Study Island

1. During heatstroke, the body can't dispose of excess heat. As a result, the homeostatic balance is disturbed, and internal body temperatures can reach as much as 110°.

Heatstroke is dangerous to people primarily because

- **A.** it causes pneumonia.
- **B.** blood pressure becomes too low.
- **C.** blood vessels may rupture.
- **D.** cells can't function properly at high temperatures.

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2. Homeostasis is the regulation of metabolic processes within an organism in order to maintain the stable internal conditions required for life.

The human respiratory system includes the nose, the larynx, and the lungs. This body system helps maintain homeostasis by

- **A.** transporting oxygen to other organ systems.
- **B.** enabling gas exchange in the body.
- **C.** regulating hormone levels in the body.
- **D.** removing solid waste from the body.

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3. Homeostasis is the process through which an organism regulates its internal environment in order to maintain a stable and constant condition.

An example of homeostasis is the regulation of the glucose sugar level in blood through the interaction of the hormones insulin and glucagon.

What happens if the body is unable to maintain its blood glucose levels?

- **A.** This regulation is unnecessary to the viability of organisms.
- **B.** The body adapts to a different blood glucose level.
- **C.** Diseases, such as diabetes and hypoglycemia, result.
- **D.** New hormones are created to solve the problem.

4. The components of the human body, from organ systems to cell organelles, interact to maintain a balanced internal environment (homeostasis).

To successfully accomplish this, organisms possess many different control mechanisms that detect deviations and make corrective actions.

For example, when there is an increase in muscle cell activity, the body responds by

I. increasing the heart rate.
II. increasing the respiratory rate.
III. producing more red blood cells.
IV. producing more hemoglobin.

- **A.** III and IV only
- **B.** I and II only
- **C.** I, II, III and IV
- **D.** I, II and III only

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5. Diffusion is the spontaneous movement of a substance from an area of _____ concentration to an area of _____ concentration.

- **A.** higher; lower
- **B.** high; similar
- **C.** low; similar
- **D.** lower; higher

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6. Materials are able to move across a cell membrane through one of two methods: active transport or passive transport. What is the difference between active transport and passive transport?

- **A.** Passive transport is the only form of transport that requires the use of protein carriers.
- **B.** Active transport requires the cell to expend energy, while passive transport does not.
- **C.** Active transport requires the cell to form vesicles, while passive transport requires the use of membrane pumps.
- **D.** Active transport is the only form of transport that requires the use of protein carriers.

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7. When dry environmental conditions exist, guard cells close the openings in leaves to reduce the loss of water from the plant. This process is an example of a feedback mechanism that plants use in order to

- **A.** expend their resources.
- **B.** produce more chlorophyll.
- **C.** maintain homeostasis.
- **D.** absorb more solar energy.

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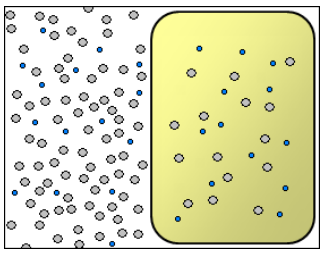
8. Look at the diagram below.



The yellow box represents a cell with a semi-permeable membrane. The small, blue dots represent molecules of water, and the larger, gray dots represent a solute such as sugar or salt. The membrane is thin enough for water to pass through, but it is not thin enough for the solute to pass.

What will happen to the substances in this diagram to bring the concentrations closer to equilibrium?

- **A.** Nothing will change--it is already in equilibrium.
- **B.** The solute will flow into the cell from the surrounding environment.
- **C.** Water will flow out of the cell and into the surrounding environment.
- **D.** Water will flow into the cell from the surrounding environment.

9. Homeostasis is classified under which of the following?

- **A.** cell regulation
- **B.** cell respiration
- **C.** photosynthesis
- **D.** transcription

10. The _____ essentially aids in cellular homeostasis by providing the main transport mechanism for proteins within the cell.

