Name _____ Date _____

How the Circulatory and Respiratory Systems Work Together

Directions: Read the passage and study the table. Then answer each question.

A Breath Test for Carbon Dioxide

Most of your body's cells release the energy in food by using oxygen. That process also makes carbon dioxide, a waste gas the body must get rid of. Two body systems share the job of moving these gases.

The respiratory system includes your nose, windpipe and lungs. Deep in the lungs are hundreds of millions of tiny air sacs, each wrapped in tiny blood vessels. There, oxygen from the air you breathe in passes into the blood. At the same time, carbon dioxide passes out of the blood into the air sacs, and you breathe it out.

The circulatory system includes your heart, blood vessels and blood. The heart pumps blood that carries oxygen from the lungs to cells all over the body. On the way back, the blood carries carbon dioxide from the cells to the lungs. When muscles work hard, their cells use more oxygen and make more carbon dioxide, so both systems speed up: you breathe faster, and your heart beats faster.

A class tested breath with bromothymol blue (BTB), a blue liquid that turns yellow when enough carbon dioxide mixes into it. First, they pumped room air through a cup of BTB for 5 minutes, and it stayed blue. Then five students each sat quietly and counted their breaths for one minute. Next, each one breathed out gently through a straw into a cup of 50 mL of BTB, never sucking in, and timed how long it took to turn yellow. Finally, each student jogged in place for 2 minutes and repeated both tests right away, using a fresh cup.

Breathing rates and BTB color-change times for five students, resting and after jogging in place

Student	Breaths per minute, resting	Breaths per minute, after jogging	Seconds for BTB to turn yellow, resting	Seconds for BTB to turn yellow, after jogging
1	16	30	70	38
2	14	26	80	44
3	18	34	64	32
4	16	28	76	40
5	16	32	70	36

1. According to the passage, what happens in the lungs' tiny air sacs?
A. Oxygen passes into the blood, and carbon dioxide passes out of the blood.
B. Oxygen is turned into carbon dioxide.
C. Carbon dioxide passes into the blood, and oxygen passes out of the blood.
D. Food is broken down to release energy.

2. Why did the class pump room air through a cup of BTB before testing anyone's breath?

A. To remove the carbon dioxide that was already in the BTB

B. To see whether room air alone would turn the BTB yellow during the test

C. To warm the BTB so it would change color faster

D. To make the BTB turn yellow before the test began

3. What did the class change on purpose between each student's first and second BTB test?

A. The number of seconds the BTB took to turn yellow

B. The amount of BTB in the cup

C. Whether the student had just jogged in place

D. Which student breathed into the cup

4. What was the mean number of breaths per minute for the five students after jogging?

_____ breaths per minute

5. Find the mean number of seconds for the BTB to turn yellow when the students were resting, and the mean after jogging. How many seconds shorter was the mean after jogging?

_____ seconds

6. Which claim do the BTB results from this test support?

A. Room air contains more carbon dioxide than breath does.

B. Jogging made the students' lungs start making carbon dioxide.

C. In this test, the students breathed out carbon dioxide faster after jogging than when resting.

D. In this test, the students breathed out less carbon dioxide after jogging, since the BTB needed less time.

7. Based on the passage, which explanation describes why the students breathed out carbon dioxide faster after jogging?

A. Their working muscle cells made more carbon dioxide, the blood carried it to the lungs, and faster breathing moved it out.

B. Jogging warmed the BTB, which made it turn yellow faster.

C. Their hearts turned oxygen into carbon dioxide, and their lungs stored it.

D. Their lungs made extra carbon dioxide, and the blood carried it to their muscles.

8. The class measured breathing but not heartbeat. Based on the passage, what else most likely happened while the students jogged?

A. Their hearts beat slower to save oxygen.

B. Their lungs began pumping blood in place of their hearts.

C. Their hearts beat faster, moving blood through the body more quickly.

D. Their blood stopped carrying carbon dioxide until they rested.

9. A sixth student took 24 breaths per minute after jogging. Based on the pattern in the table, how long would that student's BTB most likely take to turn yellow?

A. Between 36 and 40 seconds

B. Less than 32 seconds

C. Exactly 38 seconds, the same as the mean

D. More than 44 seconds