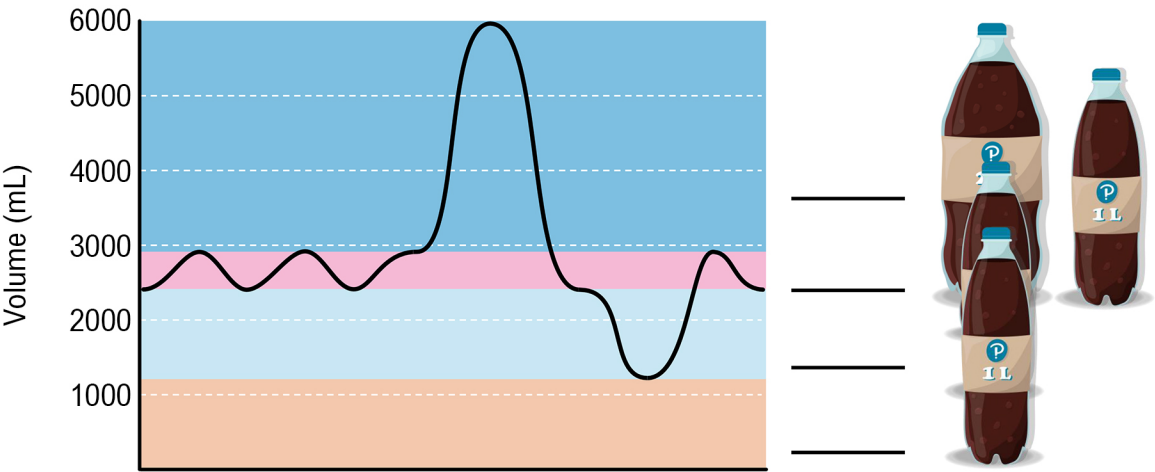


TOPIC: VOLUMES & CAPACITIES

Lung Volumes

- ♦ Lung Volumes: Non-overlapping measures of lung space.
 - Tidal Volume () : air moved during breathing (eupnea). ~500 mL
 - Reserve Volumes: air that can be ventilated tidal volume.
 - Inspiratory Reserve Volume () : maximum forced inhalation. ~1900 - 3100 mL
 - Expiratory Reserve Volume () : maximum forced exhalation. ~700 - 1200 mL
 - Residual Volume () : amount of air that be exhaled from the lungs. ~1100 - 1200 mL

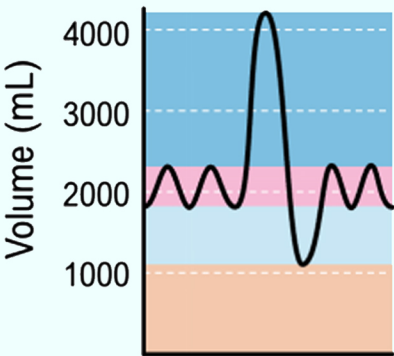


EXAMPLE

In the table below, descriptions of the four lung volumes are given. The graph shows spirometry results from a typical healthy female for reference. Fill in the empty cells in the table according to the following instructions:

- a) Write the name or abbreviation of the lung volume to which each description refers.
- b) Rank the volumes in order of size from 1-4 with 1 being the smallest and 4 being the largest.

	Volume Name	Size 1-4
Amount able to be inhaled beyond a normal inspiration.		
Amount left that cannot be removed from lungs through expiration.		
Amount of air moved during quiet breathing.		
Amount able to be exhaled beyond a normal expiration.		



TOPIC: VOLUMES & CAPACITIES

PRACTICE

Of the following four lung volumes, which do you think would be the hardest to measure without advanced instrumentation?

- | | |
|-------------------------------------|--------------------------------------|
| a) Expiratory reserve volume (ERV). | c) Residual Volume (RV). |
| b) Tidal Volume (TV). | d) Inspiratory Reserve Volume (IRV). |

PRACTICE

Under normal conditions which of the following volumes do you expect to be the *smallest*?

- | | |
|-------------------------------------|--------------------------------------|
| a) Expiratory reserve volume (ERV). | c) Residual Volume (RV). |
| b) Tidal Volume (TV). | d) Inspiratory Reserve Volume (IRV). |

TOPIC: VOLUMES & CAPACITIES

Lung Capacities

◆ Lung Capacities: measures of _____ volumes _____ together.

