Name _____ Class _____

Date _____ Lung Capacity Lab
(40 minutes)

Human lung capacity can be measured in several ways. One way is by using a complex piece of laboratory equipment called a spirometer. However, lung capacity can also be measured by using a balloon.

Several different lung volume measurements can be made. The amount of air taken in or expelled during normal breathing is about 500 cm3. This volume of air called the tidal volume. The largest possible amount of air which can be exhaled after drawing in 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. A certain amount of air in the lungs cannot be expelled. This is the residual volume.

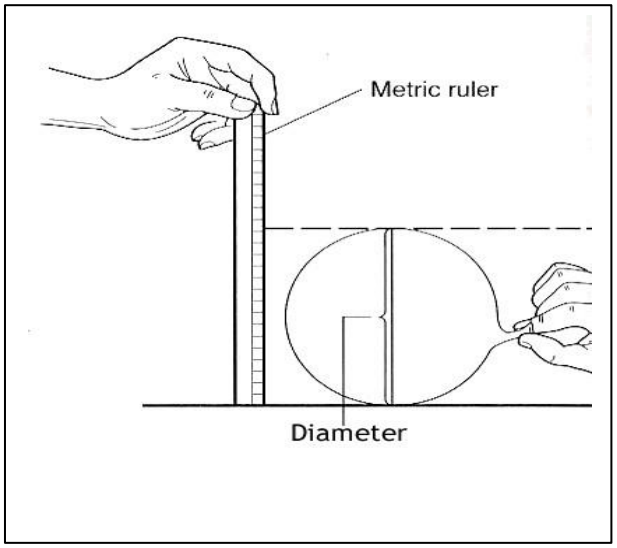
Purpose

- To measure your tidal volume, expiratory reserve, and vital capacity
- To compare your experimental data with lung capacity data obtained from a spirometer

Materials

Round Balloon Metric Ruler

Procedure



Part A. Tidal Volume

1. Stretch a balloon several times
2. Take in a normal breath. Exhale into the balloon *only* as much air as you would normally exhale. DO NOT force your breathing.
3. Pinch the balloon to prevent air from escaping.
4. Place the balloon next to a metric ruler. Determine the diameter of the balloon by sighting across the top of the balloon to the ruler.
5. Record the diameter of the balloon in centimeters in column A of Table 4-1.
6. Deflate the balloon.
7. Repeat steps 2–5 four more times. Measure and record each balloon diameter in Table 4-1.

Part B. Expiratory Reserve

1. Exhale normally.
2. Then, exhale into the balloon as much air as possible.
3. Measure and record the diameter of the balloon in column B of Table 4-1.
4. Repeat steps 1–3 four more times. Record the diameter of the balloon in the data table.

Part C. Vital Capacity

1. Take as deep a breath as possible. Then exhale all the air you can into the balloon.
2. Measure and record the diameter of the balloon in column C of Table 4-1.
3. Run four more trials. Record the diameter of the balloon for each trial in the data table.

Part D. Conversion of Diameters to Volume

Lung volume is expressed in cubic centimeter units (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 of Figure 6-2. Follow this number up to the line, then move left to the y axis to locate the volume.

   For example, if your balloon diameter is 14.5 cm, then the corresponding lung volume is 1500 cm3.

2. Convert each diameter for vital capacity, tidal volume, and expiratory reserve to volume.
3. Record the volumes in columns D, E, and F of Table 4-1.
4. Calculate and record your average lung volume for each of the three measurements.

