GRADE 10 BIOLOGY

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GRADE 10 BIOLOGY
IN-SCHOOL PREPARATION

MEETING THE EXPECTATIONS

LEARNING BIOLOGY LANGUAGE

BIOLOGY LANGUAGE EXERCISE

CIRCULATORY SYSTEM

SCIENTIFIC METHOD

RESPIRATORY SYSTEM
MEETING THE EXPECTATIONS

Grade 10 Biology Activities
Ontario Curriculum Connections Grade 10 Science - Biology

BIOLOGY – Tissues, Organs, and Systems of Living Things

Activities
Includes activities in the pre-visit, field trip, and post-visit to Canada’s Wonderland

Scientific Investigation Skills
A1.1 Formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research
A1.3 Identify and locate print, electronic, and human sources that are relevant to research questions
A1.6 Gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams
A1.7 Select, organize, and record relevant information on research topics from various sources, including electronic, print, and/or human sources (e.g., websites for public health organizations, federal and provincial government publications, reference books, personal interviews), using recommended formats and an accepted form of academic documentation
A1.8 Analyze and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty
A1.10 Draw conclusions based on inquiry results and research findings, and justify their conclusions
A1.11 Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

Career Exploration
A2.2 Identify scientists, including Canadians (e.g., Sheela Basrur, William Richard Peltier, Alice Wilson, Willard Doyle), who have made a contribution to the fields of science under study

Developing Skills of Investigation and Communication
B2.1 Use appropriate terminology related to cells, tissues, organs, and systems of living things
Understanding Basic Concepts

B3.4 Explain the primary functions of a variety of systems in animals (e.g., the circulatory system transports materials through the organism; the respiratory system supplies oxygen to and removes carbon dioxide from the body)

B3.5 Explain the interaction of different systems within an organism (e.g., the respiratory system brings oxygen into the body, and the circulatory system transports the oxygen to cells) and why such interactions are necessary for the organism’s survival
LEARNING BIOLOGY LANGUAGE

DEFINITIONS

Alveolus Any of the tiny air sacs in the lungs at the end of the bronchioles, through which oxygen is taken into the blood

Anxiety A state of intense apprehension, uncertainty, and fear resulting from the anticipation of a threatening event or situation

Arteries Any of the branching blood vessels carrying blood away from the heart

Blood Capillary One of the minute blood vessels that connect arterioles and venules and are a part of an intricate network throughout the body for the interchange of oxygen, carbon dioxide, and other substances between blood and tissue cells

Bronchiole Any of the small, thin-walled tubes that branch from a bronchus and end in the alveolar sacs of the lung

Bronchus Either of the two main branches of the trachea that lead to the lungs, where they divide into smaller branches

Circulatory System The system of organs and tissues, including the heart, blood, blood vessels, lymph, lymphatic vessels, and lymph glands, involved in circulating blood and lymph through the body

Dehydration Excessive loss of water from the body or from an organ or a body part, as occurs during illness or fluid deprivation

Diaphragm The large muscle that separates the chest cavity from the abdominal cavity in mammals and is the principal muscle of respiration. As the diaphragm contracts and moves downward, the lungs expand and air moves into them. As the diaphragm relaxes and moves upward, the lungs contract and air is forced out of them

Heart A hollow, pump-like organ of blood circulation, composed mainly of smooth muscle, located in the chest between the lungs and consisting of four chambers: a right atrium, a right ventricle, a left atrium, and a left ventricle

Heart Rate The number of heartbeats per unit of time, usually expressed as beats per minute

Larynx The upper part of the trachea in most vertebrate animals, containing the vocal cords. Sound is produced by air passing through the larynx on the
way to the lungs, causing the walls of the larynx to vibrate; it is also called the voice box.

**Lungs**  
Either of the two saclike organs of respiration that occupy the pulmonary cavity of the thorax and in which aeration of the blood takes place. It is common for the right lung, which is divided into three lobes, to be slightly larger than the left, which has two lobes.

**Pharynx**  
The passage that leads from the cavities of the nose and mouth to the larynx (voice box) and esophagus. Air passes through the pharynx on the way to the lungs, and food enters the esophagus from the pharynx.

**Pulse**  
The rhythmical dilation of arteries produced when blood is pumped outward by regular contractions of the heart, especially as palpated at the wrist or in the neck.

