Chapter 02
Pharmacokinetics and Factors of Individual Variation

Multiple Choice Questions

1. Identify the term used for the process by which a drug enters the bloodstream from its site of administration.
A. Drug absorption
B. Drug excretion
C. Drug distribution
D. Drug metabolism

Drug absorption refers to the entrance of a drug into the bloodstream from its site of administration.

ABHES: 3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e. root, prefix, suffix, combinations, spelling, and definitions
Blooms: Remember
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 1 Easy
Learning Outcome: 02.02

2. Identify the drug that is available as a transdermal patch system.
A. Nitroglycerin
B. Clonidine
C. Estrogen
D. All of the above

Transdermal products are administered through a bandage or patch system. Nitroglycerin, estrogen, and clonidine are drugs available in this form.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Remember
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 1 Easy
Learning Outcome: 02.01

3. Identify the drug form that contains dried and finely ground drugs or drug extracts.
A. Powders
B. Tablets
C. Troches
D. Capsules

Powders are drugs or drug extracts that are dried and ground into fine particles.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Remember
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 1 Easy
Learning Outcome: 02.01

4. Identify the medical condition that the drug form known as a "troche" is commonly used to treat.
A. Asthma
B. Bradycardia
C. Sore throat
D. Toothache

Troches are flattened tablets that are allowed to dissolve in the mouth. They are commonly used for colds and sore throats.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Understand
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 1 Easy
Learning Outcome: 02.01

5. Among the factors that affect drug distribution, the factor that plays the biggest role in determining the concentration of a drug that penetrates the brain by overcoming the blood–brain barrier is:
A. lipid solubility.
B. blood circulation.
C. plasma protein binding.
D. GI absorption rate.

An additional lipid barrier, the blood–brain barrier, protects the brain by restricting the passage of electrolytes and other water-soluble substances. Since the brain is composed of a large amount of lipid (nerve membranes and myelin), lipid-soluble drugs pass readily into the brain. As a general rule, then, a drug must have a certain degree of lipid solubility if it is to penetrate this barrier and gain access to the brain.

ABHES: 2.a. List all body systems, their structure and functions
Blooms: Understand
CAAHEP: I.C.7. Describe the normal function of each body system
Difficulty: 1 Easy
Learning Outcome: 02.02

6. Identify the drug preparation that is described as a solution containing water, sugar, and a drug.
A. Elixir
B. Tincture
C. Syrup
D. Fluid extract

Syrups are commonly used aqueous preparations. A syrup is a solution of water and sugar to which a drug is added.

ABHES: 6.a. Identify drug classification, usual dose, side effects, and contraindications of the top most commonly used medications
Blooms: Understand
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 1 Easy
Learning Outcome: 02.01

7. The processes of drug absorption, drug distribution, drug metabolism, and drug excretion are components of the study known as _____.
A. synergism
B. pharmacokinetics
C. bioavailability
D. enzyme induction

Pharmacokinetics is a study of the factors that determine drug absorption, drug distribution, drug metabolism, and drug excretion.

ABHES: 3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e. root, prefix, suffix, combinations, spelling, and definitions
Blooms: Understand
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 1 Easy
Learning Outcome: 02.02

8. Identify the usual range of alcohol concentration used in alcoholic preparations of drugs such as elixirs, spirits, tinctures, and fluid extracts.
A. 35 to 45 percent
B. 25 to 35 percent
C. 20 to 25 percent
D. 5 to 20 percent

Elixirs, spirits, tinctures, and fluid extracts are drugs dissolved in various concentrations of alcohol, usually in the range of 5 to 20 percent.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Understand
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 1 Easy
Learning Outcome: 02.01

9. The fact that adipose tissue receives a relatively poor blood supply indicates that adipose tissue:
A. accumulates large amounts of drug.
B. does not accumulate large amounts of drug.
C. does not accumulate lipid-soluble drugs.
D. metabolizes large amounts of drug.

Some tissues, such as adipose tissue, receive a relatively poor blood supply and, as a result, do not accumulate large amounts of drug.

ABHES: 2.a. List all body systems, their structure and functions
Blooms: Understand
CAAHEP: I.C.7. Describe the normal function of each body system
Difficulty: 1 Easy
Learning Outcome: 02.02

10. A patient's dose of an analgesic agent that he uses to manage chronic pain is increased twice over a span of six months. In the context of the terms drug tolerance, drug dependence, and drug addiction, identify the reason for the increase in the dosage.
A. Repeated administration decreases the effect of a drug.
B. Reliance on the administration of a drug leads to a psychological dependence on the drug.
C. Compulsive dependence on a drug dominates all other activities in the patient's life.
D. None of the above statements are correct.

