

## FIVE CHOICE COMPLETION

Directions: Select the **SINGLE** best choice

- A 35 year-old, 65 kg male patient is prescribed propranolol at a dose of 50 mg in the morning, to treat hypertension. What would be the total body clearance for propranolol if the volume of distribution is 4 L/kg, oral bioavailability (F) is 0.25, and its half-life is 4 hours?

  - 25 ml/min
  - 250 ml/min
  - 750 ml/min
  - 1200 ml/min
  - 2000 ml/min
- You have a 43 year-old, 60 kg male patient with normal hepatic function. This drug, which is eliminated entirely via the kidney, has a half-life of 18 hours and a volume of distribution of 10 L. As a result of a recent onset renal dysfunction, his previously normal steady-state serum creatinine value of 0.8 mg/dl has increased to 2.4 mg/dl. What should be the new maintenance dosage if the patient has taken 60 mg/day so far?

  - 100 mg/day
  - 80 mg/day
  - 65 mg/day
  - 45 mg/day
  - 20 mg/day
- Which statement concerning treatment of gastric ulcer is **FALSE**?

  - Cimetidine inhibits gastrin-induced gastric acid secretion.
  - Famotidine inhibits histamine-induced gastric acid secretion.
  - Omeprazole inhibits acetylcholine-induced gastric acid secretion.
  - Cimetidine induces cytochrome P450.
  - Cimetidine can cause gynecomastia.
- Which of the following agents does **NOT** reduce gastric acid secretion?

  - cimetidine
  - omeprazole
  - sucralfate
  - antimuscarinic agents (e.g. pirenzepine)
  - misoprostol

