**Title of lesson:** Recovery Heart Rate

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**Teaching Date and Time:** March 22nd, 2010 at 12:50PM

**Length of Lesson:** 50 minutes

**Grade/Topic:** 7th grade/ Circulatory and respiratory systems

**Source of the lesson:** Spark systems - Recovery heart rate

**Appropriateness for Middle School Students:**

Students will be presented material in ways that stimulates a variety of their senses through visual, auditory, and kinesthetic activities. The pre-test, post-test, and all assignment hand-outs all share the same font for the heading, allowing the students to better organize these things as related to each other, and separate from their other assignments, as well as being designed in similar formats to other assignments we have taught. The instructional steps will be located directly on the worksheet give to the students, which will help them to see the bigger picture by breaking it down and focusing on the activity one step at a time.

**Concepts**

The respiratory system functions to get oxygen from the environment to the body, and to remove carbon dioxide from the body. Air is transported into the lungs through mechanical movements, and oxygen is used in chemical reactions that release energy from the body’s cells. Proper levels of carbon dioxide and oxygen are required in cells and tissues. The respiratory system is made up of the nose, throat, trachea, lungs, ribs, and diaphragm. In the nose, dirt and particles are filtered out of the air by cilia and mucus. The nasal cavity also warms the air before it moves down the throat to the trachea. Air enters the lungs through the trachea, and moves through structures called bronchial tubes. The bronchial tubes branch into smaller and smaller tubes until they enter tiny air sacs called alveoli. Oxygen passes from the alveoli into the blood stream at the same time that carbon dioxide passes from the blood stream to the alveoli. The ribs enclose the thoracic cavity and are connected to the breastbone and each other by cartilage. This makes them flexible and allows them to expand with breathing. The diaphragm is a muscle that stretches across the bottom of the thoracic cavity and controls the expansion and contraction of the thoracic cavity. When inhaling, the diaphragm pulls downward, expanding the thoracic cavity, and vice versa for exhaling.

The circulatory system transports material from the digestive and respiratory systems to the cells in the body. These materials are carried by blood. The heart pushes blood through the system. The right side of the heart pumps blood to the lungs, and the left side of the heart pumps blood to the body. Each side of the heart has two chambers. Blood flows from the right atrium to the right ventricle to the lungs, back to the left atrium, to the left ventricle, and then throughout the body, returning to the right atrium. (Above sourced from: Life Science, Florida Edition, pg. 133-148, published by McDougal Littel)

Exercise moderately increases heart and breathing rate. For a healthy person, heart rate usually increases from 60 beats/minute to about 100-120 beats/ minute. Breathing rate increases from 50 breaths/minute to 80 breaths/minute. The exact increase depends upon a number of factors, including which exercise is being done, the intensity of the exercise, the physical condition of the person, what muscle groups are being used, age of the person, and weight of the person. (Sourced from “Ask a scientist” on the department of education’s website; http://www.newton.dep.anl.gov/askasci/gen06/gen06265.htm)

**Performance Objectives**

Students will be able to:

1) Identify which system removes carbon dioxide and waste from the cells in the body.

2) Identify which system removes carbon dioxide from the body and brings in oxygen.

3) Explain the effect exercise has on heart rate.

4) Explain the effect exercise has on respiration rate.

**Florida State Standards:**

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| **Science Process** |  |
| **Benchmark Number** | SC.L.14.5 |
| **Benchmark Description** | Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis. |
| **Subject Area** | Science |
| **Grade Level** | 6 |
| **BODY OF KNOWLEDGE** | Life Science |
| **Big Idea** | Organization and Development of Living organisms –   1. All living things share certain characteristics. 2. The scientific theory of cells, also called cell theory, is a fundamental organizing principle of life on Earth. 3. Life can be organized in a functional and structural hierarchy. 4. Life is maintained by various physiological functions essential for growth, reproduction, and homeostasis. |

**Materials List:**

Spark systems (10)

