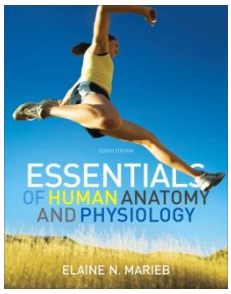
ESSENTIALS OF HUMAN ANATOMY AND PHYSIOLOGY

TENTH EDITION



ANSWERS TO END OF CHAPTER QUESTIONS

CHAPTER ONE

ANSWERS TO IN TEXT QUESTIONS

Questions appear on p. 14

Directional Terms

The wrist is proximal to the hand.

The breastbone is anterior or ventral to the spine.

The brain is superior to the spinal cord.

The thumb is lateral to the fingers.

ANSWERS TO END OF CHAPTER REVIEW QUESTIONS

Questions appear on pp. 23–24

Multiple Choice

1. d (p. 3)
2. a, b, c, d (pp. 12–13)
3. c (pp. 9, 12)
4. superior, deep, proximal, proximal, medial, posterior (p. 14; Table 1.1)
5. e, c, i, f, h, a, b, d, g (pp. 16–17; Figure 1.5)
6. c (p. 15; Table 1.1)
7. c (p. 20)
8. c (pp. 20–21; Figure 1.8)

Short Answer Essay

9. *Anatomy:* Study of the structure and shape of body parts and their relationship to one another. *Physiology:* Study of the function of the body or body parts, that is, how they work or operate. (p. 1-2)
10. See pp. 3–7, which summarize the body's organ systems. *Integumentary system:* Functions basically to protect. Ancillary roles of vitamin D production, excretion. The integumentary system or skin, is an organ and an organ system. (Students may name skin derivatives such as sweat glands and the like, but this is not really necessary.) *Skeletal system:* Major role is to support the body and provide a framework on which the muscles can act to create

movement; also protects by enclosing soft tissue and organs. Bones, ligaments. *Muscular system:* Major role is to promote body movement. Ancillary role in body temperature regulation. Organs are the skeletal muscles. *Nervous system:* The body's fast-acting controlling and coordinating system; acts via electrical signals called nerve impulses. Brain, spinal cord, nerves. *Endocrine system:* The body's slower-acting controlling and coordinating system, which acts through chemicals called hormones. Pineal gland, pituitary, thyroid, parathyroid, thymus, adrenals, pancreas, ovaries (female), testes (male). *Cardiovascular system:* Transport and delivery system for bringing adequate supplies of oxygen and nutrients to the body's cells and for getting rid of cell wastes. Heart, blood vessels. *Lymphatic system:* Collects fluid leaked from the cardiovascular system and returns it to the bloodstream. Houses cells involved in the immune response. Lymphatic vessels, lymph nodes, spleen, tonsils. *Respiratory system:* Exchanges respiratory gases, that is, takes in oxygen and releases carbon dioxide to the body exterior. Nose, pharynx, larynx, trachea, bronchi, lungs. *Digestive system:* Breaks down ingested foods so that they can be absorbed into the bloodstream and thereby made available to the body's cells. Mouth (oral cavity), esophagus, stomach, small intestine, large intestine, rectum. *Urinary system:* Rids the body of nitrogenous wastes and regulates the acid-base, water balance, and electrolytes of the body fluids. Kidneys, ureters, bladder, urethra. *Reproductive system:* Produces sex (germ) cells so that reproduction of the individual can occur. Gonads (ovaries or testes), accessory organs in the male: epididymis, ductus deferens, urethra (the previous three form the duct system), seminal vesicles, prostate, bulbourethral glands, and external genitalia (scrotum and penis). Also the duct system of the female reproductive tract: uterus, uterine tubes, vagina. (pp. 3-7).

11. *Homeostasis:* A dynamic equilibrium state of the body's internal environment that is stably maintained by cross-communicating organ systems that have various functional mechanisms in response to changes in the environment. (p. 12)
12. Aging, abnormal body functioning leading to illness and disease and/or death. (pp. 12-13)
13. Yes. No. (pp. 20–21)
14. Nose—anterior surface; calf—posterior surface; umbilicus—anterior surface; fingernails—posterior surface. (Figure 1.5)
15. Both subdivisions of the ventral body cavity—cardiovascular, circulatory, digestive, and muscular. Thoracic cavity only—respiratory. Abdominopelvic cavity only—reproductive and urinary. (pp. 20–21)

ANSWERS TO CRITICAL THINKING AND CLINICAL APPLICATION QUESTIONS

16. *Antecubital region:* He should have held out the anterior surface of his arm. (The antecubital region is the anterior aspect of the elbow. *Deltoid region:* He should have taken off his shirt to receive a shot in the shoulder region. *Sural:* His left calf was bruised/black and blue. (pp. 16–17; Figure 1.5)
17. With age, body organs and control systems become less efficient at adapting to interior and exterior stressors. This drop in efficiency causes the internal environment to be less and less stable. Examples include: sweat glands become less active; decreased amounts of hormones are produced by endocrine glands; bones become weaker due to loss of bone mass; muscles start to atrophy; and decreased efficiency of the circulatory system. In terms of disease, a straightforward example is cancer. Cancer /tumor cells are the body's own cells that multiply out of control and lose proper functioning. Also autoimmune diseases from

allergies to such diseases as multiple sclerosis can be discussed. (See “Homeostatic Imbalance” sections in each chapter.)