**Respiratory System**  
The integrated system of organs involved in the intake and exchange of oxygen and carbon dioxide between the body and the environment and including the nasal passages, larynx, trachea, bronchial tubes, and lungs.

**Scientific Method**  
A method of research in which a problem is identified, relevant data is gathered, a hypothesis is formulated from these data, and the hypothesis is empirically tested.

**Trachea**  
The tube in vertebrate animals that leads from the larynx to the bronchial tubes and carries air to the lungs. In mammals the trachea is strengthened by rings of cartilage, it is also called the windpipe.

**Veins**  
Any of the branching blood vessels carrying blood toward the heart.
1. The system of organs and tissues involved in circulating blood and lymph through the body
   __ Veins
   __ Anxiety

2. An organ of blood circulation located in the chest between the lungs and consisting of four chambers
   __ Dehydration
   __ Trachea

3. Any of the branching blood vessels carrying blood toward the heart
   __ Heart
   __ Alveolus

4. The number of heartbeats per unit of time, usually expressed as beats per minute
   __ Bronchus

5. Any of the branching blood vessels carrying blood away from the heart
   __ Circulatory system
   __ Blood Capillary

6. One of the minute blood vessels that connect arterioles and venules
   __ Pharynx
   __ Bronchiole

7. The rhythmical dilation of arteries produced when blood is pumped outward by regular contractions of the heart
   __ Respiratory System
   __ Diaphragm

8. A state of intense apprehension, uncertainty, and fear resulting from the anticipation of a threatening event or situation
   __ Larynx
   __ Arteries

9. Excessive loss of water from the body or from an organ or a body part, as occurs during illness or fluid deprivation
   __ Pulse
   __ Scientific Method

10. A method of research in which a problem is identified, relevant data are gathered, a hypothesis is formulated from these data, and the hypothesis is empirically tested
    __ Lungs
    __ Heart Rate

11. The integrated system of organs involved in the intake and exchange of oxygen and carbon dioxide
    __ Heart Rate

12. The passage that leads from the cavities of the nose and mouth to the larynx (voice box) and esophagus.
13. This is also called the voice box

14. This is also called the windpipe

15. Either of the two main branches of the trachea that lead to the lungs

16. Any of the small, thin-walled tubes that branch from a bronchus and end in the alveolar sacs of the lung

17. Any of the tiny air sacs in the lungs at the end of the bronchioles, through which oxygen is taken into the blood

18. Either of the two saclike organs of respiration that occupy the pulmonary cavity of the thorax

19. The large muscle that separates the chest cavity from the abdominal cavity and is the principal muscle of respiration.
CIRCULATORY SYSTEM

Background Information

The circulatory system is one of the major organ systems of the body. It comprises mainly of the heart, arteries, veins and capillaries. The purpose of this body system is to pump blood to organs (liver, kidneys, pancreas, etc.) and tissues (muscle, fat, cartilage) of the body. It is important to pump blood so that red blood cells (RBC) are able to carry oxygen to all tissues and organs in order for them to function properly. The fundamental role of the circulatory system is to transport oxygen, via RBC, to the different tissues and organs of the body. Providing adequate amounts of oxygen to organs and tissues allows them to function properly and any interruption or blockage of oxygen can cause damage or death to the tissue or organ. For instance, a stroke occurs due to a blockage of oxygen to the brain, which results in the death of brain tissue.

In order to understand the mechanism behind how the circulatory system works each component of it needs to be explained.

Heart: Made of a special type of muscle called cardiac muscle. The function of the heart is to act like a pump that is responsible for generating enough pressure to push blood around the body. For every beat of the heart there are 2 different events occurring with respect to the flow of blood:

1. Collecting red blood cells that have released their oxygen, becoming deoxygenated, to a tissue, and sending it to your lungs so red blood cells can pick up oxygen (that you breathe from the air).
2. Sending red blood cells that have picked-up oxygen (from the lungs) to the different organs and tissues around your body.

Veins: Act as passages for blood to get back to the heart.

Arteries: Act as passages for blood to get to organs and tissues.

Capillaries: Smallest component of the circulatory system and the site where oxygenated blood cells give their oxygen to surrounding cells of a tissue/organ.