- **A.** nucleus
- **B.** endoplasmic reticulum
- **C.** mitochondrion
- **D.** Golgi apparatus

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11. Emphysema is a health condition in which the lungs can no longer expel carbon dioxide normally. As a result, a person who has emphysema may have high blood acidity levels.

The body process that would attempt to return the blood pH to normal so that cells could function properly is called _____.

- **A.** active transport
- **B.** acidosis
- **C.** homeostasis
- **D.** adaptation

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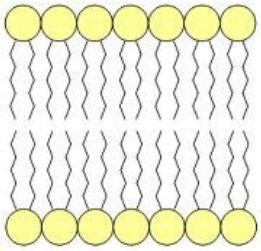
12. The cell membrane, or plasma membrane, is made up of a lipid bilayer in which hydrophilic heads face outward and hydrophobic tails face inward.



This arrangement within the cell membrane allows it to

- **A.** absorb water from the cytoplasm whenever necessary.
- **B.** fuse with ribosomes during DNA replication.
- **C.** keep out all viral and bacterial infections.
- **D.** control the movement of substances in and out of the cell.

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13. Cells can function

- **A.** at any temperature and pH.
- **B.** only in a narrow range of temperature and pH.
- **C.** in rapidly changing temperatures and pHs.
- **D.** in a wide range of pHs and temperatures.

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14. All cells have a protective barrier that is formed of proteins and a lipid bilayer. What is the name of this barrier?

- **A.** cell wall
- **B.** phospholipid barrier
- **C.** cytoplasm
- **D.** cell membrane

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15. In order to maintain homeostasis, human cells must have a higher concentration of sodium ions outside the cell than inside the cell. In addition, the concentration of potassium ions must be higher inside the cell than outside the cell. Which of the following forms of cellular transportation helps human cells maintain a relatively constant sodium and potassium concentration?

- **A.** diffusion
- **B.** endocytosis
- **C.** osmosis
- **D.** a cell membrane pump

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16. The secretion of hormones is an example of a physiological feedback loop. When hormones are needed, they are secreted by glands. When the hormones are no longer needed, the glands are signaled to stop secreting the hormones until they are needed again.

Thus, the basic function of a physiological feedback loop is

- **A.** to regulate a process.
- **B.** to destroy substances.
- **C.** to end a process.
- **D.** to create substances.

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17. Which of the following describes how body systems interact to maintain homeostasis?

I. When too much salt and electrolytes are consumed, they are filtered out of the blood and removed by the kidneys.

II. When body parts, such as muscles, need calcium, it is released from calcium stores in the bones.

III. When the body temperature rises, the brain signals for an increase in blood flow to the skin.

- **A.** II and III only
- **B.** I only
- **C.** I and III only
- **D.** I, II, and III

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18. Organisms must be able to adapt to a changing external and internal environment. An organism's ability to maintain a stable internal environment is known as homeostasis. How does a cell's membrane help an organism maintain homeostasis?

- **A.** Cell membranes protect the cell organelles from large doses of radiation.
- **B.** Cell membranes directly control the temperature of the cell.
- **C.** Cell membranes use a large portion of the cell's energy supply.
- **D.** Cell membranes control the substances that enter or leave cells.

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19. Permeability is the condition of being capable of having materials flow into and out of a membrane. The permeability of a cell membrane is determined by how easily a molecule can diffuse across the membrane. Usually, only molecules that are fat-soluble can permeate across a cell membrane. Why is this the case?

- **A.** Cell membranes are composed of a lipid bilayer.
- **B.** Water-soluble molecules are too large.
- **C.** Water-soluble molecules are nonpolar.
- **D.** Cell membranes are composed of cytosol.

20. The Golgi apparatus helps to maintain cellular homeostasis by

- **A.** modifying, sorting, and packaging proteins prior to transport.
- **B.** synthesizing ATP molecules from glucose during glycolysis.
- **C.** controlling which proteins are synthesized during the cell cycle.

