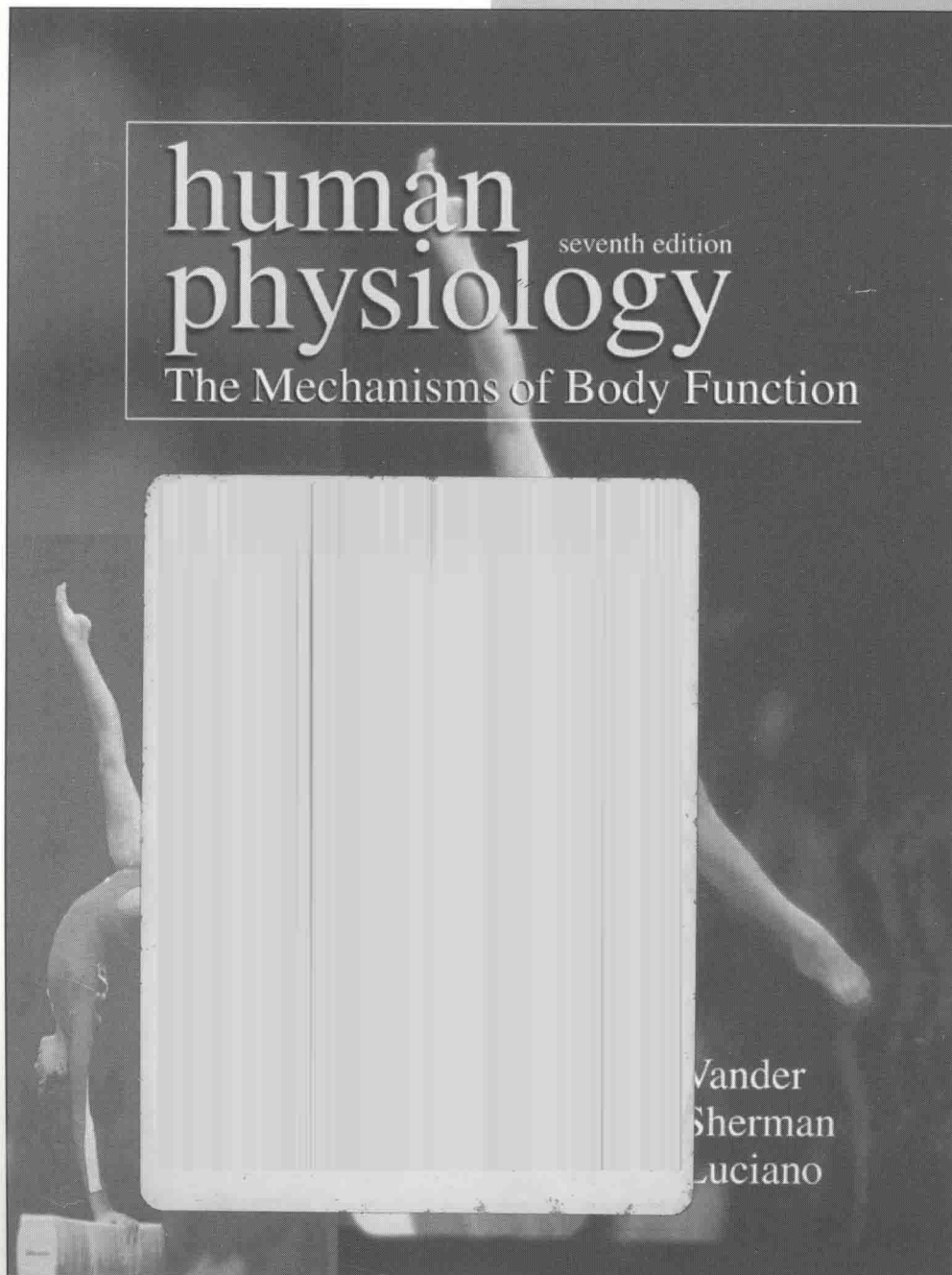


Student Study Guide

to accompany



by
Donna M. Van Wynsberghe

Student Study Guide

to accompany

Vander/Sherman/Luciano

Human Physiology

Seventh Edition

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HUMAN PHYSIOLOGY

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INTRODUCTION

This Student Study Guide is written to closely complement the textbook *Human Physiology*, 7th ed., by Vander, Sherman, and Luciano. A study guide is intended to be a guide to studying the content of the material covered, and this one is so intended. The questions are of a mixed variety and difficulty. The answers are at the end of each chapter for easy reference. I highly recommend that you, as a student of physiology, work through these questions diligently; diagram, draw, label, and fill in the blanks when asked; write notes in the margins; take time to think; and share your learning with others. You will find that if you can draw, diagram, write, or say it, you know it. Try it. And most importantly, I hope you will enjoy the learning of these physiological principles in your study of physiology.