Packages with Heart Rate Sensor (10)

Pre-tests (“What do you know?” 22 copies – 1 per student)

Post-tests (“What did you learn?” 22 copies – 1 per student)

Student worksheets (“Recovery Heart Rate” 22 copies – 1 per student)

Small orange cones (15)

**Advance Preparations**

The Sparks need to be charged up and turned on before the students arrive in the class. The pre-tests need to be on the students’ desks before they arrive. The students also need to be told the day before to wear shoes they can run in, and clothes that are conducive to running. (For example, no sandals or flip-flops, and no skirts or dresses.)

**Safety**

The students must be told to allow enough space between individuals to avoid collision or contact when running. The students must also be told to wait until they are told specifically that they can go, and to stay on the designated path. The path will be obstacle free, but the students will still be told to watch where they’re running. The students will be told not to try to race each other.

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| **Engagement** | | **Time: 5 minutes** |
| **What the Teacher Will Do** | **Probing Questions** | **Student Responses and Potential Misconceptions** |
| Show the kids a parkour/ free running video. | What internal parts in the body are allowing for these people to do this?  What are the systems in the body made up of the lungs, heart, veins, and arteries?  Besides food, what is fueling these free-runner’s body’s cells?  What two major organs are involved in circulating oxygen through the body?  Can you give us a brief description on how the lungs and heart help to fuel these runners’ bodies? | [Muscles, bones, heart, lungs, cells.]  [The circulatory and respiratory systems.] (Students may also say the heart & lung system, and not the technical term.)  [The heart and lungs.] (Students may also say vitamins, water, metabolism.)  [Heart and lungs.] (They may also include veins and arteries, or mention the throat, esophagus.)  [Air goes into the lungs where it enters the bloodstream. Then it is carried to the cells through the blood. The heart pumps the blood through the body.] |

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| **Exploration** | | **Time: 20 minutes** |
| **What the Teacher Will Do** | **Probing Questions** | **Student Responses and Potential Misconceptions** |
| Explain how they will be doing the activity.  Explain that the heart probe they are using will measure their beats per minute. | Key question:  How does exercise affect your heart rate and body systems? | [Exercise increases the heart rate and allows the circulatory and respiratory systems to endure higher strain.] |
| ACTIVITY:  Students will be put into ten groups by counting off.  Students will be following instructions provided to them by the Spark.  The spark will provide questions throughout the activity that the kids will record on a piece of paper provided.  First students will sit in a chair and hold the heart rate grips in their hands in order to get a recording for their resting heart rate.  The students will then collect their data.  Next we will take the students outside and have them run around for a minute.  They will be instructed beforehand to return to the classroom immediately.  They need to make sure their spark screen is set up to start recording their new heart rate.  They will hold onto the heart rate grips and immediately record their heart rate.  Then they will collect their data and finish answer questions provided by the spark. | Questions will be provided by the spark.  1. What do you think resting heart rate will be while relaxing in a chair?  2. How do you think your resting heart rate will change when you run?  3. How long will it take your heart rate to recover to normal after exercising?  4. How did this compare to your prediction?  5. Observe the heart rate graph. How did it compare to what you predicted?  6. Calculate the difference between your running heart rate and your resting heart rate.  7. Calculate the percentage change in heart rate.  (equation provided)  8. Determine how long it took for heart rate to return to normal.  9. How did the actual recovery time compare to what you predicted?  10. Talk to group members about physical activity. After sharing, write relationships between physical level and condition time. | [~60-80 bpm]  [It will increase.]  [Up to 30 minutes after intense workout.]  [Answers will vary.]  [Varies depending on data.]  [Varies depending on data.]  [Varies depending on data.]  [Varies depending on data.]  [Varies depending on data.]  [Come to the conclusion that people who are more physically active have lower resting heart rates and better recovery time.] |

