

# Overview of Respiration

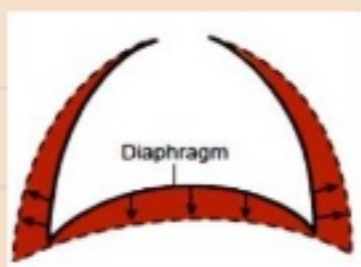
## Inspiration

### I-Muscles of Inspiration:

#### 1-Main Muscles:

##### A- Diaphragm:-

- supplied by the phrenic nerve (origin from C3 to C5).
- responsible for 70% of normal inspiration
- Contraction (= descent) of the diaphragm leads to enlargement of the thoracic cavity vertically.
- ↑ vertical diameter of the chest



##### B-External Intercostal Muscles:

- Contraction of them lead to elevation and eversion of the ribs.
- ↑ the transverse diameter.

#### 2-Accessory Muscles:-

- Act only in forced inspiration.

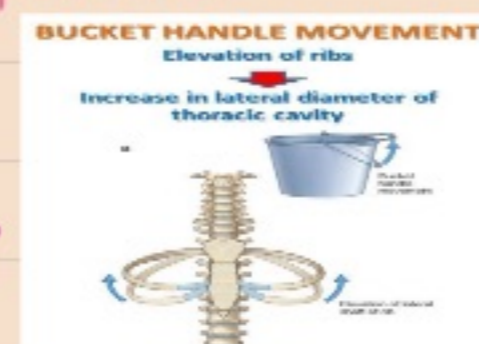
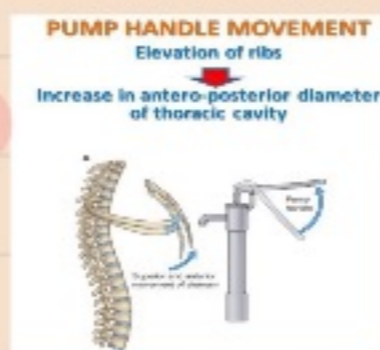
- They are Sternomastoid (elevates the sternum), →