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Examination #1  
1 February 2000  
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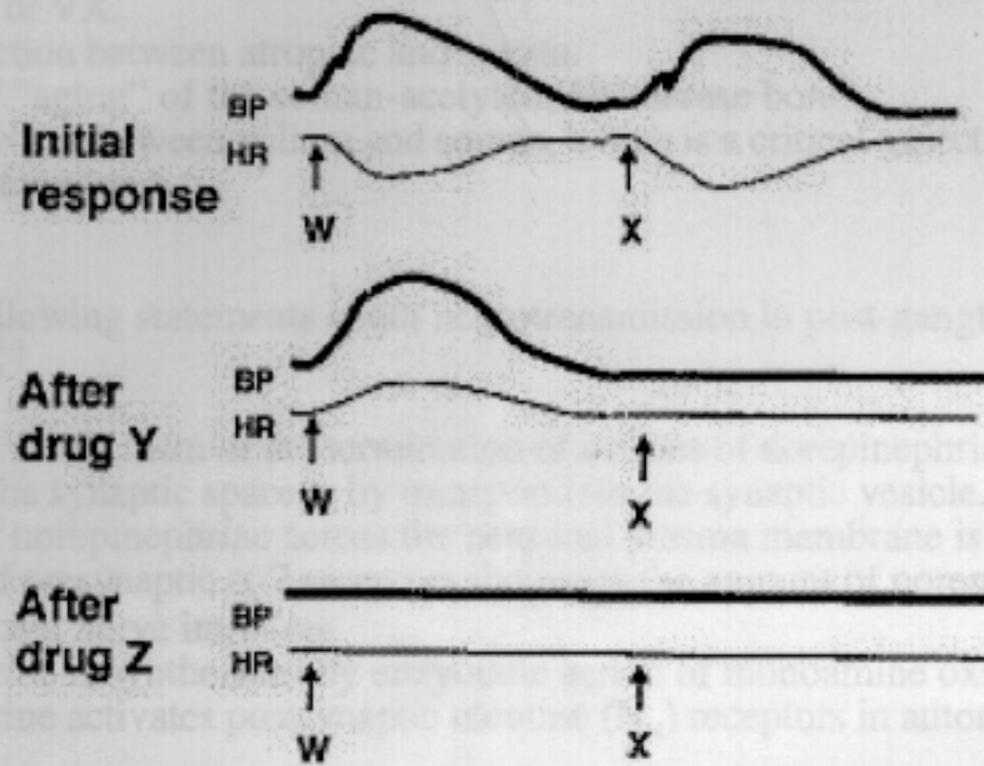
5. In an in vitro bioassay system, application of an agonist induces muscle contraction. Which of the following observations offers the best evidence that there are spare receptors in this system?
- A. The concentration of agonist needed to induce 50% of maximum response was significantly increased in the presence of a competitive antagonist.
  - B. Application of a low concentration of an irreversible antagonist resulted in a shift of the agonist dose-response curve to the right with no reduction in maximum response.
  - C. Application of a partial agonist induced a small contraction of the muscle preparation.
  - D. Measurement of the number of receptors in the muscle preparation showed that a high concentration of receptors was present.
  - E. The  $K_D$  for the antagonist in this preparation was higher than the estimated  $K_D$  for the agonist.
6. As a forensic pathologist, you are interested in examining the stomach contents of a suicide victim who has ingested chloroquin, a basic drug with a pK of 8.0. Assume gastric fluid is at pH 1.0 AND plasma at pH 7.0, and that an idealized equilibrium is reached. The theoretical ratio of drug concentration in the gastric fluid to drug concentration in plasma would be approximately
- A. stomach : plasma ratio of 1 to 10 million.
  - B. stomach : plasma ratio of 1 to 1 million.
  - C. stomach : plasma ratio of 1 to 1.
  - D. stomach : plasma ratio of 1 million to 1.
  - E. stomach : plasma ratio of 10 million to 1.
7. Which statement correctly describes non-competitive antagonism by drug X of the actions of drug Y? Assume there are no spare receptors in the assay system.
- A. Drug X binds to more receptors than drug Y.
  - B. Drug X has a higher affinity (i.e., lower dissociation constant,  $K_D$ ) for the receptor than drug Y.
  - C. Drug X interacts with drug Y in solution and thus prevents the binding of drug Y to the receptor.
  - D. The maximum response to drug Y alone will be greater than the maximum response to drug Y in the presence of drug X.
  - E. In the presence of increasing doses of drug X, dose-response curves for drug Y will be shifted to the right, but remain parallel to and have the same maximum as the initial curve.
8. The therapeutic index for a drug may be defined as the
- A. ratio of its LD50 to its ED50.
  - B. ratio of its ED50 to its EC50.
  - C. page number on which the drug is described in the US Pharmacopeia.
  - D. concentration of the drug required to occupy 50% of its physiologic receptors.
  - E. percentage of patients treated with the drug who experience therapeutic benefit.

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The following blood pressure (BP) and heart rate (HR) records were obtained sequentially. After obtaining initial responses to drugs W and X, drug Y was given. The effects of drugs W and X were retested first after drug Y, and then again after drug Z. Note that drug Y was still present during testing after drug Z.



9. If drug Y is hexamethonium and drug Z is prazosin, which is the most probable pairing for drugs W and X?

	Drug W	Drug X
A.	histamine	isoproterenol
B.	nicotine	epinephrine
C.	epinephrine	norepinephrine
D.	acetylcholine	nicotine
E.	norepinephrine	nicotine

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10. Pyridostigmine

- A. is an effective treatment for reversal of nerve agent intoxication when administered orally after exposure to the nerve agent.
- B. functions as an adjunct to atropine and must be administered before exposure to an organophosphate nerve agent in order to protect a critical amount of acetylcholinesterase from irreversible inhibition by the nerve agent.
- C. functions as an adjunct to atropine and must be administered before exposure to an organophosphate nerve agent in order to bind directly with the nerve agent which will prevent inhibition of acetylcholinesterase.
- D. is effective only if valium therapy is provided after exposure to soman in order to prevent further inhibition of acetylcholinesterase by this nerve agent.
- E. is able to counteract the direct effect of the nerve agents on both muscarinic and the nicotinic receptors.

