

## Interactions Among Structural Components

Base your answers to questions 1 on the information below and on your knowledge of biology.

Diabetes is a condition characterized by elevated blood sugar levels. One form of diabetes occurs when insulin fails to properly regulate blood sugar levels. Complications from diabetes can include nerve cell damage and poor blood flow, especially in the feet and legs. In individuals with diabetes, wounds usually take longer than normal to heal.

1 One reason for the change in wound healing time in a diabetic is that

- (1) elevated hormone levels block the synthesis of glucose in immune cells
- (2) nerve damage increases absorption of glucose by healthy cells
- (3) poor circulation reduces the supply of nutrients and oxygen to the cells
- (4) decreased enzyme production slows protein synthesis in pancreatic cells

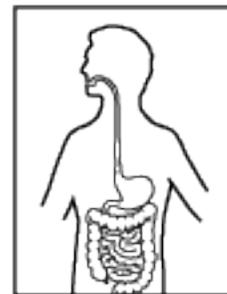
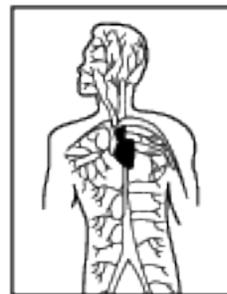
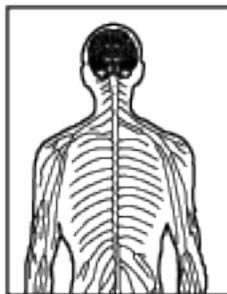
2 The human body has many cells that are deep inside the body. For this reason, the human body requires

- (1) a transport system and other organs
- (2) carbon dioxide from the air
- (3) the synthesis of many inorganic compounds
- (4) the breakdown of glucose by the digestive system

3 Bumblebees show some ability to control their own body temperature. During cold weather, bumblebees have been observed warming their flight muscles by shivering. The bees are able to maintain a body temperature several degrees above that of the surrounding air. Regulation of their internal body temperature is an example of

- (1) diffusion
- (2) synthesis
- (3) respiration
- (4) homeostasis

Base your answers to questions 4 on the diagrams below and on your knowledge of biology. The diagrams represent some of the systems that make up the human body.



4 A similarity between these systems is that they all

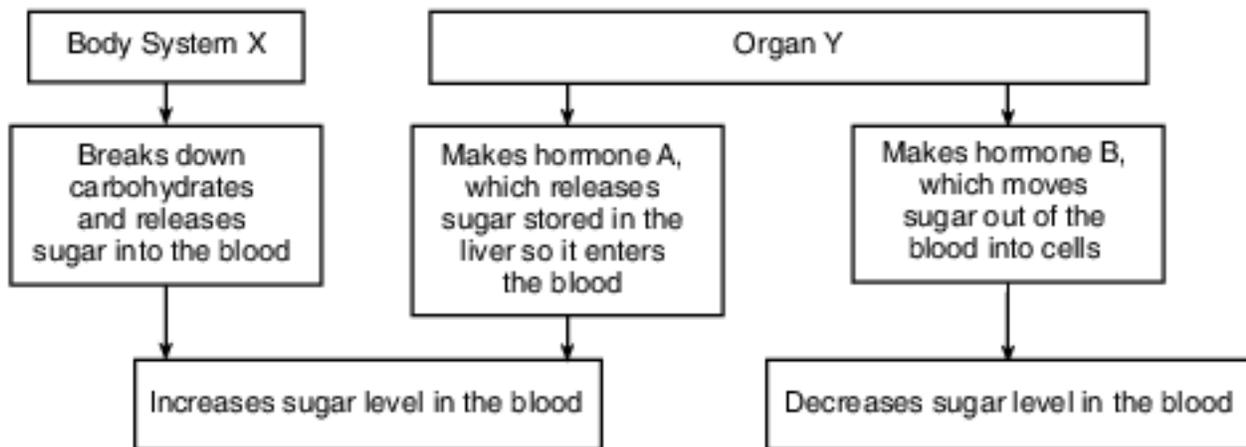
- (1) are made of cells that are identical in structure and function
- (2) contain organs that work independently from other organs in that system
- (3) work together to maintain a stable internal environment
- (4) are separate and do not interact with other body systems

