Just Breathe

By: Joyce Green

Lung Capacity

When we breathe, we are taking in oxygen and releasing carbon dioxide into the air. We need oxygen to help breakdown the food that we eat, to build muscles, and to help us remain active. While our cells are performing these tasks, they are using up the oxygen we breathe in and producing carbon dioxide and water which we exhale.

The main job of the Respiratory System is to bring oxygen to all parts of our body. Air comes in through the nose and mouth and travels down the trachea. The trachea then branches off into two bronchi, which lead towards our right and left lungs. The lungs are made up of tiny sacs called alveoli. The alveoli help the blood exchange gases, like oxygen and carbon dioxide.

When we exhale, air flows back through the bronchi, up the trachea and back out into the air. When each breath is completed, the lung still has some air, called the residual volume.

The amount of air in the lungs can be measured in several different ways:

Tidal Volume is the volume of air that you normally inhale and exhale.

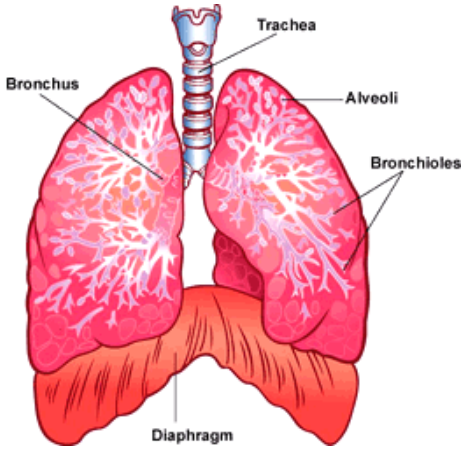
Vital Capacity is the maximum volume of air that you can inhale and exhale.

Residual Volume is the air that remains in your lungs after you exhale the maximum amount of air in your lungs.

Total Lung Capacity is the total volume your lungs can hold; vital capacity plus residual volume.

Different factors such as age, activity level, height, and gender, can affect lung capacity. You can increase your lung capacity through regular exercise.

Today we are going to look at Vital Capacity by measuring the amount of air that can be exhaled into a balloon. Then we will compare that volume to an Expected Vital Capacity which takes into account a person's age and height to calculate lung volume.



MOST*

VOCABULARY

Alveoli

Bronchi

Residual volume

Tidal volume

Total lung capacity

Trachea

Vital capacity

Inside This Packet

New York State Standards

High School

Living Environment
Key idea 2.4
Key idea 3.1a
Use string/metric ruler to measure circumference
Intermediate science

Standard 1:
Key idea M1
Key idea M2
Key idea M3

Standard 4:
Key idea 1: 1.2b, 1.2e

Activity: 1-2-3 Blow!

MATERIALS NEEDED

Large balloon

String

Measuring tape or meter stick

Student Worksheet

Students should be able to:

Calculate their total lung capacity, vital capacity and residual volume.

What to do:

1. With a partner to complete the activity. One person will record the measurements (**data collector**) and the other will blow up the balloon (**test subject**). If you have asthma or any other lung condition, have your partner blow up the balloon.

2. **Test subject** - Stretch the balloon and blow it up several times before you begin taking measurements.

3. **Test subject** - Take a deep breath and exhale as much air as you can into the balloon in **ONE BREATH**. Pinch the opening shut with your fingers.

4. **Data collector** - Take the string and wrap it around the widest part of the balloon. Place the string on the meter stick and record the length of the string in centimeters. This will give us the circumference of the balloon. Record this value under Trial 1 in **Table 1** on your worksheet.

5. Repeat this 4 times for a total of **5 trials**.

6. Calculate the average circumference of your 5 trials and record this value in **Table 2**.

7. Calculate the diameter of the balloon using the following formula then record your result in **Table 2**.

   Diameter= circumference / pi pi= 3.14

8. Calculate the radius of the balloon using the following formula then record your result in **Table 2**.

   Radius= diameter/ 2

9. Calculate the volume of air in the balloon using the following formula then record your result in **Table 2**.

   Volume = radius^3 x pi x ¾

10. Convert the volume of air (mL) to volume of air (L) or Experimental vital capacity using the following formula then record your results in **Table 2**.

    Volume (L)= Volume (mL) / 1000

    The volume of air you calculated is your Experimental Lung Capacity, or the amount of air your lungs actually held.

    We can also calculate your Vital Capacity, or the amount of air your lungs should hold when based on your height and age.

11. Calculate your height in cm using the following formula then record your results in **Table 3**.

    Height in cm= height in inches x 2.54

12. Calculate your expected vital capacity using the following formula then record your result in **Table 3**.

    Vital Capacity = 0.041 x height (in cm) – 0.018 x your age – 2.69

Activity: 1-2-3 Blow! Student Worksheet

Name: _____ *Date:* _____

Name: _____

Table 1: Circumference of the Balloon

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5

Table 2: Calculated Values

Average Circumference	Diameter of the Balloon	Radius of the Balloon	Volume of Air in ML	Volume of Air in L

Table 3: Expected Vital Capacity

Age in Years	Height in Inches	Height in CM	Expected Vital Capacity in L	Experimental Vital Capacity (from Table 2)

Questions

1. How does your expected vital capacity compare to your calculated vital capacity?

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2. Why might the experimental vital capacity be different than the calculated vital capacity?

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3. Compare your experimental vital capacity with other students in your class. Are they the same or different Explain your answer.

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