○ **D.** transforming absorbed light energy to manufacture carbohydrates.

21. Which of the following is a function of the cell membrane of a cell?

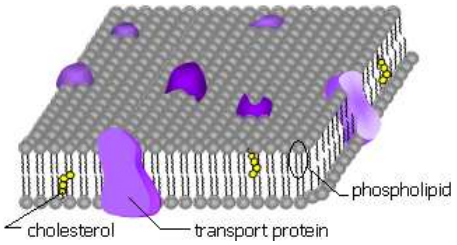
○ **A.** The transport of genetic material within the cytoplasm of the cell.

○ **B.** The production of genetic material through DNA transcription.

○ **C.** The transport of molecules into and out of the cell through osmosis and diffusion.

○ **D.** The production of energy from food molecules using cellular respiration.

22.



The fluid mosaic model shown above describes the structure and function of

○ **A.** cell membranes.

○ **B.** chromosomes.

○ **C.** nuclei.

○ **D.** chloroplasts.

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23. If the water concentration inside a cell is higher than the water concentration outside the cell, water flows out of the cell. This method of molecular transport is called

○ **A.** endocytosis.

○ **B.** a sodium pump.

○ **C.** exocytosis.

○ **D.** osmosis.

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24. An organism's ability to maintain a stable internal environment in the midst of external environmental change is known as

- **A.** metabolism.
- **B.** commensalism.
- **C.** reproduction.
- **D.** homeostasis.

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25. Cells use _____ to take in large molecules or other cells.

- **A.** passive transport by diffusion
- **B.** active transport by endocytosis
- **C.** passive transport by osmosis
- **D.** active transport by carrier proteins

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26. There are two main ways in which molecules are transported into and out of cells - active transport and passive transport. Which of the following statements is true of passive transport?

- **A.** Carrier proteins are sometimes used during passive transport.
- **B.** Molecules move up a concentration gradient during passive transport.
- **C.** Energy, in the form of ATP, is essential for passive transport.
- **D.** Endocytosis and exocytosis are two forms of passive transport.

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27. Which of the following best describes the process of diffusion?

- **A.** Diffusion is the movement of molecules from an area of lower concentration to one of higher concentration by random molecular motion.
- **B.** Diffusion is the movement of molecules from an area of lower concentration to one of higher concentration caused by an input of energy to the system.
- **C.** Diffusion is the movement of molecules from an area of higher concentration to one of lower concentration by random molecular motion.
- **D.** Diffusion is the movement of molecules from an area of higher concentration to one of lower concentration caused by an input of energy to the system.

28. Osmosis is the diffusion of water across a selectively permeable membrane in which water moves from a solution containing a low concentration of solute to what kind of solution?

- **A.** a solution containing only the solute
- **B.** a solution containing the same amount of solute
- **C.** a solution containing a high concentration of solute
- **D.** a solution containing a high concentration of water

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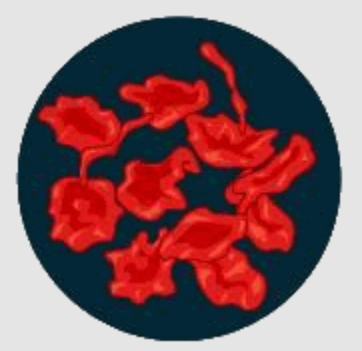
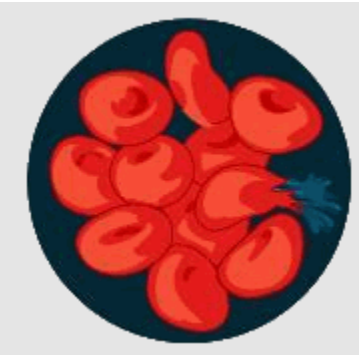
29. Look at the diagrams of red blood cells below.

X.



Y.



Z.

According to the diagrams, which cell is in an environment with a similar concentration of water?

