LAB #_____Exercise

Lab Instructor_____ Name_____

Date _____ Period_____

Objective: To determine the relationship between exercise and respiration rate, CO_2 exhalation and heart rate

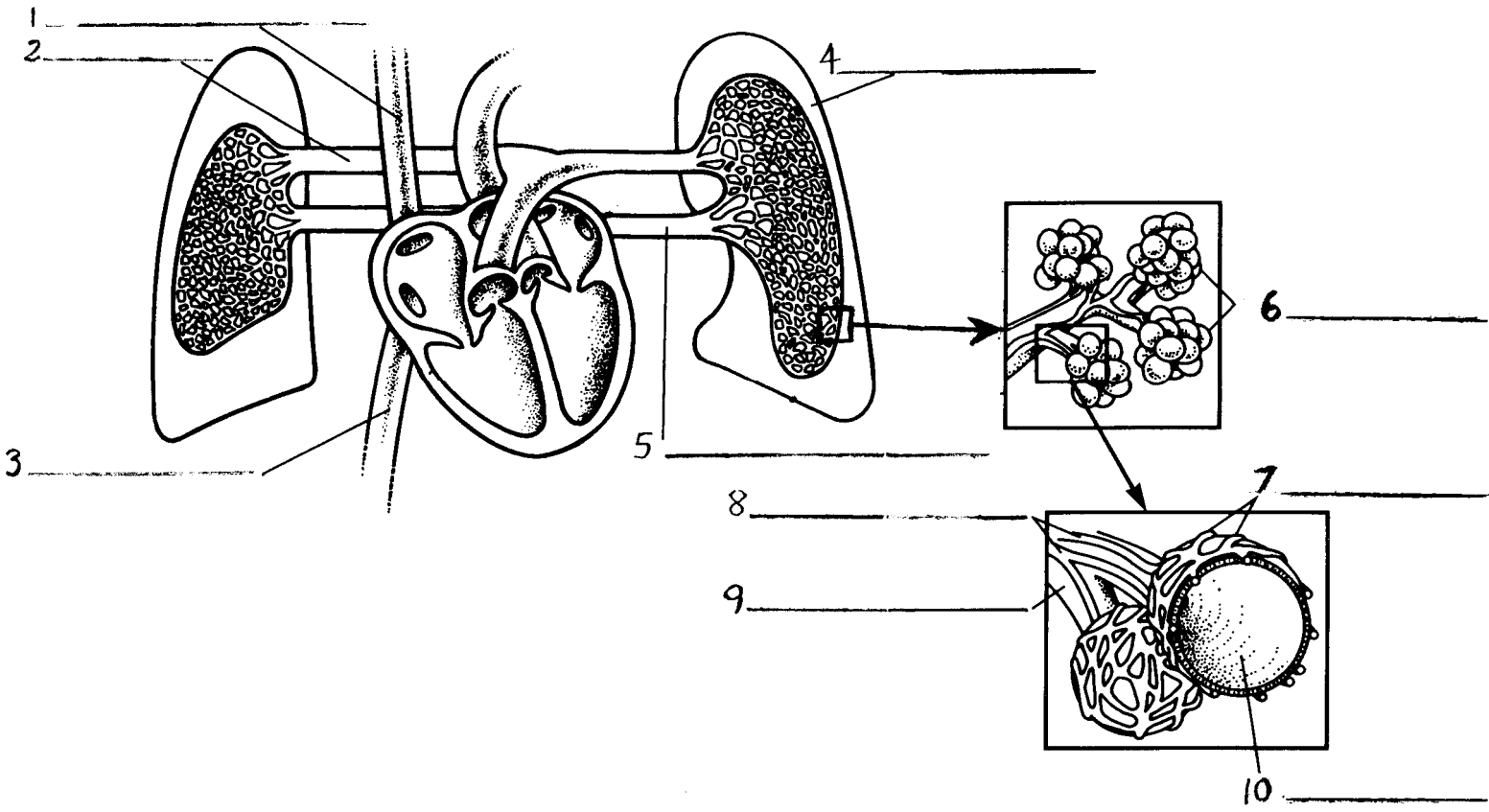
******Use full sentences when answering all questions.******