Drug tolerance is defined as a decreased drug effect that occurs after repeated administration. In order to attain the previous drug effect, the dosage must be increased.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 2 Medium
Learning Outcome: 02.07

11. Use a half-life of 8 hours to determine the amount of a drug left in the body at 4 p.m. if a 500-mg dose of the drug was taken at 8 a.m.

A. 250 mg
B. 125 mg
C. 375 mg
D. None of the above

The half-life of a drug is the time required for the blood or plasma concentration of the drug to fall to half of its original level. The number of hours that have lapsed between 8 a.m. and 4 p.m. is 8 hours. The half-life of the drug is 8 hours; this implies that one half-life has elapsed since the administration of the drug. The amount of the drug remaining at 4 p.m. is 50 percent of its initial dose (50% × 500 mg = 250 mg).

ABHES: 6.b. Demonstrate accurate occupational math and metric conversions for proper medication administration
Blooms: Apply
CAAHEP: II.C.2. Apply mathematical computations to solve equations
Difficulty: 2 Medium
Learning Outcome: 02.03

12. Use a half-life of 4 hours to determine the amount of a drug left in the body at 2 p.m. if a dose of 200 mg was administered intravenously at 6 a.m.

A. 25 mg
B. 12.5 mg
C. 50 mg
D. None of the above

The half-life of a drug is the time required for the blood or plasma concentration of the drug to fall to half of its original level. The number of hours that have elapsed between 6 a.m. and 2 p.m. is 8 hours. The half-life of the drug is 4 hours; this implies that two half-lives have elapsed since the administration of the drug. The amount of the drug remaining at 2 p.m. is 25 percent of its initial dose (25% × 200 mg = 50 mg).

ABHES: 6.b. Demonstrate accurate occupational math and metric conversions for proper medication administration
Blooms: Apply
CAAHEP: II.C.2. Apply mathematical computations to solve equations
Difficulty: 2 Medium
Learning Outcome: 02.03

13. A patient education program should include educating patients on the effective administration of drugs. How should patients be instructed to take enteric-coated products?
A. On an empty stomach with water
B. One hour before meals
C. Two hours after meals
D. All of these are correct.

Enteric-coated products should be taken on an empty stomach with water, either 1 hour before or 2 hours after meals.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 2 Medium
Learning Outcome: 02.01

14. In terms of patient safety and ease of drug administration, identify the most convenient route of drug administration for a patient with a busy lifestyle and a hectic schedule.
A. Intramuscular administration
B. Oral administration
C. Topical administration
D. Intravenous administration

Whenever possible, the oral administration route is the safest and the most convenient method.

ABHES: 6.a. Identify drug classification, usual dose, side effects, and contraindications of the top most commonly used medications
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 2 Medium
Learning Outcome: 02.01

15. Which of the following routes of drug administration has the slowest onset of action?
A. Inhalation
B. Transdermal
C. Intramuscular
D. Sublingual

The transdermal route of administration has an onset of action at approximately 30 to 60 minutes.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 2 Medium
Learning Outcome: 02.01

16. Which of the following routes of drug administration has the fastest onset of action?
A. Inhalation
B. Transdermal
C. Intramuscular
D. Sublingual

The inhalation route of administration has an onset of action of less than a minute from the time of administration.

ABHES: 6.a. Identify drug classification, usual dose, side effects, and contraindications of the top most commonly used medications
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 2 Medium
Learning Outcome: 02.01

17. In the context of the factors of individual variation that alter the effect of a drug, select the statement that best describes the placebo effect.
A. Excitement can lead to perceived symptom improvement.
B. Positive attitude can lead to perceived symptom improvement.
C. Less body fat can lead to perceived symptom improvement.
D. None of the above statements are correct.

It has been observed that if patients have a positive attitude and think that the drug or treatment will help, chances are the patients claim an improvement whether there actually is one or not.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 2 Medium
Learning Outcome: 02.04

18. Differentiate between the routes of drug administration in order to select the route that is restricted to use in a hospital setting due to immediate onset of action and high percentage of drug bioavailability.
A. Intramuscular injection method
B. Intravenous injection method
C. Topical application method
D. Suppository insertion method

Intravenous (IV) injection is usually restricted to use in the hospital. IV injection offers the fastest means of drug absorption because the drug is delivered directly into the circulation; therefore, the onset of drug action is almost immediate.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Analyze
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.01

19. Which transport mechanism is used by cells to allow drugs to pass through the cell membrane?
A. Filtration
B. Passive transport
C. Active transport
D. All of the above

Cells have special transport mechanisms that allow various substances (including drugs) to pass through the cell membrane. These mechanisms include filtration, passive transport, and active transport.