I would like to thank David E. Cochrane, Tufts University, for providing feedback on preliminary chapters. I also would like to thank Jeffrey and Karianne Prince for their help with formatting this study guide.

D. M. Van Wynsberghe, Ph.D.

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1

A FRAMEWORK FOR HUMAN PHYSIOLOGY

MECHANISM AND CAUSALITY

1. How does a "mechanist" view life?

2. How does a "vitalist" view life?

3. Define and give an example of teleology.

A SOCIETY OF CELLS

Cells: The Basic Units

4. List several functions that all cells perform.

5. Match:
 - a. organs 1. _____ simple structural units that can divide and carry on life
 - b. tissues 2. _____ the process of transforming an unspecialized cell into a specialized cell
 - c. cells 3. _____ an aggregate of a single type of specialized cells
 - d. cell differentiation 4. _____ several tissue types joined together

6. List the levels of cellular organization from a single cell up to a total organism (human being).
7. Four functional categories of cells are:
 - a.
 - b.
 - c.
 - d.
8. Give a brief description of the function of each of the above specialized cells.
 - a.
 - b.
 - c.
 - d.

Tissues

9. Four general tissue types are:
 - a.
 - b.
 - c.
 - d.

Organs and Organ Systems

10. List the ten organ systems of the body and give an example of an organ in each of the organ systems.
 - a.
 - b.
 - c.
 - d.

- e.
- f.
- g.
- h.
- i.
- j.

THE INTERNAL ENVIRONMENT AND HOMEOSTASIS

- 11. The internal environment surrounding each cell is known as _____ fluid.
- 12. The concept of maintaining the internal environment relatively constant is known as _____.

BODY FLUID COMPARTMENTS

- 13. Extracellular fluid can be divided into _____ and _____.
- 14. Eighty percent of the extracellular fluid is (*interstitial, plasma*). The remaining eighty percent is (*interstitial, plasma*).
- 15. The chemical composition of the interstitial fluid and plasma are similar except for plasma which has a higher _____ concentration.
- 16. Intracellular and extracellular fluid have similar chemical compositions. (*true, false*)
- 17. Describe or diagram how the 42 L of total body water is compartmentalized.

Review the SUMMARY and REVIEW QUESTIONS at the end of this chapter in your textbook.

Chapter 1 Answer Key

1. All phenomena of life are described in terms of physical and chemical laws.
2. Some "vital force" beyond physical and chemical laws is required to explain or describe phenomena of life.
3. Teleology is an explanation of events in terms of purpose. Examples include: it is raining because the sun is not out; there is blood pressure because the heart is beating.
4. exchange materials with their immediate environment; obtain energy from organic nutrients; synthesize complex molecules; undergo cell duplication.
5. 1. C 2. D 3. B 4. A
6. Cells differentiate into specialized cells which become tissues which form functional units known as organs which form organ systems which become a whole functional being.
7.
 - a. muscle cells
 - b. nerve cells
 - c. epithelial cells
 - d. connective tissue cells
8.
 - a. Muscle cells produce force and movement.
 - b. Nerve cells initiate and conduct electrical signals.
 - c. Epithelial cells selectively secrete and transport ions and organic molecules.
 - d. Connective tissue cells connect, support and anchor structures of the body.
9.
 - a. muscle
 - b. nerve
 - c. epithelial
 - d. connective
10.
 - a. Circulation (heart);
 - b. Respiration (lungs);
 - c. Digestion (stomach);
 - d. Urinary (kidneys);
 - e. Musculoskeletal (muscle);
 - f. Immune (lymph nodes);
 - g. Nervous (brain);
 - h. Endocrine (pancreas);
 - i. Reproductive (ovaries);
 - j. Integumentary (skin)
11. extracellular
12. homeostasis
13. interstitial (intercellular), plasma

14. interstitial, plasma
15. protein
16. false
17. intracellular water = 28 L; extracellular water = 14 L [consisting of 11 L interstitial water (80 percent) and 3 L plasma (20 percent)] (See Fig. 1-3, p.7)

2

CHEMICAL COMPOSITION OF THE BODY

ATOMS

1. The units of matter that form all chemical substances are called _____.
2. Three subatomic particles in atoms are:
 - a.
 - b.
 - c.
3. The atomic particles located in the nucleus are:
 - a.
 - b.
4. The electric charges of each of the particles in an atom are:
5. Most of the mass of an atom is located in the _____.

