Breathing and ventilation

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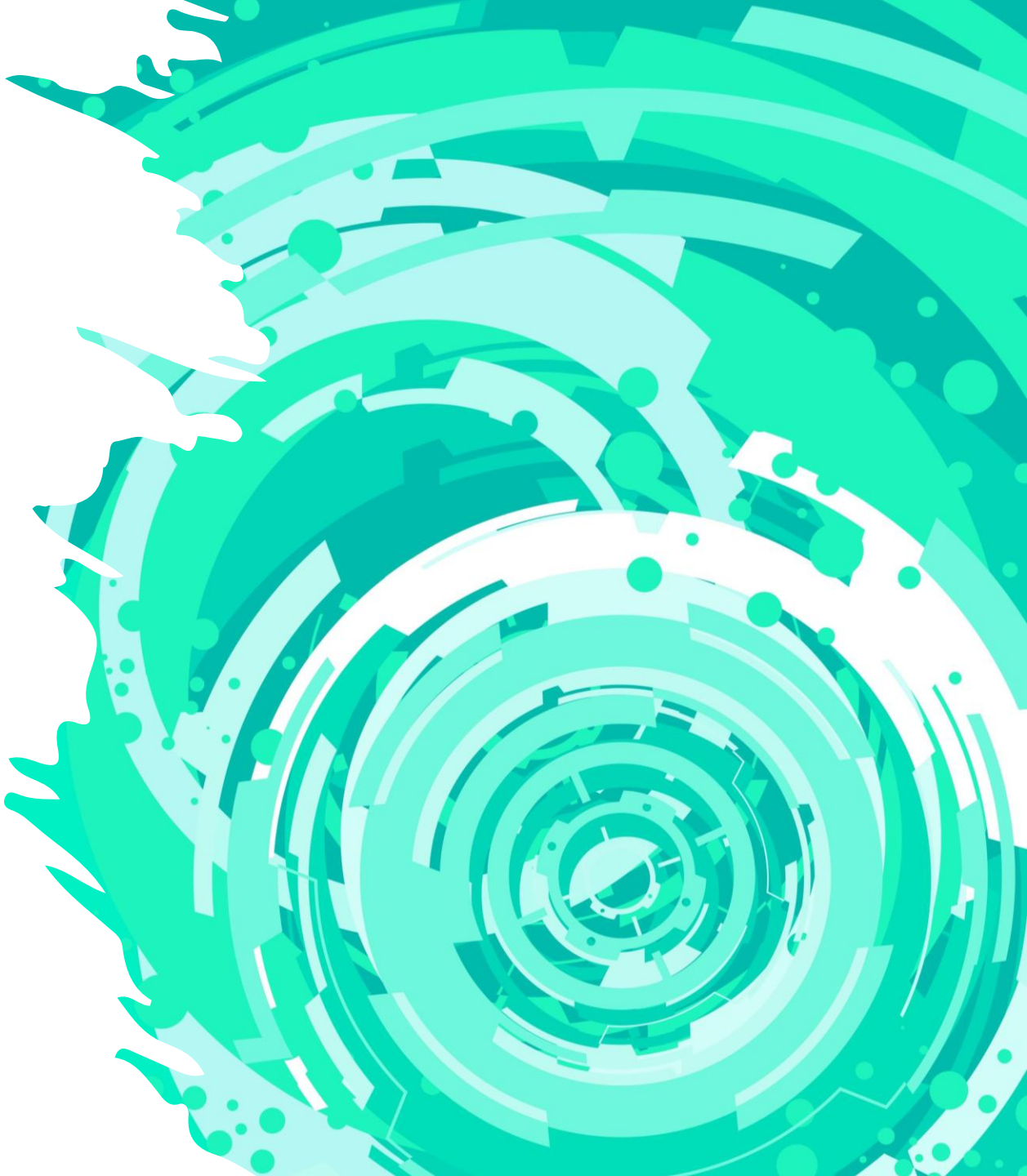
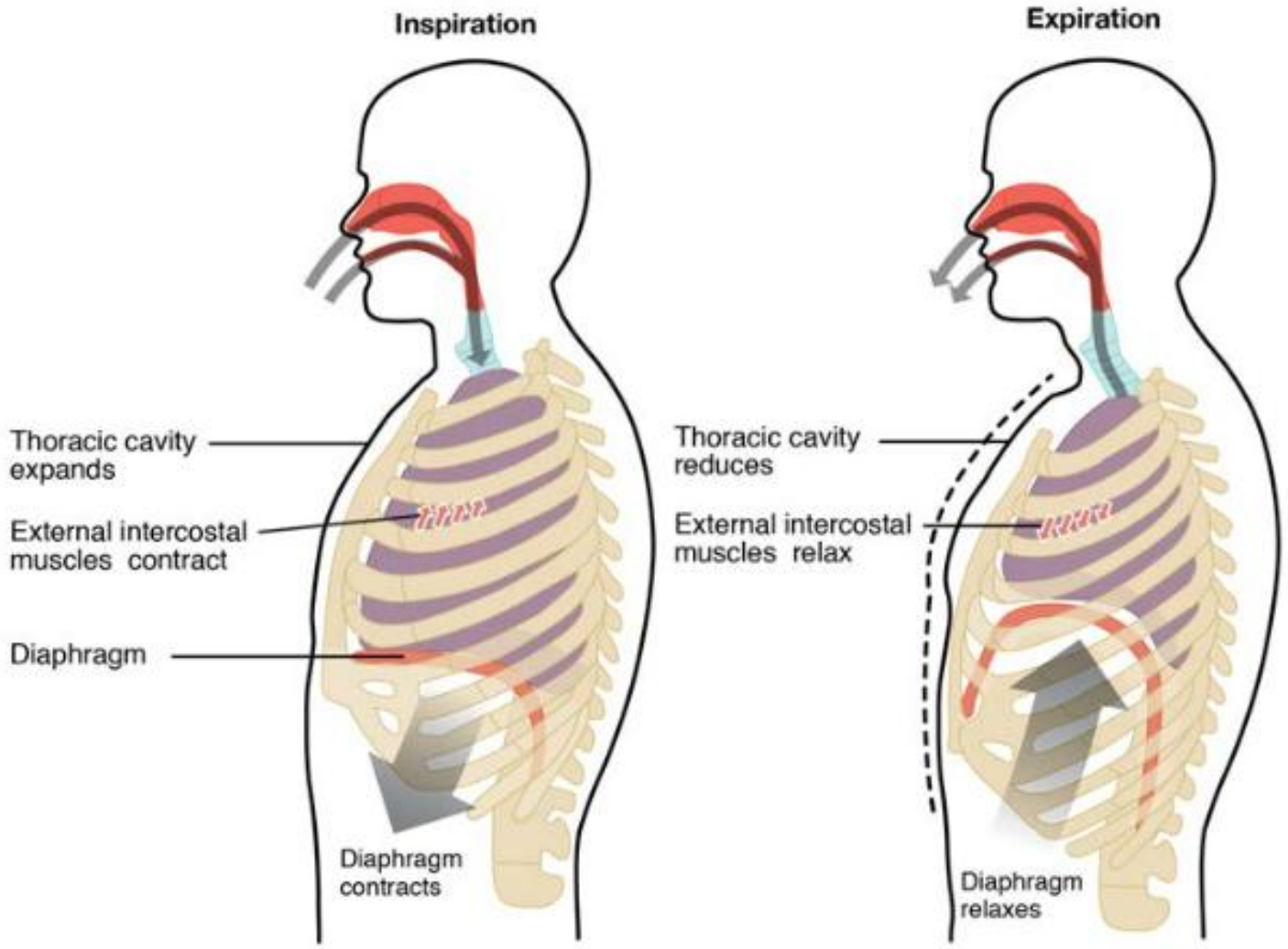


