Lab-Investigating Heart Rates & Blood Flow

Name: ____________________________________________

Date: _________________________________

Benchmark:
SC.912.L.14.36: Describe the factors affecting blood flow through the cardiovascular system.

Background:
During each heartbeat, the muscles of the heart contract causing a wave of pressure which forces blood through the arteries. This wave of pressure is known as a pulse. There is one pulsation for each heartbeat. The pulse can be felt at various points on the body where the arteries are just under the skin, such as the temples, neck, wrist, groin, back of the knee, and the inside back of the ankle. With exercise or physical activity, the heart rate increases to supply the muscles with more oxygen to produce extra energy. The heart can beat up to 200 times per minute with extreme exercise. The brain sends nerve signals to the heart to control the rate. There are two ways the heart can meet the body's need for oxygen during exercise, it can beat faster or it can beat harder, moving more blood per pump. But it can only beat harder if it has been strengthened through regular exercise.

Range of Heart Rates per Minute and Average Heart Rate for Various Ages:

<table>
<thead>
<tr>
<th>Age</th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-16</td>
<td>60-110</td>
<td>80</td>
</tr>
<tr>
<td>≥ 17</td>
<td>50-90</td>
<td>70</td>
</tr>
</tbody>
</table>

Purpose:
To compare heart rates and blood flow while: sitting, standing and after doing jumping jacks for 1 minute.

Procedure:
1. Locate your pulse on either your wrist or neck using your index and middle fingers.
2. SITTING: count the number of beats in 15 seconds. Multiply this by four; this is how many times the heart beats in one minute. Enter this "at rest" heart rate on the first row of Data Table 1.
3. Use your initial data to complete Data Table 1.
4. EXERCISING: Perform jumping jacks, or run in place at your seat for one minute, when finished remain standing and IMMEDIATELY count the number of beats in 15 seconds. Multiply this by four; this is how many times the heart beats in one minute. Enter this "jumping jacks" heart rate in Data Table 2 (Trial 1).
5. RECOVERY: Continue to take your pulse every 60 seconds for 3 more minutes. Enter the data in Data Table 2 (Trial 1).
6. Repeat steps 4 & 5 and enter the data in Data Table 2 (Trial 2).
7. Calculate your average for both trials.
8. SHARE your data with the class and calculate the class averages in Data Table 3.
9. GRAPH the data in Data Table 2. Construct a line graph, with your time intervals on the X-Axis and your heart rate on the Y-Axis. Place both sets of data (you and your partner) on the same graph. Include a key for each data set.
10. GRAPH the class average data from Data Table 3. Construct a new graph, using the same axes as in Step 9.
### Data Table 1: Resting heart rate calculations:

<table>
<thead>
<tr>
<th>Resting Heart Rate</th>
<th>You</th>
<th>Your Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of beats in 15 seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of beats in a minute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of beats in an hour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of beats in a day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of beats in a year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Data Table 2: Heart Rate Data (Beats per Minute)

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>You (Trial 1)</th>
<th>You (Trial 2)</th>
<th>Average</th>
<th>Your Partner (Trial 1)</th>
<th>Your Partner (Trial 2)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 1 Minute of Exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Minute after stopping exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Minutes after stopping exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Minutes after stopping exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Data Table 3: Class Data

| Student Heart Rates | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | AVG |
|---------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Interval:            |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| After exercise       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Recovery 1           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Recovery 2           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Recovery 3           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Graph 1: Individual Data

Graph 2: Class Data
Data Analysis:

1. Using your data on Graph 1, describe the changes in your heart rate over time.

____________________________________________________________________________________
____________________________________________________________________________________

2. Using your data on Graph 1, compare your results to your partner. Describe the similarities and differences in the data.

____________________________________________________________________________________
____________________________________________________________________________________

3. Compare your data in Graph 1 to the class data in Graph 2. Describe the similarities and differences in the data.

____________________________________________________________________________________
____________________________________________________________________________________

4. Using the data in Graph 2, do you see any outlier data points? Explain the reason for this data.

____________________________________________________________________________________
____________________________________________________________________________________

Conclusions:

1. What caused your heart rate to increase and decrease?

____________________________________________________________________________________
____________________________________________________________________________________

2. What metabolic process is occurring in your cells that caused this change?

____________________________________________________________________________________
____________________________________________________________________________________

3. How will your fitness level affect heart rate and blood flow?

____________________________________________________________________________________
____________________________________________________________________________________

4. How does blood pressure change with pulse rate? (You may need to research this in your text book)

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____________________________________________________________________________________

5. If a person has hypertension, what does this mean?

____________________________________________________________________________________
____________________________________________________________________________________

6. If a person with hypertension performed this experiment, what effect would their condition have on their heart rate? What if they had hypotension?

____________________________________________________________________________________
____________________________________________________________________________________
7. Sketch a graph of what you think their data would look like. Include a line for hypertension and a line for hypotension; make sure to label both axes.