The heart pumps oxygenated blood through a series of arteries until it reaches a capillary where the red blood cell donates its oxygen to surrounding cells. Once deoxygenated, the red blood cell exits the capillary and travels through a series of veins back up to the heart to be re-oxygenated.
Schematic of the Circulatory System

To the left is a basic schematic of the circulatory system. The red coloring of the blood is meant to represent oxygenated blood whereas the blue represents deoxygenated blood. The numbers in the picture correspond to the numbers below.

1. The pulmonary artery pumps deoxygenated blood to the lungs.
2. Blood flows through capillaries where red blood cells pick up oxygen.
3. Pulmonary veins bring the now oxygenated blood back to the heart.
4. The heart pumps the newly oxygenated blood through arteries.
5. Blood eventually flows to organs/tissues, where it passes through capillaries; here the red blood cells release the bound oxygen to the surround cell.
6. The blood, now deoxygenated, returns back to the heart where the cycle repeats again.

The cycle outlined above defines the basic concepts behind the function of the circulatory system; this cycle repeats itself every time the heart beats. Tissues always require a constant supply of oxygen, hence why the heart beats all the time!

Apply the Knowledge: Eating an unhealthy diet high in fats (especially saturated fat) can lead to a rise in cholesterol which can cause a build-up of plaque in the walls of your arteries, making them narrow and less flexible. Using the internet, your text books, and information learned in class, research the health implications of excess plaque in your arteries.

Measuring Pulse

How to Measure Pulse

With many different methods of measuring pulse (heart rate monitor, ECG) the easiest way is through palpitation (another word for feeling) your pulse points (areas on your body where your heart beat can be felt). To measure your pulse through palpitation only requires a timer (or
watch) in order for an accurate measurement. On the body there are 2 major cites which pulse points can be felt which are:

**Radial Pulse (wrist)** - place your index and middle fingers together on the opposite wrist, about 1/2 inch on the inside of the wrist joint, in line with the index finger. Pulse points may vary within people so try moving fingers around the wrist until pulse is found.

**Carotid Pulse (neck)** - To take your heart rate at the neck, place your first two fingers on either side of the neck. Be careful not to press too hard! Pulse points may vary within people so try moving fingers around the neck until pulse is found.

You check your pulse rate by counting the beats in a set period of time (at least 15 to 20 seconds) and multiplying that number to get the number of beats per minute.

**Example:** If you counted 13 beats in 15 seconds, your heart rate would be 60 beats/minute.

**Math:** Since 15 goes into 60 four times, multiply the number of heart beats you measure in that time by 4.

$$\frac{60}{15} = 4$$

$$4 \times 13 = 52 \text{ bpm}$$

**Try It Out!**
If I measure 20 beats in 20 seconds, how many times did my heart beat in 60 seconds (1 minute)

Measure your own: Measure you heart rate, in 15 and 20 seconds, and then calculate what your bpm is.

1) ______ beat in 15 second = _________ beats per minute
II) ______ beat in 20 second = ________ beats per minute

III) Try calculating how many times your heart beats:

a) In an hour

b) In a day

c) In a year

Factors of Heart Rate

When you have taken your own pulse and figured out how many times your heart beats per minute, take another minute to compare with your classmates. You may notice that for the most part everyone’s heart rate is a little different, and don’t worry this is not unusual at all. The reason why there is variation and inconsistency between heart rates is complex, as many different factors impact your heart rate: genetic background, health status, daily diet, gender, age and hormonal levels. The list below outlines some (but not all) of the factors that can influence your heart rate:

1. Emotions and anxiety: These can raise your heart rate; during stress your body releases different hormones that signal a change in your heart rate. For instance if you are stressed (about to write an exam, or going skydiving) your body releases 2 different types of catecholamines (a hormone) called norepinephrine and epinephrine (commonly known as adrenaline). These hormones, released by the nervous system, bind to cells of the heart causing it beat faster.
2. **Body Temperature:** If you become too hot or too cold your body senses a thermal stress load. Blood is sent to your skin to enhance heat dissipation to cool you or increase blood flow to warm you. Temperatures above 21°C degrees and below 2°C degrees will increase your heart rate at least 2-4 beats per minute. Over 90% humidity can equal as much as a 10 beat increase in heart rate.

3. **Physical activity:** As you exercise your muscles are working hard and thus require more blood flow (for oxygen delivery), so to satisfy this increased demand for oxygen your heart rate increases.