Inspiration and expiration

Thoracic cavity – the space/ the cavity where lungs are located

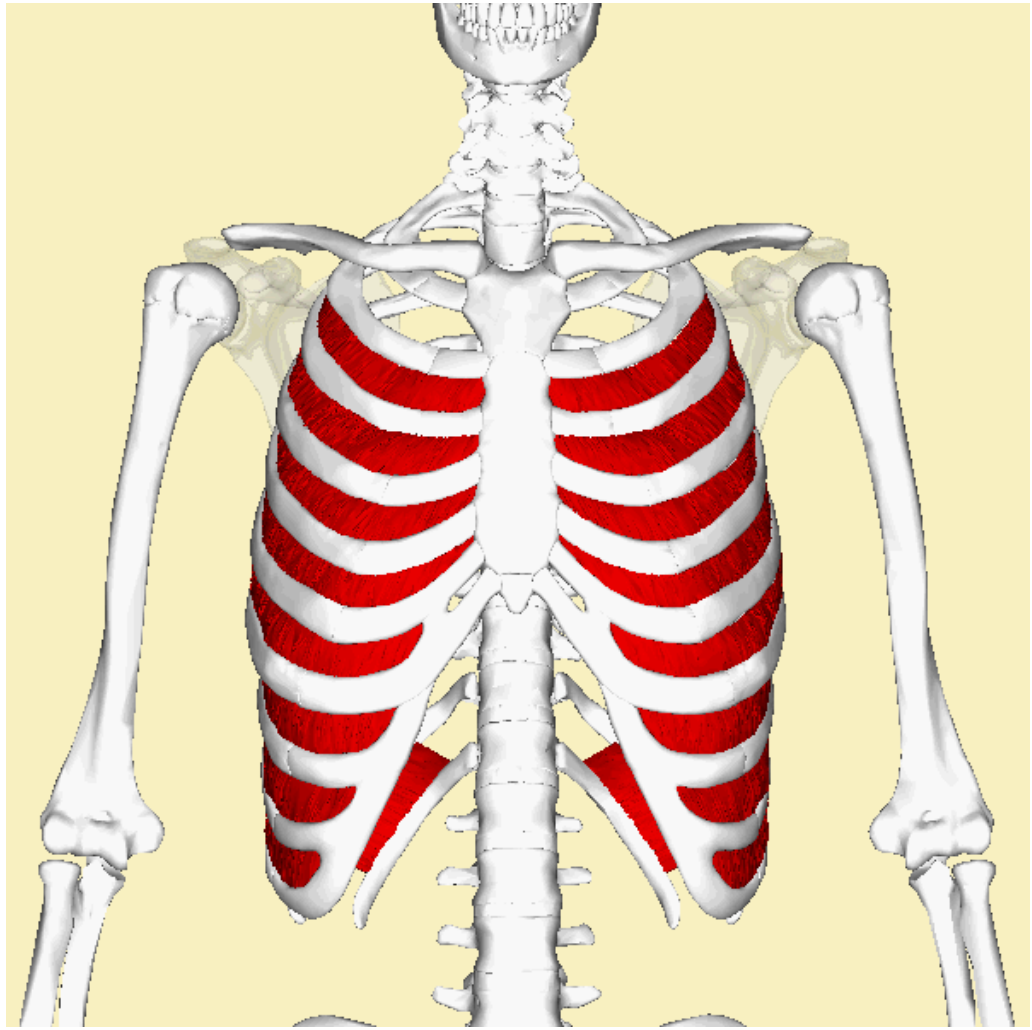
- **Left side (Inhalation):**
  - Diaphragm contracts (arrow pointing down).
  - External intercostal muscles contract (arrows pointing up).
- **Right side (Exhalation):**
  - Diaphragm relaxes (arrow pointing up).
  - External intercostal muscles relax (dashed arrows pointing down).



