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Mechanisms of Breathing

Mechanics of Breathing

Two muscles are involved in the mechanics of breathing:

- Diaphragm = large sheet of muscle located beneath the lungs that is the primary muscle in breathing
- Intercostal Muscle = a muscle that raises the rib cage, decreasing pressure inside the chest cavity

Breathing In

- When we inhale the intercostal muscles (between the ribs) and diaphragm contract to expand the chest cavity.
- The diaphragm flattens and moves downwards and the intercostal muscles move the rib cage upwards and out.
- This increase in size decreases the internal air pressure and so air from the outside rushes into the lungs to equalise the pressures.

Breathing Out

- When we exhale the diaphragm and intercostal muscles relax and return to their resting positions.
- This reduces the size of the thoracic cavity, thereby increasing the pressure and forcing air out of the lungs.

Control of Breathing

- The rate at which we inhale and exhale is controlled by the respiratory centre, within the Medulla Oblongata in the brain.
- Sensors detect either CO_2 or O_2 and signal to increase/decrease breathing rates.

Vital Capacity

Human lung capacity – or how much air can fit in your lungs – can be measured in several ways. One way is by using a piece of laboratory equipment called a spirometer. Lung capacity can also be measured using a balloon. The data you obtain may not be as accurate as that obtained using a spirometer.

Several different lung volume measurements can be made:

> **Vital capacity** is the largest possible amount of air that can be exhaled after drawing a deep breath
>
> **Expiratory** reserve is the amount of air that remains in the lungs after exhaling normally (it is the extra air that can be breathed out)
>
> **Tidal volume** is the amount of air taken in or expelled during normal breathing

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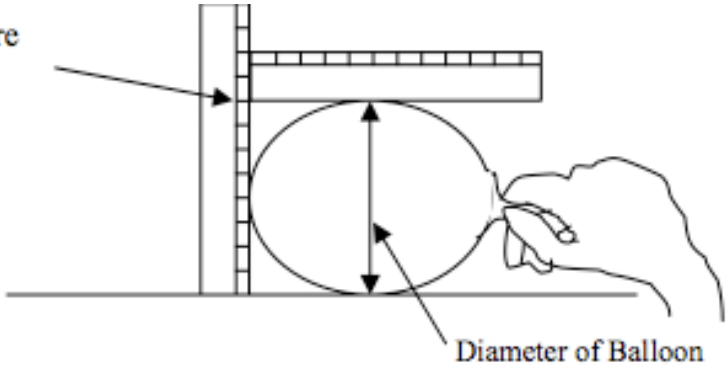
Part A: Vital Capacity

1) Stretch the balloon several times.
2) Take as deep a breath as possible.
3) Exhale all the air you can into the balloon and pinch the balloon closed to prevent air from escaping.

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) Measure and record the diameter of the balloon in centimeters in your Data Table below.
5) You will need a helper to hold the two metric rulers to measure it.
6) Deflate the balloon and do three more trials. Record the diameters of the balloon in your Data Table.
7) Using Graph A on the LAST PAGE of this worksheet, find the volume that goes with the diameter.

Trail Number	Diameter of Balloon in Centimeters	Volume of Balloon (see graph)
1		
2		
3		

Part B: Expiratory Reserve

1) Inhale normally then exhale normally.
2) Exhale the REST of the air still in your lungs into the balloon.
3) Measure and record the diameter of the balloon in centimeters in your Data Table below. You will need a helper to hold the two metric rulers to measure it.
4) Deflate the balloon and do three more trials. Record the diameters of the balloon in your Data Table.
5) Using Graph A on the LAST PAGE of this worksheet, find the volume that goes with the diameter.

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Trail Number	Diameter of Balloon in Centimeters	Volume of Balloon (see graph)
1		
2		
3		

Part C: Tidal Volume

1) Take in a normal breath.
2) Exhale into the balloon only as much air as you would normally exhale. DO NOT force your breathing.
3) Measure and record the diameter of the balloon in centimeters in your Data Table below. You will need a helper to hold the two metric rulers to measure it.
4) Deflate the balloon and do three more trials. Record the diameters of the balloon in your Data Table.
5) Using Graph A on the LAST PAGE of this worksheet, find the volume that goes with the diameter.