11. The most important mechanistic difference between the nerve agent, **soman**, and other organophosphate anticholinesterase agents (sarin, tabun, VX) which affects the ability to provide antidotal therapy for soman intoxication is the

- A. direct interaction between pyridostigmine and soman.
- B. rapid rate of onset of signs and symptoms of nerve agent intoxication following aerosol exposure to a lethal concentration of soman, compared to a similar exposure to sarin, tabun, or VX.
- C. direct interaction between atropine and soman.
- D. rapid rate of "aging" of the soman-acetylcholinesterase bond.
- E. direct interaction between valium and soman, which is a critical aspect of therapy specifically for soman.

• 12. Which of the following statements about neurotransmission in post-ganglionic sympathetic nerves is **TRUE**?

- A. The primary mechanism of the termination of actions of norepinephrine released from nerves into the synaptic space is by transport into the synaptic vesicle.
- B. Transport of norepinephrine across the neuronal plasma membrane is blocked by cocaine.
- C. Activation of presynaptic  $\alpha$ -2 receptors increases the amount of norepinephrine released with subsequent nerve impulses.
- D. Norepinephrine is synthesized by enzymatic action of monoamine oxidase.
- E. Norepinephrine activates postsynaptic nicotine ( $N_N$ ) receptors in autonomic ganglia.

• 13. Which of the following drugs relaxes smooth muscle by binding to adrenergic receptors and increasing intracellular cyclic AMP?

- A. ketamine
- B. amphetamine
- C. phenylephrine
- D. carbachol
- E. albuterol

• 14.  $\beta_2$  adrenergic receptors that are physiologically activated by endogenous epinephrine

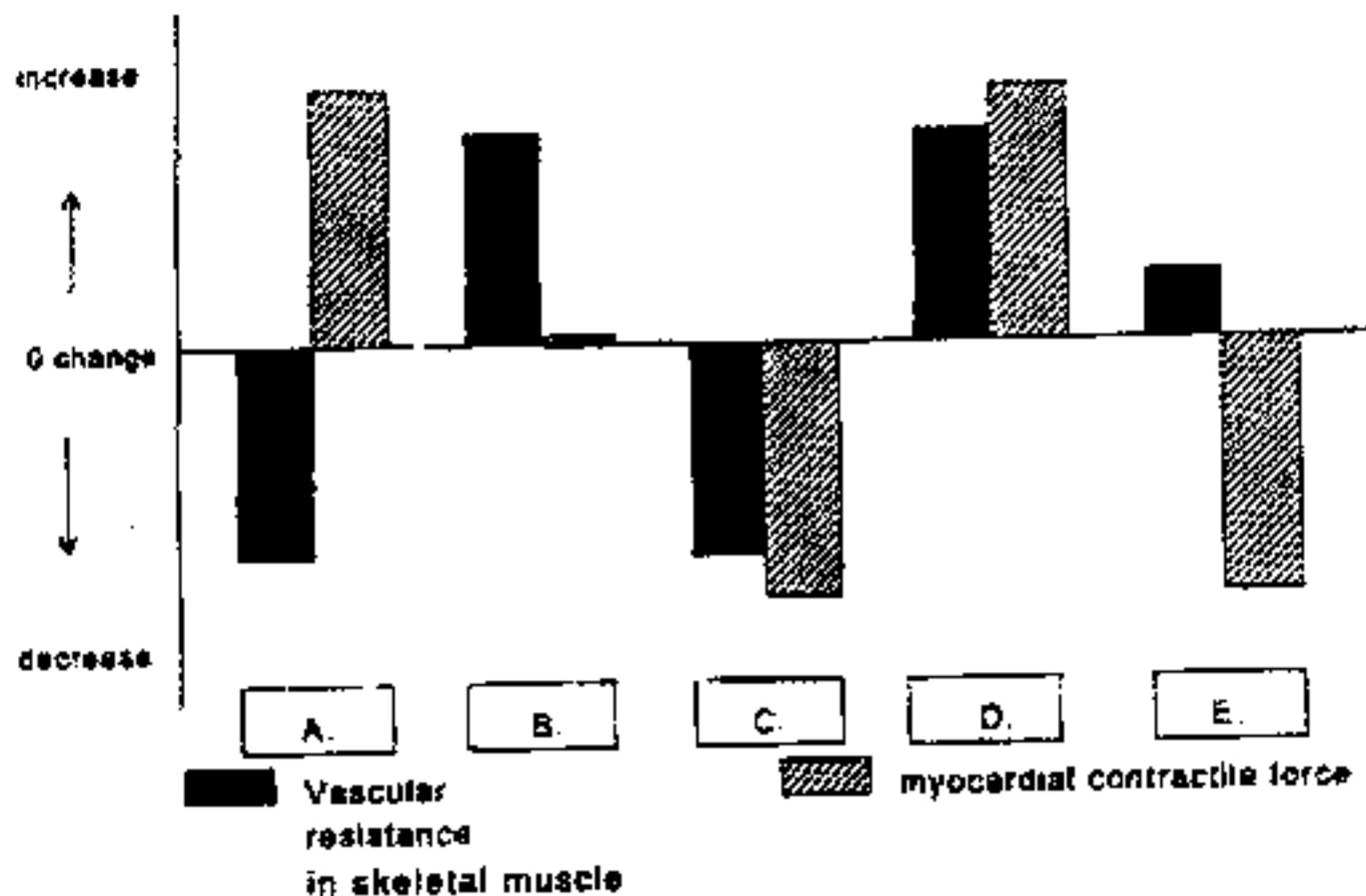
- A. are also activated by similar doses of norepinephrine.
- B. are primarily located on renal and mesenteric vasculature.
- C. cause prominent slowing of A-V nodal conduction.
- D. are blocked by labetalol.
- E. result in pupillary dilation.