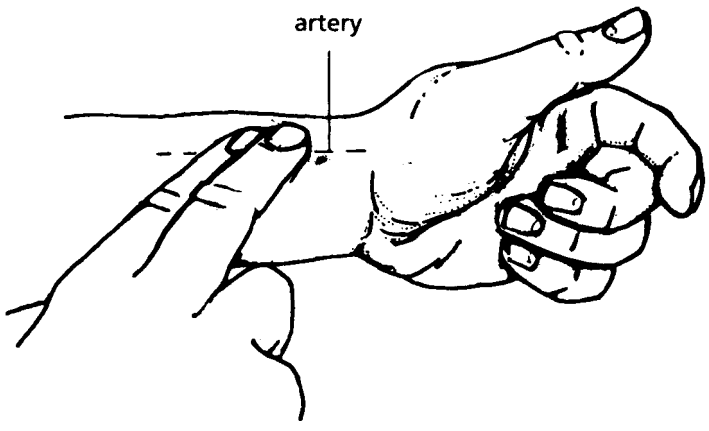
Background

The human body obtains energy through *cellular respiration*, a process that uses oxygen and produces waste products of carbon dioxide (CO_2) and water. Cellular respiration is supported by a series of events called *respiration*. Respiration has four phases: breathing; the exchange of carbon dioxide and oxygen in the lungs; the transport of these gases from or to body cells; the exchange of gases between blood and the cells. Changes in the concentration of these gases in the blood affect the rate of respiration.

The heart pumps blood through blood vessels to all parts of the body. With each contraction of the heart, blood is forced into the arteries. This surge of pressure is felt in the arteries as the *pulse*. The rhythmic pulse can be felt any place where an artery is close to the surface of the body and can be pressed against some firm tissue. The pulse rate is exactly equal to the heartbeat rate. Medical personnel use the pulse rate as one indication of how the heart is functioning. Heart rate is influenced by many things, such as age, sex, physiological state, and temperature.

Label the structures indicated on the diagram below.





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Pre-Lab

Read the entire lab description and, if needed, the textbook to answer the following questions.

1. Compare anaerobic respiration and aerobic respiration.

2. Describe the process of **inhalation**.

3. Define what is meant by **rate**.

LAB

Materials

100 mL beaker, graduated cylinder, 3 straws, 3 test tubes, 1 test tube rack, 1 stop watch, phenolphthalein and sodium hydroxide dropper bottles, goggles

Procedures and Observations

Working in groups of four you will be collecting the following data: breathing rate, CO_2 exhalation rate, and pulse rate for the following three conditions: jogger at rest, jogging in place for one minute, and jogging in place for three minutes.

Predictions:

A) What do you expect to occur to breathing rate as the runner performs more strenuous activity?

B) What do you expect will be the outcome in detecting CO_2 as the runner performs more strenuous activity?

C) What is your hypothesis about the pulse rate as more strenuous activity is performed?

1. Observe and record the breathing rate (number of chest compressions) for a jogger at rest for a one-minute interval. Record this number in the data table.

2. Into each of three test tubes pour 5 mL water, 5 drops phenolphthalein and 5 drops sodium hydroxide (NaOH). Determine the number of seconds it takes the jogger at rest to blow through a straw into one of the test tubes with the pink solution until it turns clear. Record this rate in Table 1 and give it a title.

a. What happens to phenolphthalein in the presence of a base (e.g. NaOH)?

b. Why does the pink solution turn clear when the jogger blows out into the test tube? (Be sure to include the chemical reaction to support your answer.)

Name_____

Period_____

3. There are several methods of determining the heart rate. In this activity we will use pulse rate data obtained from measuring at the carotid artery (either side of larynx), the temporal artery (at the temples), or the radial artery (at the base of the thumb at the wrist). Take the pulse rate of the jogger at rest for one minute. Record data in data table.
Repeat above steps for the jogger after running in place for one minute. Use the second prepared test tube
Repeat again for the jogger after running in place for three minutes. Use the third prepared test tube.

ACTIVITY	AT REST	AFTER 1-MINUTE JOG	AFTER 3-MINUTE JOG
BREATHING RATE (BREATHS/MINUTE)			
AMOUNT OF TIME TO DETECT CO_2 (SECONDS)			
HEART RATE (BEATS/MINUTE)			

TABLE 1.

Post-Lab

1. Assume that the average heart beats 70 times per minute. How many times has the heart beat in a person who has lived 14 years? Show calculations.

2. Explain what your results suggest about how exercise affects breathing rate, CO_2 exhalation and heart rate. Compare your experimental findings to your hypotheses.

3. Using collected data, prepare three separate line graphs as follows:
   a. Breathing Rate (breaths/minute) vs. Minutes of Activity
   b. Amount of Time to Detect CO_2 (seconds) vs. Minutes of Activity
   c. Heart Rate (beats/minute) vs. Minutes of Activity

Remember to make titles, label axes and number axes using even increments.