Mrs. Raco/Mrs. Adair-Foote (Per. 3)
Human Physiology
Assignments 4 & 5, Week 3

Heart Rate, Blood Pressure & Exercise

The ability of the heart to respond to stressors can be observed during exercise, when the activity of skeletal muscles increases. The cardiovascular system, consisting of the heart and blood vessels, responds to exercise with an increase in heart rate and strength of contraction with each beat, resulting in a higher *cardiac output* (*cardiac output* = quantity of blood pumped through the heart per unit of time) and blood pressure. Positive pressure is created by forceful contraction of the left ventricle of the heart, measured as *systole*. It is maintained during relaxation of the ventricle by closure of the aortic valve and recoil of arteries, measured as *diastole*. Mean arterial pressure is the average pressure in a person's arteries during one cardiac cycle.

In this experiment, heart rate and blood pressure readings were taken before and after exercise. Changes in heart rate, systolic, diastolic blood pressure, mean arterial pressures, and heart rate are show in the table below.

Table 1–Baseline Blood Pressure			
Systolic pressure (mm Hg)	Diastolic pressure (mm Hg)	Mean arterial pressure (mm Hg)	Pulse (bpm)
108	67	84	73

Table 2–Blood Pressure After Exercise			
Systolic pressure (mm Hg)	Diastolic pressure (mm Hg)	Mean arterial pressure (mm Hg)	Pulse (bpm)
142	86	91	140

Table 3–Heart Rate	
Condition	
Resting heart rate (bpm)	89
Maximum heart rate (bpm)	140
Recovery time (s)	124

<u>Directions</u>: Answer the following questions on a separate piece of paper.

1. How did the following change before (baseline) and after exercise?

a. systolic pressure
b. diastolic pressure
c. mean arterial pressure
d. pulse rate

2. What is stroke volume?

b. The stroke volume increased from 75mL/beat to 100 mL/beat. Use this information and the **change** in pulse rate with exercise to calculate *cardiac output* (stroke volume × heart rate) that occurred per minute.

3. *Pulse pressure* is the difference between systolic pressure (peak pressure during active contraction of the ventricles) and diastolic pressure (the pressure that is maintained even while the left ventricle is relaxing).
   a. Calculate pulse pressure.
   b. Which component of the blood pressure (systolic or diastolic pressure) is most responsible for this change?

4. Normal resting heart rates range from 55−100 beats per minute.
   a. What was the subject's resting heart rate?
   b. How much did the subject's heart rate increase above resting rate with exercise?
   c. What percent increase was this?

5. Congestive heart failure is a condition in which the strength of contraction with each beat may be significantly reduced. For example, the ventricle may pump only half the usual volume of blood with each beat.
   a. Would you expect a person with congestive heart failure to have a faster or slower heart rate at rest?
   b. With exercise?

Use pages 358-360 and 373-376 to answer the following questions.

<u>Regulation of Stroke Volume</u>

6. What is the critical factor that controls stroke volume?

7. How does the sympathetic nervous system affect heart rate? The parasympathetic system?

8. How do blood levels of ionic calcium affect heart rate?

9. How do the following physical factors affect heart rate?

a. Age

b. Gender

c. Body temperature

10. Name & describe 3 factors affect blood pressure.