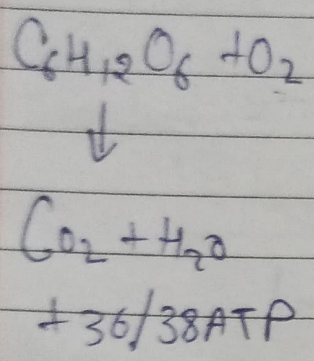


Human Respiratory System

Respiration:- Breakdown of food to release Energy.

Aerobic



Anaerobic

- yeast $[C_2H_5OH + CO_2]$
+ 2 ATP
- Muscles $[Lactic acid]$
+ 2 ATP
- RBC $[PPP - Pentose phosphate Pathway]$

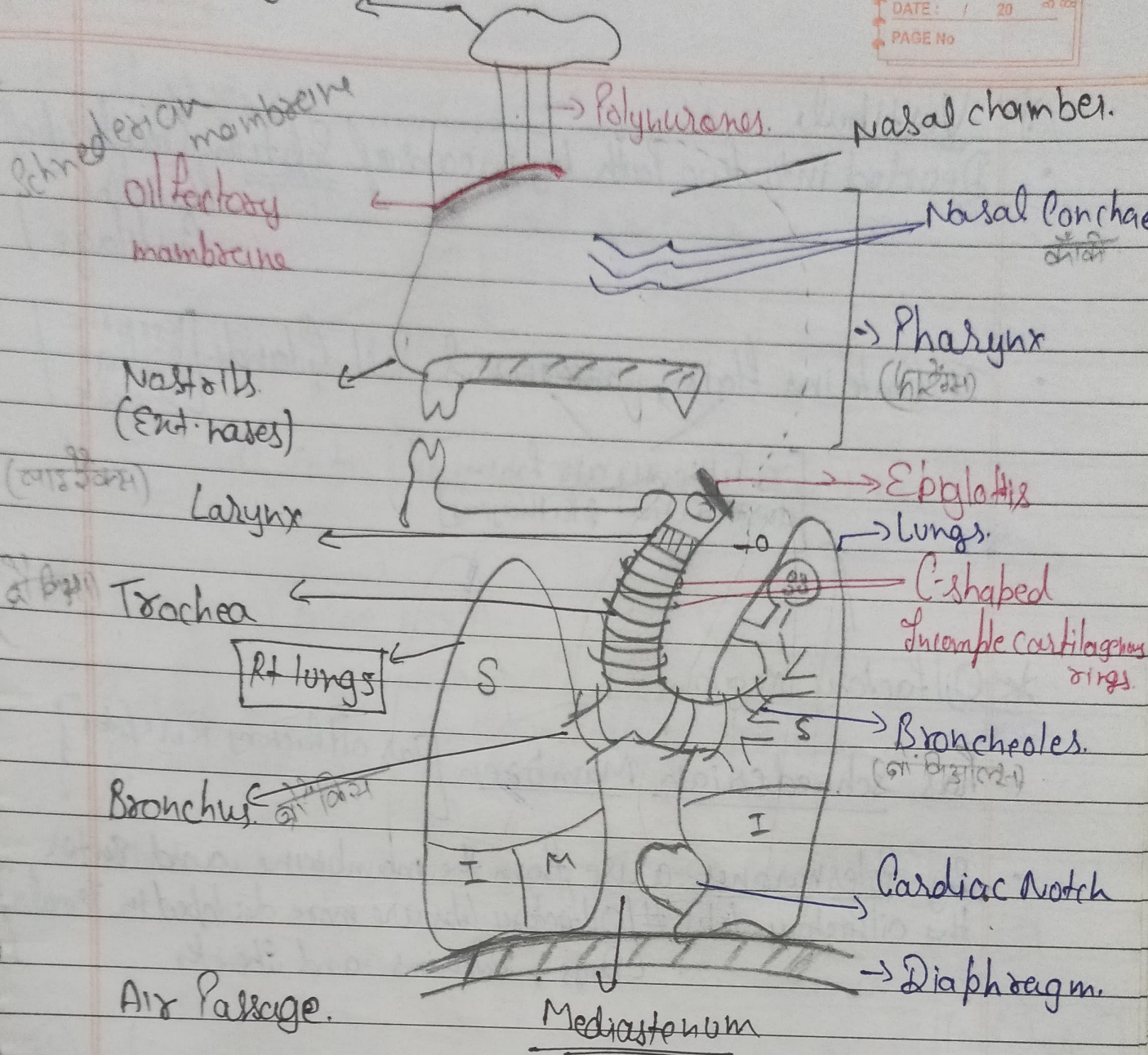
* 5 Steps of Anaerobic Respiration. Breathing/Ventilation External Respiration

- 1.) Gaseous exchange b/w atmosphere and lungs/skin
- 2.) Gaseous exchange b/w lungs and blood.
- 3.) Transport of Gas by blood.
- 4.) Gaseous exchange b/w blood and cell.
- 5.) Utilization of O_2 by Cell to produce Energy. Cellular Respiration

Types of Respiration

Direct	Indirect
<ul style="list-style-type: none"> • Direct exchange gaseous b/w atmosphere to cell. • No role of blood as no respiratory pigment. <p>eg. Unicellular organisms, Cockroach.</p>	<ul style="list-style-type: none"> • Exchange of gas b/w gas & cell & atmosphere by medium of blood. • Blood has respiratory pigment e.g. Annelida, Mollusca, Echinodermata, Cordates

oil factory lobes



Nostrils → Nasal chamber → Pharynx → Larynx → Trachea →
 Bronchi → 1° Bronchioles → 2° Bronchioles → 3° Bronchioles →
 Terminal Bronchioles → Alveoli 1st → Alveoli 2nd → Alveoli 3rd →
 Alveoli

- Nostrils
Paired, External, lead into the nasal chamber.
- Nasal chamber.
 - ↓ Vestibules
 - ↓ Oil factory Region
 - ↓ Respiratory Region

* Vestibule

- Divided into two path by means of Septum (made up of Hairline Cartilage)
- It contains Hair, mucous & oil Glands. [keep the passage moisture]
[To filter the air from dust particles & pathogens]

* Oilfactory Region

- has Schneiderian Mambæen [Has oilfactory Receptors]
- By Polesterones arise from the mambæene and enter the oilfactory lobe. # [Oilfactory lobe are more developed in female] [Dogs, Dolphins and Sharks]

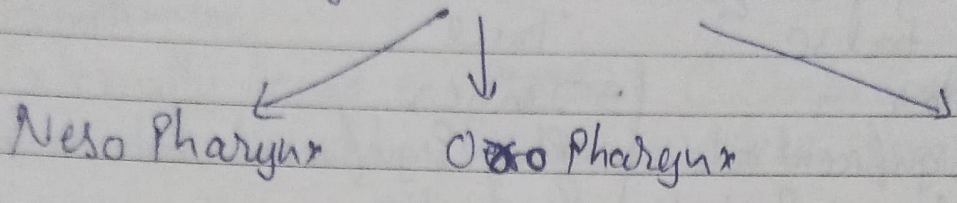
* Respiratory Region

- Bear Nasal Conchal.
- Bony regions.
- Three in no.
- made up of Inferior turbinals. ^{→ Bone}

function → Humidification [adding moisture]
Thermoregulation.