Trail Number	Diameter of Balloon in Centimeters	Volume of Balloon (see graph)
1		
2		
3		

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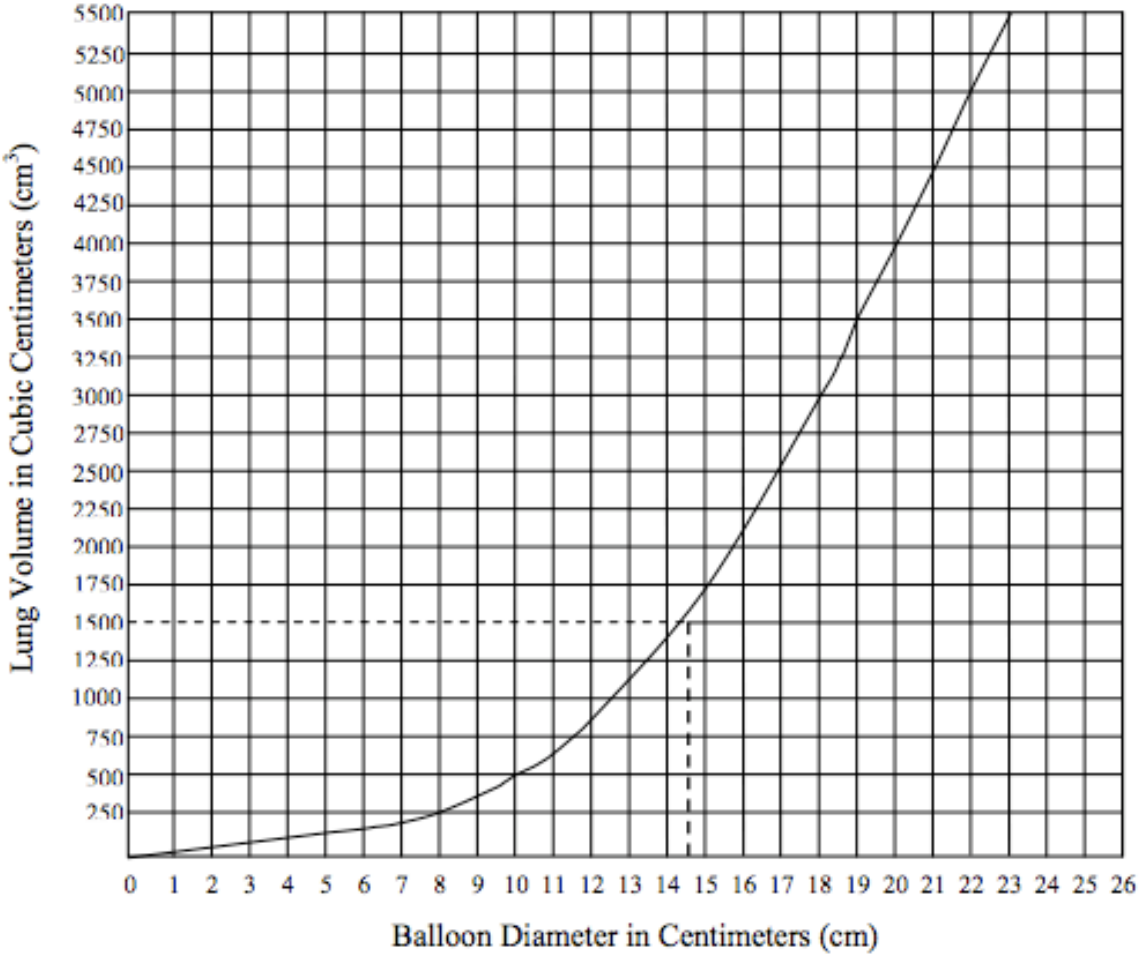
Relationship Between Balloon Diameter (cm) and Lung Volume (cm^3)



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ANALYSIS

Compare the volumes of the balloons in part A, B and C. Which has the greatest volume: Vital capacity, Expiratory volume, or Tidal volume? (1 mark)

Compare your results to someone else in the room. How are their results the same or different compared to yours? (1 mark)

Why do you think different people have different lung volumes? List two factors you think may effect lung volume. (2 marks)

What were some of the difficulties you had in doing this lab? Do you think you made any mistakes? (If you did, explain how) (2 marks)