**IB HL Biology II: Cardiac Rate and Physical Fitness**

During physical exertion, the cardiac rate (beats per minute) increases. This increase can be measured as an increase in pulse rate. Although the maximum cardiac rate is usually the same in people of the same age group, those who are physically fit have a higher stroke volume(millimeters per beat) then more sedentary individuals. A person who is in poor physical condition, therefore, reaches their maximum cardiac rate at a lower work level than a person with of comparable age who is in better shape. Maximum cardiac rates are listed in Table 10.3. Individuals who are in good physical condition can deliver more oxygen to their muscles before reaching maximum cardiac rate than can those in poor condition.

**Test 1: Standing Pulse Rate**

**Procedure**

1. The subject should stand at ease for 2 minutes.

2. After the two minutes, determine your partner's pulse.

3. Count the number of beats for 30 seconds and multiply by 2. The pulse rate is the number of beats per minute. Record this on the fitness data sheet. Assign fitness points based on the table below and record them on the data sheet.

**Table: Standing Pulse Rate**

|  |  |
| --- | --- |
| **Pulse Rate (beats/min)** | **Fitness Points** |
| **60-70** | **3** |
| **71-80** | **3** |
| **81-90** | **2** |
| **91-100** | **1** |
| **101-110** | **1** |
| **111-120** | **0** |
| **121-130** | **0** |
| **131-140** | **-1** |

**Test 2: Reclining Pulse Rate**

**Procedure**

1. The subject should recline for 5 minutes.

2. The other partner will determine the subject's resting pulse.

3. Count the number of beats for 30 seconds and multiply by 2. Record it on the Data Sheet. Assign fitness points based on the table below and record them on the fitness data sheet.

**Table: Reclining Pulse Rate**

|  |  |
| --- | --- |
| **Pulse Rate (beats/min)** | **Fitness Points** |
| **50-60** | **3** |
| **61-70** | **3** |
| **71-80** | **2** |
| **81-90** | **1** |
| **91-100** | **0** |
| **101-110** | **-1** |

**Test 3: Baroreceptor Reflex (Pulse Rate Increase from Reclining to Standing)**

**Procedure**

1. The reclining subject should now stand up.

2. Immediately take the subject's pulse. Record this value below. The observed increase in pulse rate is initiated by baroreceptors (pressure receptors) in the carotid artery and in the aortic arch. When the baroreceptors detect a drop in blood pressure they signal the medulla of the brain to increase the heart beat, and consequently the pulse rate.

Pulse immediately upon standing = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

3. Subtract the reclining pulse rate (recorded in Test 2) from the pulse rate immediately upon standing (recorded in Test 3) to determine the pulse rate increase upon standing. Assign fitness points based on the table below and record on the fitness data sheet.

**Table: Pulse Increase from Reclining to Standing**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reclining Pulse (beats/min)** | **Pulse Rate Increase on Standing (# beats)** | | | | |
| **0-10** | **11-18** | **19-26** | **27-34** | **35-43** |
| Hhhhhhhh | **Fitness Points** | | | | |
| **50-60** | **3** | **3** | **2** | **1** | **0** |
| **61-70** | **3** | **2** | **1** | **0** | **-1** |
| **71-80** | **3** | **2** | **0** | **-1** | **-2** |
| **81-90** | **2** | **1** | **-1** | **-2** | **-3** |
| **91-100** | **1** | **0** | **-2** | **-3** | **-3** |
| **101-110** | **0** | **-1** | **-3** | **-3** | **-3** |

**Test 4: Step Test- Endurance**

**Procedure**

1. Place your right foot on an 18-inch high stool. Raise your body so that your left foot comes to rest by your right foot. Return your left foot to the original position. Repeat these exercise five times, allowing three seconds for each step up. (An alternative procedure could be to quickly climb our stairs.)

2. Immediately after the completion of the exercise, measure the pulse for 15 seconds and record below; measure again for 15 seconds and record; continue taking the pulse and record at 60, 90, and 120 seconds.

Number of beats in the 15 second interval \_\_\_\_ X4= \_\_\_\_ beats per minute

Number of beats in the 30 second interval \_\_\_\_ X4= \_\_\_\_ beats per minute

Number of beats in the 60 second interval \_\_\_\_ X4= \_\_\_\_ beats per minute

Number of beats in the 90 second interval \_\_\_\_ X4= \_\_\_\_ beats per minute

Number of beats in the 120 second interval \_\_\_\_ X4= \_\_\_\_ beats per minute

3. Observe the time that it takes for the pulse rate to return to approximately the level as recorded in Test 1. Assign fitness pints based on the table below and record them on the fitness data sheet.

**Table: Time Required for Return of Pulse Rate to Standing Level after Exercise**

|  |  |
| --- | --- |
| **Time (seconds)** | **Fitness Points** |
| **0-30** | **4** |
| **31-60** | **3** |
| **61-90** | **2** |
| **91-120** | **1** |
| **121+** | **1** |
| **1-10 beats above standing pulse rate** | **0** |
| **11-30 beats above standing pulse rate** | **-1** |

**4.** Subtract your normal standing pulse rate(recorded in Test 1) from your pulse rate immediately after exercise (the 0-to 15-second interval) to obtain pulse rate increase. Record this on the data sheet. Assign fitness points based on the table below and record them on the fitness data sheet.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Standing Pulse (beats/min)** | **Pulse Rate Increase Immediately after Exercise (#beats)** | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41+** |
| hhhhhhhh | **Fitness Points** | | | | |
| **60-70** | **3** | **3** | **2** | **1** | **0** |
| **71-80** | **3** | **2** | **1** | **0** | **-1** |
| **81-90** | **3** | **2** | **1** | **-1** | **-2** |
| **91-100** | **2** | **1** | **0** | **-2** | **-3** |
| **101-110** | **1** | **0** | **-1** | **-3** | **-3** |
| **111-120** | **1** | **-1** | **-2** | **-3** | **-3** |
| **121-130** | **0** | **-2** | **-3** | **-3** | **-3** |
| **131-140** | **0** | **-3** | **-3** | **-3** | **-3** |

**Data Sheet:**

**Fitness Data**

|  |  |  |
| --- | --- | --- |
|  | **Measurement** | **Points** |
| **Test 1. Standing Pulse Ratev** | rrssss **beats/min** | rrssss |
| **Test 2. Reclining Pulse Rate** | rrssss **beats/min** | rrssss |
| **Test 3. Baroreceptor reflex Pulse Rate increase on standing** | rrssss **beats/min** | rrssss |
| **Test 4. Return of Pulse Rate to Standing after Exercise** | rrssss **seconds** | rrssss |
| **Pulse Rate increase immediately after exercise** | rrssss **beats/min** | rrssss |
|  | **Total Score** | rrssss |

|  |  |
| --- | --- |
| **Total Score** | **Relative Cardiac Fitness** |
| **16-14** | **Excellent** |
| **13-10** | **Good** |
| **9-8** | **Fair** |
| **7 or less** | **Poor** |