Atomic Number

6. The atomic number of an atom is determined by:

Atomic Weight

7. The atomic weight of an atom is approximately equal to its number of _____ plus its number of _____.
8. One gram atomic mass of a chemical element is:

Atomic Composition of the Body

9. The four major elements that constitute over 99% of the atoms of the body are:
10. The seven essential mineral elements in the body are:

MOLECULES

11. A molecule is defined as:
12. The molecular formula for water is _____ and for glucose is _____.

Covalent Chemical Bonds

13. Describe a covalent bond.
14. The number of covalent bonds formed by the following are:
- a. hydrogen:
 - b. oxygen:
 - c. nitrogen:
 - d. carbon:
15. Draw a covalent bonding for water, carbon dioxide and ammonia.

IONS

16. An atom becomes an ion when it gains or loses one or more _____.

17. The sodium ion has (*gained, lost*) one electron, and is called a(n) (*anion, cation*).

18. Ions are referred to as electrolytes because _____

FREE RADICALS

19. A free radical is defined as a _____.

20. An example of a biologically important free radical is _____.

POLAR MOLECULES

21. Describe a polar bond.

22. The electrical charge associated with a polar bond is (*greater, lesser*) than the charge of a fully ionized atom.

23. Differentiate between polar and nonpolar molecules.

Hydrogen Bonds

24. Describe a hydrogen bond.

Water

25. Describe the type of bonds in a water molecule. Compare with the type of bonds that attract water molecules to each other.

SOLUTIONS

26. Differentiate between a solute, solvent and solution.

27. The most abundant solvent in the body is _____.

Molecular Solubility

28. Describe an ionic bond.

29. Differentiate between hydrophilic and hydrophobic molecules.

30. Amphipathic molecules have a _____ region at one end of the molecule and a _____ region at the opposite end.

Concentration

31. The concentration of a substance in solution is defined as:

32. The molecular weight of a molecule is defined as:

33. A mole of a compound is defined as:

34. A solution containing 45 g of glucose in 1 L of solution is a _____ M glucose solution.

Hydrogen Ions and Acidity

35. Molecules that release hydrogen ions into solution are called _____ while substances that accept hydrogen ions are called _____.

36. (*Strong, weak*) acids or bases completely ionize in solution while (*strong, weak*) acids or bases do not completely ionize in solution.

37. The relationship between pH and hydrogen ion concentration expressed in a formula is:
38. The pH of solution A with a hydrogen ion concentration of $1 \times 10^{-5} M$ is _____ while the pH of solution B with a hydrogen ion concentration of $1 \times 10^{-9} M$ is _____. Solution A is more (*acidic, basic*) than solution B.
39. As acidity increases, pH (*increases, decreases*).
40. The normal range for the pH of body fluids is _____. This value is slightly (*acidic, basic*).

CLASSES OF ORGANIC MOLECULES

41. The four major categories of organic molecules in the body are:
- a.
 - b.
 - c.
 - d.

Carbohydrates

42. Carbohydrates are composed of the following atoms -- _____, _____, _____ -- in the proportions represented by the following formula: _____.
43. Differentiate between monosaccharides and disaccharides.
44. Differentiate between pentoses and hexoses.
45. The most abundant monosaccharide in the body is _____ and is stored in cells as the polysaccharide _____.

Lipids

46. Lipids are composed predominately of the atoms _____ and _____ and lack polar and ionized groups and are therefore (*soluble, insoluble*) in water.
47. The four subclasses of lipids are:
- a.
 - b.
 - c.
 - d.

Fatty Acids

48. A fatty acid consists of a long chain of _____ atoms with a _____ group at one end.
49. When all the carbons in a fatty acid chain are linked by single covalent bonds, the fatty acid is said to be (*saturated, unsaturated*).
50. If more than one double bond is present in a fatty acid, that fatty acid is said to be _____.

Triacylglycerols

51. Triacylglycerols are formed by linking together _____ and _____.
52. Animal fats contain a high proportion of (*saturated, unsaturated*) fatty acids whereas vegetable fats contain a high proportion of (*saturated, unsaturated*) fatty acids.

Phospholipids

53. Differentiate between a phospholipid and a triacylglycerol.

Steroids

54. The basic structure of all steroids is:
55. Examples of steroids are: