**Chapter 1—Introduction to Physiology and Homeostasis**

**MULTIPLE CHOICE**

1. Select the incorrect association.

|  |  |
| --- | --- |
| a. | anatomy/heart structure |
| b. | human body/multicellularity |
| c. | oxygen/cellular waste |
| d. | physiology/stomach function |
| e. | unicellularity/amoeba |

ANS: C PTS: 1 DIF: Comprehension

2. Which of the following is a mechanistic explanation of a physiological phenomenon?

|  |  |
| --- | --- |
| a. | You breathe to obtain oxygen. |
| b. | You sweat to cool off. |
| c. | Your stomach secretes digestive juices when stimulated by the nervous system. |
| d. | Your heart beats to pump blood. |
| e. | Your kidneys produce urine so that cellular wastes do not poison your body. |

ANS: C PTS: 1 DIF: Application

3. The influence of oxytocin on the uterus during childbirth and the subsequent effect of uterine stretch on the release of oxytocin is an example of

|  |  |
| --- | --- |
| a. | negative feedback |
| b. | positive feedback |
| c. | extrinsic control |
| d. | negative feedback and extrinsic control |
| e. | none of these |

ANS: B PTS: 1 DIF: Knowledge

4. Food in your stomach is in direct contact with \_\_\_\_\_\_ tissue.

|  |  |
| --- | --- |
| a. | connective |
| b. | epithelial |
| c. | glandular |
| d. | muscle |
| e. | nervous |

ANS: B PTS: 1 DIF: Comprehension

5. Which of the following does a person not maintain through homeostasis?

|  |  |
| --- | --- |
| a. | Concentration of nutrients in the blood |
| b. | Concentration of oxygen around the body |
| c. | Blood pressure |
| d. | Temperature of the brain |
| e. | Posture while sitting in a chair |

ANS: B PTS: 1 DIF: Comprehension

6. Sweat glands consist of specialized \_\_\_\_\_\_ cells.

|  |  |
| --- | --- |
| a. | connective |
| b. | endocrine |
| c. | epithelial |
| d. | muscle |
| e. | nervous |

ANS: C PTS: 1 DIF: Knowledge

7. The respiratory system

|  |  |
| --- | --- |
| a. | obtains O2 from and eliminates CO2 to the internal environment |
| b. | includes the heart and lungs |
| c. | helps regulate the pH of the internal environment by removing acid-forming CO2 from the blood |
| d. | performs all of the functions listed above |
| e. | obtains O2 from and eliminates CO2 to the internal environment and helps regulate the pH of the internal environment by removing acid-forming CO2 from the blood |

ANS: C PTS: 1 DIF: Knowledge

8. Select the incorrect statement about connective tissue.

|  |  |
| --- | --- |
| a. | Bone is an example. |
| b. | Blood is an example. |
| c. | Elastin may be found in the extracellular material. |
| d. | It has tightly-packed cells. |
| e. | It is a primary tissue type. |

ANS: D PTS: 1 DIF: Knowledge

9. Which of the following body systems is not directed entirely toward maintaining homeostasis?

|  |  |
| --- | --- |
| a. | reproductive system |
| b. | endocrine system |
| c. | nervous system |
| d. | muscular system |
| e. | integumentary system |

ANS: A PTS: 1 DIF: Knowledge

10. Which sequence represents a correct hierarchy of biological organization in a human, from smaller to larger?

|  |  |
| --- | --- |
| a. | chemical, organ, tissue, system, organism |
| b. | cell, tissue, organ, system, organism |
| c. | tissue, cell, system, organism, organ |
| d. | organ, tissue, cell, organism, system |
| e. | system, cell, organ, organism, tissue |

ANS: B PTS: 1 DIF: Knowledge

11. The internal environment

|  |  |
| --- | --- |
| a. | is not in direct contact with the body's cells |
| b. | consists of the intracellular fluid |
| c. | must be maintained at absolutely unchanging composition, temperature, and volume for survival of the body |
| d. | is in direct contact with the body's cells and consists of the extracellular fluid |
| e. | consists of the intracellular fluid and must be maintained at absolutely unchanging composition, temperature, and volume for survival of the body |

ANS: D PTS: 1 DIF: Comprehension

12. Extracellular fluid

|  |  |
| --- | --- |
| a. | is the internal environment of the body |
| b. | is outside the cells but inside the body |
| c. | consists of the plasma and interstitial fluid |
| d. | exhibits a dynamic steady state in regard to composition, temperature, and volume |
| e. | is described by all of the above statements |

ANS: E PTS: 1 DIF: Knowledge

13. Nutrients and oxygen are distributed through the body mainly by the \_\_\_\_ system.

|  |  |
| --- | --- |
| a. | circulatory |
| b. | digestive |
| c. | endocrine |
| d. | integumentary |
| e. | skeletal |

ANS: A PTS: 1 DIF: Knowledge

14. Which of the following statements about negative feedback is incorrect?

|  |  |
| --- | --- |
| a. | It exists when a change in a regulated variable triggers a response that opposes the change. |
| b. | It exists when the input to a system increases the output and the output inhibits the input. |
| c. | The control system's input and output continue to enhance each other. |
| d. | It is the method by which most of the body's control mechanisms operate. |
| e. | It helps maintain the body's dynamic, steady state. |

ANS: C PTS: 1 DIF: Comprehension

15. Identify the characteristics associated with endocrine glands.

|  |  |
| --- | --- |
| a. | lack ducts |
| b. | secrete chemicals directly into the blood |
| c. | derived from epithelial tissue |
| d. | include the parathyroids |
| e. | all of these |

ANS: E PTS: 1 DIF: Knowledge

16. Which of the following is least related to connective tissue?

|  |  |
| --- | --- |
| a. | gland |
| b. | bone |
| c. | blood |
| d. | tendon |
| e. | elastin |

ANS: A PTS: 1 DIF: Knowledge

17. Which of the following is not an example of negative feedback?

|  |  |
| --- | --- |
| a. | A low grade on an exam causes a student to study harder for the next exam. |
| b. | A small stone rolls down a hill and starts an avalanche. |
| c. | A person goes to eat in the cafeteria when he/she gets hungry. |
| d. | You change a flat tire so you can continue on a journey in your car. |
| e. | A person's body shivers after the person falls into a cold river. |

ANS: B PTS: 1 DIF: Application

18. Evaporation of sweat cooling the body is an example of

|  |  |
| --- | --- |
| a. | negative feedback |
| b. | positive feedback |
| c. | a feedforward mechanism |
| d. | an intrinsic (local) control mechanism |
| e. | autoregulation |

ANS: A PTS: 1 DIF: Comprehension

19. The two major regulatory systems in the body are

|  |  |
| --- | --- |
| a. | nervous and respiratory |
| b. | nervous and endocrine |
| c. | endocrine and respiratory |
| d. | endocrine and lymphatic |
| e. | circulatory and endocrine |

ANS: B PTS: 1 DIF: Knowledge

20. Calcium is stored mainly in the \_\_\_\_ system.

|  |  |
| --- | --- |
| a. | digestive |
| b. | endocrine |
| c. | integumentary |
| d. | muscular |
| e. | skeletal |

ANS: E PTS: 1 DIF: Knowledge

21. If a letter in the alphabet is equated to a cell, then which of the following would be most like an organ?

|  |  |
| --- | --- |
| a. | two paragraphs |
| b. | a paragraph |
| c. | a word |
| d. | a sentence |
| e. | two sentences |

ANS: D PTS: 1 DIF: Application

22. Identify the correct statement(s) about stem cells.

|  |  |
| --- | --- |
| a. | They are undifferentiated embryonic cells. |
| b. | They may reproduce many times. |
| c. | Their daughter cells may differentiate into a number of different specialized cell types. |
| d. | All of the above. |
| e. | None of the above. |

ANS: D PTS: 1 DIF: Knowledge

23. Which of the following is a feedforward phenomenon?

|  |  |
| --- | --- |
| a. | Increasing the amount of insulin secreted before nutrients in food enter the blood. |
| b. | Shivering in response to having cold air around the body. |
| c. | Sweating after being in a sauna for 10 minutes. |
| d. | Eating a doughnut because you are hungry. |
| e. | Jerking your hand away from a hot stove after you touch it. |

ANS: A PTS: 1 DIF: Application

24. The statement “Things are going from bad to worse” would be most closely related to

|  |  |  |  |
| --- | --- | --- | --- |
| a. | feedforward | d. | homeostasis |
| b. | positive feedback | e. | regulatory control |
| c. | negative feedback |

ANS: B PTS: 1 DIF: Application

25. The ability of the brain to maintain optimum blood pressure by speeding up or slowing down the heart is an example of

|  |  |  |  |
| --- | --- | --- | --- |
| a. | intrinsic control | d. | Both a and c |
| b. | extrinsic control | e. | Both b and c |
| c. | positive feedback |

ANS: B PTS: 1 DIF: Comprehension

**TRUE/FALSE**

1. Cells eliminate carbon dioxide as a waste product.

ANS: T PTS: 1 DIF: Knowledge

2. All cells that are not pluripotent can reproduce.

ANS: F PTS: 1 DIF: Knowledge

3. Highly differentiated tissues such as nervous and cardiac muscle are incapable of reproduction because they are pluripotent.

ANS: F PTS: 1 DIF: Knowledge

4. Enzymes are carbohydrates that speed up chemical reactions in the body.

ANS: F PTS: 1 DIF: Knowledge

5. A mechanistic explanation of why a person breathes is to obtain oxygen.

ANS: F PTS: 1 DIF: Comprehension

6. A non-mechanistic explanation of why a person sweats is to cool off.

ANS: T PTS: 1 DIF: Comprehension

7. Tissues are composed of two or more types of cells organized to perform a particular function or functions.

ANS: F PTS: 1 DIF: Knowledge

8. Blood is a type of connective tissue that contains small fibers of elastin protein in the extracellular material called plasma.

ANS: F PTS: 1 DIF: Knowledge

9. Glands are formed during embryonic development by pockets of epithelial tissue that dip inward from the surface.

ANS: T PTS: 1 DIF: Knowledge

10. Endocrine glands secrete hormones through ducts into the blood.

ANS: F PTS: 1 DIF: Knowledge

11. Insulin is a hormone that is secreted into the lumen of the intestine in response to the presence of food.

ANS: F PTS: 1 DIF: Comprehension

12. The epidermis that covers the skin is a simple organ.

ANS: F PTS: 1 DIF: Knowledge

13. The external environment is found outside cells but inside the body.

ANS: F PTS: 1 DIF: Knowledge

14. Factors that are homeostatically regulated are maintained at a constant, fixed level unless disease is present.

ANS: F PTS: 1 DIF: Comprehension

15. The respiratory system removes carbon dioxide transported to it by the blood.

ANS: T PTS: 1 DIF: Comprehension

16. To sustain life, the internal environment must be maintained in an absolutely unchanging state.

ANS: F PTS: 1 DIF: Comprehension

17. Some activities performed by the muscular and nervous systems are not directed toward maintaining homeostasis.

ANS: T PTS: 1 DIF: Knowledge

18. The plasma surrounds and bathes all of the body's cells.

ANS: F PTS: 1 DIF: Knowledge

19. The concentration of salt in the extracellular fluid influences how water enters and leaves cells.

ANS: T PTS: 1 DIF: Knowledge

20. Exocrine glands are the only structures in the body capable of secretion.

ANS: F PTS: 1 DIF: Knowledge

21. Secretion in response to appropriate stimulation refers to the release of specific products that have, in large part, been synthesized by the cell.

ANS: T PTS: 1 DIF: Knowledge

22. The endocrine system relies on the circulatory system for the transport of hormones.

ANS: T PTS: 1 DIF: Knowledge

23. One organ can belong to more than one body system.

ANS: T PTS: 1 DIF: Knowledge

24. The integumentary system contains specialized organs called sweat glands, which are important in regulating body temperature.

ANS: T PTS: 1 DIF: Knowledge

25. Negative feedback operates to prevent any change in the value of a controlled factor in the body.

ANS: F PTS: 1 DIF: Comprehension

26. Positive feedback moves a controlled variable even further away from a steady state.

ANS: T PTS: 1 DIF: Knowledge

27. With positive feedback, a control system's input and output continue to enhance each other.

ANS: T PTS: 1 DIF: Comprehension

28. Feedforward mechanisms bring about a response in reaction to a change in a regulated variable.

ANS: F PTS: 1 DIF: Knowledge

29. Most homeostatic mechanisms operate on the principle of positive feedback.

ANS: F PTS: 1 DIF: Comprehension

30. A single pluripotent cell without dividing can differentiate into more than one kind of mature body cell.

ANS: F PTS: 1 DIF: Knowledge

31. With negative feedback, a control system's output counteracts the input into the system.

ANS: T PTS: 1 DIF: Comprehension

32. The simple fact that exercising muscles use more O2 is an example of negative feedback.

ANS: F PTS: 1 DIF: Comprehension

33. If a pluripotent cell differentiates to become a skin cell, it may revert back to its pluripotent condition and then become a muscle cell.

ANS: F PTS: 1 DIF: Comprehension

34. The way in which the nervous system affects a person’s heart rate is an example of intrinsic control since both the nervous system and the heart are inside the body.

ANS: F PTS: 1 DIF: Comprehension

35. The integumentary, nervous, and endocrine systems are the only systems involved in regulating body temperature.

ANS: F PTS: 1 DIF: Knowledge

**COMPLETION**

**Complete each of the following statements.**

1. The smallest unit capable of carrying out the processes associated with life is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

ANS: cell

PTS: 1 DIF: Knowledge

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells are specialized to send electrical signals.

ANS: Nerve

PTS: 1 DIF: Knowledge

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ muscle tissue composes the heart.

ANS: Cardiac

PTS: 1 DIF: Knowledge

4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are composed of two or more types of primary tissue organized to perform a particular function or functions.

ANS: Organs

PTS: 1 DIF: Knowledge

5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ glands secrete through ducts, whereas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ glands secrete directly into the blood.

ANS: Exocrine, endocrine

PTS: 1 DIF: Knowledge

6. A(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a collection of organs that perform related functions and interact to accomplish a common activity that is essential for survival of the whole body.

ANS: system or organ system

PTS: 1 DIF: Knowledge

7. The internal environment consists of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is made up of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; the fluid portion of the blood; and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which surrounds and bathes all cells.

ANS: extracellular fluid, plasma, interstitial fluid

PTS: 1 DIF: Knowledge

8. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the liquid part of the blood.

ANS: plasma

PTS: 1 DIF: Knowledge

9. The body cells are in direct contact with, and make life-sustaining exchanges with, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

ANS: internal environment (extracellular fluid)

PTS: 1 DIF: Knowledge

10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ refers to maintenance of a relatively stable internal environment.

ANS: Homeostasis

PTS: 1 DIF: Knowledge

11. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tissue is composed of cells specialized for contraction and force generation.

ANS: Muscle

PTS: 1 DIF: Knowledge

12. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system consists of all hormone-secreting tissues.

ANS: endocrine

PTS: 1 DIF: Knowledge

13. The two major control systems of the body are the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

ANS: nervous system, endocrine system

PTS: 1 DIF: Knowledge

14. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are the blood vessels where materials are exchanged between the blood and the interstitial fluid.

ANS: Capillaries

PTS: 1 DIF: Knowledge

15. The tonsils are part of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system.

ANS: immune or lymphatic

PTS: 1 DIF: Knowledge

16. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system eliminates waste products other than carbon dioxide and plays a key role in regulating the volume, electrolyte composition, and acidity of the extracellular fluid.

ANS: urinary

PTS: 1 DIF: Knowledge

17. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system controls and coordinates bodily activities that require swift responses, especially to changes in the external environment.

ANS: nervous

PTS: 1 DIF: Knowledge

18. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ refers to the abnormal functioning of the body associated with disease.

ANS: Pathophysiology

PTS: 1 DIF: Knowledge

19. If after making a bad grade on an exam causes a student to study harder in order to make a better grade on the next exam, the student’s response to making the bad grade would be an example of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ feedback.

ANS: negative

PTS: 1 DIF: Comprehension

20. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells are not specialized for a specific function but can divide to give rise to highly specialized cells.

ANS: Stem

PTS: 1 DIF: Knowledge

21. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ stem cells are partially differentiated, harvested from adults, and can become highly differentiated, specialized cell types.