18. Jennie’s nerve is injured where her upper appendage attaches to the trunk (armpit). Torn ligaments are located in her neck and shoulder blade region. The broken bone is located in the right upper appendage between the shoulder and elbow. (pp. 16–17)
19. The doctors would probably use MRI because it has the highest resolving power to examine soft tissues such as the brain. Dense structures would not show up, so bones of the skull would not impair the view. (pp. 10–11)
20. Levels of calcium in the blood should increase as more parathyroid hormone (PTH) is secreted. This hormone is released in response to low levels of calcium in the blood; therefore, its functions include moving calcium out of storage (e.g., bones) and into the bloodstream, increasing calcium absorption in the intestines, and retaining calcium in the kidneys. These functions will increase blood calcium levels. (p. 13). (See also Chapter 9 for more information about the endocrine system functions.)

CHAPTER TWO

ANSWERS TO END OF CHAPTER REVIEW QUESTIONS

Questions appear on pp. 60–62

Multiple Choice

1. a, c, d (pp. 27, 29-31)
2. a, c, e (p. 32)
3. a, b, c, d, e (p. 41)
4. c, e (43; Figure 2.12)
5. b, c (pp. 49–50, 53)
6. d (p. 48)
7. a, b, c, d, e (p. 53)
8. c (p. 56-57)
9. a (28; Table 2.1)
10. a, c, d (40; Table 2.4)

Short Answer Essay

11. Chemistry is basic to an understanding of anatomy and physiology because our bodies, everything in our environment, and everything we take into our bodies are all chemical substances and therefore interact with each other through chemical reactions for physiological processes. (p. 25)

12. Energy has no mass and does not occupy space. It can only be defined by its effect on matter. Energy is defined as the ability to do work or put matter into motion. (pp. 26–27)
13. When energy is active (doing work or movement), it is called kinetic energy. Potential energy is an inactive form where energy is stored (e.g., ATP). All forms of energy have both kinetic and potential work capacities. (p. 26)
14. Chewing food—mechanical energy; vision—light energy and electrical energy (of a nerve impulse); bending the fingers—mechanical energy; breaking ATP bonds—chemical energy. (p. 26)
15. Both lead and gold are elements. Elements are the unique building blocks of matter and have a definite number of protons in their nuclei that cannot be transformed into one another (Theoretically it can be done, however the cost of putting in enough energy to remove protons would far exceed the value of gold produced). Lead has three more protons than gold. (p. 27)
16. Carbon (C), hydrogen (H), nitrogen (N), and oxygen (O) make up the bulk of living matter. Nitrogen is found chiefly in proteins and nucleic acids. (pp. 27–28)
17. Atoms contain equal numbers of protons and electrons, meaning that the positive and negative charges are balanced. With balanced charges, the atom is neutral. (p. 27, 29)
18.

Particle	**Position in Atom**	**Charge**	**Mass**
Proton	Nucleus	+	1 amu
Neutron	Nucleus	None	1 amu
Electron	Orbital around the nucleus	–	0

(p. 29; Table 2.2)

19. Radioactivity is defined as spontaneous deterioration of an (unstable) atom by emission of particles or energy from the nucleus. The heaviest isotopes (structural variants of an element with differing numbers of neutrons) of elements are usually radioisotopes because they are unstable and often decompose through radioactivity to become more stable. (p. 30, 31)
20. A molecule is a combination of two or more atoms held together by chemical bonds. (p. 31-32)
21. Ionic bonds form when electrons are transferred from one atom to another. (pp. 34)
22. Hydrogen bonds are fragile bonds formed when hydrogen atoms bonded to one molecule (or one part of a single molecule) are attracted by electron-hungry atoms of other molecules (or other atoms of the same molecule). They are important to the body because they not only hold water molecules together, but also play a major role in determining the three-dimensional shape (and therefore, function) of proteins and DNA. (p. 37)
23. This statement is false. A polar molecule is formed when the atoms of the molecule have different electron-attracting abilities, and therefore there is unequal electron-pair sharing between the atoms. Oxygen gas contains two oxygen atoms and is therefore nonpolar, as the electrons are shared equally between the two atoms comprising the molecule. (pp. 35–36)
24. Argon has a full valence shell so it will not readily donate or accept electrons, meaning that it does not combine easily with other elements. Oxygen does not have a full valence shell (it only has 6 electrons in its outermost shell), so it can accept (share) electrons when combining with other elements. (pp. 33–34)
25. $2\ Hg + O_2 \longrightarrow 2\ HgO$; synthesis.

    $Fe^{2+}\ CuSO_4 \longrightarrow FeSO_4 + Cu^{2+}$; exchange.