Scaleni

(elevates the 1st rib), Serratus posterior superior

and Serratus posterior inferior

(elevate the remaining ribs). →



## Expiration

### I-Muscles of Expiration:

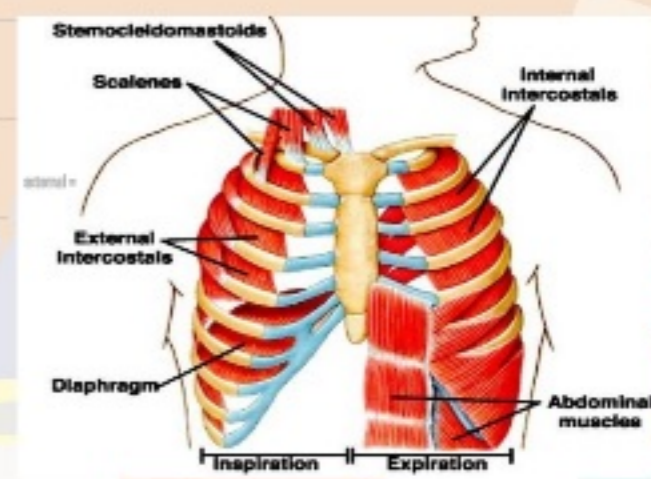
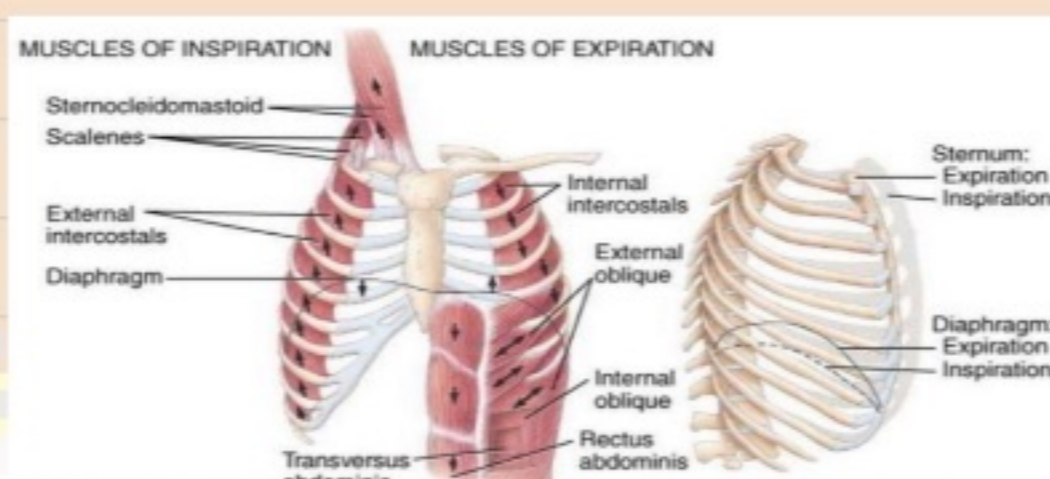
