Unforced or silent inspiration:

- Primarily results from the contraction of the dome-shaped diaphragm
- It lowers and flattens when it contracts
- Thoracic volume increases in the vertical direction
- Inspiration is aided by ***contraction of the parasternal and external intercostals*** →raises the ribs and increases the thoracic volume laterally
- Muscles involved in **forced inspiration are : scalene, pectoralis minor and in extreme cases →sternocleidomastoid muscles**
- Contraction of these muscles elevates the ribs in anterioposterior direction
- Same time the upper rib cage is stabilized
- Increase in thoracic volume = decreases intrapul pressure →due to the contraction of the muscles →inspiration

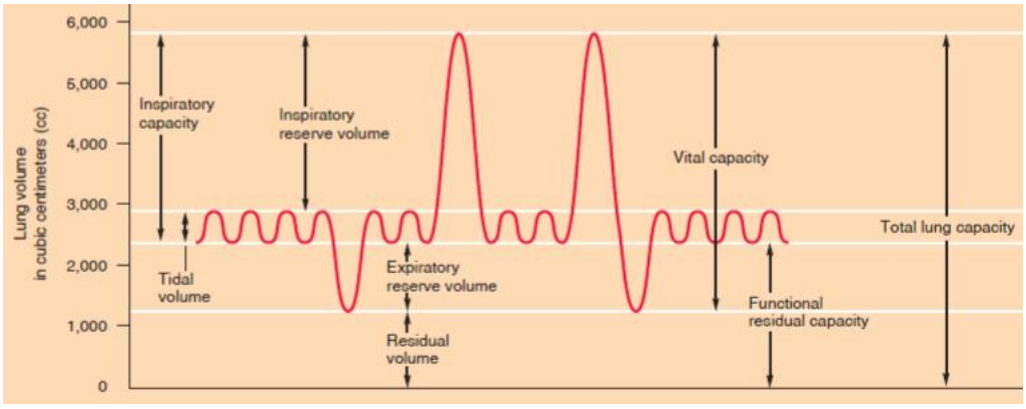
Quite expiration

- It is a passive process
- After inspiration the lungs and thorax recoil as a result of elastic tension→respiratory muscles relax
- Decreased lung volume = increased pressure in the alveoli →air pushes out
- **Forced expiration: internal intercostal muscles** contract and depress the rib cage
  - Along the abdominal muscles. Why? →These muscles force abdominal organs against the diaphragm and decrease the volume of the thorax
  - →Hence intrapul pressure rises 20 or 30mmHg above atmospheric pressure
- **Note:** interchondral part of muscles is not included.

Pulmonary function tests

1. Spirometry:

- **Technique used to assess pulmonary function**
- Patient breathes into a closed system in which the air is trapped within the light plastic bell floating in water
  →Bell moves up: when person exhales
  →Bell moves down: when person inhales
- The bell causes the movement in the pen which records the breathing called a ***SPIROGRAM***



Lung volumes and capacities

1. ***Lung capacity :*** it is equal to the sum of two or more lung volumes
2. ***Tidal volume:*** the amount of air expired in each breathe during quiet breathing
3. ***Vital capacity (VIP)***: the max amount of air that can be forcefully exhaled after a max inhalation
   ⇒ VITAL CAPACITY = **inspiratory reserve volume** + **tidal volume** + **expiratory reserve volume**
4. ***Residual volume:*** the volume of air that always remains even after a max forced expiration

So now,

Oxygen carried by the red blood cells must 1st dissolve in plasma before it can diffuse to the tissue cells

So the if the PO2 is doubled = rate of oxygen diffusion is doubled

For this reason, 100% oxygen filled tank if used for breathing can increase the oxygen delivery to the tissue and it wont affect the total oxygen content of the blood

Now the important part

Pulmonary arteries: takes blood from tissue to lungs (deoxygenated)

★ **It has PO2 of 40mmHg and PCO2 of 46mmHg.**

Pulmonary veins: they take blood from lungs to tissue (oxygenated)

★ **It has PO2 of 100mmHg and PCO2 of 40mmhg**

What do we see? → The arterial blood value is constant and is clinically hence significant because it reflects lung function

Why is the arterial blood considered and not the venous?

→Because the venous blood values are far more variable like during exercise the PO2 values are much lower and PCO2 is much higher than at rest. Whereas arterial blood remains constant.

Clinical: pulse oximeter:

★ Commonly used in hospitals to measure oxyhemoglobin saturation

★ Used: **clips on the finger or pinna** and gives reading of oxygen saturation an pulse rate within short time
→helpful in emergency medicine and during anesthesia

★ Has 2 light emitting diodes with different wavelength(red and infrared range)

★ Oxyhemoglobin and deoxyhemoglibin absord this light differently and determine the conc.

Pulmonary circulation and ventilation/perfusion ratios

Fetal pulmonary circulation:

In fetus the pulmonary circulation has high vascular resistance due to partially collapsed lungs

Because of this, the vascular resistance helps to shunt the blood from

- ✦ the right to the left atrium through : foramen ovale
- ✦ pulmonary artery to the aorta: ductus arteriosus

After birth these two close and the vascular resistance e falls sharply due to:

1) opening of vessels as a result of subatmospheric intrapulm pressure
2) physical stretching of the lungs during inspiration
3) dilation of the pulmonary arterioles in response to increased alveolar PO2

Adult pulmonary circulation:

Right ventricle like left has a cardiac output: 5.5L per minute

Rate of blood flow in pulmonary circulation = same in systemic circulation

Hence the,

1) Blood flow α 1/vascular resistance
2) blood flow α pressure difference between two ends of the vessels

★ eg: mean arterial pressure is 90 to100 mmHg - pressure of the right atrium is 0 mmHg
Hence the driving pressure in the pulmonary circulation: 100mmHg

Now read carefully:

1. driving pressure in the pulmonary circulation = 1/10th of systemic circulation