ABHES: 2.a. List all body systems, their structure and functions
Blooms: Analyze
CAAHEP: I.C.7. Describe the normal function of each body system
Difficulty: 3 Hard
Learning Outcome: 02.02

20. Select the basic principle in passive transport by which most drug molecules diffuse through cell membranes.
A. Drug passes from an area of high concentration to an area of low concentration.
B. Drug passes from an area of low concentration to an area of high concentration.
C. Drug passes from an area of high concentration to an area of high concentration.
D. Drug passes from an area of low concentration to an area of low concentration.

Most drugs pass through membranes by passive transport. An important principle in passive transport is that the concentration of drug on each side of the membrane differs. In passive transport, drug molecules diffuse from an area of high concentration to an area of low concentration (law of diffusion).

ABHES: 2.a. List all body systems, their structure and functions
Blooms: Analyze
CAAHEP: I.C.7. Describe the normal function of each body system
Difficulty: 3 Hard
Learning Outcome: 02.02

21. Differentiate between tolerance, antagonism, and synergism in order to select the drug interaction that occurs during antagonism.
A. The combined effect of two drugs, by the same mechanism of action, is equal to the sum of their individual effects.
B. The combined effect of two drugs, by different mechanisms of action, is equal to the sum of their individual effects.
C. The combined effect of two drugs is less than the sum of their individual effects.
D. The combined effect of two drugs is greater than the sum of their individual effects.

Antagonism occurs when the combined effect of two drugs is less than the sum of their individual effects.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Analyze
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.06

22. In the context of the FDA Pregnancy Categories for drugs, identify the proper category for a drug for which studies on animals have not demonstrated fetal risk and no studies have been performed in pregnant women.
A. Pregnancy Category A
B. Pregnancy Category B
C. Pregnancy Category D
D. None of the above

Pregnancy Category B: Drug studies have not been performed in pregnant women and animal studies have not demonstrated fetal risk.

ABHES: 6.e. Comply with federal, state, and local health laws and regulations
Blooms: Analyze
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.05

23. When differentiating between enzyme induction and enzyme inhibition, enzyme induction can be interpreted as resulting in:
A. an increase in the rate of drug metabolism in the liver, leading to a decreased duration of action.
B. a decrease in the rate of drug metabolism in the liver, leading to a decreased duration of action.
C. a decrease in the bioavailability of the drug, leading to an increased duration of action.
D. none of the above.

By stimulating the drug microsomal metabolizing system, the drugs actually increase the amount of enzymes (cytochrome P450s) in the system; this process is referred to as enzyme induction. With an increase in the amount of enzymes, there is a faster rate of drug metabolism. Consequently, the duration of drug action is decreased for all drugs metabolized.

ABHES: 2.a. List all body systems, their structure and functions
Blooms: Analyze
CAAHEP: I.C.7. Describe the normal function of each body system
Difficulty: 3 Hard
Learning Outcome: 02.02

24. Identify a difference between free drug molecules and drug molecules that are bound to plasma proteins.
A. Only unbound or free drug molecules can exert a pharmacological effect.
B. Only the drug molecules that are bound to plasma can exert a pharmacological effect.
C. Free drug molecules exert a lower level of pharmacological effect than drug molecules that are bound to plasma.
D. None of the above statements are correct.

Only unbound or free drug molecules can exert a pharmacological effect.

ABHES: 2.a. List all body systems, their structure and functions
Blooms: Analyze
CAAHEP: I.C.11.b. Identify the classifications of medications including desired effects
Difficulty: 3 Hard
Learning Outcome: 02.02

25. You have been asked to explain to a patient the possibility that he will experience drug interactions while taking his newly prescribed medications. Select the appropriate statement you will use when explaining synergism to the patient.
A. Drugs may increase each other's effect to the equivalent of the sum of their individual effects.
B. Drugs may increase each other's effect to an amount that is greater than the sum of their individual effects.
C. Drugs may cancel each other's effect or lead to a response that is less than the sum of their individual effects.
D. None of the above statements are correct.

Synergism occurs when the combined effect of two drugs is greater than the sum of their individual effects.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Analyze
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.06

26. Select the drug administration method by which the bioavailability of the drug in the circulatory system will be 100 percent immediately after the administration.
A. Subcutaneous injection method
B. Inhalation method
C. Transdermal patch method
D. Intravenous injection method

Bioavailability is the percentage of the dose of a drug that is actually absorbed into the bloodstream. Differences in drug formulation, route of administration, and factors that affect gastrointestinal (GI) absorption can influence bioavailability. In intravenous (IV) administration of a drug, the drug is delivered directly into the circulation.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Analyze
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.03

27. Select the most appropriate reason why a patient with cirrhosis of the liver may not get the therapeutic response expected from the medication that she is taking.
A. The patient's ability to absorb drugs is impaired.
B. The patient's ability to distribute drugs throughout the body is impaired.
C. The patient's ability to metabolize drugs is impaired.
D. The patient's ability to maintain bioavailability of drugs is impaired.