- 5 One characteristic of all living things is that they
- (1) develop organ systems
  - (2) produce identical offspring
  - (3) maintain internal stability
  - (4) synthesize only inorganic matter
- 6 In order for the human body to maintain homeostasis, the breakdown of glucose to release energy must be followed by the
- (1) production of oxygen
  - (2) division of the cell
  - (3) removal of wastes
  - (4) production of receptor molecules
- 7 A similarity between humans and many other multicellular animals is that they
- (1) occupy the same niche in most food webs
  - (2) are composed of organ systems
  - (3) have the same DNA sequences
  - (4) carry out autotrophic nutrition

- 8 In response to an increasing blood glucose level, the human body will normally
- (1) store the glucose in cell nuclei
  - (2) release a hormone that lowers the blood glucose
  - (3) produce a hormone that destroys the glucose
  - (4) use the excess glucose to make proteins
- 9 Energy drinks have become increasingly popular. Some of these drinks contain large amounts of caffeine, which is known to increase heart rates in most individuals. This effect on the heart rate can be dangerous because it can lead to
- (1) a disruption in the absorption of starch
  - (2) an increase in blood volume
  - (3) a decrease in oxygen levels
  - (4) an imbalance in homeostasis

Base your answers to questions 10 on the diagram below and on your knowledge of biology. This diagram represents the roles of different parts of the human body in keeping blood sugar at a balanced, normal level over time.

### Homeostasis of Blood Sugar Level





- 14 Organ systems of the human body interact to maintain a balanced internal environment. As blood flows through certain organs of the body, the composition of the blood changes because of interactions with those organs. State one change in the composition of the blood as it flows through the respiratory system. [1]

Base your answers to questions 15 on the passage below and on your knowledge of biology.

#### The Protein Shredder

In every cell, thousands of important processes are occurring around the clock. One of the ways a cell manages to coordinate all of these processes is by sending protein messages. After the protein messages are delivered and read, they need to be destroyed to prepare for the arrival of the next message.

The task of destroying these proteins falls on cell structures known as proteasomes. Think of a proteasome as a tubelike protein shredder. Protein molecules that have served their purpose are transported to the proteasome, unfolded, fed through the tube, and cut into smaller molecules that can then be used to synthesize new protein molecules. Proteasomes can shred any type of protein.

Individuals with a neurological disorder known as hereditary ataxia have been found to have an excess of protein in the cells of their brains and spinal cords. The abnormal level somehow leads to the death of cells in portions of the cerebellum. These areas of cell loss can be seen on a brain scan.

There are several forms of hereditary ataxia but all of them result in poor coordination. The symptoms progress over a period of years. In the beginning, the individuals experience only minor coordination problems. As time passes, the symptoms become worse. The affected individuals will have poor balance when walking. They will be clumsy and have difficulty talking and swallowing.

- 15 Based on the symptoms shown by individuals with hereditary ataxia, state two functions regulated by the cerebellum and spinal cord. [1]

Functions: \_\_\_\_\_ and

\_\_\_\_\_

## Answer Keys

1 3

2 1

3 4

4 3

5 3

6 3

7 2

8 2

9 4

10 1

11 4

12 1

13 2

14 Allow 1 credit. Acceptable responses include, but are not limited to:

- — The blood takes in oxygen as it flows through the respiratory system.
- — The oxygen level goes up/increases.
- — It releases water.
- — It releases carbon dioxide.

15 Allow 1 credit. Acceptable responses include, but are not limited to:

- — coordination
- — balance
- — walking
- — talking
- — swallowing
- Note: Do not accept symptoms, i.e, “poor balance” or “difficulty walking.”