New Paltz High School
Science Department

**Name**:…….……..…….……**Due Date**:…....

**Lab Title:**…*Lung Capacity*…….**Lab #**…**….**

**Lab Partners:**……

Your Lab Score will be based on the following:

**Neatness**: All labs must be **well-written and done in pencil** unless directed otherwise. There are to be no cross-outs or misspelled words. Questions should be answered in complete sentences.

**Accuracy:** Certain **questions will be checked** for accuracy.

**Completeness:** All questions are to be answered completely. There are to be **NO BLANKS** or incomplete sections.

**Lab Class Procedure:** You are to **follow directions** and use lab equipment properly, work for the entire period, and follow proper clean-up procedures

**Rubric:**

| Lab Score Category | Points Earned |
|---|---|
| **Neatness** | **0 1** |
| **Accuracy** | **0 1 2 3 4** |
| **Completeness** | **0 1 2 3** |
| **Lab Class Procedure** | **0 1 2** |
| **Total Lab Score** | **0 1 2 3 4 5 6 7 8 9 10** |

You are to submit all lab material with this lab report:

Comments:

Mr. Ulrich
Regent's Biology

# DON'T BLOW IT LAB

Human lung capacity can be measured in several ways. One way, is by using a piece of laboratory equipment called a spirometer. However, lung capacity can also be measured using a balloon. The data you obtain may not be as accurate as that obtained using a spirometer though.

Several different lung volume measurements can be made. The largest possible amount of air that can be exhaled after drawing a deep breath, is the **vital capacity**. The amount of air that remains in the lungs after exhaling normally but which can be expelled is the **expiratory reserve**. The amount of air taken in or expelled during normal breathing is called the **tidal volume**. A certain amount of air in the lungs cannot be expelled. This is the **residual volume**.

**Purpose:** To determine your lung capacity.

**Pre-Lab Questions:**

1. Which gases are we trying to exchange with our environment when we breathe?

2. What life process most directly produces/uses those gases?

3. Write out the chemical equation for that life process.

4. Some hypotheses to make:
   a. Which of the three capacities you are going to measure will be the largest?

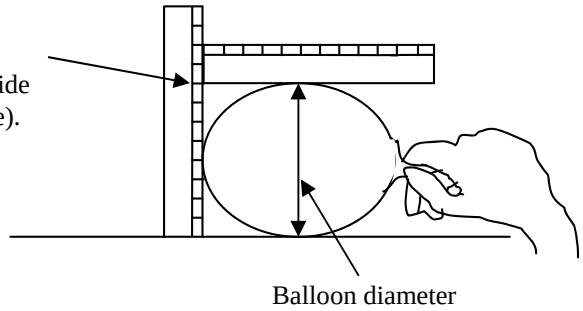
   b. What will your vital capacity be?

   c. Will your vital capacity be above or below the average? **WHY**?

**Procedure:** Part A Vital Capacity

1. Stretch balloon several times.
2. Take as deep a breath as possible. Then exhale all the air you can into the balloon and pinch the balloon closed to prevent air from escaping.
3. Measure and record the diameter of the balloon in centimeters in column A of the Data Table. This is done by using two metric rulers as shown in the diagram below.

Record measurement where the height of the balloon meets the side ruler (with the balloon on its side). This is the balloon's diameter.




4. Deflate balloon and do three more trials. Record the diameters of the balloon in column A.

Part B Expiratory Reserve

1. Exhale normally.
2. Without inhaling as you normally would, put the balloon in your mouth and exhale all the air still left in your lungs.
3. Measure and record the diameter of the balloon in centimeters in column B of the Data Table.
4. Do three more trials. Record the diameters of the balloon in column B.

Part C Tidal Volume

1. Take in a normal breath. Exhale into the balloon **only** as much air as you would **normally exhale**. DO NOT force your breathing.
2. Record the diameter of the balloon in centimeters in column C of Data Table.
3. Do three more trials. Record the diameters of the balloon in column C.

Part D: Convert Diameters to Volume Using Graph Lung volume is expressed in cubic centimeters ($cm^3$). (1,000 $cm^3$ is slightly more than a quart.)

1. To convert from balloon diameter to volume, locate the balloon diameter on the x-axis on the graph in Figure 1. Follow this number up to the curve, then read across to locate the corresponding volume. **Example**: if balloon diameter is 14.5 cm, then the corresponding lung volume is 1500 $cm^3$.
2. Convert each diameter in your Data Table to its corresponding volume and record each volume onto the Data Table in columns D, E, and F.
3. Calculate and record your average lung volume for each of the three measurements.