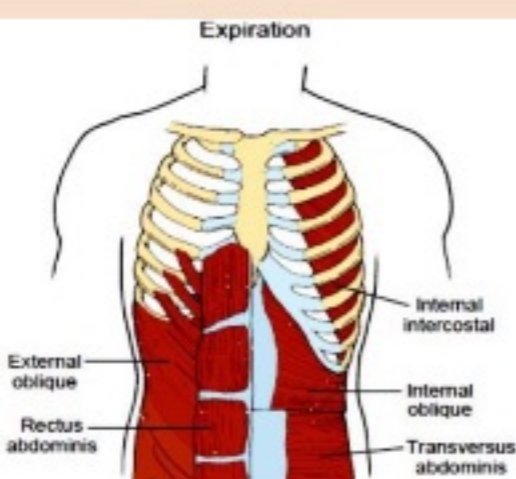
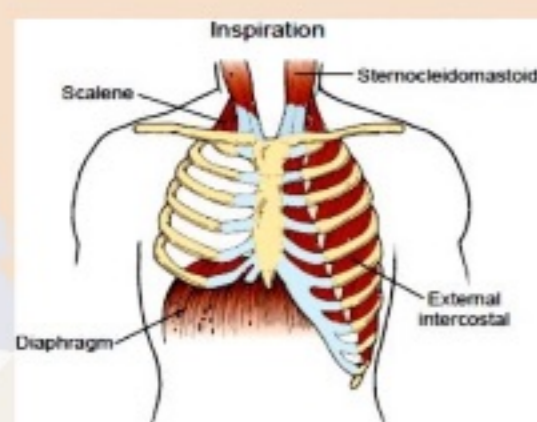
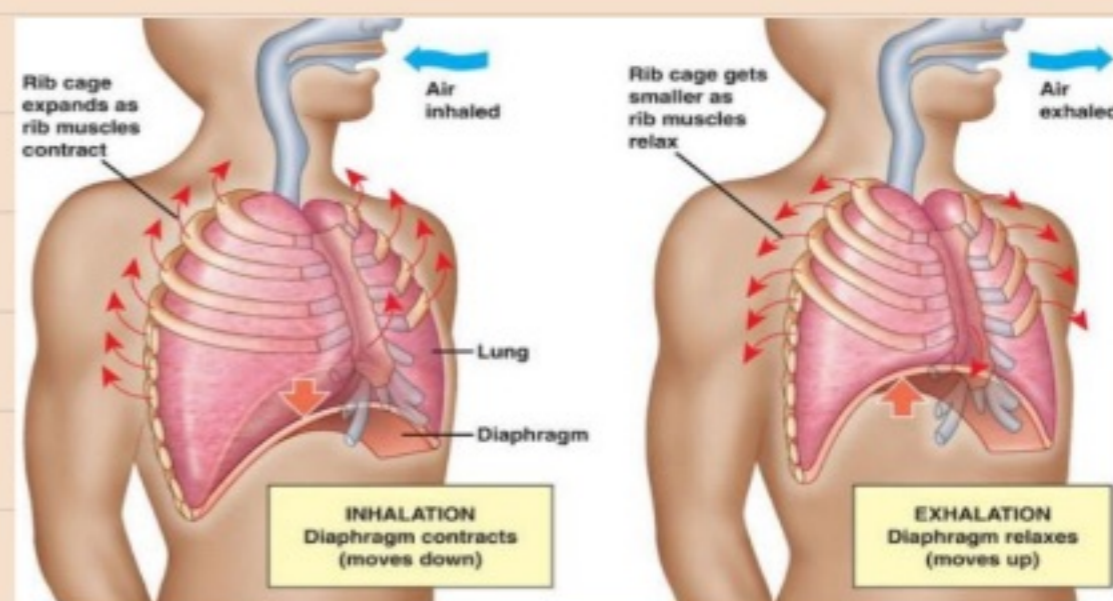
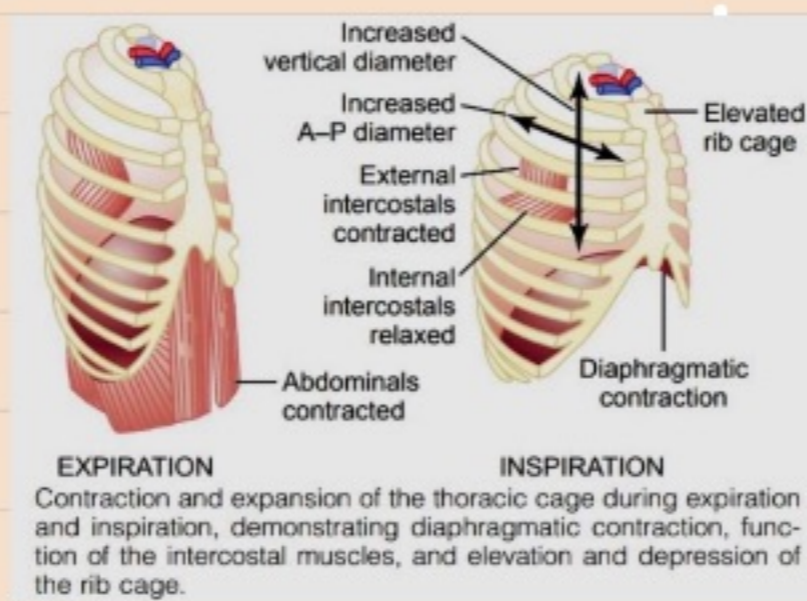
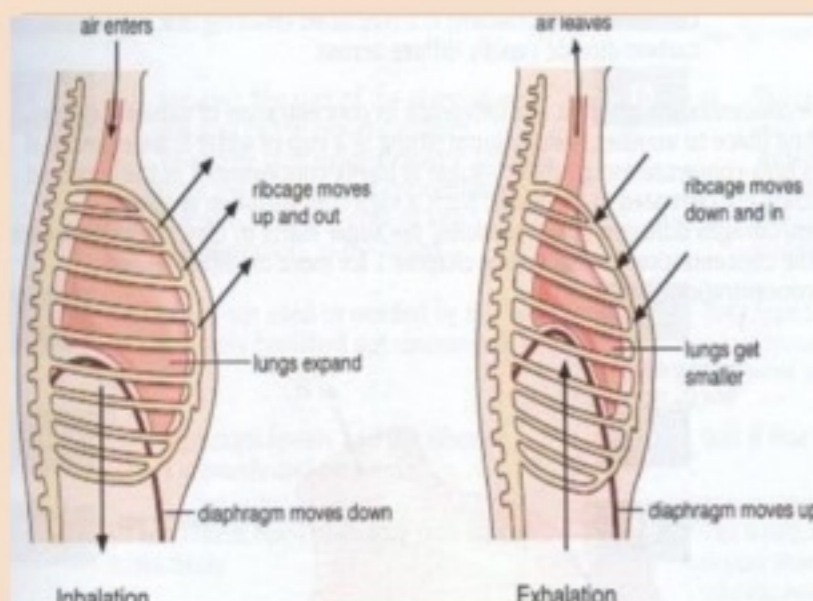
Expiratory muscles act only in forced expiration.

