MiSP Human Physiology Worksheet #3, L3

Name _____ Date _____

CARDIAC RECOVERY TIME

Key Question: How much time does it take for a person's heart to return to its resting heart rate after vigorous exercise?

Safety:

In this lab you will be exercising to increase your heart rate. DISCUSS WITH YOUR TEACHER ANY HEALTH CONDTIONS THAT YOU HAVE THAT MAY BE A REASON NOT TO PARTICIPATE IN THE EXERCISE ACTIVITIES. Be careful when exercising. Follow your teacher's instructions for safe exercise.

Introduction:

The circulatory system functions to deliver oxygen and nutrients to all parts of your body for growth and respiration and to remove metabolic wastes. The heart pumps blood through a circuit that includes arteries, arterioles, capillaries, venules, and veins. One important circuit is the pulmonary circuit, where there is an exchange of gases within the alveoli of the lung. With increased exercise, several changes occur within the circulatory system to increase the delivery of oxygen to actively respiring muscle cells.

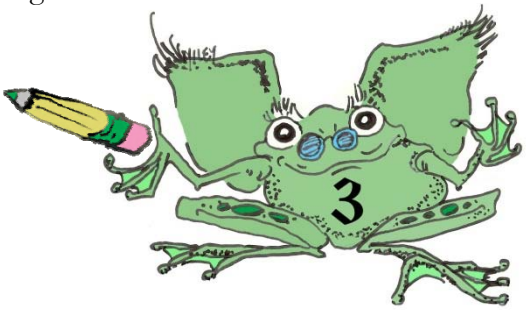
Earlier in this unit you practiced measuring your heart rate by finding and counting your pulse. Today you will first determine your resting heart rate. You will then vigorously exercise. At the conclusion of your exercise, you will measure your elevated heart rate. At regular intervals, you will measure your heart rate until it returns to your resting heart rate. The time needed after exercise for your heart rate to return to its resting heart rate is called cardiac recovery time.

Procedure:

Students may work in pairs or individually.

Determining Resting Heart Rate:

1. Sit at ease for two minutes.
2. Take your pulse. (Or your partner can take your pulse.) Count the number of beats for 15 seconds and multiply by 4. Do this three times. Record this data in the data chart on the next page.
3. Calculate the average of three pulse measurements. This is your resting heart rate.



Record your data:

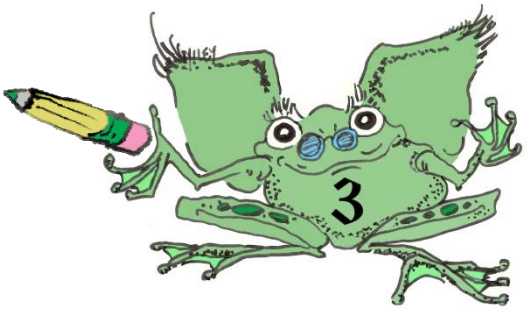
RESTING HEART RATE

Trial	Beats in 15 Seconds	x 4 Beats per Minute
1		
2		
3		

AVERAGE/RESTING HEART RATE = _____

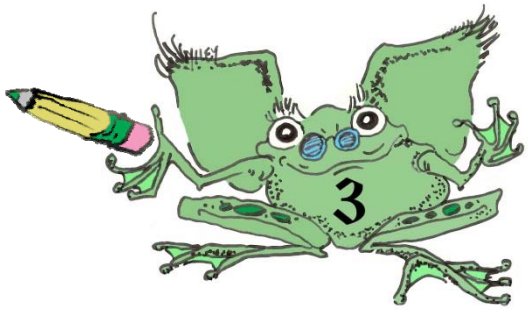
Cardiac Recovery Time:

1. Work with a partner. Take turns exercising and recording data.
2. Exercise vigorously for two (2) minutes. Exercise may consist of jumping jacks, running in place, energetic dancing, etc. Your teacher will tell you what exercises are permitted and will review the safety rules.
3. Immediately upon completion of this exercise, sit down and measure your pulse for 15 seconds and record the count in the data chart below. This will be your zero (0) time after exercise measurement. Multiply each 15-second count by 4 to get the heart rate per minute. Remain seated and measure the pulse rate every one-half minute (30 seconds) until the pulse rate returns to your resting heart rate (within 5 beats per minute).
4. Compare your cardiac recovery time (minutes) with other students' data in the class.