- **A.** Z and X only
- **B.** X only
- **C.** Z only
- **D.** X and Y only

30. Materials essential to life processes move across a cell membrane through a variety of methods. What cell membrane structure allows water-soluble materials to be passively transported to the cytoplasm?

- **A.** hydrophilic phospholipid tails
- **B.** carrier proteins
- **C.** Golgi complex vesicles
- **D.** endocytosis vesicles

Answers

1. D
2. B
3. C
4. B
5. A
6. B
7. C
8. C
9. A
10. B
11. C
12. D
13. B
14. D
15. D
16. A
17. D
18. D
19. A
20. A
21. C
22. A
23. D
24. D
25. B
26. A
27. C
28. C
29. B
30. B

Explanations

1. Cells function properly only in a narrow range of temperatures. The body attempts to maintain internal temperatures within this range though the process of homeostasis. However, in cases of exposure to extreme heat or cold, the homeostatic balance is disturbed, and cell die-off, organ damage, or even death can result.

2. The function of the human respiratory system is to **enable gas exchange in the body**. In order for the cells of the body to function, a constant supply of oxygen is required, while a constant supply of carbon dioxide is produced as a waste product and must be removed from the body.

3. The glucose sugar concentration in blood must be maintained within a specific range in order for the body to function normally. If the body is unable to maintain its blood glucose levels, **diseases, such as diabetes or hypoglycemia, result**.

4. Feedback mechanisms have evolved that maintain homeostasis. For example, when there is an increase in muscle cell activity, the body responds by **increasing the heart rate** and **respiratory rate**.

Increasing the heart rate allows oxygenated blood to travel through the body at a faster rate, while increasing the respiratory rate allows the carbon dioxide produced during cellular respiration to be removed at a faster rate through exhalation.

5. Diffusion is the spontaneous movement of a substance from an area of **higher** concentration to an area of **lower** concentration. Diffusion is known as *passive transport* because the movement happens without energy being expended from the cell.

6. Passive transport is a form of cellular transport in which no energy is expended. Passive transport includes diffusion, diffusion through ion channels, osmosis, and facilitated diffusion which requires a carrier protein.

Active transport is the movement of materials from areas of lower concentration to areas of higher concentration. This requires a cell to expend energy. Active transport includes endocytosis, exocytosis, and cell membrane pumps.

Both of these processes are important in the movement of materials in and out of cells.

7. Homeostasis refers to an organism's ability to maintain a relatively constant internal environment. In many organisms, feedback mechanisms have evolved to help **maintain homeostasis**.

For example, plants require a certain amount of water for survival. When dry environmental conditions exist, guard cells close the openings in leaves to reduce the loss of water from the plant. This feedback mechanism helps plants maintain a relatively constant internal environment.

8. Because the solute cannot pass through the membrane, water is the only substance that can flow in order to make the concentrations balanced on either side of the membrane.

Osmosis is the process by which water flows down its concentration gradient--that is, water will flow from an area of high concentration (of water) to an area of low concentration. In this case, the concentration of water relative to the solute is much greater inside the cell, and so **water will flow out of the cell and into the surrounding environment**.

9. Homeostasis describes the process through which a body maintains a stable internal environment. Thus, homeostasis is a form of **cell regulation**.

Without cellular regulation, cells would not be able to control their water concentrations, temperatures, and acidities, and cells would die.

10. The **endoplasmic reticulum** essentially aids in cellular homeostasis by providing the main transport mechanism for proteins within the cell.

Protein transport begins on the endoplasmic reticulum. Proteins are packaged within transport vesicles and then moved along the membrane of the endoplasmic reticulum.

11. Homeostasis is the body process that attempts to maintain balance of internal environment variables such as pH, temperature, and blood sugar levels because cells and organs function properly in only a narrow range of conditions.

12. All cells have a cell membrane. The cell membrane separates the cell's internal environment from the external world. Cell membranes are constructed of proteins and a lipid bilayer that includes phospholipids. The arrangement of the phospholipids allows the cell membrane to **control the movement of substances in and out of the cell**.