► **Inspiratory Capacity** : TV + IRV

- After normal exhale, how big is your _____ inhale?

~ 2400 mL – 3600 mL

► **Functional Residual Capacity** : ERV + RV

- After normal exhale, how much air is _____ in your lungs?

~ 1800 mL – 2400 mL

► **Vital Capacity** : IRV + TV + ERV

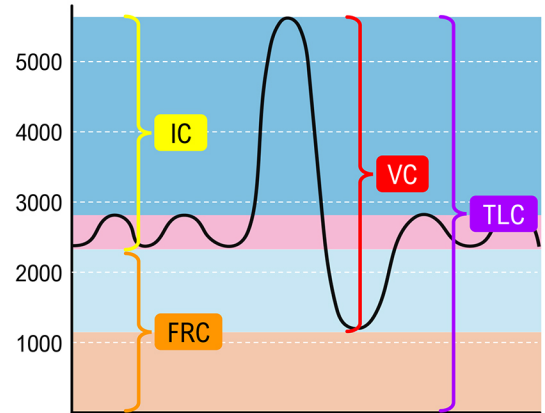
- After biggest inhale how big is your _____ exhale?

~ 3100 mL – 4800 mL

► **Total Lung Capacity** : IRV + TV + ERV + RV

- How much _____ air can you fit in your lungs?

~ 4200 mL – 6000 mL



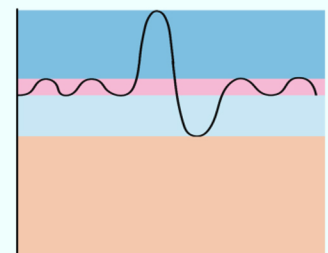
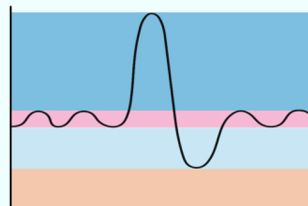
◆ **Anatomical Dead Space**: volume of air that remains in the _____ during ventilation: ~150 mL

EXAMPLE

Below are two graphs showing lung volumes. One graph shows a healthy person, while the other shows a person with COPD (chronic obstructive pulmonary disease). In COPD, many of the alveoli walls break down creating relatively large open spaces in the lung with relatively low surface area. The lungs also lose elasticity, and therefore do not recoil normally.

On the line above each graph, identify each individual as either “Normal” or “COPD” based on your understanding of lung volumes and capacities. Then, based on the graphs, write “increased”, “decreased” or “no change” next to the four lung capacities listed based on how you think they would be affected by COPD.

Total Lung Capacity _____
Vital Capacity _____
Inspiratory Capacity _____
Functional Residual Capacity _____



TOPIC: VOLUMES & CAPACITIES

PRACTICE

Which of the following would best predict how likely someone is to blow out all their birthday candles in a single breath?

- a) Tidal Volume (TV).
- b) Inspiratory Capacity (IC).
- c) Expiratory Reserve Volume (ERV).
- d) Vital Capacity (VC).

PRACTICE

The Functional Residual Capacity can be thought of as a combination of which other measures of lung volume?

- a) Tidal Volume (TV) and Inspiratory Capacity (IC).
- b) Residual Volume (RV) and Expiratory Reserve Volume (ERV).
- c) Tidal volume (TV) and Functional Residual Capacity (FRC).
- d) Total Lung Capacity (TLC) and Residual Volume (RV).

PRACTICE

Distinguish between inspiratory reserve volume (IRV) and inspiratory capacity (IC)?

- a) IRV measures total inspiration starting at the end of a normal expiration while IC measures total inspiration starting at the end of a normal inspiration.
- b) IC includes tidal volume (TV) and IRV; IRV does not include TV.
- c) IC includes both tidal volume (TV) and vital capacity (VC); IRV does not include VC.
- d) IC measures total inspiration starting at the end of forced expiration, while IRV measures total inspiration starting at the peak of tidal volume.

PRACTICE

The typical person has about 150 ml anatomical dead space. If the typical tidal volume is about 500 ml, how much air that starts completely outside the body actually makes it to the alveoli with each inspiration?

- | | |
|------------|------------|
| a) 500 mL. | c) 650 mL. |
| b) 150 mL. | d) 350 mL. |