

Lab report due to _____

Introduction: 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. You will do both today. 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 using two different methods.

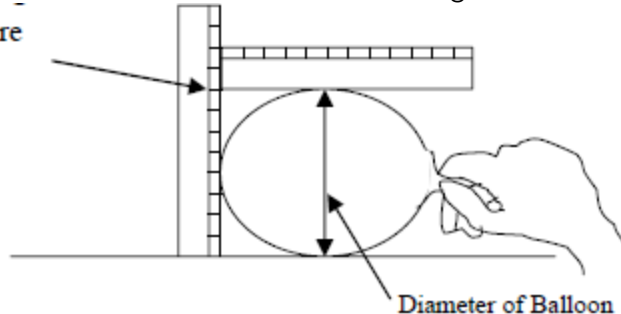
PART I: BALLOON METHOD

Procedure for BALLOON METHOD:

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 (cm³).

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 cm³.

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.

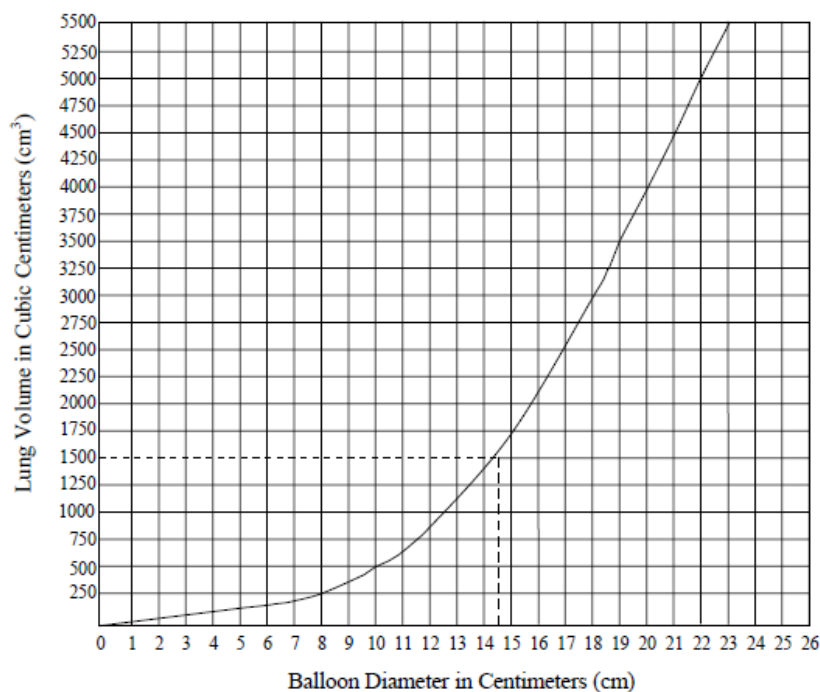
Results:

Data Table

Trial	Balloon Diameter (cm)			Lung Volume (cm ³)		
	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						

Figure 1:

Relationship Between Balloon Diameter (cm) and Lung Volume (cm³)



PART II: BOTTLE METHOD

Watch video <https://www.youtube.com/watch?v=cy4kzOeLD5E> to finish following tasks.

1. Write lab procedures for "bottle method"
2. Carry out the lab and fill in the following result table.
3. Answer questions

Results:

LUNG VOLUME (ml)			
	Vital Capacity	Expiratory Reserve	Tidal Volume
TRIAL 1			
TRIAL 2			
TRIAL 3			
Total			
Average			

Questions:

- 1) Complete the data tables. Calculate your Inspiratory reserve volume in cm^3 or ml for both methods: balloon and bottle.
$$\text{VC} = \text{IRV} + \text{ERV} + \text{TV}$$
- 2) Which of the methods is more practical for calculating vital capacity?
- 3) Compare the vital capacity of each method. Account for the differences.
- 4) What were some of the difficulties or errors encountered in this lab? Be specific.
- 5) Give 3 suggestions for improvements of this lab.
- 6) Why must inspiratory reserve volume be calculated and not measured?
- 7) Compare your results with the averages in the table below.

"Average" 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

- 8) Predict how the vital capacity of an athlete, an asthmatic and a smoker would be different. Why?
- 9) How does pregnancy affect lung capacity? Explain the biology!