**ANATOMY & PHYSIOLOGY MUSCLE LAB**

You may work in groups of 3 or 4. Each group will submit one document on Google doc and invite me to edit. (eduncan@wcpss.net)

**PART 1 – Muscle Strength**

**Procedure**

1. Standing with your back against the wall assume a squat position. Your back should be flat against the wall and knees bent to no more than 90 degrees. Do not support yourself with your hands by holding on to anything or anyone.
2. Hold this position for one minute.
3. Answer the following questions:
4. Did your leg muscles get tired?
5. What accounts for the burning sensation in your legs? (Discuss the process that produces this sensation).
6. What muscle action was involved (flexion, extension, etc.) at both the hip and knee joints?
7. What major muscles were contracting in this activity?

**PART 2 – Muscle Fatigue**

**Procedure**

1. Within your group select 2 people who are willing to do sit-ups non-stop for 2 minutes.
2. Using a timing device, have each volunteer do as many sit-ups as possible within 2 minutes, they should go one at a time. The volunteer should lie flat on his or her back with the knees bent. One group member should hold the feet and count while the other keeps up with the time and records the data.

You will be recording the number of sit-ups completed during each 30-second interval.

Record this information on your data sheet in the Data Table 1.

1. Utilizing the data above, answer the following questions. (Put thought into your answers and respond with complete sentences and specific data that supports what you state.)
2. What is a reason for the reduction in number of sit-ups done by these students between the various 30-second intervals? Be specific and support what you say with DATA.
3. What is the name of the energy source in the human body?
4. Is there a difference in the number of sit-ups between the 2 volunteers? How can you account for these differences?

**PART 3 – Temperature Effects**

Energy required to produce a muscle contraction is obtained from ATP. Most of the energy released during the breakdown of ATP during a muscular contraction is used to shorten the muscle fiber; however, some of the energy is lost as heat during the reaction. It is this heat that helps us to maintain our body temperature at a constant level. The contraction of muscle fibers produces most of the heat required to maintain our body temperature.

A fever or elevation in body temperature of only one or two degrees will result in illness. Any decrease below normal, a condition called hypothermia will drastically affect normal body function. In the following activity you will experience how changes in body temperature affect muscular activity.

**Procedure**

1. Use a separate sheet of paper (provided for you) and sign your name on it 3 times.
2. Completely submerge your writing hand in the ice water; leave it submerged for 2 minutes. DO NOT DRY, SHAKE OR RUB YOUR HAND ONCE YOU REMOVE IT FROM THE WATER!
3. Immediately after removing your hand, write your name 3 times on the same sheet of paper. Do not worry about getting the paper wet. Place your paper on the drying racks above the sinks to allow it to dray. Be sure you turn this into your teacher the next day as it is the data for this part of the lab.
4. Answer these questions.
5. How does your second handwriting compare to the first?
6. What does this activity demonstrate about the effects of temperature on muscle control?
7. What is the source of your body heat? Be specific.

**Part 4 – Amount of Carbon Dioxide Exhaled After Muscular Activity**

While performing various activities, muscles in your body contract. Muscle contraction requires energy. This energy is obtained through cellular respiration and creatinine phosphorylation. Cell respiration produces carbon dioxide (CO2) as a waste product. Carbon dioxide is carried by the blood to the lungs where it is exhaled. Would an increase in muscular activity such as running create an increased energy demand? Would an increase energy demand affect the amount of carbon dioxide produced?

**Procedure**

1. Gather a flask of bromothymol blue solution with a straw.
2. Sit down and breathe normally. Breathe in through your nose and exhale into the flask through the straw.
3. Continue breathing this way for exactly 2 minutes. The solution should change colors from blue to green or yellow. **CAUTION: DO NOT SUCK THE SOLUTION INTO YOUR MOUTH.** Do not force your breathing, try to exhale normally through the straw.
4. After 2 minutes remove the straw from the flask.
5. With a dropper, add a drop of NaOH (sodium hydroxide) to the flask. Swirl the flask to mix its contents.
6. After 10 seconds add another drop of NaOH to the flask. Again, swirl the contents and wait 10 seconds.
7. Continue to add and count the number of drops of NaOH needed to return the liquid to its original blue color. Record this number in the data table.
8. If time, repeat steps 1-7 using a fresh flask of bromothymol blue solution. Record the number of NaOH drops needed and average your two trials.
9. Gather another fresh flask of bromothymol blue solution and straw.
10. Now run in place or up and down the steps (as quietly as possible) for 2 minutes.
11. Repeat steps 2-7 and record the number of drops of NaOH used after breathing into the flask.
12. If time, perform the running trial again and average your two results.
13. Answer the following questions.
14. Were there differences in the amount of NaOH needed between sitting and running trials? Explain these differences.
15. Why is measuring the amount of CO2 produced a reliable method of discerning the amount of muscular activity taking place in your body?
16. What energy system (of cellular respiration) is being utilized by the muscles for a slow jog? For a fast sprint? Name two major differences between the two energy systems.