Record your data:

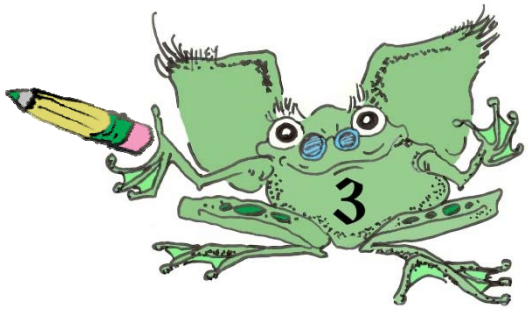
RECORD YOUR DATA: Time (minutes) after Exercise	Beats per 15 Seconds	x 4 Beats per Minute
0		
.5		
1		
1.5		
2		
2.5		
3		
3.5		
4		
4.5		
5		
5.5		
6		
6.5		
7		
7.5		
8		
8.5		
9		
9.5		

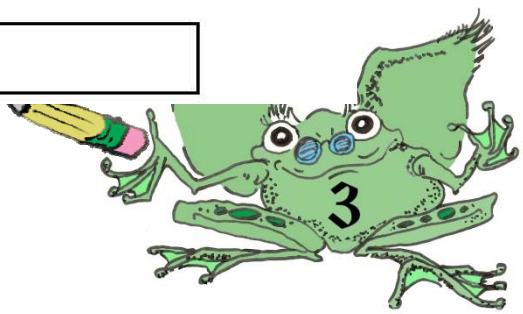


Graph your data:

Graph the data on the next page to show the relationship between time (minutes) and heart rate (beats per minute).

- Label the *x*-axis with time (minutes). Is this the dependent or the independent variable? _____
- Label the *y*-axis with heart rate (beats per minute). Is this the dependent or the independent variable? _____
- Draw a best-fit line of your data.
- Give your graph a title.

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Discussion Questions:

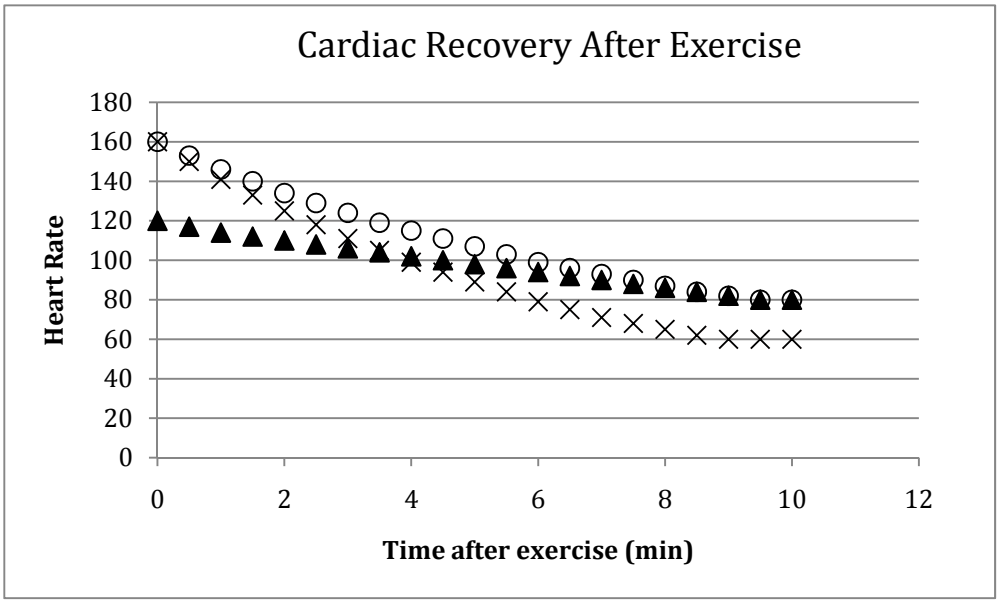
1. How many minutes did it take your heart rate to decrease to the resting heart rate after exercise?

   _____

2. How did your results compare to other students'?

   _____

3. Study the graph below, and then answer the associated questions. You can assume that resting heart rate is equal to the heart rate in the flat part of the curve at the later times after exercise.



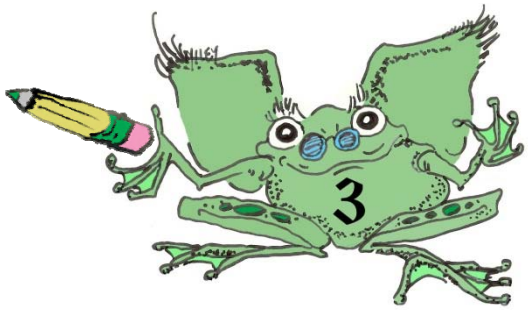
   a. Which student has the fastest recovery to the resting heart rate after exercise?