* Pharynx

- Common Passage for food and air



- It leads into Ventral Trachea. Trachea.

* Larynx (Voice Box)

(ophen)

- Present on the Anterior Side of Trachea.
- Opening is known as Glottis.
- Guarded by Epi-Glottis.
- Made up of 9 Cartilages [3-Pair, 3 Unpaired]

3-Paired

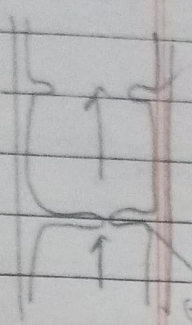
3-Unpaired

EST

ACC

<p>- Arytenoid अरीटेनॉयड</p>	<p>- Epi-Glottis [leaf shape] [hyaline cartilage]</p>
<p>- Corniculate</p>	<p>- Thyroid Cartilage - Butterfly shape → hyaline cartilage # Large # k/a Adam's Apple ↓ Sees as neck Prominence in male.</p>
<p>- Cuneiform कुनीफॉर्म</p>	<p>- Cricoid (क्रिकॉयड)</p>

→ Vocal Chord / Thin muscular lips on the Inner wall of Larynx



- | | |
|--|--|
| <p>→ outer</p> <p>→ insignificant role in Sound Production</p> <p>→ smaller.</p> | <p>→ Inner</p> <p>→ Play significant role in Sound Production</p> <p>→ larger.</p> |
|--|--|

<p>• Male Vocal chords</p>	<p>Female</p>
----------------------------	---------------

- | | |
|---|---|
| <p>→ Thicker under the effect of testosterone.</p> <p>→ Hoarse and loud sound. (low Pitch) (higher Amplitude)</p> | <p>→ Thinner</p> <p>→ shrill and less loud (High Pitch) (low Amplitude)</p> |
|---|---|

* Trachea (wind pipe)

Wind Pipe

- Externally lined by C-shaped / Incomplete Cartilaginous str.
- Made up of hyaline Cartilage
- Prevent trachea from collapsing during Inhalation
- Internally lined by Pseudo stratified Columnar ciliated epithelium. (Produce mucus & cilia push the mucus out)
- It divides into two Bronchi at 5th Thoracic Thoracic vertible column

* Bronchus

- Each Bronchus enter each lung and divides into bronchioles.
- Externally lined by ~~Pseudo~~ C-shape Cartilagenous ring.
- Internally lined by Pseudo stratified columnar ciliated epithelium.

sub

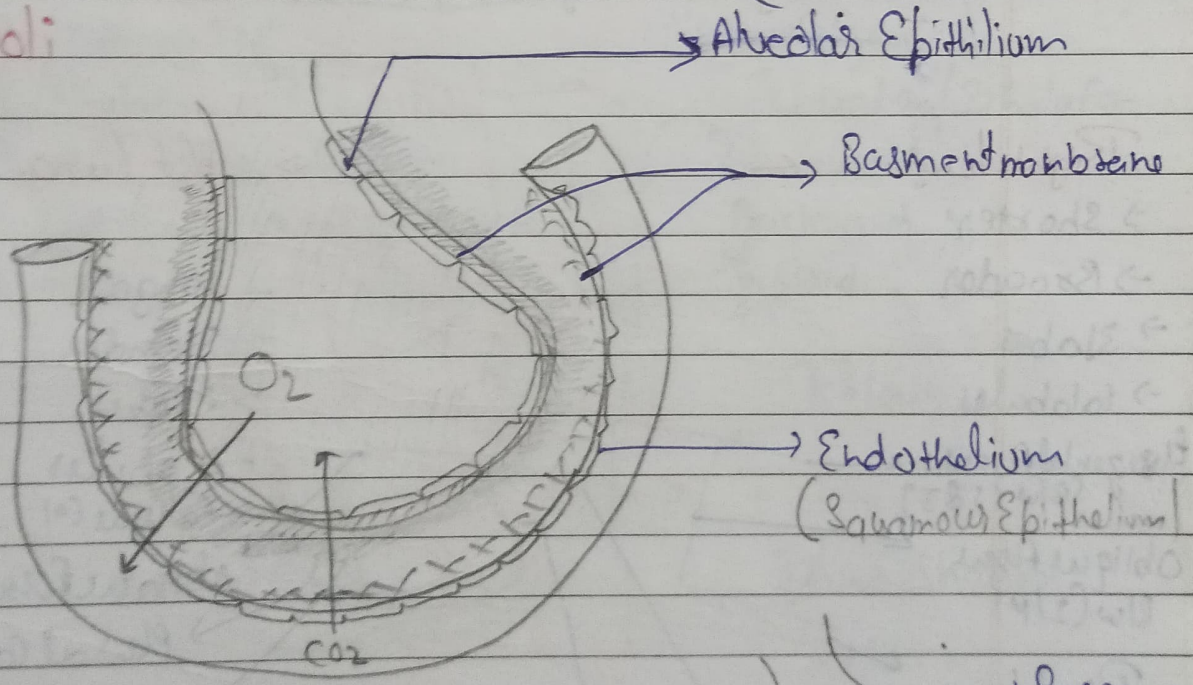
* Bronchioles

- * Bronchioles Internally lined by pseudo-stratified cuboidal Epithelium
- * P.B are Externally lined by C-shaped Cartilagenous ring. (ciliated)
- * 1^o → 2^o → 3^o → Internal → Respiratory → Atresia → Alveolar Puct → Alveoli.

* Alveoli

* Alveoli

- Type I Alveolar cells
- (1.) Simple Squamous Epi
 - (2.) Elastin Fiber (CT)



SURFACTANTS/ Keratin (phospholipids) ←

↓
lower the osmotic pressure & reduce surface tension

- Produced by CLARA CELLS / Pneumocytes II, Type II Alveolar cell.