4. **Dehydration:** As you become increasingly dehydrated during a long walk, hike, or run, your blood becomes thicker and waste products build up in bloodstream. Your heart will work harder to maintain constant cardiac output. A fluid loss of 3% of your body weight will result in an increased pulse rate because of the decrease in circulating blood volume.

5. **Insufficient nutrition:** Heart rate increases.

6. **Insufficient sleep:** Heart rate increases.

7. **Insufficient recovery:** After a long hike, run, or other hard work out your heart rate increases.

8. **Recent illness:** Can alter heart rate.

9. **Medication:** Depending upon the medication, heart rate can either decrease or increase. Be certain to ask your physician about any medication you are taking and its effects on your exercise heart rate.

**Apply your knowledge:** Why do you think doing something scary (such as riding a roller coaster) increases your heart rate? Using the internet, your text books, and information learned in class, research both the hormones released when you are scared and what else they do in the body. In your answer outline what the ‘fight or flight’ response is.
The scientific method is a technique for investigating, acquiring new knowledge, as well as correcting previous knowledge. The scientific method of inquiry is unique in the fact that it is based on empirical and measurable evidence.

**Question:** Development of a question

**Purpose:** Outlining why the experiment is relevant and what knowledge you plan on gaining from it.

**Hypothesis:** Stating what you think the outcome will be, and explaining why.

**Procedure:** Explaining how you plan on answering your question. Usually outlined as a step-by-step process of your planned experiment

**Testing hypothesis:** Usually a discussion of how your experiments went, stating any observations that stood out during your experimental trials. If you are using animals or people in the experiments you usually report how many subjects they tested and their characteristics (age, height, weight) and any other relevant information.

**Analyze data and conclusions:** You usually include the collected data along with analysis. Lastly conclude what you found in the experiment and state if your hypothesis was right or wrong. Lastly you can state what the strengths and weaknesses were in your experiment and things you would change if you had to repeat it.

**Factors in Heart Rate – An Experiment**
Working in small groups or independently, come up with a testable question regarding heart rate. Outline your question, hypothesis, materials, methods results, discussion and conclusions about what you found. Use the example below as a template

**Question**

<table>
<thead>
<tr>
<th>How long does it take for heart rate to get back to basal (resting) level after minimal intensity* exercise, in the example we are defining moderate as 5 minutes of constant exercise (such as jumping jacks)?</th>
</tr>
</thead>
</table>

* This is our own definition of moderate, if you were to repeat this experiment duration and intensity of exercise is a variable that can be changed

**Hypothesis**

Knowing that physical activity increases heart rate we would expect heart rate to increase after exercise, to 1/3 of maximum heart rate (this is an estimate since subjects are only doing a minimal intensity exercise, if they were doing moderate we might expect heart rate to increase 2/3 of maximum heart rate). We hypothesize that subject will then quickly recover back to resting heart rate. We believe there will be a fast recovery since the subject is only doing minimal exercise so their body will be able to compensate easier and quicker than if they were doing moderate or extreme intensity exercise.

**Materials**

- Watch (with second hand)
- 5 people (who have been instructed how to measure their carotid pulse and know how to do jumping-jacks

**Methods**

- Subjects were informed that they will be doing minimal exercise (jumping jacks) for 5 minutes and were instructed how to take carotid pulse (they had the right to stop at any point in the experiment if they were feeling unwell/uncomfortable).
- Resting heart rate is taken of each subject before exercise.
- Experimenter instructed subject to start jumping jacks then informed them after the 5 minute time period had elapsed
- Subject measured their pulse directly after they stopped (they measured their pulse for 20 seconds, experimenter later calculated bpm) and every minute after they stopped for 7 minutes (again subjects just had to measure how many beats they felt in 20 seconds, and again this number was used to calculate bpm)
Results

Subject #1:
- Resting heart rate ______ bpm
- Heart rate directly after exercise _____ bpm
- 1 minute after exercise ______ bpm
- 2 minute after exercise ______ bpm
- 3 minute after exercise ______ bpm
- 4 minute after exercise ______ bpm
- 5 minute after exercise ______ bpm

Subject #2:
- Follow same procedure as subject #1

Subject #3:
- Follow same procedure as subject #1

Subject #4:
- Follow same procedure as subject #1

Subject #5:
- Follow same procedure as subject #1

Subject Characteristics:
- The subjects that were tested (n=5) had an average age of 22 and average height and weight of 5’11, 150lbs (respectively). They all reported they were in good health, adequately hydrated and not feeling stressed in any way. We found asking these questions were important as health, hydration and stress influence heart rate. We would expect that if one of our subjects were dehydrated, sick or stressed that their heart rate would differ significantly (thus we could account for this when analyzing our data).