Intercostal muscles

Intercostal muscles contract during inhalation, aiding in the expansion of the rib cage, which causes your chest to expand as you breathe in.

Conversely, during exhalation, intercostal muscles relax, contributing to the reduction of the rib cage, which leads to your chest shrinking as you breathe out.

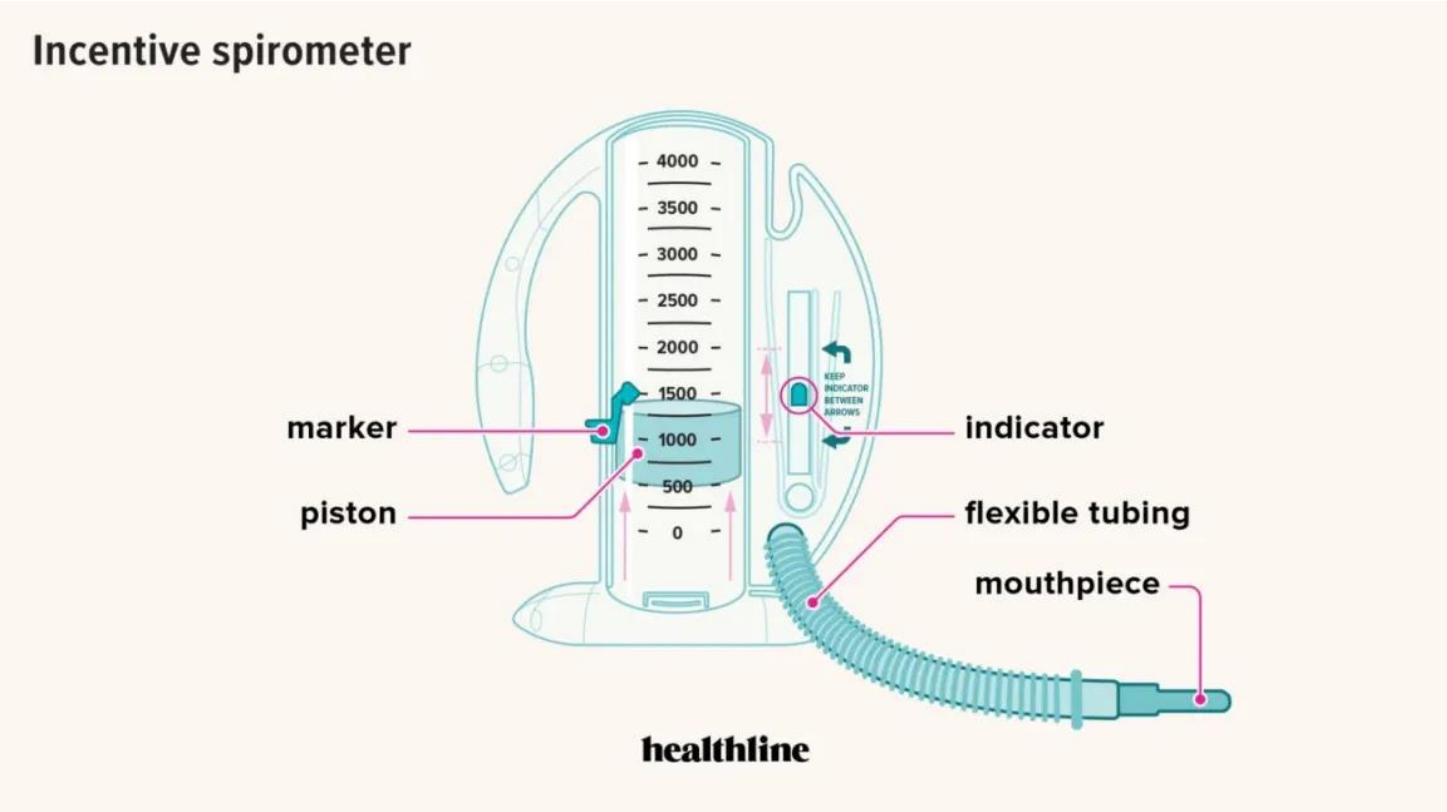


Measurement of lung capacity

A spirometer is a device used to measure lung function by assessing the volume of air inhaled and exhaled by an individual.