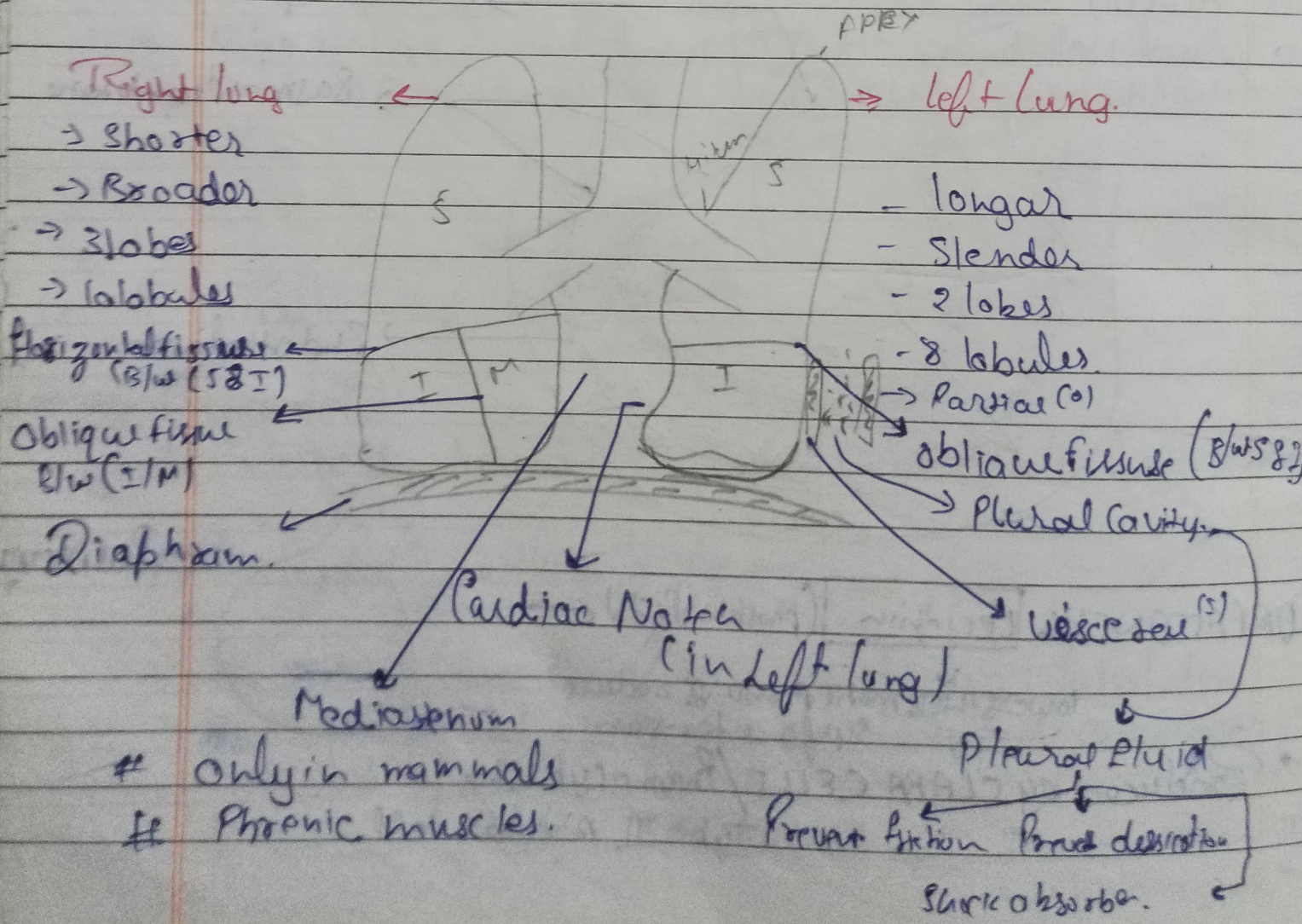
Atelectasis (collapse of alveoli)

- Surface Area ↓
- Inefficient O₂ Supply to tissues
- Bluishness of skin (CYANOSIS)
- H₂T • B.P.T • Fatigue easily

* Lungs

Chief Resp structure.

- Pinkish when born turns greyish due to pollution
- Paired Paired
- Lie in thoracic cavity.
- Protected by Rib cage & pleurae.



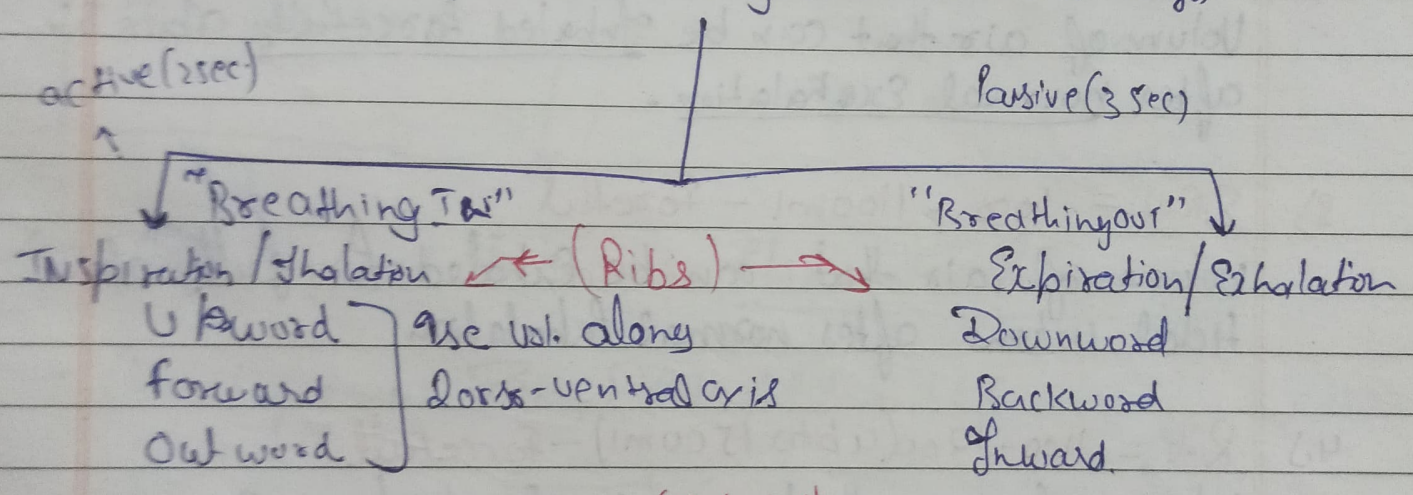
* Pleurisy - Hoarseness in pleural fluid
→ occurs in pneumonia

* Physiology of Respiration.