13. Cells can function **only within a narrow range of temperatures and pHs** because many of their components, such as enzymes, become less efficient or completely inactive in more extreme conditions.

The process of homeostasis helps keep internal conditions, such as body temperatures and blood pHs, within the ideal range.

14. All cells have a **cell membrane**. The cell membrane separates the cell's internal environment from the external world. Cell membranes are constructed of proteins and a lipid bilayer that includes phospholipids. The cell membrane controls the movement of materials into and out of the cell.

15. For the cell to maintain a higher or lower concentration of a certain kind of molecule inside the cell than the fluids surrounding the cell, the cell must use a form of active transport. Endocytosis and cell membrane pumps are forms of active transport. A cell membrane pump known as the sodium-potassium pump maintains homeostasis inside the cells.

16. The basic function of a physiological feedback loop is **to regulate a process**.

In the hormone example, the function of the feedback loop is to regulate the release of hormones.

17. Choices **I, II, and III** all show examples of body systems interacting to maintain homeostasis.

The digestive, circulatory, and excretory systems interact when too much salt and electrolytes are consumed. The salt and electrolytes are then filtered out of the blood and removed by the kidneys.

The muscular, circulatory, and skeletal systems interact when body parts, such as muscles, need calcium. The calcium is released from stores in the bones and travels through the blood to wherever it is needed.

The integumentary, circulatory, and nervous systems interact when the body temperature rises. The brain signals for the blood vessels to dilate and increase the blood flow to the skin so that heat can be released more easily.

18. In order for a cell to maintain its homeostasis, it must be able to get rid of wastes and excess materials as well as take in new materials to be used in cellular processes. Since cell membranes control the substances that enter and leave cells, they help organisms maintain homeostasis.

19. Cellular fluid (cytosol) and the cell's organelles are contained by the cell's membrane, which is composed of a lipid bilayer. Lipids are a type of fat. Because a cell's membrane is composed of fat, only fat-soluble molecules are able to dissolve through the membrane into the cytosol.

20. The Golgi apparatus helps maintain cellular homeostasis by **modifying, sorting, and packaging proteins prior to transport**.

Though proteins synthesized on the rough endoplasmic reticulum comprise the majority of the macromolecules managed by the Golgi, it is also involved in the transport of lipids and the creation of lysosomes.

21. One of the major functions of the cell membrane is the passive **transport of molecules into and out of the cell through osmosis and diffusion**. The cell membrane also separates the cell's internal environment from the external world.

22. The *fluid mosaic model* shown in the question describes the structure and function of **cell membranes**. The cell membrane controls the movement of particles and chemicals to and from the outside of the cells. The "fluid" aspect of the membrane allows for this movement, as well as the transport proteins that are embedded into the layer.

23. Water moves across cell membranes through a special type of diffusion called **osmosis**.

Osmosis is a type of passive transport because it is facilitated by concentration gradients — movement from areas of high concentration to areas of low concentration - and the cell does not have to expend energy during this process.

24. **Homeostasis** is the tendency of an organism to maintain stable internal conditions amid environmental change.

Cells in the body need certain conditions in order to function properly. Homeostatsis maintains those conditions even when the external environment is changing. For example, cells need to have enough oxygen to produce the right amount of energy. When people exercise, their cells need more energy. The body is able to increase respiration and circulation so that the cells can still get the oxygen that they need. Increased circulation simultaneously helps the body dissipate

the extra heat that is created.

Reproduction is the process through which a species produces offspring.

Commensalism is the relationship between two organisms in which one benefits and the other neither benefits nor is harmed.

Metabolism refers to the physical and chemical changes in an organism which release or use energy.

25. Small molecules diffuse across cell membranes through openings called pores. These openings are too narrow, however, to allow the cell to take in large molecules or other types of cells. In fact, the carrier protein channels that actively move building materials and waste products across the cell membrane are also too small to transport these larger items.

