

# Physiology of Respiration

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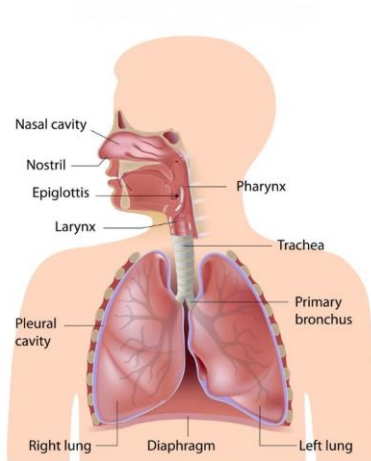
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## Outline

- The lungs
- How the lungs work
- Lungs volumes
- Lungs capacities
- Lungs functioning tests

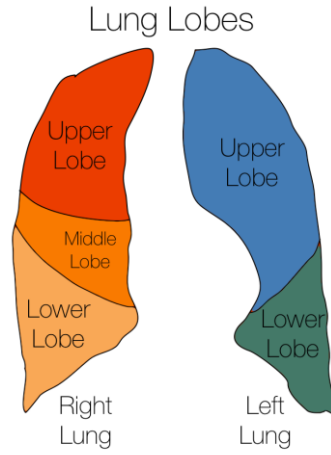
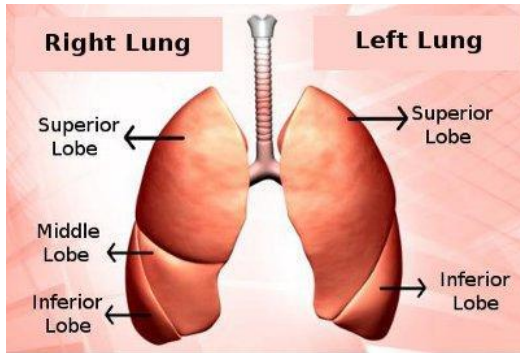
# The respiratory system



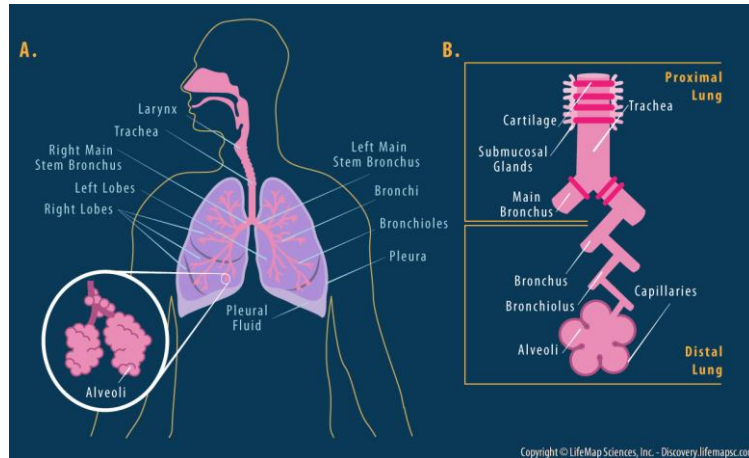
## How the lungs work:

- [https://www.youtube.com/watch?v=K14cU9sG\\_08](https://www.youtube.com/watch?v=K14cU9sG_08)
- [https://www.youtube.com/watch?v=GVU\\_zANtroE](https://www.youtube.com/watch?v=GVU_zANtroE)
- [https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner\\_id/2207941/uiconf\\_id/37292221/entry\\_id/0\\_ycaofp3y/embed/dynamic](https://cdnapisec.kaltura.com/index.php/extwidget/preview/partner_id/2207941/uiconf_id/37292221/entry_id/0_ycaofp3y/embed/dynamic)