• Principles → Air moves from low pressure to High Pressure. Each gases move independent of other gas.

• $P \propto \frac{1}{V}$

Breathing / Ventilation / External Resp. (Gaseous Exchange btw alveoli and Lungs)



Contract (External) Internal costal Muscles Relax

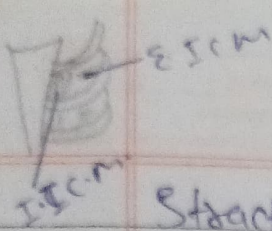
flattens → ↑ the vol. along Diaphragm (Pneum muscles) Dome shaped
anterior-posterior Relax

Contract

Vol ↓, P ↑

Vol of thoracic cavity ↑ P ↓
∴ Air goes in

∴ Air goes out



Structure Involve in Forcefull Exhalation

→ Ribs, Inter Costed muscles, Diaphragm & Abdominal muscles & Internal I.C.M.

* Pulmonary Volume & Capacities

1) Tidal Volume (T.V) = 500ml - Normal

Volume of air that is Inhaled and exhaled during Normal Breathing [T.V/min = 6000-8000ml]

2) I.R.V = 2500ml - 3000ml - Forceful

Volume of air that can be Inhaled forcefully above T.V after normal Exhalation.

3) E.R.V = 1000 - 1100ml - Forceful

Volume of air that can be Exhaled forcefully above tidal volume after normal Inhalation.

4) R.V = 1100-1200 (upto 1500ml) - Forcefull (E.)

Volume of air that remain inside lungs even after forcefull Exhalation.

5) F.R.V = E.R.V + R.V - Normal

Volume of air that remain inside lungs even after normal Exhalation.

6) Vited Capacity = I.R.V + T.V + E.R.V

Volume of air that can be Inhaled forcefully after forcefull Exhalation. Or

Volume of air that can be Exhaled forcefully after forcefull Inhalation.

7] Total Lung Capacity = $UC + RV$
Volume of air that lungs can hold.

$$TLC = UC + RV$$

$$IRV + TV + ERV + RV$$

$$IC + ERV + RV$$

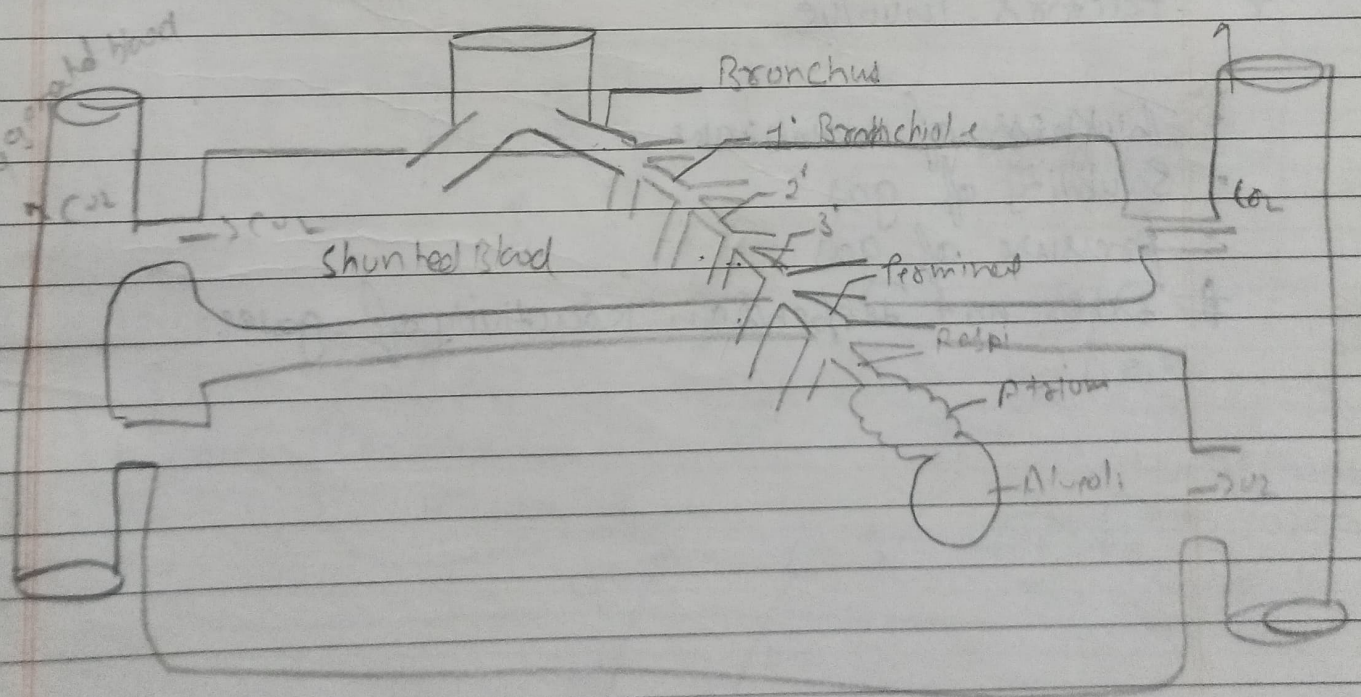
$$IRV + EC + RV$$

$$IC + FRV$$

Dead Space → Conducting Path of our passage
→ Because does not participate in Gaseous Exch.
150ml / 500ml (Dead air vol.)