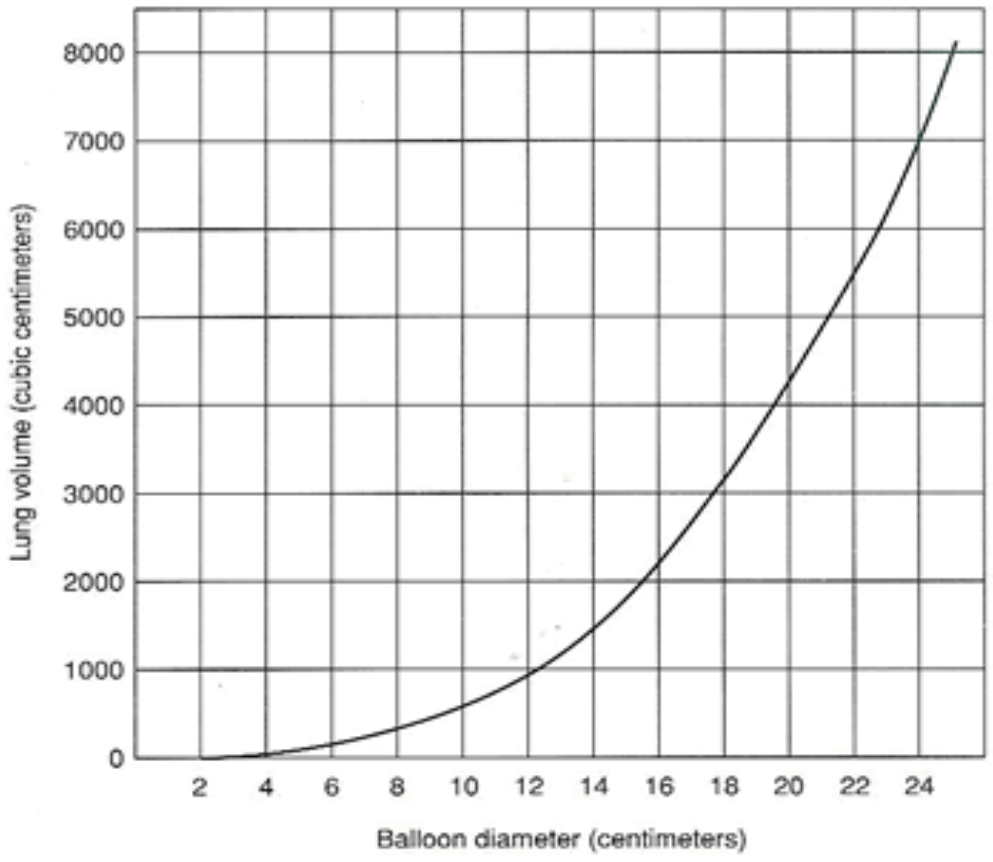


Figure 6-2

Table 4-2: Average Lung Volumes

	Male (cm3)	Female (cm3)
Tidal Volume	525	475
Expiratory Reserve	1,200	1,000
Vital Capacity	5,000	4,000

Listed in Table 4-2 are “average” male and female lung volume measurements. The volumes were determined by using a spirometer.

Data/Results

	Balloon Diameter (cm)			Lung Volume (cubic centimeters)		
	A Tidal Volume	B Expiratory Reserve	C Vital Capacity	D Tidal Volume	E Expiratory Reserve	F Vital Capacity
Trial 1						
2						
3						
4						
5						
			Total			
			Average			

Discussion:

1) Why is it important to measure tidal volume, expiratory reserve, and vital capacity five times and then get an average?

2) What is the difference between Tidal volume and Vital capacity?

3) How does your Tidal Volume compare with the average Tidal Volumes found in Table 4-2?

4) Why may there be differences between your data and the given average volumes in Table 4-2?

5) Give two (2) suggestions for improving the accuracy of your results.

6) How might an athlete's vital capacity compare to a non-athlete? Explain your reasoning.

7) How might vital capacity be important to a musician?

Examine the data table of a person who entered into a training program. This person's vital capacity was measured over a 60 day period.

Data

Day of Training	Vital Capacity
0	4800
10	4840
20	4890
30	4930
40	4980
50	5180
60	5260

8) What happened to the person's vital capacity over the course of the training period?

9) What probably caused the change?

INTERPRETATION QUESTION: Write a story in the 1st person to answer the following scenario: Pretend you are a molecule of oxygen (O_2). Explain the path that you would take if you were inhaled, used in the process of cellular respiration and then exhaled as a different molecule (identify this molecule in your story). Be sure to include ALL the places you travel through on the way in and on the way out as well as what happens in those places. The trip through the human respiratory system is longer than you think!

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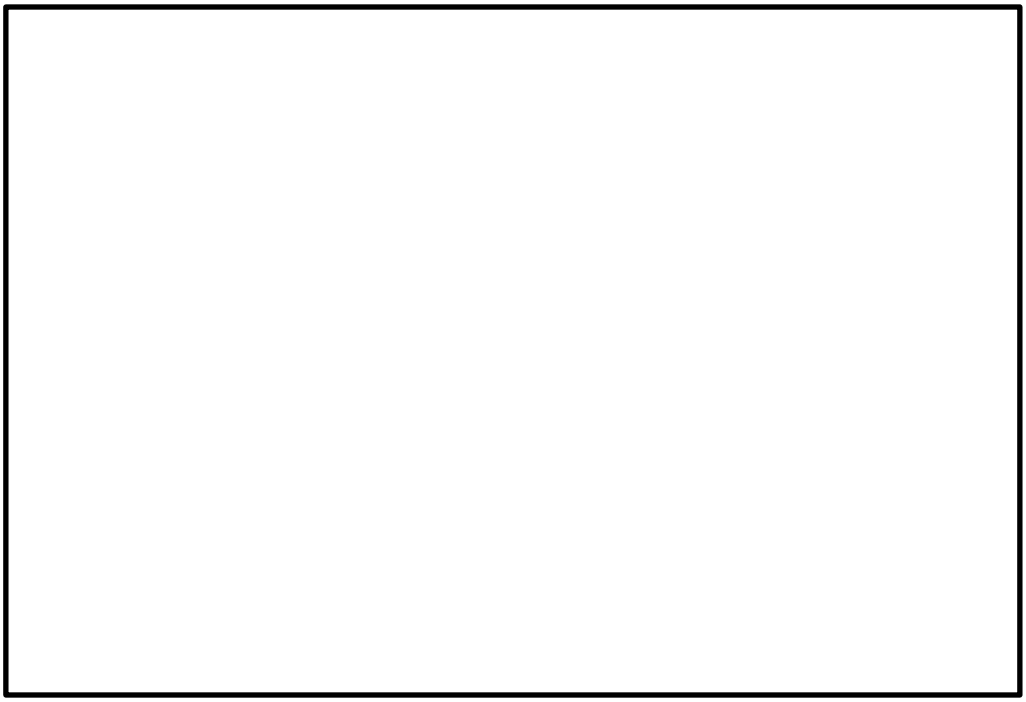
Alveoli Activity

A. Draw a picture of alveoli.
In the drawing be sure to label:
- gases diffusing through the wall of the alveoli
- in which direction the gases are traveling
- the blood vessels that surround the alveoli



B. Answer the following questions in complete sentences.

1. List several characteristics of alveoli _____
2. What type of blood vessels surround the alveoli _____
3. Why are alveoli important (be as specific as possible) _____

_____