#### A-Abdominal Wall Muscles:

- abdominal recti, transverses abdominis, internal & external oblique muscles .
- Contraction leads to compression of abdominal contents which increases the intra-abdominal pressure and elevates the diaphragm upward.

#### B-Internal Intercostal Muscles:

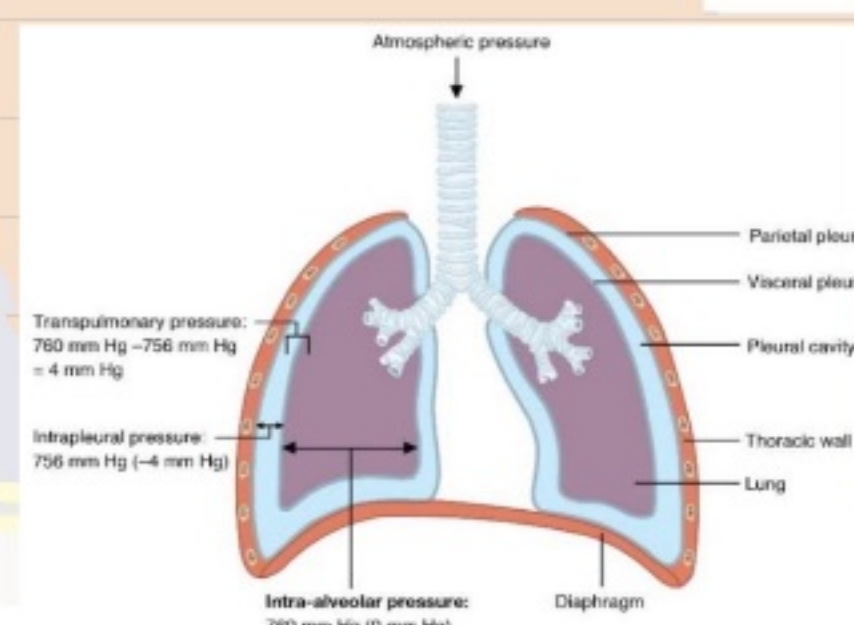
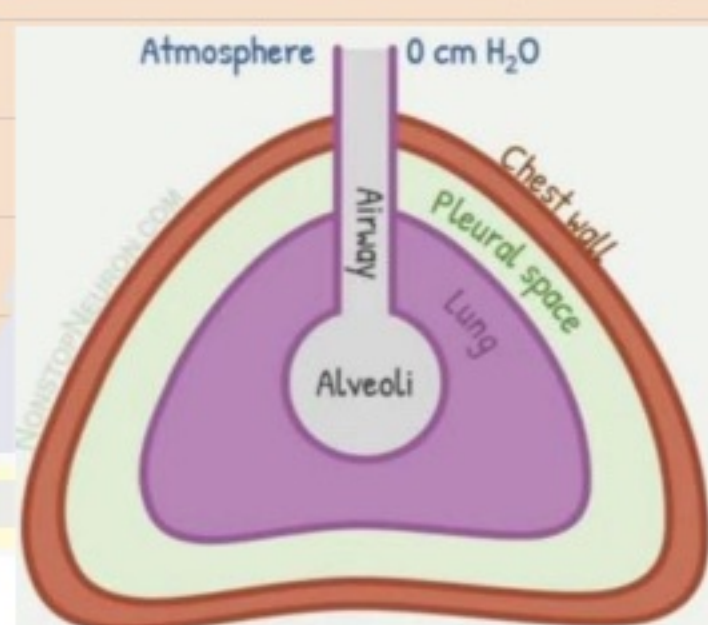
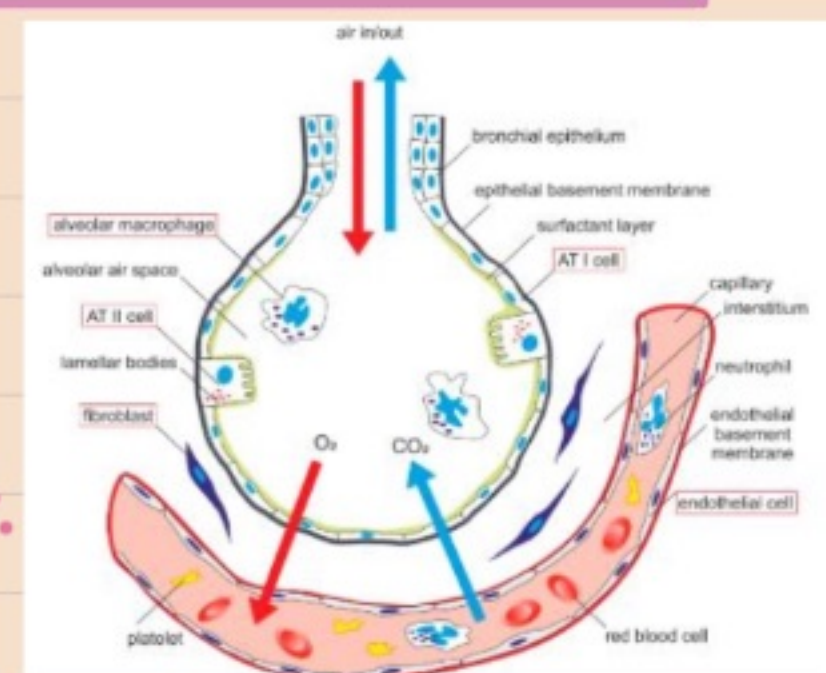
Contraction of the internal intercostal muscles leads to depression and inversion of the ribs.