Device used to measure Spirometer / Pulmometer

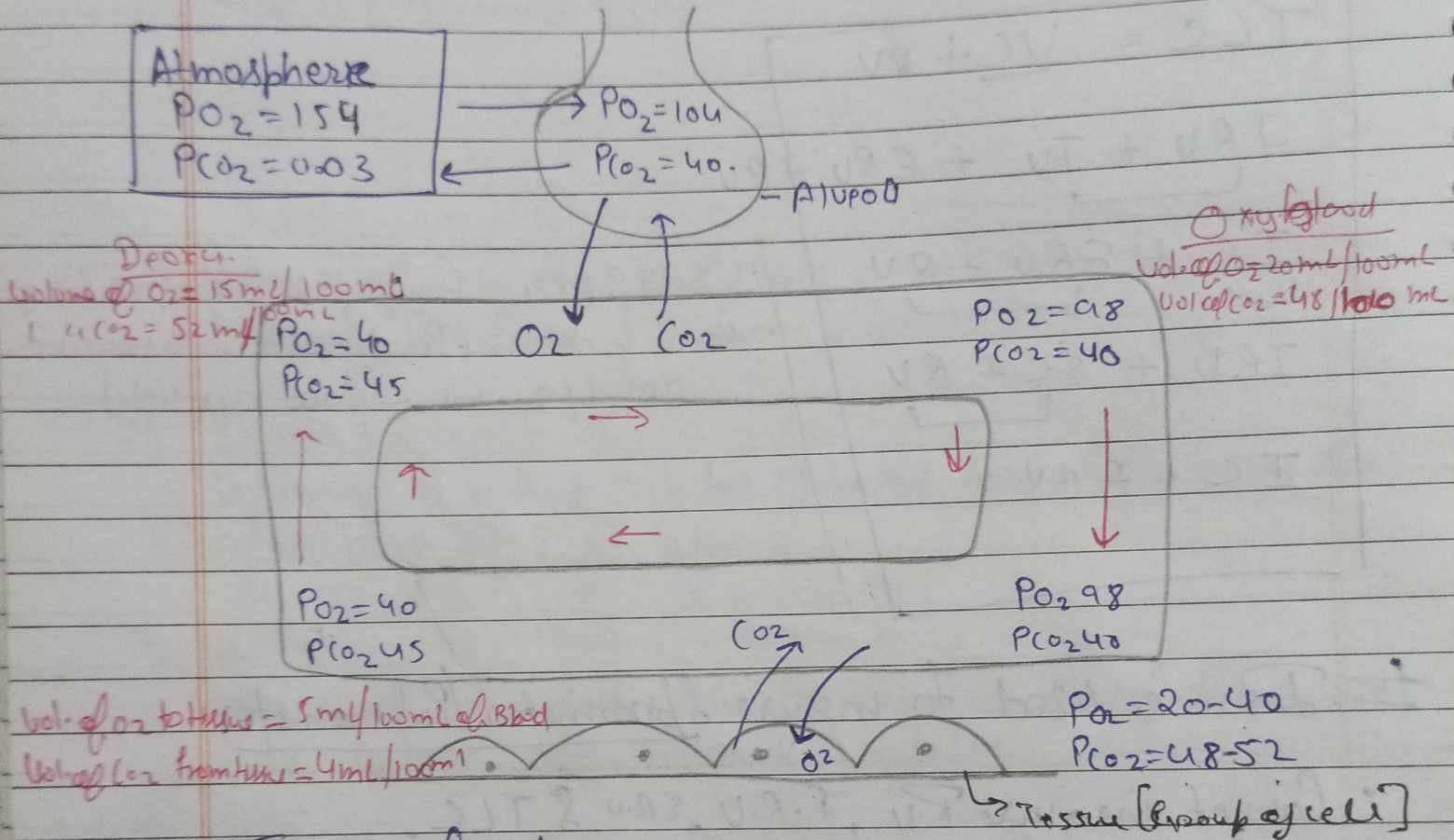
- Cannot measure $R.V$, $F.R.V$, ERV & TLC .



* Physiological Shunted blood:-

→ Blood flowing around dead air space does not get oxygenated

* Gaseous Exchange between Alveoli & Blood & cell.