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15. In the anesthetized dog pretreated with phentolamine, the intravenous administration of epinephrine would cause which of the following changes in vascular resistance in skeletal muscle and in myocardial contractile force?



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16. A 72 year-old man with hypertension and angina pectoris is treated with atenolol. In this patient, atenolol is exerting its therapeutic effects by all of the following mechanisms **EXCEPT**
- A. blockade of vascular adrenergic receptors.
  - B. reduction of the release of renin and lowering plasma angiotensin II levels.
  - C. decreasing cardiac cAMP formation.
  - D. reducing myocardial contractility.
  - E. relatively selective blockade of  $\beta_1$  adrenergic receptors.
17. Each of the following drugs is paired with a likely therapeutic use **EXCEPT**
- A. albuterol : bronchial asthma
  - B. fenoldopam : acute hypertensive crisis
  - C. phentolamine : erectile dysfunction
  - D. dobutamine : renal failure
  - E. pindolol : chronic hypertension

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18. Phenylpropanolamine, a sympathomimetic amine contained in many over-the-counter cold and weight-loss medications, can result in each of the following actions **EXCEPT**
- A. release of norepinephrine.
  - B. exacerbation of urinary outflow problems in benign prostatic hyperplasia.
  - C. inhibition of presynaptic  $\alpha_2$  adrenergic receptors.
  - D. increased mean arterial blood pressure.
  - E. constriction of arterioles in mucous membranes.
- 19. This antihypertensive drug is selective for the  $\alpha_1$  adrenergic receptor subtype, decreases blood pressure with only a modest reflex rise in heart rate, but may result in orthostatic hypotension.
- A. phenylephrine
  - B. albuterol
  - C. guanethidine
  - D. prazosin
  - E. cimetidine
20. First pass metabolism
- A. occurs in the bloodstream.
  - B. applies only to drugs activated by metabolism.
  - C. has no effect on the clinical efficacy of a drug.
  - D. applies to drugs administered intravenously.
  - E. none of the above.
- 21. Which of the following reactions is not catalyzed by the cytochrome P450 family of mixed function oxidases?
- A. hydroxylation
  - B. oxidative dealkylation
  - C. sulfation
  - D. S-oxidation
  - E. epoxidation
- 22. Quinidine, an antiarrhythmic agent, may exhibit enhanced toxicity when administered with which of the following drugs?
- A. ciprofloxacin (a quinolone antibiotic)
  - B. ketoconazole (a triazole antifungal)
  - C. acetaminophen (an antipyretic)
  - D. rifampin (an antituberculosis agent)
  - E. ibuprofen (an anti-inflammatory agent)