Key Components:

- **Mouthpiece:** Where the individual breathes into the spirometer.
- **Tubing:** Connects the mouthpiece to the device.
- **Measurement Display:** Shows the volume of air breathed in and out.

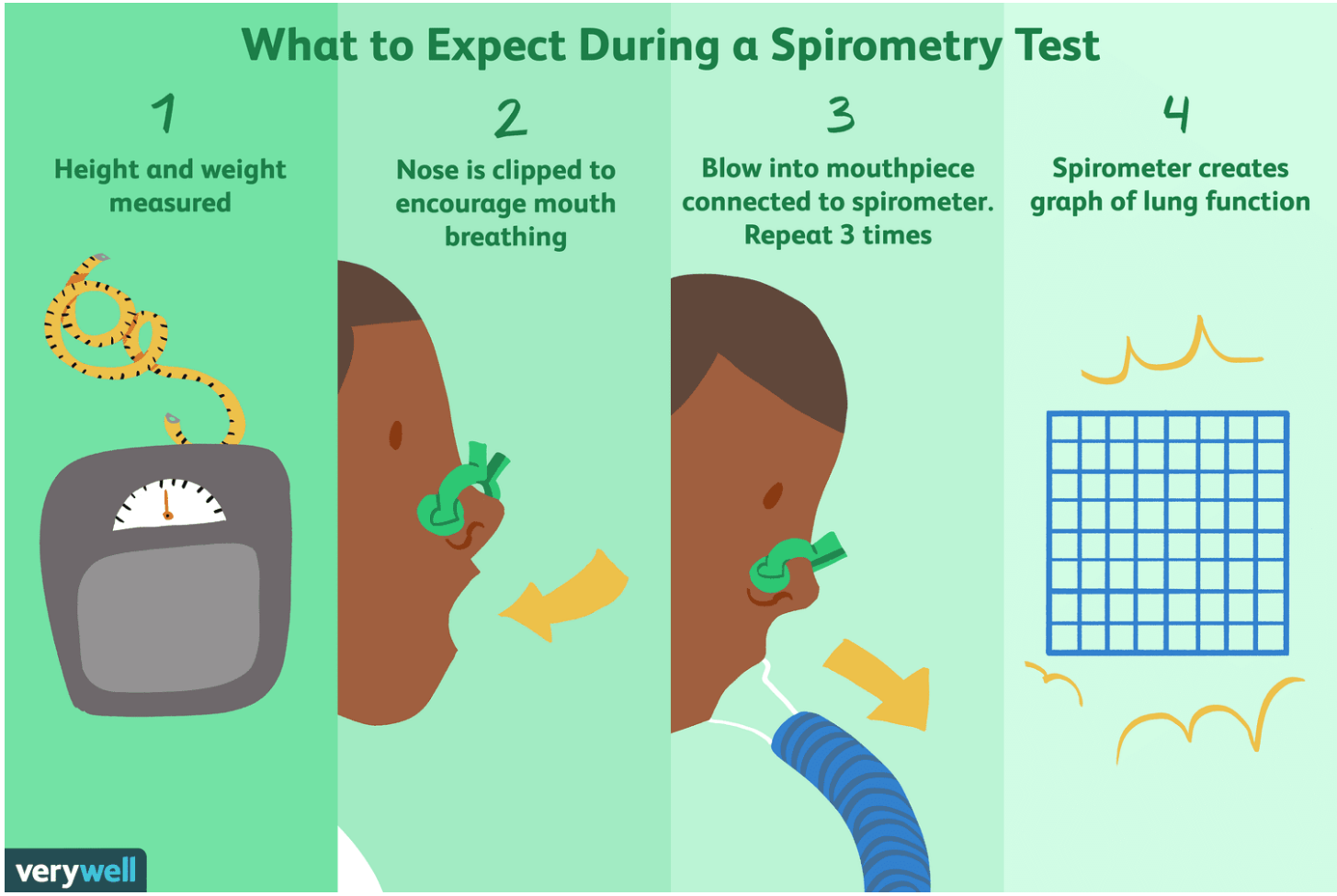


Benefits of Spirometry

- Helps diagnose respiratory conditions like asthma, chronic obstructive pulmonary disease (COPD), and lung function impairment.
- Monitors lung health over time.
- Guides treatment plans and assesses the effectiveness of interventions.

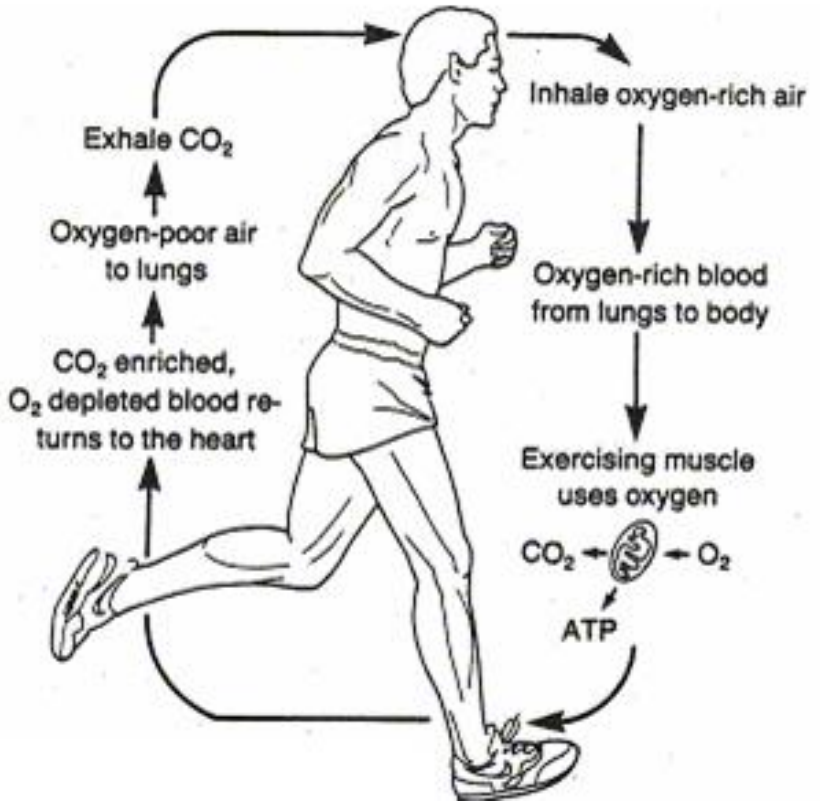
Process of Spirometry

- **Inhale:** The individual takes a deep breath in and then exhales forcefully into the mouthpiece of the spirometer.
- **Measurement**: The spirometer measures the volume and flow rate of air as it is exhaled.
- **Data Analysis:** The results are displayed on the spirometer's screen, showing various parameters such as forced vital capacity (FVC) and forced expiratory volume in one second (FEV1).
- **Interpretation:** Healthcare professionals analyze the results to assess lung function and identify any abnormalities.