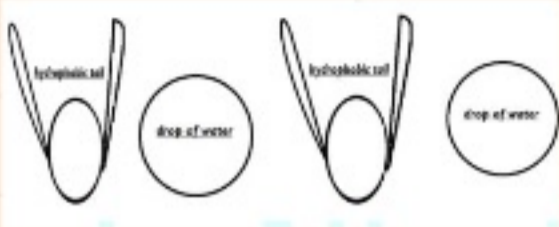
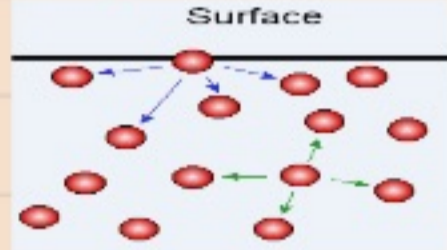
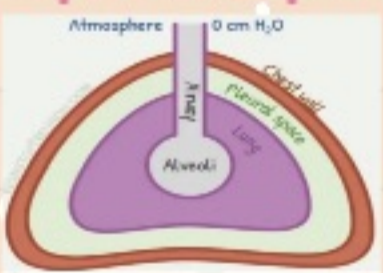
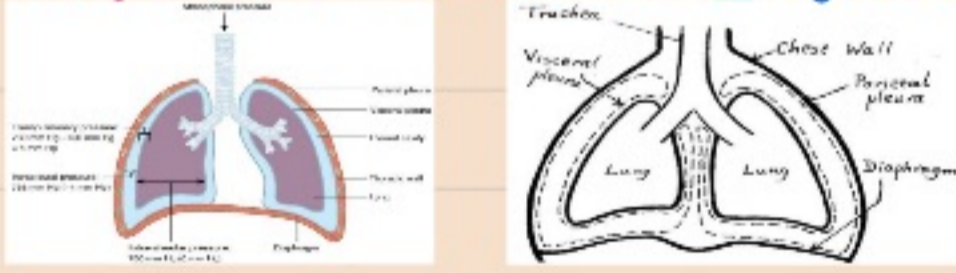