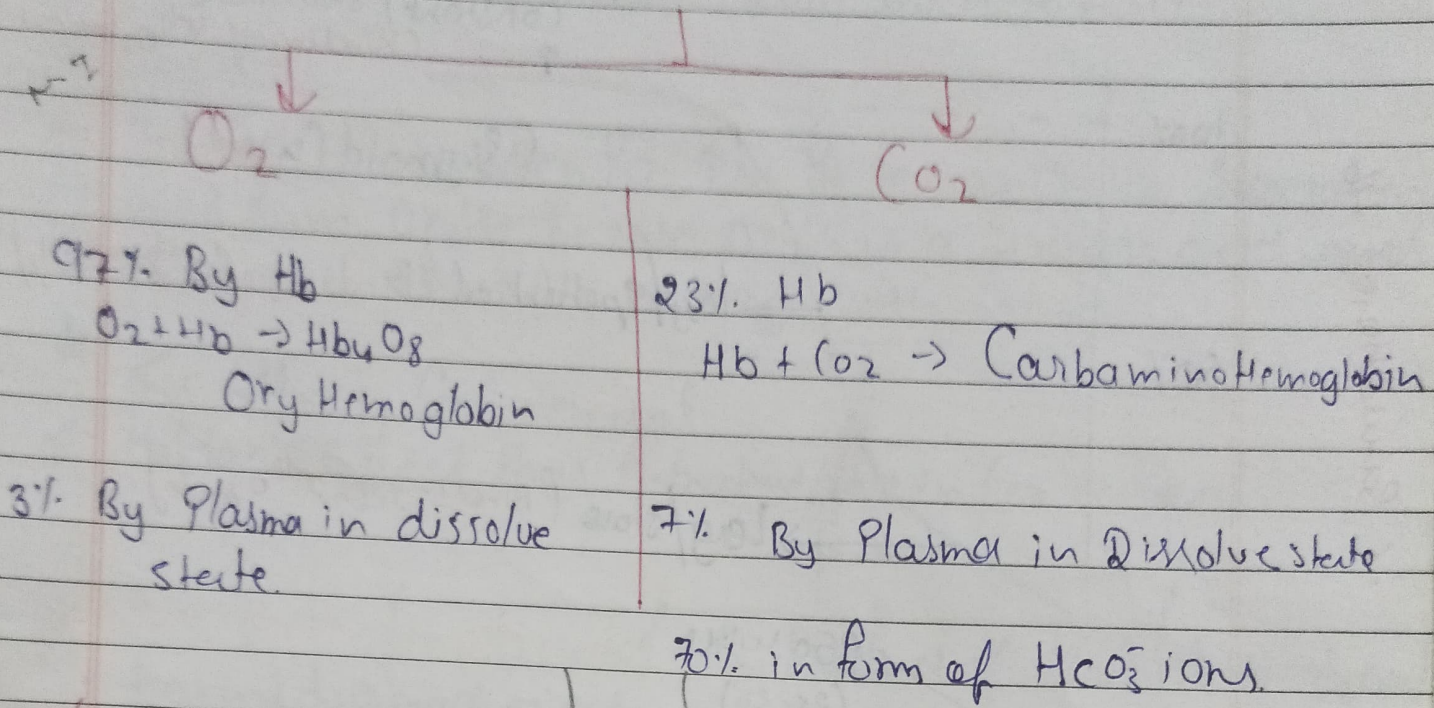


* Factors Involve

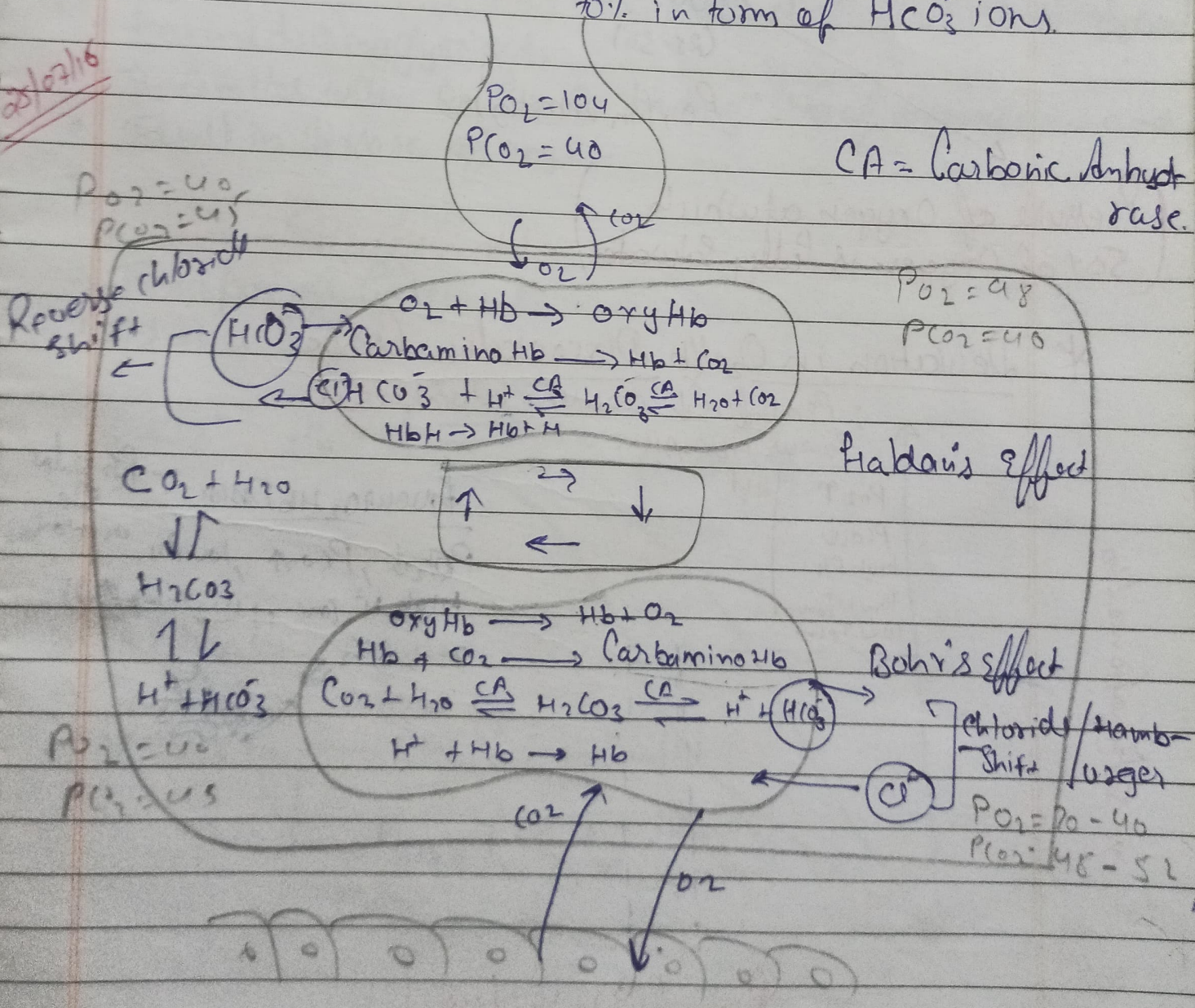
- Thickness of membrane.
- Solubility of gas
- pressure of gas
- * Does not Depend on Reactivity of gases.

Page No. Table of Press & Pressure.