# Lung lobes

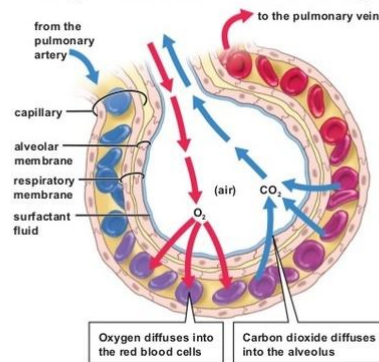


# The lungs

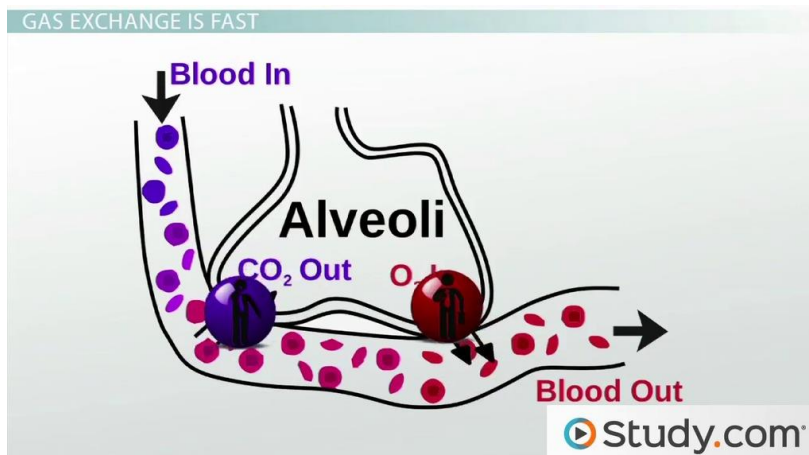


## Function of the lungs

Gas Exchange Between Alveoli and Capillaries



## Function of the lungs



## Respiratory volumes

- There are 4 lung volumes.
- Used to assess a person's respiratory status.
- The lung volumes are:
  1. Tidal volume (TV)
  2. Inspiratory reserve volume (IRV)
  3. Expiratory reserve volume (ERV)
  4. Residual volume (RV)

## Tidal volume (TV)

- The volume of air inspired or expired during a normal inspiration or expiration.
- Or, the amount of air inhaled or exhaled with each breath under resting conditions.
- The volume of the air is about **0.5 Liter**.

## Inspiratory reserve volume (IRV)

- The amount of air that can be inspired forcefully after inspiration of the normal tidal volume.
- Or, the amount of air that can be forcefully inhaled after a normal tidal volume inhalation.
- The volume of the air is about **3.1 Liter**.

## Expiratory reserve volume (ERV)

- The amount of air that can be expired forcefully after expiration of the normal tidal volume.
- The volume of the air is about **1.2 Liter**.

## Residual volume (RV)

- The amount of air still remaining in the respiratory passages and lungs after the more forceful expiration.
- Or, Amount of air remaining in the lungs after a forced exhalation.
- The volume of the air is about **1.2 Liter**.

## Respiratory capacities

1. Inspiratory capacity (IC)
2. Vital capacity (VC)
3. Functional residual capacity (FRC)
4. Total lung capacity (TLC)

## Inspiratory capacity (IC)

- It is the amount of air that a person can **inspire maximally** after a normal expiration.
- **$IC = TV + IRV$ .**
- The volume is about **3.6 Liter**.

## Vital capacity (VC)

- It is maximum volume of air that a person can expel from the respiratory tract **after a maximum inspiration**.
- **$VC = IRV + TV + ERV$**
- The volume is about **4.8 Liter**.



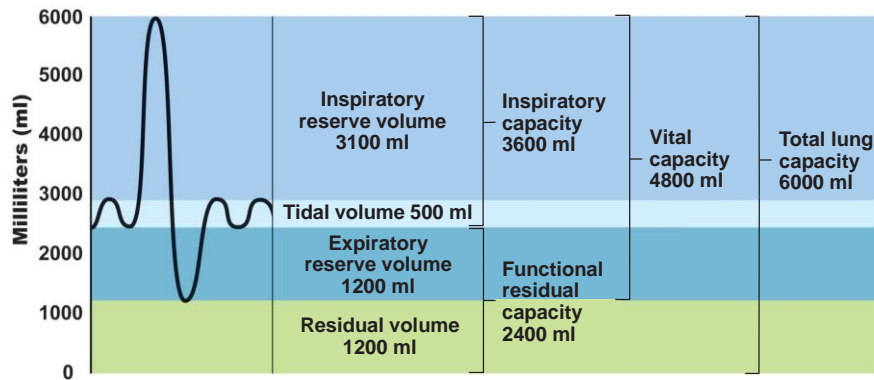
## Functional residual capacity (FRC)

- It is the amount of **air remaining in the lungs** at the end of a normal expiration.
- **$FRC = ERV + RV$**
- The volume is about **2.4 Liter**.

## Total lung capacity (TLC)

- **$TLC = TV + IRV + ERV + RV$**
- The volume is about **6.0 Liter**.

