \beta_1, \beta_2$
 M
 α_1, β_1
 $\alpha_1, \beta_1, \beta_2$

FIVE CHOICE COMPLETION

Directions: Select the **SINGLE** best choice

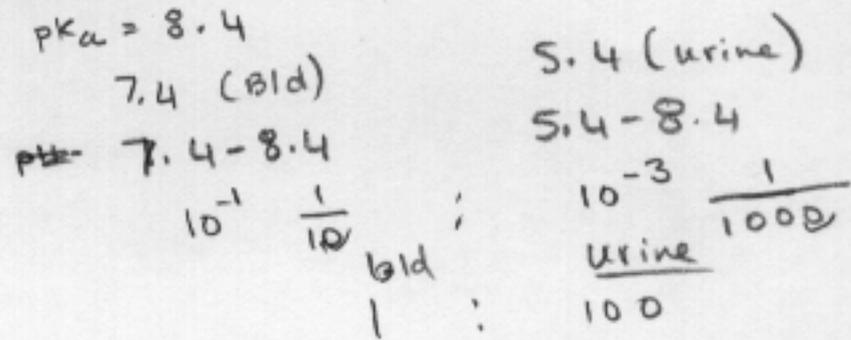
1st to go last to Recover

31. A patient who received lidocaine injections around a cut on his hand before it was sutured will **MOST LIKELY**



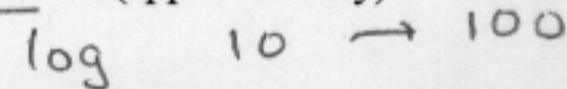
- A. have the Aβ fibers blocked for a longer time than the Aδ fibers. F
- B. have the Aα fibers blocked before the C fibers. F
- C. notice his sense of touch returning before he feels the return of pain. T
- D. suffer more systemic side effects from the local anesthetic if a vasoconstrictor is included in the anesthetic solution. F
- E. lose his sense of cold or warmth before he loses his sense of pain. F

32. A weak base with a pKa of 8.4 is excreted in the urine. Assuming pH of 7.4 for blood, pH of 5.4 for urine, and equilibrium of the weak base between blood and urine, the concentration of drug in the urine will be approximately



- A. 10 times greater than in the blood.
- B. 10 times less than in the blood.
- C. 100 times greater than in the blood.
- D. 100 times less than in the blood.
- E. 500 times greater than in the blood.

33. If the maintenance dose of a drug which obeys first order kinetics is doubled and the time between doses is doubled, the steady state concentrations will (approximately)



- A. double.
- B. decrease to 1/2 the original level.
- C. remain unchanged.
- D. decrease to 1/4 the original level.
- E. increase by 50%.

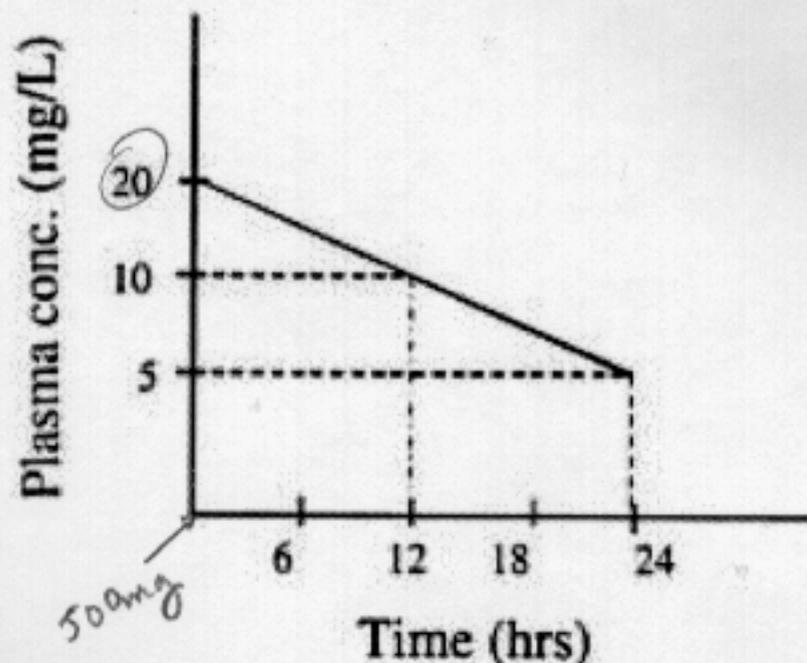
MD = [D] [DR] C_{SS} =

2 MD 2 t_{1/2} C_{SS} = ↑

Directions: Select the **SINGLE** best choice

You are participating in a clinical trial of a new drug. Its plasma concentration as a function of time after a single i.v. dose of 500 mg is shown below on a semilogarithmic plot.

THE FIGURE PERTAINS TO THE ABOVE STATEMENT.



$t_{1/2} = 10 \text{ hrs}$
 $C_0 = 500 \text{ mg}$

34. You wish to administer the drug as an i.v. bolus once daily, without allowing the plasma concentration to fall below 5 mg/L at steady state. The minimum daily dose that could accomplish this is closest to

$C_{ss} = 5 \text{ mg/L}$

- A. 200 mg.
- B. 300 mg.
- C. 400 mg.**
- D. 500 mg.
- E. 600 mg.

$DR =$

$MD =$

$C_{ss} = \frac{\text{Dosing Rate}}{CL = V_d K_e}$

$5 \text{ mg/L} = \frac{DR}{V_d K_e}$

~~$MD =$~~

$LD = 500 \text{ mg} = [V_d] [C_{ss}^{5 \text{ mg/L}}]$

$100 \text{ L} = V_d$

Directions: For each numbered word or phrase, select the one
LETTERED heading that is most closely related to it.

- A. tolterodine ^{3°}
- B. ipratropium ^{4°}
- *C. pirenzepine
- D. atropine
- E. bethanechol → choline Ester

B 35. quaternary amine anticholinergic drug useful in treating asthma

4° for asthma

E 36. muscarinic receptor agonist useful in postoperative treatment of (abdominal distension and urinary retention)

- A. sarin
- B. soman
- C. pyridostigmine
- D. atropine
- E. neostigmine

B 37. organophosphate anticholinesterase whose bond with acetylcholinesterase rapidly "ages", so that the enzyme cannot be reactivated

C 38. carbamate anticholinesterase useful in treating myasthenia gravis

- A. botulinum toxin - ncb
- B. succinylcholine -
- C. tubocurarine -
- D. pancuronium
- E. dantrolene

D 39. neuromuscular blocking agent that does not release histamine

M. 40. useful for brief neuromuscular blockade, for example during intubation for surgery

B

MEDICAL PHARMACOLOGY PHO 2001

EXAMINATION #1 ANSWER SHEET

MONDAY, FEBRUARY 5, 2001

0730-0820 hours

- | | | | |
|-------|---------|-------|---------|
| 1. A | 11. A | 21. D | 31. c |
| 2. D | 12. E | 22. B | 32. c |
| 3. B | 13. c | 23. E | 33. c |
| 4. E | 14. A | 24. D | 34. c |
| 5. B | 15. c | 25. A | 35. B |
| 6. D | 16. C | 26. D | 36. E |
| 7. E | 17. D | 27. B | 37. B |
| 8. B | 18. A&C | 28. C | 38. C&E |
| 9. C | 19. D | 29. E | 39. D |
| 10. c | 20. B | 30. A | 40. B |