ANS: Tissue-specific

PTS: 1 DIF: Knowledge

22. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ stem cells are undifferentiated cells that result from the early divisions of a fertilized egg and ultimately give rise to all specialized cells of the body.

ANS: Embryonic stem

PTS: 1 DIF: Knowledge

**MATCHING**

Indicate whether the following physiological event represents:

|  |  |
| --- | --- |
| a. | feedforward control |
| b. | negative feedback control |
| c. | positive feedback control |

1. X increases the production of Y and Y decreases the production of X.

2. A small fire initiated with a match becomes a raging forest fire.

3. Increased cardiac activity to elevate blood pressure when blood pressure is low

4. Doing warm-up exercises prior to a sporting event in order to prepare one’s muscles for the event.

5. A decrease in body temperature causes a decrease in metabolism, which causes less heat to be generated, which causes the body temperature to decrease even more.

1. ANS: B PTS: 1 DIF: Application

2. ANS: C PTS: 1 DIF: Application

3. ANS: B PTS: 1 DIF: Application

4. ANS: A PTS: 1 DIF: Application

5. ANS: C PTS: 1 DIF: Application

Use the following answer code to indicate which tissue is being identified.

|  |  |
| --- | --- |
| a. | nervous tissue |
| b. | epithelial tissue |
| c. | muscle tissue |
| d. | connective tissue |

6. Composed of cells specialized for contraction

7. Includes cells specialized for exchanging material between plasma and interstitial fluid

8. Connects, supports, and anchors body parts

9. Primary component of the heart

10. Primary component of a bone

11. Includes cells that form glands

12. Lines the digestive tract

13. Primary component of the brain

14. Includes blood as a major type

15. Has relatively few cells within an extracellular material

16. Has one specific type classified as "smooth"

6. ANS: C PTS: 1 DIF: Knowledge

7. ANS: B PTS: 1 DIF: Knowledge

8. ANS: D PTS: 1 DIF: Knowledge

9. ANS: C PTS: 1 DIF: Knowledge

10. ANS: D PTS: 1 DIF: Knowledge

11. ANS: B PTS: 1 DIF: Knowledge

12. ANS: B PTS: 1 DIF: Knowledge

13. ANS: A PTS: 1 DIF: Knowledge

14. ANS: D PTS: 1 DIF: Knowledge

15. ANS: D PTS: 1 DIF: Knowledge

16. ANS: C PTS: 1 DIF: Knowledge

Temperature-sensitive nerve cells monitor the body temperature and provide information about its status to a temperature-control center in the hypothalamus, a part of the brain. The hypothalamus can bring about adjustments in body temperature by inducing shivering or sweating, among other things. Indicate the roles served by each component of this control system using the following answer code.

|  |  |
| --- | --- |
| a. | controlled variable |
| b. | integrator |
| c. | sensor |
| d. | effector |

17. Body temperature

18. Temperature-sensitive nerve cells

19. Skeletal muscles and sweat glands

20. Hypothalamus

17. ANS: A PTS: 1 DIF: Comprehension

18. ANS: C PTS: 1 DIF: Comprehension

19. ANS: D PTS: 1 DIF: Comprehension

20. ANS: B PTS: 1 DIF: Comprehension

Someone sees a burglar breaking into your house, so they call 911 and the dispatcher sends police officers to your house. Relating this scenario to a feedback loop that maintains homeostasis in your body, indicate the role of each component using the following answer code.

|  |  |
| --- | --- |
| a. | Effector |
| b. | Message sent from sensor |
| c. | Sensor |
| d. | Message sent from integrator |
| e. | Controlled variable |
| f. | Integrator |

