SB1-3U: Respiratory System Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **/5 Communication**

**/10 Application**

**BREATHING DEEPLY**

Lab: Measuring Lung Volumes

**Background:**

There are several different measurements that can be made concerning human lung volumes. These include:

1. Vital Capacity – the largest amount of air that can be exhaled after taking a deep breath.
2. Tidal Volume – the amount of air expelled during a normal breath
3. Expiratory Reserve – the amount of air that remains in the lungs after a normal breath but can be forcibly exhaled

(\*\*NOTE: a certain amount of air (~1 litre) is never exhaled; called the Residual Volume)

**Purpose:**

1. Determine your vital capacity.
2. Compare expected and observed lung volume values and provide reasons why there is a difference.

**Materials:**

Tape Measure

Lung Volume Bag with mouth piece

**Method:**

1. Take as deep a breath as possible, pinch your nose, bend and exhale into the bag. When you have finished, close off the opening to the bag.
2. Roll the bag to squeeze the air to one side.
3. Record the volume of air exhaled into observation table #1 below (value found on bag).
4. Repeat steps 1-3 two more times alternating turns with your partner. Each partner should have three recorded trials total.
5. Measure your height (cm) and record this value into table #2.
6. Select the appropriate multiplication factor and record this in table #2:
   1. Normal female = 20
   2. Athletic female = 22
   3. Normal male = 25
   4. Athletic male = 29

\*\* Note: an athletic person regularly takes part in various sporting activities which require good lung capacity or exercises multiple times a week. People who play a wind instrument are also considered “athletic”.

1. Determine your Expected Vital Capacity by multiplying *height x factor.*
2. Calculate the percent difference between the observed and expected values for vital capacity. Show your work in the chart.
3. Complete the discussion questions.

**Observations:**

Table #1: Observed Vital Capacity

|  |  |  |
| --- | --- | --- |
| Value | Trial | Lung Volume (mL) |
| Vital Capacity   (Observed) | 1 |  |
| 2 |  |
| 3 |  |
| Average |  |
| Total Lung Volume: (V.C. + 1L) | |  |

Table #2: Differences in Expected and Observed Vital Capacity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Height (cm) | Factor | Expected V.C. | Observed V.C. | Percentage Difference |
|  |  |  |  |  |

**Discussion** (Complete these answers on a separate sheet and staple to the handout)**:**

1. What factors could account for differences between observed and expected vital capacity values in your results from the lab as well as other factors discussed in class? **(2)**

**List reasonable examples from the lab experiment – chose wrong multiplication factor, broadness of build, smoker, sick the day of the experiment etc. (1)**

**List other possible factors – respiratory illness, altitude changes etc. (1)**

1. Why would someone living at a higher altitude have a larger vital capacity (~ 30% greater than those living at sea level)? **(2)**

**At higher altitudes, there is less oxygen in the atmosphere.(1) People who live there must adapt to breath in enough oxygen (by having larger vital capacity) so that their breathing remains steady/normal. (1)**

1. At higher altitudes, your body also produces more of the hormone Erythropoietin (EPO). EPO is responsible for increasing the production of red blood cells. Explain why increased amounts of RBCs would benefit a person living at high altitudes. **(2)**

**Red blood cells contain hemoglobin in which oxygen binds in order to be transported through the blood. (1) At high altitudes, there is less oxygen. If there are ore RBCs (via EPO), more oxygen can bind through a single breath and therefore more oxygen can be transported through the body. (1)**

1. EPO is also used to enhance athletic performance. How would this be beneficial to an athlete? What other controversial ways are athletes known to use to increase performance and how do they relate? **(4)**

**By using EPO, athletes increase RBC count therefore being able to bind and transport more oxygen. (1) During physical activity they are more likely to perform better if they can transport enough oxygen, increasing muscle endurance. (1)**

**Another way athletes increase performance is through blood doping (injecting your own blood back into your body in order to increase RBCs right before physical activity). (1) Blood doping again increases RBCs leading to better oxygen transport and better endurance. (1)**