23. Acetaminophen toxicity is enhanced by chronic use of ethyl alcohol. Which of the following is the primary mechanism of that enhanced toxicity?
- A. inhibition of glucuronide conjugation
  - B. induction of CYP2E1
  - C. inhibition of CYP3A4
  - D. induction of CYP2C19
  - E. decrease in renal clearance
24. Which of the following is **NOT** a mechanism of genetic alteration of drug metabolizing enzymes?
- A. single nucleotide polymorphisms (SNPs)
  - B. duplication
  - C. deletion
  - D. telomere shortening
25. Genetic inactivation of which of the following enzymes is associated with enhanced cure rates of peptic ulcers following a therapeutic regimen containing omeprazole (a proton pump inhibitor)?
- A. N-acetyl transferase
  - B. CYP1A2
  - C. CYP2C19
  - D. CYP2D9
  - E. CYP3A4
26. Which of the following can cause toxicity by concentration in pneumocytes and eventual onset of pulmonary fibrosis?
- A. 2,4-D (2,4-dichlorophenoxy acetic acid)
  - B. arsine gas
  - C. paraquat
  - D. hydrogen cyanide
  - E. elemental mercury
27. Which statement regarding carbon monoxide is **FALSE**?
- A. It binds to hemoglobin with over 200-fold greater avidity than does oxygen.
  - B. It can displace the hemoglobin-oxygen dissociation curve.
  - C. It has the smell of bitter almonds.
  - D. It causes a cherry red cyanosis evident on post-mortem examination following fatal intoxication.
  - E. It is almost invariably fatal when carboxyhemoglobin concentrations exceed 60%.

28. An 8 year-old boy has repeated incidences of motion sickness when traveling in the family car. His parents are tired of cleaning up the mess, and come to you for advice. Which of the following should you recommend?
- A. cisapride
  - B. dimenhydrinate
  - C. diphenoxylate
  - D. granisetron
  - E. tetrahydrocannabinol
29. A 10 year-old girl returns home from a trip with her grandparents to Mexico with a severe case of diarrhea. Which of the following could be used to treat her symptoms?
- A. castor oil
  - B. chlorpromazine
  - C. loperamide
  - D. metoclopramide
  - E. ondansetron
30. You are in charge of administering atropine intravenously to a young adult undergoing surgery for an injured knee. As you increase the amount of atropine administered, you expect to see
- A. miosis (pupillary constriction) before decreased sweating.
  - B. tachycardia before decreased salivation.
  - C. decreased respiratory tract secretion before mydriasis (pupillary dilatation).
  - D. centrally mediated (CNS) excitation before decreased bowel sounds (decreased gastrointestinal activity).
  - E. bradycardia before decreased respiratory tract secretion.
31. Pralidoxime (2-PAM)
- A. reverses neuromuscular blockade produced by tubocurarine.
  - B. is administered prophylactically if an attack with soman is expected.
  - C. acts primarily by binding muscarinic receptors.
  - D. produces its effect by its action in the central nervous system.
  - E. reactivates acetylcholinesterase that is blocked by an anticholinesterase.
32. Which statement is **TRUE** for both physostigmine and pyridostigmine?
- A. They cross the blood-brain barrier and produce convulsions.
  - B. They form bonds with acetylcholinesterase that rapidly undergo aging.
  - C. They are useful in the treatment of myasthenia gravis.
  - D. They do not permanently inactivate acetylcholinesterase.
  - E. They act only at nicotinic, but not muscarinic receptors.