Drug metabolism, also referred to as biotransformation, is the chemical alteration of drugs and foreign compounds in the body. The liver is the main organ involved in drug metabolism.

ABHES: 2.b. Describe common diseases, symptoms and etiologies as they apply to each system
Blooms: Analyze
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.02

28. A patient is instructed to take two tablets orally on the first day and then take one tablet orally daily for the next four days. Select the term that refers to the instruction to take two tablets by mouth on the first day.
A. Maintenance dose
B. Therapeutic dose
C. Loading dose
D. None of the above

A loading dose is usually an initial higher dose of drug, often administered IV, to rapidly attain the therapeutic drug level and drug effects. Loading doses are usually followed by maintenance doses that are smaller and calculated to maintain the drug level within the therapeutic range.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Analyze
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.03

29. Select the most likely reason why a patient who has been diagnosed with end-stage renal disease must have routine blood work drawn to check his plasma levels of a prescribed drug.
A. Due to the renal disease, the patient will be unable to effectively eliminate the drug, causing accumulation of the drug in the plasma.
B. Due to the renal disease, the patient will be unable to effectively metabolize the drug, causing low levels of the drug in the plasma.
C. Due to the renal disease, the patient will be unable to effectively absorb the drug, causing low levels of the drug in the plasma.
D. None of the above statements are correct.

Patients with hepatic or renal disease suffer a greater incidence of adverse drug effects because they are unable to eliminate the drug and its metabolites effectively. Consequently, plasma drug levels are much higher in these patients due to accumulation of the drug in the plasma.

ABHES: 2.b. Describe common diseases, symptoms and etiologies as they apply to each system
Blooms: Analyze
CAAHEP: I.C.11.d. Identify the classifications of medications including adverse reactions
Difficulty: 3 Hard
Learning Outcome: 02.04

30. A surgical team decides to use a spinal anesthetic to aid the surgery on a patient's spinal cord. The preferred route of administration for such anesthetic is _____.
A. intrathecal
B. intraarterial
C. inhalation
D. transdermal

The preferred route of administration to achieve local effects within the spinal cord is intrathecal. Drugs administered through this route take several minutes for onset of action.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.01

33. A patient is prescribed a drug preparation that contains barbiturates to treat a medical condition. The patient is also being treated with medications for other medical conditions. After a few days of consuming the barbiturate-containing medication, the patient realizes that his other medical conditions have worsened. What is the most likely reason for this occurrence?

A. The barbiturate medication is causing drug overdose.
B. The previous medications are causing enzyme inhibition and blocking the effects of the barbiturate medication.
C. The barbiturate medication is causing enzyme induction.
D. The patient has developed tolerance to both the barbiturate medication and his previous medications.

The most likely reason for this occurrence is that the barbiturate medication is causing enzyme induction. When barbiturates and other sedative hypnotic drugs are taken repeatedly, they stimulate the drug microsomal metabolizing system. By stimulating this system, the drugs actually increase the amount of enzymes (cytochrome P450s) in the system; this process is referred to as enzyme induction.

ABHES: 6.d. Properly utilize Physician's Desk Reference (PDR), drug handbook and other drug references to identify a drug's classification, usual dosage, usual side effects, and contraindications
Blooms: Apply
CAAHEP: I.C.11.d. Identify the classifications of medications including adverse reactions
Difficulty: 3 Hard
Learning Outcome: 02.02

34. Veronica is being treated with amphetamines for narcolepsy. After a month of treatment, the medication begins to have a reduced effect on Veronica's medical condition. This scenario exemplifies _____.

A. first-pass metabolism
B. enzyme inhibition
C. enzyme induction
D. drug tolerance

Drug tolerance is defined as a decreased drug effect that occurs after repeated administration. This scenario exemplifies drug tolerance.

ABHES: 2.c. Identify diagnostic and treatment modalities as they relate to each body system
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.07

35. William is narcoleptic and his physician prescribes amphetamines to treat his medical condition. After a few months of treatment, William's medical condition improves and the physician reduces the required dosage of amphetamines. However, the reduced dosage produces unpleasant feelings associated with withdrawal symptoms. William doubles the dosage to counter what he perceives as drug tolerance without consulting his physician and begins consuming more than the recommended dosage regularly. This scenario exemplifies _____.

A. enzyme inhibition
B. drug intolerance
C. drug addiction
D. enzyme induction

This scenario exemplifies drug addiction. When drug dependence is particularly severe and compulsive drug behavior dominates all other activities, the term drug addiction is used.

ABHES: 2.c. Identify diagnostic and treatment modalities as they relate to each body system
Blooms: Apply
CAAHEP: I.C.11.a. Identify the classifications of medications including indications for use
Difficulty: 3 Hard
Learning Outcome: 02.07