Cells must take in these items using a type of active transport called endocytosis. During endocytosis, the cell surrounds the material to be ingested. The pocket that is formed then breaks away from the rest of the cell membrane, and a vacuole containing the engulfed material is formed.

26. There are four main kinds of passive transport: diffusion, faciliated diffusion, filtration, and osmosis. All of these forms involve molecules moving down a concentration gradient (i.e. from a high concentration to a low concentration) and do not require the input of metabolic energy or ATP.

Small molecules such as oxygen, ethnanol, and carbon dioxide easily diffuse across membranes. Some larger molecules, such as glucose, require the assistance of a carrier protein. This form of passive transport is known as faciliated diffusion.

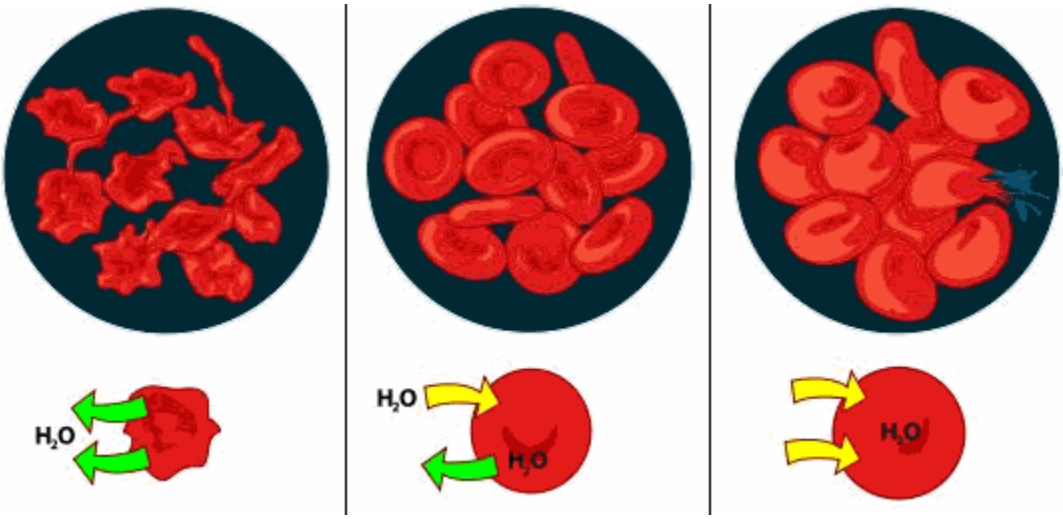
27. **Diffusion is the movement of molecules from an area of higher concentration to one of lower concentration by random molecular motion**. Some of the molecules that may be moved through diffusion include oxygen, carbon dioxide, salts, sugars, and amino acids.

Diffusion results in a gradual mixing of the materials in a system. Diffusion does not require an input of energy into the system because it is caused by random molecular motion.

28. Osmosis is the diffusion of water across a selectively permeable membrane in which water moves from a solution containing a high concentration of solute to **a solution containing a low concentration of solute.** Solutes are substances, like salt, sugar, or food coloring, that are dissolved into a solvent, like water.

Osmosis plays a role in cell regulation since water molecules constantly relocate themselves to keep the cell at the correct concentration of all of its solutes. If osmosis did not occur, cells could enter a state of having too much water or too little water. This could cause cells to die.

29. Diagram **X** shows a red blood cell in an *isotonic* solution. This means that the solution is an equivalent concentration to what is in the cell, and thus the osmosis that occurs across the cell membrane is balanced. That is, there is no net movement of water, and the pressure remains the same.



30. Proteins in the cell membrane that assist with facilitated diffusion are known as **carrier proteins**, or transport proteins, since they carry materials across the cell membrane.

Carrier proteins bind to a molecule on one side of the membrane, change shapes to shield the molecule from the lipid bilayer, and then release the molecule on the other side of the membrane.