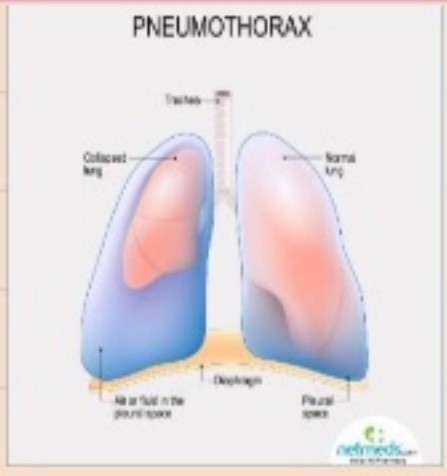


Mechanism of inspiration	Mechanism of expiration
Active process	Passive process
Contraction of inspiratory muscles.	
<p>(A) Resting inspiration:</p> <ul style="list-style-type: none"> <li>- Respiratory center</li> <li>→ phrenic and external intercostal nerves</li> <li>→ contraction of Diaphragm</li> </ul> <p>It is responsible for 70% of normal inspiration.</p> <ul style="list-style-type: none"> <li>→ ↑ vertical diameter of the chest and External intercostal muscles ↑ the transverse diameter.</li> <li>→ expansion of the chest wall in all directions</li> <li>→ distention of the lung and decrease of intrapulmonary pressure to (-1 mm Hg) &amp; rush the air into the lungs.</li> </ul>	<p>(A) Normal expiration:</p> <ul style="list-style-type: none"> <li>- Normal expiration is the passive process.</li> <li>- It is produced by relaxation of inspiratory muscles.</li> <li>- Drop of the thoracic cage and elevation of diaphragm increase of intrapulmonary pressure to (+1 mm Hg) &amp; rush the air out the lungs.</li> </ul>
<p>(B) Forced inspiration:</p> <p>The main and the accessory muscles contract strongly so, greater increase in the thoracic cavity and rush more volume to the lungs.</p>	<p>(B) Forced expiration:</p> <ul style="list-style-type: none"> <li>- The expiratory muscles contract strongly so, more depression and inversion of ribs more decrease in the thoracic cavity and rush more volume out of the lungs.</li> </ul>

Alveoli have 3 types of cells:

- 1) Type I cells (squamous pneumocyte) form the structure of the alveoli
- 2) Type II cells (granular pneumocyte) secrete surfactant.
- 3) Type III cells (alveolar macrophages or dust cell) phagocytic cells



Elastic Recoil of the Lungs	When the lung is inflated, it tends to recoil (collapse).
Surfactant	It is a surface active agentt secreted by type II alveolar epithelial cell to decrease the surface tension of fluid lining alveoli and antagonist lung collapse. <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
Compliance of the lungs	A unit change in lung volume per the unit change in distending pressure
Tidal volume	It is the volume of air that can be inspired or expired during a single breath in resting person.
Dead space	It is the volume of air which does not undergo gas exchange with blood in the lung (=150 ml ).
Respiratory rate	It is the number of breaths a person takes per minute - Respiratory rate during rest in adult male = 12 – 16 cycles/min.
Pulmonary ventilation	It is the volume of air respired in one minute (by normal respiration). Respiratory rate is normally from 12 beat/ minute. Pulmonary ventilation = tidal volume X respiratory rate. 500 X 12 = 6000 ml/minute (6 liters/min).
Alveolar Ventilation = Effective Pulmonary Ventilation	= (tidal volume - dead space) X respiratory rate = ( 500-150 ) X12 = 4200 ml/minute.
Maximum Breathing Capacity (MBC)	It is the maximum volume of air respired in one minute by deepest and fastest respiration = 60 liters/min.
Intrapulmonary pressure	It is the pressure inside the alveoli.
Intrapleural pressure	It is the pressure of the fluid in the pleural cavity. <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
Pneumothorax	It is the presence of the air in the pleural cavity <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
Hypoxia	It is the decreased of O2 supply or O2 utilization at the tissue.
Ischemia	It is a condition in which blood flow (and thus oxygen) is restricted or reduced in a part of the body