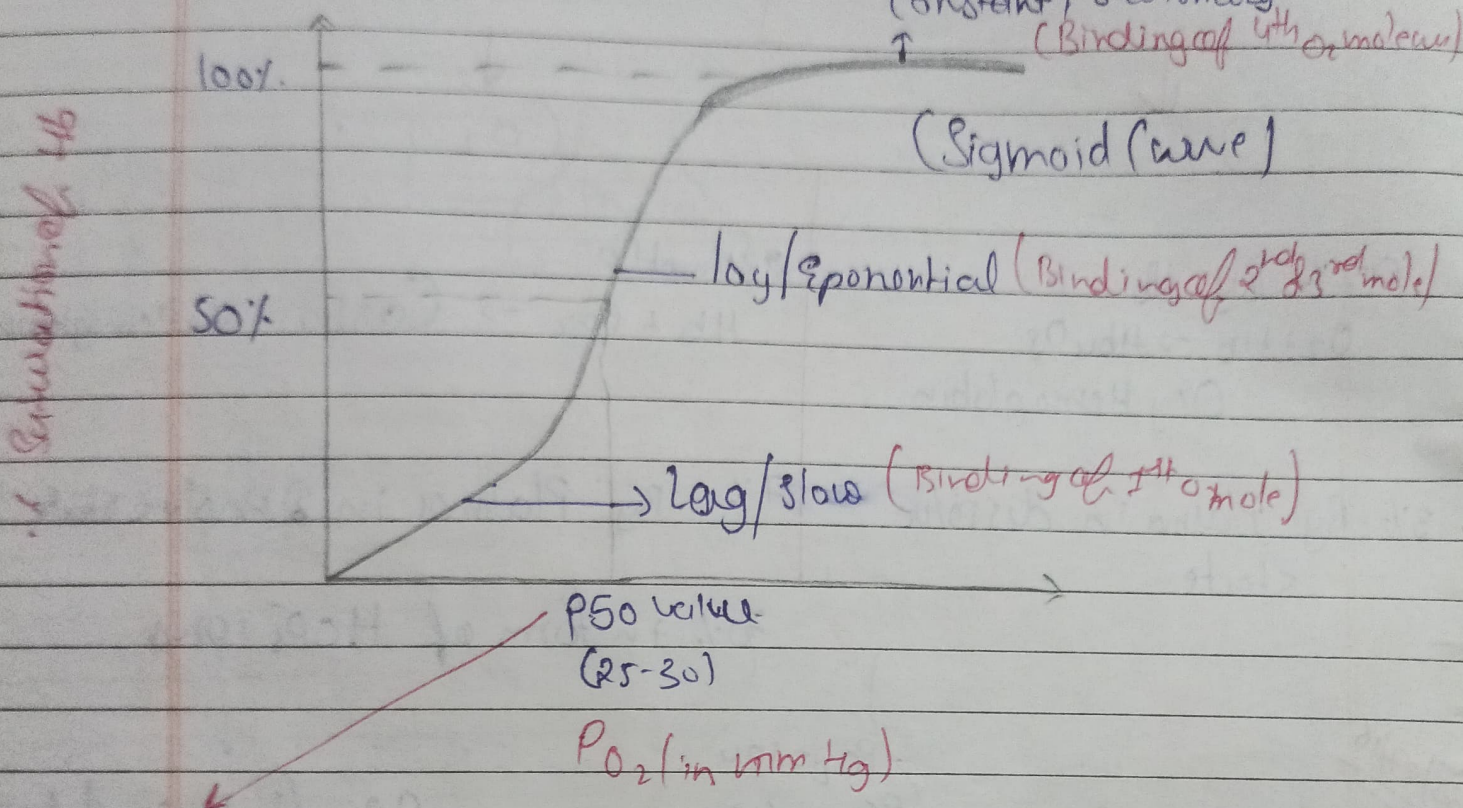
* Transport of Gases



asthmalic



* O₂-Hb Association-Dissociation Curve

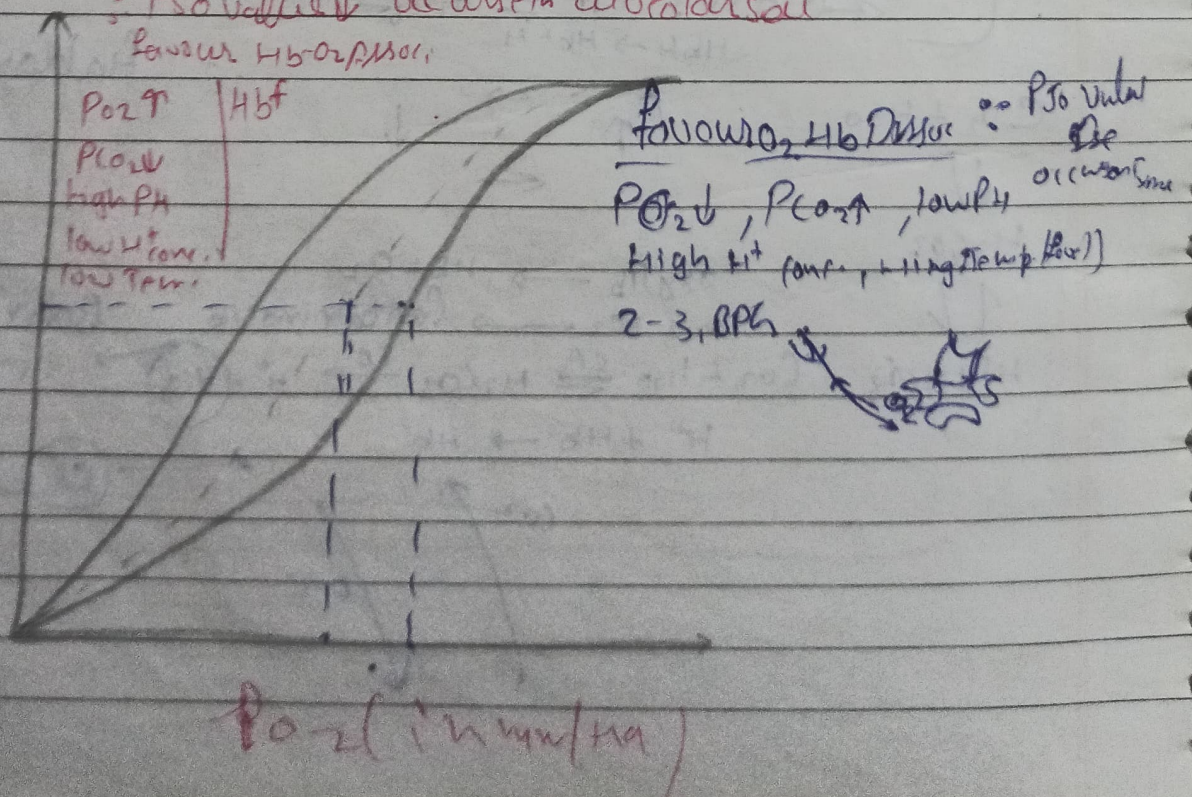


(Pressure of Oxygen at which Sat of Oxygen is fully saturated)

* Deviation in O₂-Hb Dissociation Curve

: P₅₀ value ↓ occurs in alkalosis
favour Hb-O₂ dissociation

2. Subnormal



* **Bohr's Effect**: Bohr's stated when P_{O_2} rises OxygentHb Dissociation Curve takes R.H.S(1)

* **Haldan's Effect**: When P_{O_2} ↑se. It favours O₂ Hb Association and form OxyHb because OxyHb is a stronger acid and does not allow Hb to bind with CO₂.

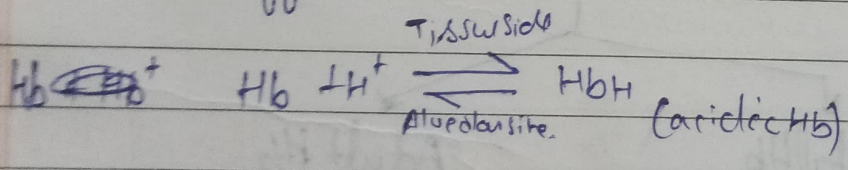
This allows CO₂ removal

Haldan's Effect plays important role in CO₂ removal.

* **2-3 BisPhosphoglycerate** (BPG) • By-product of P_{1A} (Phosphoglycerate)
 • Formed during glycolysis.
 • It competes with O₂ for O₂ binding sites of Hemoglobin, and
 • Result in Dissoc. of oxyHb.