Effect of exercise on the level of respiration

• During exercise, muscles utilize oxygen to generate energy (ATP) from glucose while simultaneously generating CO2. This results in an increase in CO2 levels in the bloodstream, which is then transported to the heart. The CO2-rich blood is subsequently directed to the lungs via pulmonary circulation. In the lungs, blood oxygen levels increase as CO2 is expelled. The oxygen-rich blood is then pumped back to the heart and distributed to every cell and muscle in the body for energy production. This cyclical process continues during exercise. The greater the energy demand during activities like running, the greater the need for inhalation of oxygen and exhalation of CO2 to sustain the metabolic requirements of the muscles.



1.Muscle Contraction During Exercise:

- Muscles contract during exercise, requiring energy (ATP) to perform work.

2.Oxygen Utilization and CO2 Production:

- Oxygen is utilized by the muscles to produce ATP from glucose.
- Carbon dioxide (CO2) is produced as a byproduct of this metabolic process.

3.Blood Circulation:

- CO2-rich blood travels to the heart through veins.
- The heart pumps the CO2-rich blood to the lungs via pulmonary circulation.

4.Gas Exchange in the Lungs:

- In the lungs, CO2 is exchanged for oxygen.
- Oxygen-rich blood is formed as CO2 is removed from the bloodstream.

5.Return of Oxygen-Rich Blood to the Heart:

- The oxygen-rich blood returns to the heart through pulmonary veins.

6.Distribution of Oxygen to Cells and Muscles:

- The heart pumps oxygen-rich blood to every cell and muscle in the body.

7.Energy Production in Cells and Muscles:

- Oxygen is utilized by cells and muscles to produce ATP for energy.

8.Continuation of the Cycle:

- The cycle continues as long as exercise persists, with oxygen continuously being supplied and utilized, and CO2 being produced and expelled.

9.Adjustment of Breathing Rate:

- The body adjusts breathing rate to meet the increased demand for oxygen uptake and CO2 removal during exercise.

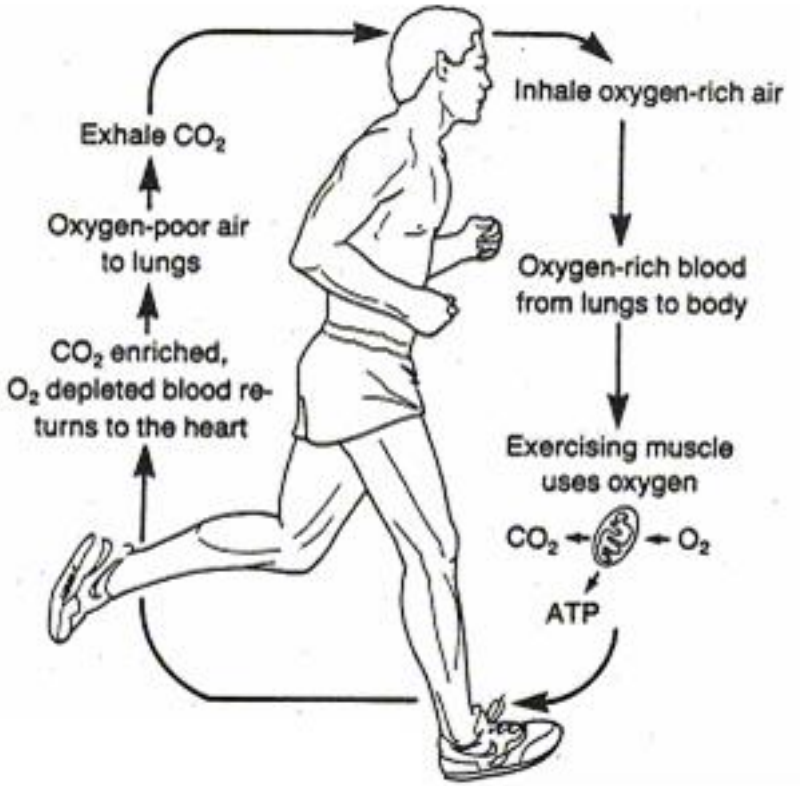


Figure 14: VO_2 MAX