$HCl + NaOH \longrightarrow NaCl + H_2O$; exchange.

$HNO_3 \longrightarrow H^+ + NO_3^-$; decomposition.

(pp. 39-40)

26. Inorganic compounds, with a few exceptions such as CO_2, are noncarbon-containing: water, salts, acids, and bases. Organic compounds are carbon-containing: carbohydrates, lipids, proteins, and nucleic acids. (pp. 40–54)
27. An electrolyte is a chemical compound that ionizes/dissociates (separates into ions) in water, and is then able to conduct an electrical current in solution. (p. 41)
28. pH is a measure of hydrogen ion concentration in solution. Blood is slightly basic. (p. 42)
29. A pH of 3.3 is ten times more acidic than a pH of 4.3. (p. 42)
30. *Monosaccharides:* simple sugars, basic units of carbohydrates; examples are glucose, fructose, and galactose. *Disaccharides:* two simple sugars bonded together; examples are sucrose, lactose, and maltose. *Polysaccharides:* many simple sugars bonded together; examples are starch and glycogen. *Carbohydrates* are the major energy fuel for producing ATP in body cells. A small percentage of carbohydrates have a structural role in the body from the gene level to the cell surface. (pp. 43–44)
31. Neutral fats consist of three fatty acid chains joined to a glycerol backbone; they insulate and cushion the body and provide stored energy fuel. Phospholipids consist of two fatty acids and a phosphorus-containing group attached to glycerol; they are part of all cell membranes. Steroids are flat structures made of four interlocking rings. One steroid, cholesterol, forms the basis of steroid hormones, such as estrogen and testosterone, as well as vitamin D, and bile salts. (pp. 45–49)

32. The R-group is different for each amino acid, giving each type unique properties. (Figure 2.16 gives a diagrammatic representation of these structures.) (p. 49)
33. Structural proteins are basically fibrous or linear proteins that usually have secondary structure; keratin, collagen (this is an exception and has quaternary structure), and elastin are examples. Functional proteins are globular or spherical proteins (having tertiary structure); examples are antibodies, enzymes, some hormones, antibodies, and hemoglobin. (pp. 50–52)
34. An enzyme is a biological catalyst. Enzymes increase the rate of chemical reactions by holding the reaction molecules in the proper position(s) to interact. (pp. 51-53)
35. High body temperature and also acidosis interfere with enzyme activity by destroying (denaturing) the three-dimensional structure that is essential for binding substrate and enzyme. (p. 50)
36. The structural unit of nucleic acids is the nucleotide. The major classes of nucleic acids are DNA and RNA. DNA is a double-stranded helix of nucleotides; its bases are A, G, C, and T, and its sugar is deoxyribose. RNA is single-stranded; its bases are A, G, C, and U, and its sugar is ribose. DNA is the genetic material that carries instructions for protein synthesis; RNA carries out DNA's instructions. (pp. 53-54; 56–57)
37. ATP is the immediate source of chemical energy for all body cells. (p. 57)
38. Surface tension (caused by hydrogen bonds) prevents water molecules "stacked" slightly above the glass from spilling over. (p. 37)
39. All salts are electrolytes and thus have the ability to conduct electrical currents within fluid solutions such as the blood. If electrolyte balance were to become severely disturbed by excessive salt water intake, virtually all life-sustaining physiological functioning would

slow down and eventually cease, as all biochemical processes require a fluid medium where salt concentration is maintained within a relatively narrow range. Excessive salt water consumption will also elevate blood pressure as increased salinization within the bloodstream will draw more fluid into the blood vessels via osmosis. For this reason, excessive salt intake is often associated with cardiovascular disease because it increases arterial blood pressure "from the inside out." (p. 41)

ANSWERS TO CRITICAL THINKING AND CLINICAL APPLICATION QUESTIONS

40. If the antibiotic binds to the enzyme region that normally bonds to reactants, the bacterial enzyme's function will be blocked. The bacteria may die as a result, meaning that the person may get better. (pp. 51–52)
41. pH is defined as the measurement of the hydrogen ion concentration in a solution. The normal blood pH is between 7.35 and 7.45. Severe acidosis is critical because blood comes in contact with nearly every body cell and can adversely affect the cell membranes, kidney functions, muscle contraction, and neural activity. Hemoglobin, an iron-containing protein in red blood cells that carries oxygen, may also be affected by the more acidic pH level. When this change happens, then oxygen delivery to the tissues will be decreased or stopped completely, which leads to impaired cell functioning all over the body. (pp. 42–43)
42. Neutral fats are found in deposits under the skin and surrounding organs. One of their functions is to insulate the body and prevent heat loss. Evelyn is thin and feels cold because she has less insulation, so she loses heat more readily than Barbara, who retains heat because she has more insulating body fat. (pp. 46 and 48; Table 2.4)

43. Proteins will be greatly affected by high temperatures. Protein structure is held together by fragile hydrogen bonds that can be easily broken with excess heat. If protein structure is not maintained, it cannot function properly. Without proper protein structure, extensive cell and tissue damage could occur. (p. 49-50)