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| **Explanation** | | **Time: 10 minutes** |
| **What the Teacher Will Do** | **Probing Questions** | **Student Responses and Potential Misconceptions** |
| Students will be able to share some of their answers and results with the rest of the class.  Teachers will call out ranges of heart rates and have students raise hands to get a broad range of where everyone’s heart rate is at and have all students participate. | Raise your hand if you had a resting heart rate greater than 80 beats per minute (bpm).  … if it’s less than 80 bpm.  … if it’s less than 70 bpm.  … if it’s less than 60 bpm. |  |
| A picture/simulation of the lungs will be put up and asked how they were being used during this activity.  Teachers will show a picture/simulation of the heart and show the blood flow movement through it. | What system is this and what does it do?  What waste product does this system release?  What structures does oxygen move into the lungs?  What two structures allow movement to occur when lungs inhale and exhale?  How is oxygen collected and sent to the rest of the body?  (Ask students in 4th period if they recall how protein synthesis occurs.)  What part of the heart pumps oxygen-poor blood to the lungs?  What part of the heart pumps oxygen-rich blood to the body?  What is the role of arteries?  What is the role of veins?  Do arteries carry oxygen-rich blood or oxygen-poor blood? | [The respiratory system is the body system that functions to get oxygen from the environment and remove carbon dioxide and other waste products from your body.]  [Carbon dioxide]  [Nose, throat, and trachea]  [Ribs and Diaphragm]  [An oxygen collecting protein named hemoglobin transports it to the heart which is pumped through the rest of the body.]  [Ventricle]  [Left ventricle]  [They are the vessels that take blood away from the heart.]  [Blood vessels that carry blood back to the heart.]  [Oxygen-rich blood.] |

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| **Elaboration** | | **Time: 10 minutes** |
| **What the Teacher Will Do** | **Probing Questions** | **Student Responses and Potential Misconceptions** |
| Show various pictures:  pictures of a couch potato and an athlete.  Boy and girl  Teenager and elderly  Ask students how they think the heart beat compares between each individual and ask why. | How do you think the heart rate compares between the people in these pictures?  Which one do you think has a faster heart rate?  Ask why they think a conditioned athlete has a lower heart rate. |  |
| Show students how blood pressure is taken.  SHARE a few interesting facts:  On average, it takes 20 steps to burn one calorie.  One drop of blood contains a half a drop of plasma, 5 MILLION Red Blood Cells, 10 Thousand White Blood Cells and 250 Thousand Platelets.  You have thousands of miles of blood vessels in your body. "Bill Nye the Science Guy" claims that you could wrap your blood vessels around the equator TWICE!  Keep your heart healthy...it's going to have to beat about 3 BILLION times during your lifetime! |  |  |
| **Evaluation** | | **Time: 5 minutes** |
| **What the Teacher Will Do** | **Probing Questions** | **Student Responses and Potential Misconceptions** |
| At the beginning of class, a pre-test will be passed out. (Page titled: What do you know?) | 1) Which system brings oxygen into your body and removes carbon dioxide?  A. Respiratory system  B. Digestive system  C. Circulatory system  D. Integumentary system  2) Which system transports oxygen and nutrients to the cells in your body?  A. Respiratory system  B. Digestive system  C. Circulatory system  D. Integumentary system  3) True or false: exercise increases heart rate.  4) True or false: exercise decreases respiration rate. | 1) A  2) C  3) True  4) False |
| At the end of class, a post-test will be distributed. (Page titled: What did you learn?) | 1) What system removes carbon dioxide and waste from the cells in your body?  A. Respiratory system  B. Digestive system  C. Circulatory system  D. Integumentary system  2) What system removes carbon dioxide from your body and brings in oxygen?  A. Respiratory system  B. Digestive system  C. Circulatory system  D. Integumentary system  3) What effect does exercise have on heart rate?  4) What effect does exercise have on respiration rate? | 1) C  2) A  3) Exercise increases heart rate.  4) Exercise increases respiration rate. |