## Results:

Figure 1: **Data Table**

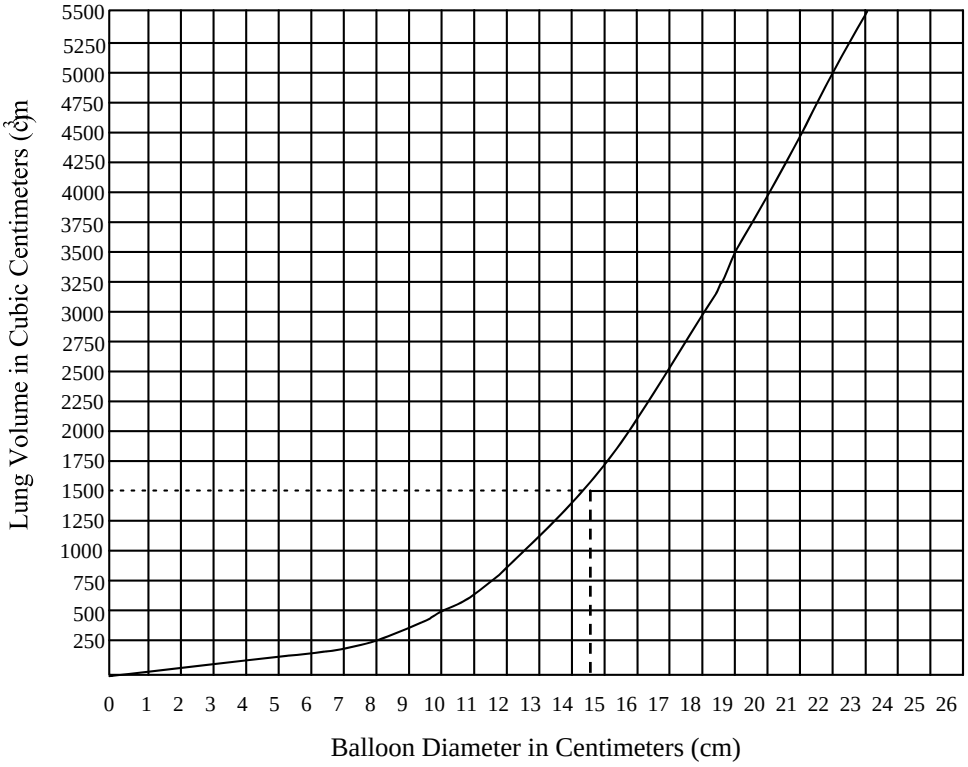
| | Balloon Diameter (cm) | | | Lung Volume ($cm^3$) | | |
|---|---|---|---|---|---|---|
| Trial | Column A Vital Capacity | Column B Expiratory Reserve | Column C Tidal Volume | Column D Vital Capacity | Column E Expiratory Reserve | Column F Tidal Volume |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| | | | | | | |
| Total | | | | | | |
| Average | | | | | | |

**Analysis:** Compare results to normal (average) lung volumes for males and females.

Figure 2: "Average" Adult Lung Volumes (Measured with a Spirometer)

| | Male | Female |
|---|---|---|
| Vital Capacity | 5000 $cm^3$ | 4000 $cm^3$ |
| Expiratory Reserve | 1200 $cm^3$ | 1000 $cm^3$ |
| Tidal Volume | 525 $cm^3$ | 475 $cm^3$ |

Figure 3: Relationship Between Balloon Diameter (cm) and Lung Volume ($cm^3$)



**Conclusion:** Feel free to type these or write these answers on a separate sheet of paper

1. What was the purpose of this investigation? What else (other than the stated purpose at the beginning of the lab) did you learn or think about by doing this lab?

2. Review your original hypotheses.
    a. Which was your highest capacity? Why is this surprising/Why does this make sense?

    b. How did your results compare to other people in the class? What might be causing these differences?

    c. How did your results compare to the averages in figure 2? Are there different reasons (than in the previous question) for the variation?

3. Where was error introduced in this experiment?

4. Give at least 2 suggestions for improving the accuracy of your results. (How can you reduce sources of error?)

5. Imagine that you are actually anaerobic. Not just your muscles during oxygen debt. A full-on, obligate anaerobe, meaning you cannot utilize oxygen. Would you still need to breathe? What for?

6. Of course, lungs make up the “business district” of the respiratory system. In which other organ system do the lungs function? Refer to your previous answer for help.

7. Which muscles are involved in breathing. Briefly describe how the muscles work to get air in and out of your lungs.

8. Some fish are every bit as big as people. Indeed, the Giant Grouper (*Epinephelus lanceolatus)* can get up to almost 900 lbs! Still, humans need far more oxygen than comparably sized fish. Why don’t fish need as much oxygen as humans?