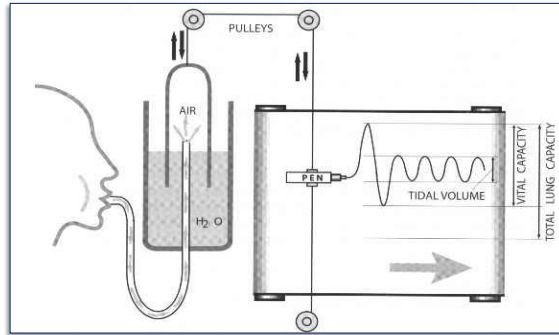
## Lungs volume and capacity – Summary



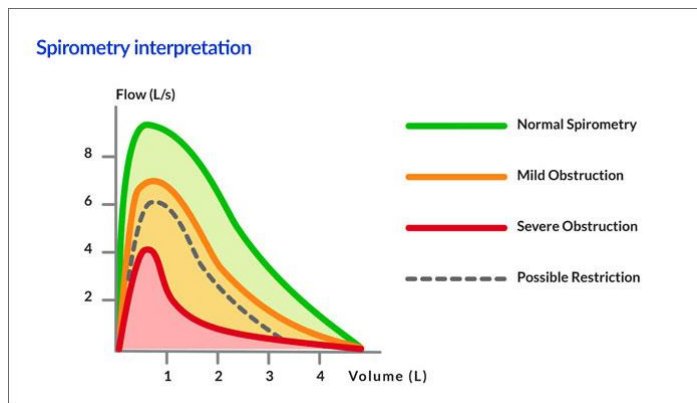
## Pulmonary Function Tests

- **Spirometer:** Is an instrument used to measure respiratory volumes and capacities.
- **Spirometry:** is the process of measuring volumes of air that move into and out of the respiratory system.
- Spirometry can distinguish between:
  - **Obstructive pulmonary disease** — Increased airway resistance (e.g., bronchitis)
  - **Restrictive pulmonary disease** — Reduction in total lung capacity due to structural or functional lung changes (e.g., fibrosis or TB)

# Spirometer



# Spirometer



## Other related devices - Pulse oximeter

- Pulse oximetry is a noninvasive and painless test that measures your oxygen saturation level, or the oxygen levels in your blood.
- It can rapidly detect even small changes in how efficiently oxygen is being carried to the extremities furthest from the heart, including the legs and the arms.



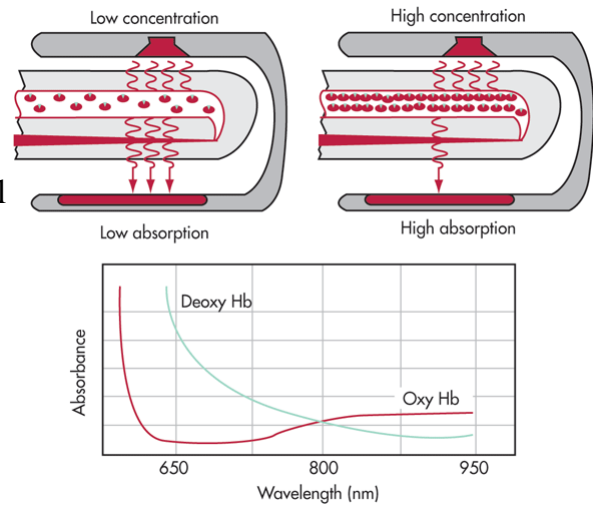
## Pulse oximeter – Purpose of its use

- The purpose of pulse oximetry is to check how well your heart is pumping oxygen through your body.
- It can detect many conditions that's related to the oxygen supply:
  - Asthma
  - Pneumonia
  - lung cancer
  - Anemia
  - Heart attack or heart failure

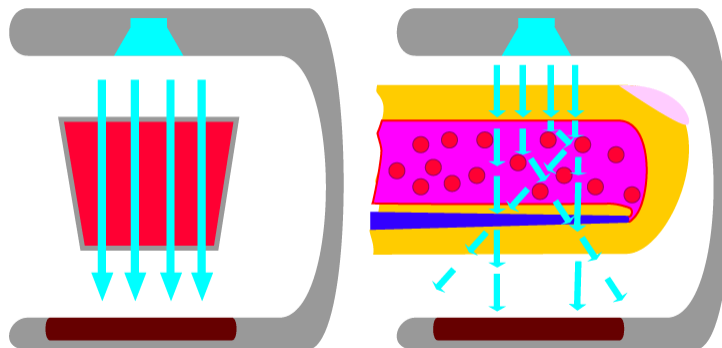


## Pule oximeter – How it works

- Two light waves are used:
  - 660 nm – red light
  - 940 nm – infrared light
- These can be focused onto a human nail tip through a clamping finger-tip sensor a measured signal obtained by a photosensitive element, will be show on the oximeters display.
  - 660 nm – deoxy Hb absorbs ten times as oxy Hb
  - 940 nm – absorption of oxy Hb is greater



## Pule oximeter – main issues



**Thank you!**  
**Any Questions?**