Dyspnea	It is awareness of difficulty in breathing
Orthopnea	This is the difficulty breathing in lying in bed but not in standing or sitting positions due to compression of the diaphragm by the viscera.
Apnea	It is the temporary stoppage of respiration.

🌸 The respiratory passages:

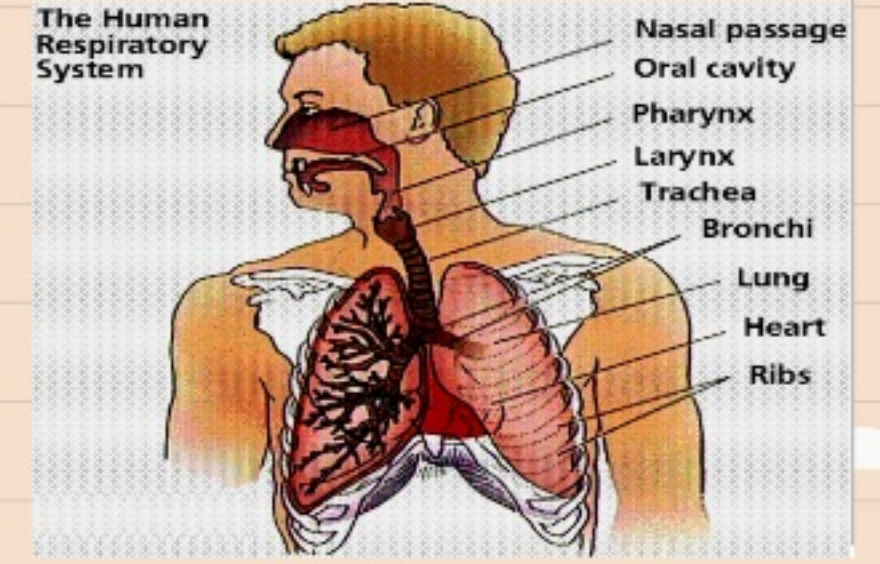
(A) Air conducting zone (Dead space):

- Nose → larynx → trachea → 2 main bronchi → bronchioles → terminal bronchioles [first 16 divisions].
- No gas exchange occurs due to thick wall.

(B) Respiratory zone (Exchange zone):

Respiratory bronchioles → alveolar duct → alveoli [20-23 divisions].

In which gas exchange occurs with blood.



	Generation	Diameter cm	Number	
Conducting zone	trachea	0	1.80	1
	bronchi	1	1.22	2
		2	0.83	4
	bronchioles	3	0.56	8
		4	0.45	16
		5	0.35	32
6		0.25	64	
Respiratory zones	terminal bronchioles	16	0.06	$6 \times 10^4$
	respiratory bronchioles	17	↓	↓
		18	↓	↓
	alveolar ducts	$T_2$	0.05	$5 \times 10^5$
		$T_1$	↓	↓
	alveolar sacs	21	↓	↓
		22	↓	↓
	T	23	0.04	$8 \times 10^6$

اللهم نورك في  
كل خطوة نخطوها  
ولطفك في كل  
صعب أمامنا  
وبركاتك في ما  
عندنا وما هو حولنا  
وما سيكون بين أيدينا