Once data is collected it would be best to graph each result in a program such as Microsoft Excel in order to create a visual representation of each subject’s heart rate recovery. Also creating a graph of the average responses at each time would provide an overall understand of how heart rate recovers after minimal physical exercise.

Below is an outline of fictitious data, set-up in an Excel table

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Subject 1</th>
<th>Subject 2</th>
<th>Subject 3</th>
<th>Subject 4</th>
<th>Subject 5</th>
<th>Averages (rounded to nearest whole number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (resting heart rate)</td>
<td>60</td>
<td>76</td>
<td>80</td>
<td>82</td>
<td>66</td>
<td>73</td>
</tr>
<tr>
<td>Directly after exercise</td>
<td>120</td>
<td>130</td>
<td>144</td>
<td>140</td>
<td>132</td>
<td>133</td>
</tr>
<tr>
<td>1 minute after exercise</td>
<td>100</td>
<td>116</td>
<td>120</td>
<td>110</td>
<td>116</td>
<td>112</td>
</tr>
<tr>
<td>2 minute after exercise</td>
<td>84</td>
<td>94</td>
<td>100</td>
<td>98</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>3 minute after exercise</td>
<td>78</td>
<td>86</td>
<td>96</td>
<td>88</td>
<td>88</td>
<td>87</td>
</tr>
<tr>
<td>4 minute after exercise</td>
<td>82</td>
<td>80</td>
<td>84</td>
<td>84</td>
<td>76</td>
<td>81</td>
</tr>
<tr>
<td>5 minute after exercise</td>
<td>60</td>
<td>78</td>
<td>82</td>
<td>82</td>
<td>68</td>
<td>74</td>
</tr>
</tbody>
</table>
Graph 1: From the graphed data of each subject’s change in heart rate, we can see a similar trend between each subject, meaning that they all have similar recovery times after moderate exercise.

Graph 2: From this graph of the average change in heart rate after exercise we can see that directly after the average heart rate was ~130bpm and then a slow but steady decrease in heart rate is seen until it returns to resting level.
Conclusion:

From the collected data we can see that exercise causes an increase in heart rate. Initially after exercise we observed a heart rate increase from basal (resting level) to around 130bmp. Each minute after exercise heart rate decreased, and after 5 minutes heart rate returned to resting levels. This data is what we would expect, since exercise increases heart rate (due to the fact the heart needs to work harder to deliver oxygen to working muscle and other organs), the recovery of heart rate back to normal or resting heart rate is probably explained by the fact that after exercise muscles no longer require as much oxygen and thus the heart does not need to work as hard to deliver oxygen, thus it slows down.

This experiment could also be altered a few ways to observe how heart rate changes in different situations. Perhaps we could test how heat rate changes after being scared, to test this we could blind fold a subject and tell them we were going to pop a balloon, and after doing so we could take their heart rate to see if a fear response increased their bpm.
RESPIRATORY SYSTEM

Background

- The primary role of the respiratory system is gas exchange such to bring oxygen into the body (inhale) and remove (exhale) carbon dioxide.
- Oxygen is an element required for numerous biological processes whereas carbon dioxide is a by-product of those processes.
  Ex. Analogy to a car. The body uses oxygen to fuel biological processes the same way in which a car engine uses gas. However, by using the fuel (oxygen) we produce carbon dioxide the same way in which a car produces exhaust.
- The respiratory system is made up of the pharynx, larynx, trachea, bronchi, bronchioles, alveoli and lungs, as well as the diaphragm.

- During the process of inhalation (breathing in) the diaphragm contracts and moves downward. This action sucks air through the mouth or nose and into the pharynx. Air then travels down the larynx, trachea and into the bronchi and bronchioles. The bronchioles terminate into the alveoli where gas exchange occurs.
- Alveoli are terminal sacs surrounded by an extensive network of small blood vessels called capillaries. The interface between the alveoli and capillaries is called the blood-air barrier. It is at this location where oxygen diffuses into the blood and carbon dioxide diffuses from the blood into the alveoli.
During the process of exhalation the diaphragm relaxes and moves upwards which pushes the carbon dioxide rich air in the alveoli out of the body to the environment.