      _____

   b. Student 1 and student 3 have the same resting heart rate, and their heart rates return to the resting rate at about the same time. Why do the curves look different?

      _____

      _____



4. Suppose two students had the same resting heart rate and the same post-exercise heart rate, but the first student's heart took longer to recover from exercise. How would lines showing the two students' heart rate recovery differ?

_____

_____

5. What are three (3) factors that may affect the length of a person's cardiac recovery time after exercise? For each one you list, explain how that factor affects cardiac recovery time.

a. _____

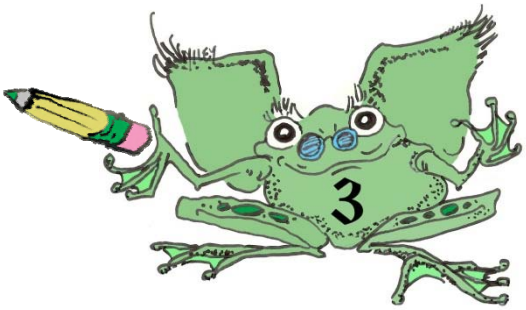
_____

b. _____

_____

c. _____

_____



6. Compare heart rate recovery of students 1 and 2 from question #3 above by comparing the unit rate of change (slope) of the average heart rate recovery line (a line connecting the first point and the last point on the line).

Unit Rate of Change = $\frac{\Delta y}{\Delta x} = \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{\Delta \text{ Heart Rate (beats per minute)}}{\Delta \text{Time (minutes)}}$

Ordered Pair used for calculation $(0, y_1)$ $(10, y_2)$	Δ Heart Rate (beats per minute) Δy	Δ Time (minutes) Δx	**Unit Rate of Change (slope)** $\boldsymbol{\Delta y/\Delta x}$
Student 1			
Student 2			

7. Which student had the fastest heart rate recovery? Explain your answer.

_____

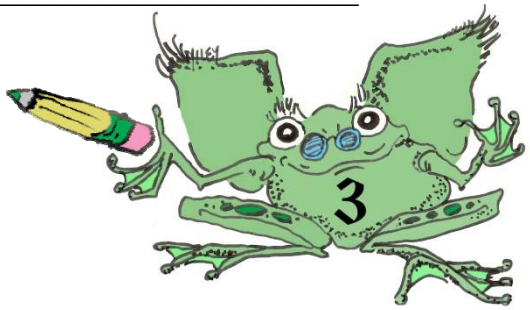
_____

8. Is the sign of the unit rate of change (slope) for each student positive (+) or negative (-)? What does the sign (positive or negative) tell you about the changes in heart rate as time increases?

_____

_____

_____



9. If two students have the same unit rate of change in heart rate after exercise, does this necessarily mean that they also had the same resting heart rate and post-exercise heart rate? Explain your answer.

_____

_____

10. If two students have the same post-exercise heart rate and the same unit rate of change in heart rate after exercise, does this necessarily mean that they also had the same heart rate recovery time? Explain your answer.

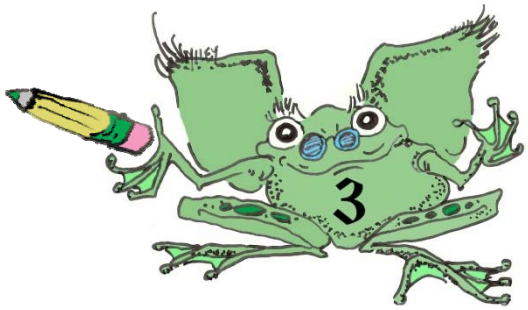
_____

_____

11. Use the equation for a line, the calculated unit rate of change (slope) for student 2 calculated in #6, and one ordered pair from student 2's heart rate recovery line to calculate the *y*-intercept of the line. The equation for a line is

$y = mx + b$
where m is the unit rate of change (slope) and
b is the y-intercept

Y-Intercept
m =   Ordered pair (x, y) = (___ , ___) $y = mx + b$ Solve for b:



12. Based on the unit rate of change that you calculated above and the *y*-intercept, write an equation for student 2's heart rate recovery line.

13. How useful is the equation above for predicting heart rate during the time when student 2 was exercising? Explain.

14. How useful is the equation above for predicting student 2's heart rate 5 minutes AFTER the heart rate returned to its resting heart rate? Explain.

15. Using the equation above, what was student 2's heart rate after 2.75 (2¾) minutes? Why does the equation work for this particular time?