The average total lung capacity of an adult human male is about 6 litres of air, but only a small amount of this capacity is used during normal breathing.

The amount of air that you move in and out of your lungs while **breathing normally** is called **TIDAL VOLUME**. This amount of air provides enough oxygen for a person who is resting.

It is possible to inhale and exhale more forcefully - the **maximum amount of air** moved in and out of the lungs is called the **VITAL CAPACITY**.

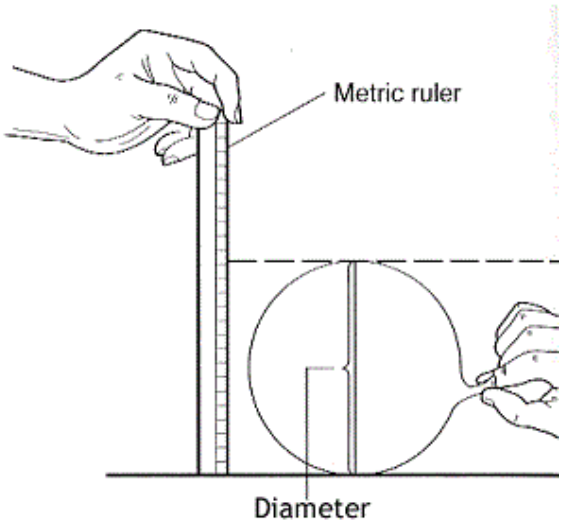
In this activity, you will be measuring the vital capacity and the tidal volume of your own lungs, this actual number can then be compared with a number derived from an equation that measures vital capacity.

In effect, you are comparing an actual number, based on laboratory measurements, to a theoretical number, based on an equation.

If you have any breathing difficulties (asthma or other condition), you should not participate in this activity, instead only take the data from your lab partner or group.

Materials - Balloons, metric ruler, meter stick, bathroom scale (optional)

How to Take Measurements with a Balloon



1. Measuring Tidal Volume

Stretch or blow into a round balloon several times to stretch it out.

Inhale normally and then exhale normally into the balloon.

Do not force your breathing.

Pinch the end of the balloon and measure its diameter.

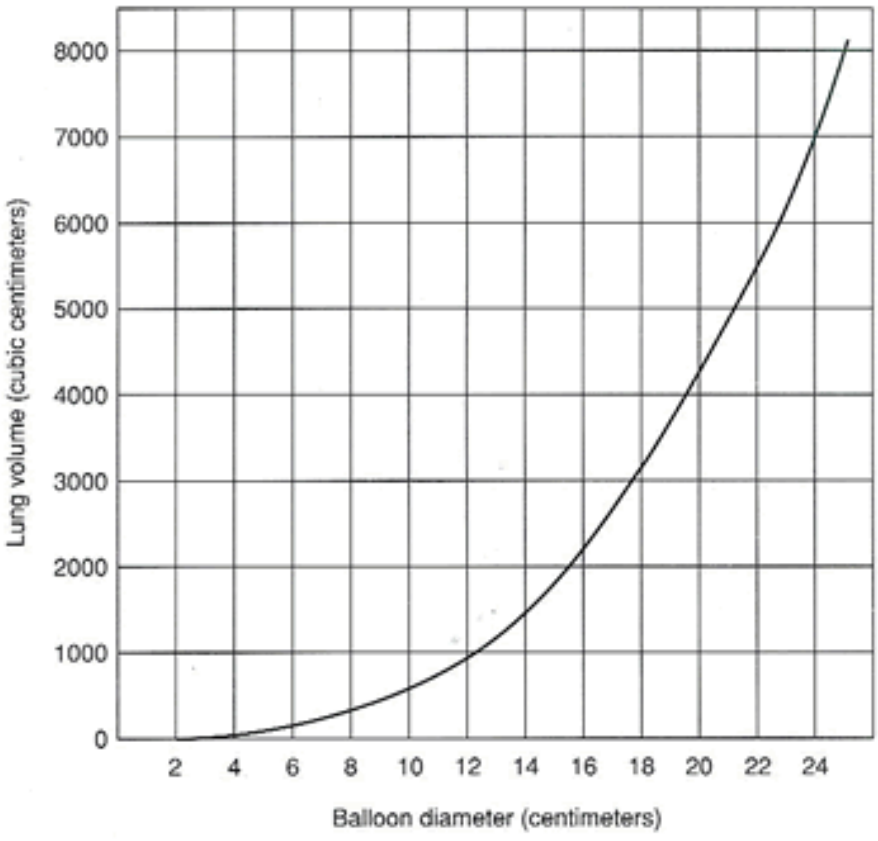
Repeat this so that you have 3 total measurements and can take the average and record in the data table.

2. Measuring Vital Capacity

Repeat the procedure, only this time **inhale as much air as you can and exhale forcefully**.

Record three measurements in the data table.

3. Convert the diameters to a volume using the graph and record this in your table – see page 3.



Hint: 1000cm^3 = 1L

4. Estimated Vital Capacity

Research has shown that the capacity of a person's lungs is proportional to the surface area of his or her body.

To find the surface area, you will need to know your height and weight.

There are a couple of different ways to calculate your body surface area in square metres (BSA m^2) mathematically.

Either use the equation below or go to a website that has an automatic calculator.
(A google search on ***body surface area calculator*** will yield many pages that have these calculators)

$$BSA\ (m^2) = (\ [Height(cm) \times Weight(kg)\ ]/\ 3600\ )^{1/2}$$
$$BSA = SQRT(\ (cm*kg)/3600\ )$$

Once you have calculated your surface area (BSA m^2), a second equation will calculate your estimated vital capacity.

Males: SA x 2500
Females SA x 2000

DATA TABLE

	Tidal Volume		Vital Capacity		Estimated Vital Capacity
	Balloon Diameter	Volume (from graph)	Balloon Diameter	Volume (from graph)	
Trial					Height (cm)
1					Mass (kg)
2					Surface Area
3					Vital Capacity
Average					

5. ANALYSIS

A. Why is it important to measure tidal volume and vital capacity three times and then get an average?

B. Compare your data to other members of the class. How can you account for differences?

C. How does your measured vital capacity compare to the vital capacity you estimated using the formula? Which do you think is more accurate and why?

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

6. APPLICATION

1. 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. Use the data to construct a graph

DATA

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

GRAPH

2. What happened to the person's vital capacity over the course of the training period?

3. What probably caused the change?

4. How might vital capacity be important to a musician?