The combined processes of inhalation and exhalation are referred to as respiration.

The average human breathes approximately 12-16 times per minute.

Respiration is an automatic process that occurs without conscious thought.

**How to Measure**

While in a state of rest, count how many breaths are taken in 15 seconds. Multiply that number by 4 and the resultant number will represent your resting rate of respiration.

**Example:** If you counted 4 breaths in 15 seconds, your resting respiratory rate would be 16 breaths per minute.

**Math:** *Hint: 60 seconds = 1 minute.*

\[
\text{60 seconds/15 seconds} = 4.
\]

Therefore, 4 breaths in 15 seconds \( \times 4 = 16 \)

\[
\frac{60 \text{ seconds in 1 minute}}{15 \text{ seconds}} = 4
\]

\[
4 \times 4 = 16 \text{ Breaths per minute}
\]

**Try it out: Measuring your Resting Respiratory Rate**

I) _____ breaths in 15 second = _________ breaths per minute

II) _____ breaths in 20 second = _________ breaths per minute
III) Try calculating how many times you breathe:

a) In an hour

b) In a day

c) In a year

Factors That Affect Respiration

The rate of respiration is tightly regulated and can be influenced by numerous factors including but not limited to temperature, activity level, stress/excitement, age, gender, physical fitness and disease. The rate of respiration is primarily driven by the amount of CO2 in your blood such that high levels stimulate an increase in respiratory rate. High levels of CO2 indicate that the body is working hard and therefore needs more oxygen to supply biological processes.

1. During exercise your muscles contract, a process which requires oxygen to generate the energy necessary for muscle contraction. As a by product of contraction your muscles produce CO2. Therefore, the harder you exercise the more CO2 you produce. This increase in CO2 signals the respiratory system to increase the rate at which oxygen is brought into the body (inhalation) and CO2 removed (exhalation).
2. During times of high stress or excitement your body rapidly produces CO2 as a result of an elevated rate of biological processes (Ex. Heart rate). This rise in CO2 stimulates the respiratory system to increase the rate at which we inhale O2 and exhale CO2.

3. During the night while sleeping the average rate of respiration becomes slower than during the day. The reason being is because while you are sleeping you are in your least active state. Therefore, you are producing the least amount of CO2 and as a result your respiratory system compensates by slowing down respiration because there is not a lot of CO2 to get rid of.

In conclusion, the goal of changing (increase or decrease) respiratory rate is to maintain a balance of CO2 and O2 in the body. Maintaining this balance is critical for the proper functioning of all organ systems and tissues within the body.

Factors Affecting Respiratory Rate – An Experiment

In order to determine how your respiratory system responds to different scenarios and stimuli everyone will conduct an experiment in groups of 2 or 3.

Question

| **How long does it take for respiratory rate to return to basal (resting) level after a short burst of intense exercise**? |
| * We will define a short burst of intense exercise as 1 minute of continuous exercise. |

Hypothesis

| Based upon your research question and prior knowledge of a given topic develop a testable question. |
| Ex. Respiratory rate will increase immediately after exercise and return to basal level within minutes. |

Materials

- Watch (with second hand)
- 2-3 people

Methods

- One at a time, measure your partners resting respiratory rate.
- Perform 1 minute of jumping jacks (each partner will time the other)
- Immediately after exercise measure your respiratory rate.
- Measure respiratory rate every two minutes past exercise for 10 minutes.

**HINT**: When measuring respiratory rate measure the number of breaths in 15 or 20 seconds and multiply
Results

Subject #1:
- Resting respiratory rate __________
- Respiratory rate directly after exercise __________
- 2 minute after exercise __________
- 4 minute after exercise __________
- 6 minute after exercise __________
- 8 minute after exercise __________
- 10 minute after exercise__________

Subject #2:
- Follow same procedure as subject #1

Subject #3(if needed):
- Follow same procedure as subject #1
  - Once all the data is collected graph your results using Microsoft Excel (or similar program) in order to create a visual representation of each subject’s respiratory rate recovery. Also creating a graph of the average responses at each time would provide an overall understand of how respiratory rate recovers after physical exercise. Use the “Factors in heart rate – An experiment” as an exam of how to chart data!