33. Lidocaine injected into the wound site is effective in reducing pain while the wound is being sutured because it
- A. prevents the sodium influx generating the axonal action potential.
  - B. increases the conduction velocity of action potentials in pain fibers, but not in other axons.
  - C. is rapidly carried to pain centers in the central nervous system.
  - D. depolarizes the axons in the vicinity of the injury.
  - E. increases the rate of repolarization of the axonal action potential by its effect on potassium permeability.
34. Lidocaine, but not procaine,
- A. exhibits cross-sensitivity with ester-type local anesthetics in an allergic patient.
  - B. is metabolized primarily in the liver.
  - C. is generally administered with a vasoconstrictor, such as epinephrine.
  - D. can cross the blood-brain barrier and cause convulsions.
  - E. increases heart rate by a direct effect on myocardial tissue.
- 35. Botulinum toxin
- A. is useful in treating disorders of the throat because it can be administered once a day with a teaspoon.
  - B. blocks nicotinic, but not muscarinic receptors.
  - C. is a naturally occurring toxin that blocks release of acetylcholine from nerve terminals.
  - D. in a single subcutaneous dose, permanently eliminates frown lines.
  - E. is being tested as an antidote for soman poisoning.
- 36. A patient is given tubocurarine during an orthopedic surgical procedure. Which of the following statements is **TRUE**?
- A. Administration of an anticholinesterase will hasten recovery of neuromuscular transmission.
  - B. The tubocurarine will be rapidly metabolized by plasma cholinesterase.
  - C. The patient is more likely to develop malignant hyperthermia than if he/she were given succinylcholine.
  - D. Tubocurarine does not produce the release of histamine and fall in blood pressure sometimes seen after succinylcholine administration.
  - E. The patient should need less anesthetic because of the sedative properties of tubocurarine.

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AGENT	MAC vol/%	Blood/Gas Partition Coefficient
desflurane	6.0	0.42
enflurane	1.7	1.9
halothane	0.75	2.4
isoflurane	1.2	1.4
nitrous oxide	105	0.47
sevoflurane	2.0	0.65

37. Based on data presented in the table, the most potent inhalational anesthetic agent is
- A. desflurane.
  - B. halothane.
  - C. isoflurane.
  - D. nitrous oxide.
  - E. sevoflurane.

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38. Which statement concerning isoflurane is **TRUE**?
- A. It causes minimal respiratory depression.
  - B. It sensitizes the myocardium to arrhythmias more than halothane.
  - C. It increases cardiac output.
  - D. It is not significantly metabolized.
  - E. It increases systemic vascular resistance.
39. Which statement regarding cardiovascular effects of inhalation anesthetic agents is **FALSE**?
- A. All the potent agents cause dose-dependent reduction in mean arterial pressure.
  - B. The newest agents reduce systemic vascular resistance.
  - C. Nitrous oxide can obscure myocardial depression.
  - D. Halogenated hydrocarbons cause significant reductions in myocardial contractility.
  - E. Of the potent agents, halothane is associated with the least arrhythmias.
40. Which statement regarding inhalational anesthetics is **TRUE**?
- A. Increasing cardiac output will increase the rate of induction.
  - B. Increasing pulmonary ventilation will decrease the rate of induction.
  - C. Increasing the inspired anesthetic concentration will increase the rate of induction.
  - D. Selecting an agent with higher MAC will increase the rate of induction.
  - E. Selecting an agent with higher solubility will increase the rate of induction.

# PHARMACOLOGY EXAMINATION #1

Tuesday 1 February 2000 0830-0920

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