

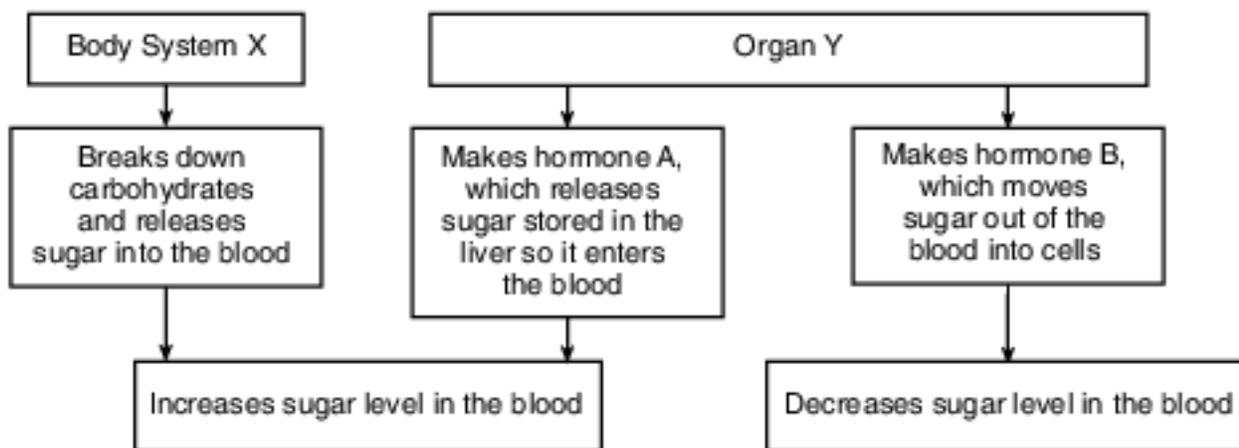


- 6 In response to an increasing blood glucose level, the human body will normally
- (1) store the glucose in cell nuclei
  - (2) release a hormone that lowers the blood glucose
  - (3) produce a hormone that destroys the glucose
  - (4) use the excess glucose to make proteins

- 7 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 8 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



- 8 The diagram shows human body structures that are coordinated to maintain homeostasis. Which row correctly identifies the functions of these structures?

Row	Body System X	Organ Y
(1)	Digestion	Regulation
(2)	Circulation	Synthesis
(3)	Excretion	Transport
(4)	Locomotion	Nutrition

- (1) 1
- (2) 2

- (3) 3
- (4) 4

Base your answers to questions 9 on the information and data table below and on your knowledge of biology.

**The Enzyme Catalase**

Catalase is an enzyme found in nearly all living organisms that breathe or are exposed to oxygen. According to recent scientific studies, low levels of catalase may play a role in the graying process of human hair. The body naturally produces hydrogen peroxide, and catalase breaks it down into water and oxygen. If there is a dip in catalase levels, hydrogen peroxide cannot be broken down. This causes hydrogen peroxide to bleach hair from the inside out. Scientists believe this finding may someday be used in anti-graying treatments for hair.

A pharmaceutical company, investigating ways to prevent hair from turning gray, took tissue samples from two different individuals. Both individuals were the same age. Each of the samples was placed in a solution of hydrogen peroxide. The volume of oxygen gas produced was measured every 5 minutes for 25 minutes. The data the company collected are shown below.

SEE BELOW.

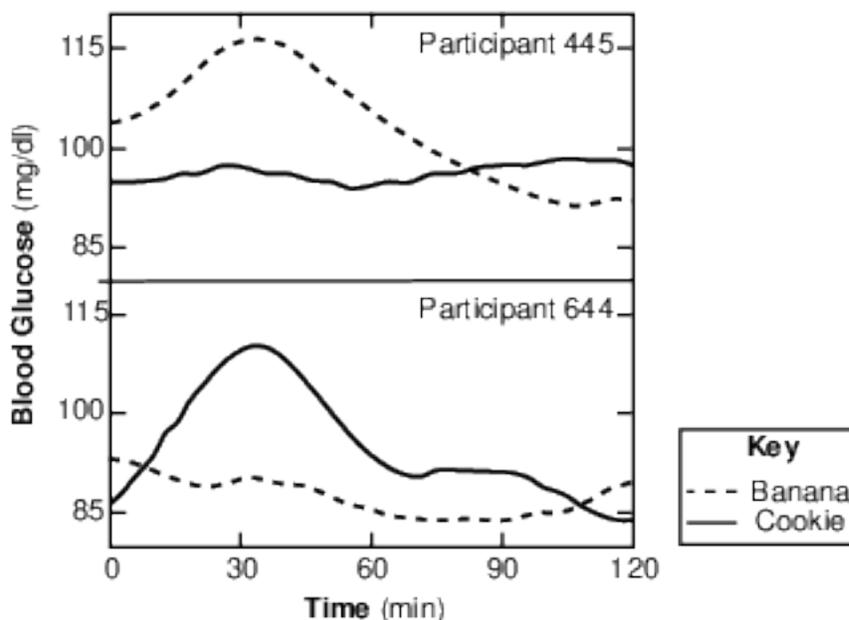
**Oxygen Production in the Breakdown of Hydrogen Peroxide by Catalase**