21. House safety

22. 911 call

23. Police officers

24. Person calling 911

25. Dispatcher

26. Radio call to police officers

21. ANS: E PTS: 1 DIF: Evaluation

22. ANS: B PTS: 1 DIF: Evaluation

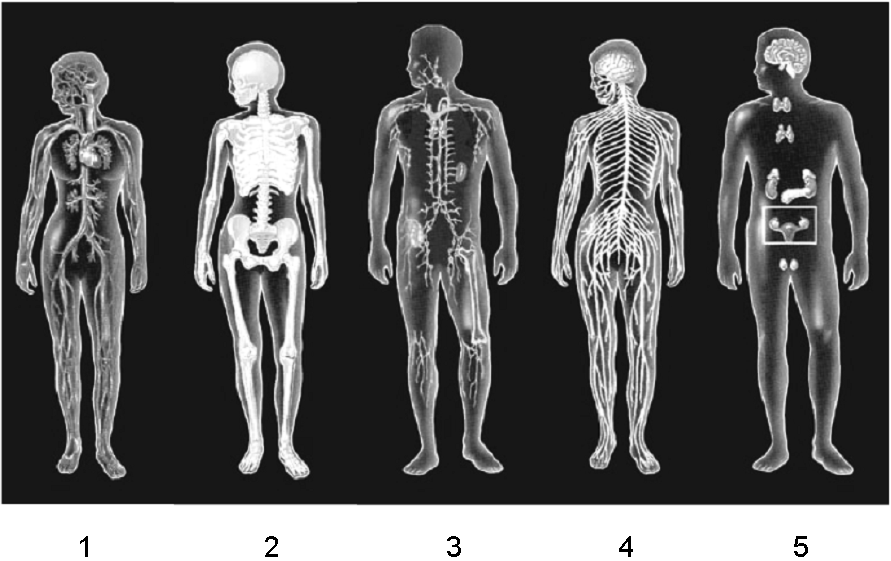
23. ANS: A PTS: 1 DIF: Evaluation

24. ANS: C PTS: 1 DIF: Evaluation

25. ANS: F PTS: 1 DIF: Evaluation

26. ANS: D PTS: 1 DIF: Evaluation

**ART-BASED QUESTIONS**



**Use the figure above to answer the corresponding questions.**

1. Which number identifies the system that serves as the source of all blood cells?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |
| e. | 5 |

ANS:

b

PTS: 1 DIF: Knowledge

2. Which number identifies the system that serves as a regulatory system in which the duration of activity is more important than the speed of activity?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |
| e. | 5 |

ANS:

e

PTS: 1 DIF: Knowledge

3. Which number identifies the system that serves as the site of nutrient and waste exchange between cells and the interstitial fluid?

|  |  |
| --- | --- |
| a. | 1 |
| b. | 2 |
| c. | 3 |
| d. | 4 |
| e. | 5 |

ANS:

a

PTS: 1 DIF: Knowledge

4. Which number identifies the system that is primarily responsible for fighting infectious diseases?

ANS:

3

PTS: 1 DIF: Knowledge

**ESSAY**

1. Beginning with the chemical level and ending with the system level, compare the different levels of organization in the human body with the following things found on a page in a book: sentence, letter, word, ink in a letter, paragraph, and all paragraphs on a page.

ANS:

*The ink would be like the chemical level and it forms the letters, which would be like cells. Two or more letters together make up a word, which is like a tissue. Two or more words make up a sentence, which is like an organ; and two or more sentences make up a paragraph, which is like a body system. All paragraphs on a page would be like all body systems together, which make up the human body.*

PTS: 1 DIF: Application

2. The pancreas is part of the endocrine system and secretes the hormone insulin, which allows most body cells to absorb glucose from the blood. A lack of insulin can result in hyperglycemia (high blood glucose), which can adversely affect one's health. Describe the roles of the digestive system, circulatory system, and endocrine systems in maintaining glucose homeostasis when a person eats a sugary meal.

ANS:

*The digestive system breaks down the sugary meal and transports the sugars into the blood. The circulatory system transports the sugars throughout the body. If the level of glucose in the blood increases above optimum, the endocrine system releases insulin that causes body cells to absorb glucose, thus lowering the glucose to optimum levels in the blood.*

PTS: 1 DIF: Comprehension

3. Explain the long-term adaptations made by the heart in response to an exercise regimen of sufficient intensity and duration, and explain how this is beneficial to the heart and to the athlete.

ANS:

*The heart increases its strength and efficiency so that it pumps more blood per beat. This allows the muscles to receive more oxygen to meet the increased demand. Because of the increased pumping ability, the heart does not have to beat as rapidly to pump a given quantity of blood as it did before beginning the exercise regimen.*

PTS: 1 DIF: Comprehension