Conclusion

Analyze the data obtained from the results section to come up with a conclusion the question. This can be done as a class together or separately in groups.
AMUSEMENT PARK ACTIVITY

Explore Canada’s Wonderland and fill out the following sheet for all of the rides you choose to go on. Record your thoughts and save your sheet for when you return to school.

*PRINT OFF MULTIPLE SHEETS FOR EACH STUDENT*

Name:_____________________________________
Class:_____________________________________
Time arrived:
Time departed:

Name of Ride ____________________________________________

Speed ___________________________ Height ___________________________

Hypothesis (Will your heart rate or respiratory rate change? WHY?)
_________________________________________________________________________
_________________________________________________________________________

<table>
<thead>
<tr>
<th></th>
<th>Before Ride</th>
<th>On Ride</th>
<th>After Ride</th>
<th>5 Min After Ride</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What else do you feel? (Check all that apply)
  o Disoriented         o Sweaty          o _____________
  o Anxious             o Scared           o _____________
  o Nauseous            o Excited          o _____________

Other Information: __________________________________________
_________________________________________________________________________
POST ACTIVITY FOLLOW UP

Students will create an experiment using the information gathered from the amusement park activity. Students should have their heart rate, respiratory rate, and recorded observations for each one of the rides they chose to ride on. They will prepare a report similar to the experiments for heart rate and respiratory rate included earlier in this package. Their reports should be organized according to the scientific method.

**Question:**
- Students should come up with a research question that can be answered using the information on the activity sheet. This could be done together as a class.
  - **Will my heart rate and respiration rate change differently based on the type of ride?**
  - **How much will my heart rate and respiration rate change throughout my time at Canada’s Wonderland?**

**Purpose:**
- Students will outline why the experiment is relevant and what knowledge they plan on gaining from it.

**Hypothesis:**
- Students will state what they think the outcome will be and explain why they think that way.
- Their reasoning can be based upon research and prior knowledge of heart rate, respiratory rate, and biology

**Materials:**
- Timing device
  - Watch with second hand
  - Stop watch
- Amusement Park Activity sheet
- Writing utensil
- Heart rate monitors (optional)

**Methods:**
- How did students complete the experiment?

**Results:**
- Students are encouraged to graph their data recorded during their trip to Canada’s Wonderland
- Information on the person being tested should also be included in this section

**Conclusion**
- Students will record what they found in the experiment and state if their hypothesis was right or wrong
- They can state what the strengths and weaknesses were in their experiment and things they would change if the experiment were repeated
IN SCHOOL ACTIVITIES

These activities could be used as a follow-up to the Canada’s Wonderland trip.

Scientist Wanted Poster

Students will research a scientist that has worked in the field of Biology and create a poster based on the scientist’s information.

Poster Specifics:

- Poster MUST be on an 8 1/2 x 11 sheet of paper.
- Mug shot - We need to know what they look like!
- First, Middle and Last name of your scientist.
- Birth date and year of death (optional).
- What country were they born in and where did they do their work?
- What are they famous (wanted) for? Complete 5-8 sentences, in your own words, for full credit.
- A fact that you found interesting OR a quote by that person.
- What sources did you use?
- Your name in the bottom right corner.

Postcard Activity

Have your students create a postcard from the perspective of a blood cell. Students will choose a specific region of the circulatory system to write the postcard from. E.g. Hello from the Right Atrium! Students can explain where they have been in the circulatory system and demonstrate their knowledge of blood flow, oxygen/carbon dioxide use, and specific regions of the heart and lungs. Students can draw a picture on the front of their postcard (be creative!) and label the important structures in their diagram.
Journal Entry – Neurotransmitter

Students will write a journal entry in which they discuss the importance of a specific neurotransmitter (e.g. dopamine) in the body. This will be a relatively new and advanced topic for most students. Have students include information such as:

- Name of neurotransmitter
- Where is it found?
- Why do we need this neurotransmitter?
- What would happen if we had too much of this neurotransmitter?
- What would happen if we had too little of this neurotransmitter?
- When is this neurotransmitter released?
- 5 interesting facts
- List of sources used