<b>Time (min)</b>	<b>Sample from Person A (mL oxygen)</b>	<b>Sample from Person B (mL oxygen)</b>
5	2.0	4.5
10	3.5	8.5
15	5.0	12.0
20	7.5	15.5
25	9.5	20.0

Directions: Using the information in the data table, construct a line graph on the grid on the next page, following the directions below.

- 9 If the temperature of the tissue samples used in the experiment had been raised from 37°C (body temperature) to 50°C, the results would have been different because
- (1) more enzymes are produced at higher temperatures, increasing the amount of hydrogen peroxide
  - (2) more hydrogen peroxide is released at higher temperatures, increasing the activity of catalase
  - (3) increasing temperatures altered the structure of catalase, decreasing oxygen production
  - (4) increasing temperatures decreased the synthesis of amino acids, increasing levels of hydrogen peroxide

10 The chart below shows a comparison of the blood sugar levels for two individuals who took part in a scientific study.



Source: Science Daily 11/19/15

Scientists have observed that blood sugar levels rose by different amounts in the two individuals even though they were given identical portions of bananas and cookies. These results were obtained because

- (1) glucose is too large a molecule to be absorbed into the blood, so the researchers were only measuring the amount of glucose already present
- (2) participant 445 didn't like bananas, and his body absorbed more of the food that he likes
- (3) individuals have genetic differences that alter their responses to environmental factors
- (4) two different foods were used; the scientists should have had only one experimental variable

Base your answers to questions 11 on the passage below and on your knowledge of biology.

### Blood Doping

Some athletes who compete in endurance events, such as marathon runners or cyclists, believe that they will be more competitive if they can increase the number of red blood cells in their bloodstreams. One way of increasing the number of red blood cells in an athlete is to engage in blood doping.

Blood doping is an illegal practice in which athletes harvest their own blood months before a competition, isolate the red blood cells, and freeze them. Just before the date of the competition, the blood cells are returned to the athlete's bloodstream. Another type of blood doping involves using donated blood from another person (blood transfusions). In either case, the athlete will have more red blood cells available than competitors who do not engage in blood doping.

Athletes who use their own blood cells to blood dope often become anemic as a result. Anemia is a condition caused by a lack of red blood cells and/or iron in the blood. Iron is a necessary part of the pigment used to carry oxygen to the cells. Athletes who use donated blood to blood dope also run the risk of contracting a blood-borne disease.

11 An athlete might believe that there is a benefit to blood doping with red blood cells because it

- (1) could improve the delivery of oxygen to the muscles
- (2) could increase the amount of training necessary
- (3) would help to deliver necessary nutrient molecules to the cells
- (4) would help an athlete to fight disease

12 The failure of the human body to effectively maintain dynamic equilibrium can result in

- (1) reproductive success    (3) differentiation
- (2) gene manipulation    (4) disease

13 Increased concern over the number of heat-related illnesses among football players has led to a possible change in uniform design. Shoulder pads were designed that constantly blew cool, dry air underneath the shoulder pads. Tests showed that the use of the device during rest and recovery periods resulted in a reduction of body temperature and heart rate. This new device would help the athlete to

- (1) control the rate of muscle activity
- (2) increase muscle strength
- (3) maintain homeostasis
- (4) eliminate the release of heat from the body

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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 4

2 3

3 3

4 3

5 2

6 2

7 4

8 1

9 3

10 3

11 1

12 4

13 3

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.”