Function of Hb Haemoglobin

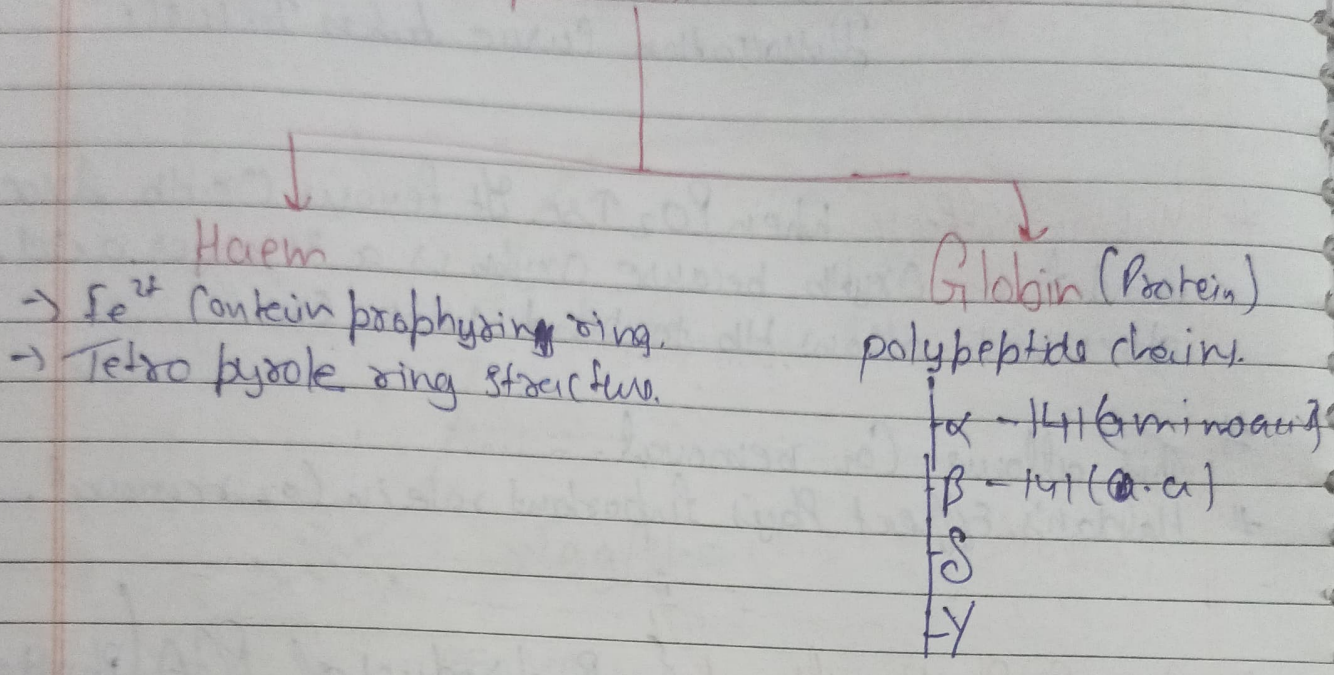
- Transport of Gases.
- Act as a Buffer.



Haemoglobin (Hb)

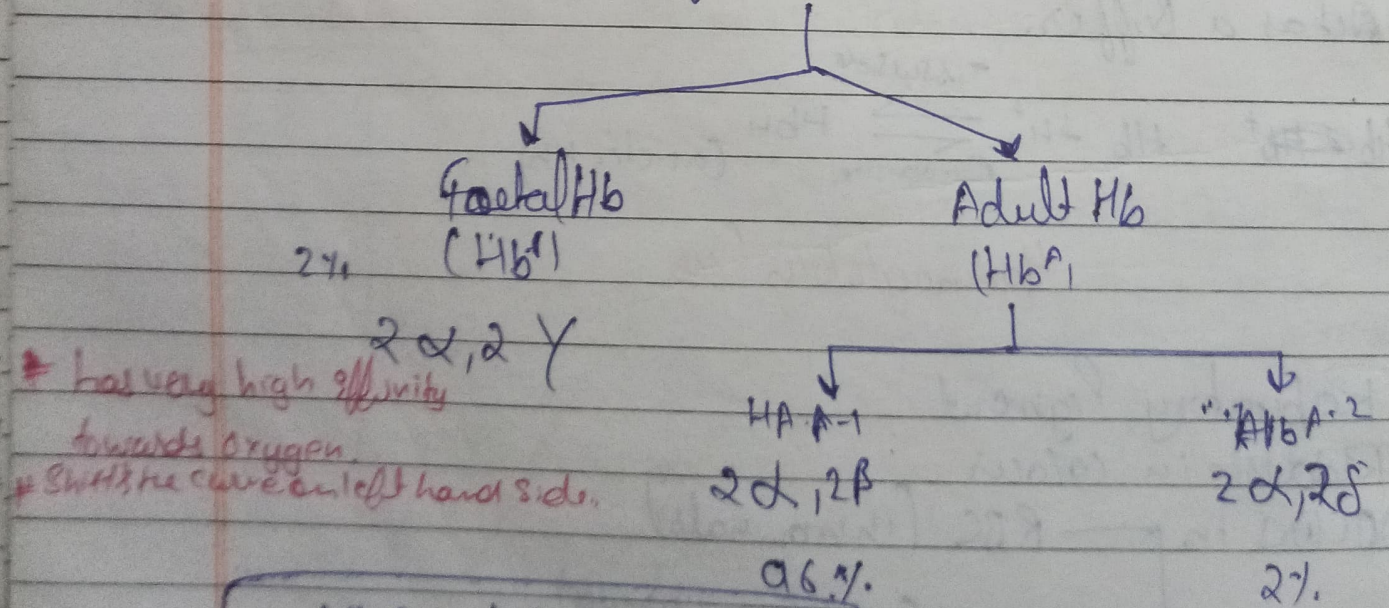
- Respiratory Pigment
- Reddish in colour
- Occurs in
 - RBC (in mammals)
 - Plasma (in invertebrates) (eg - Earthworm)

Structure - 2 Components.



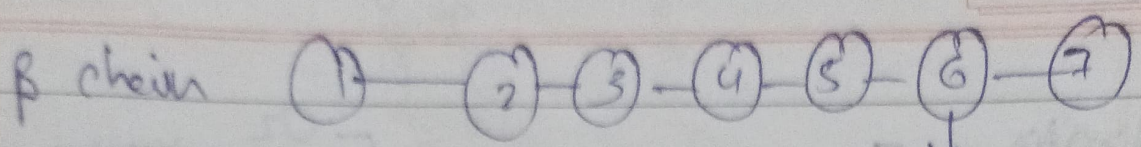
1g of Hb Carries \rightarrow 1.34 ml of O_2
 15g ' ' ' ' \rightarrow 20ml $1.34 \times 15 = 20$ ml of O_2

Types of Haemoglobin (Hb)



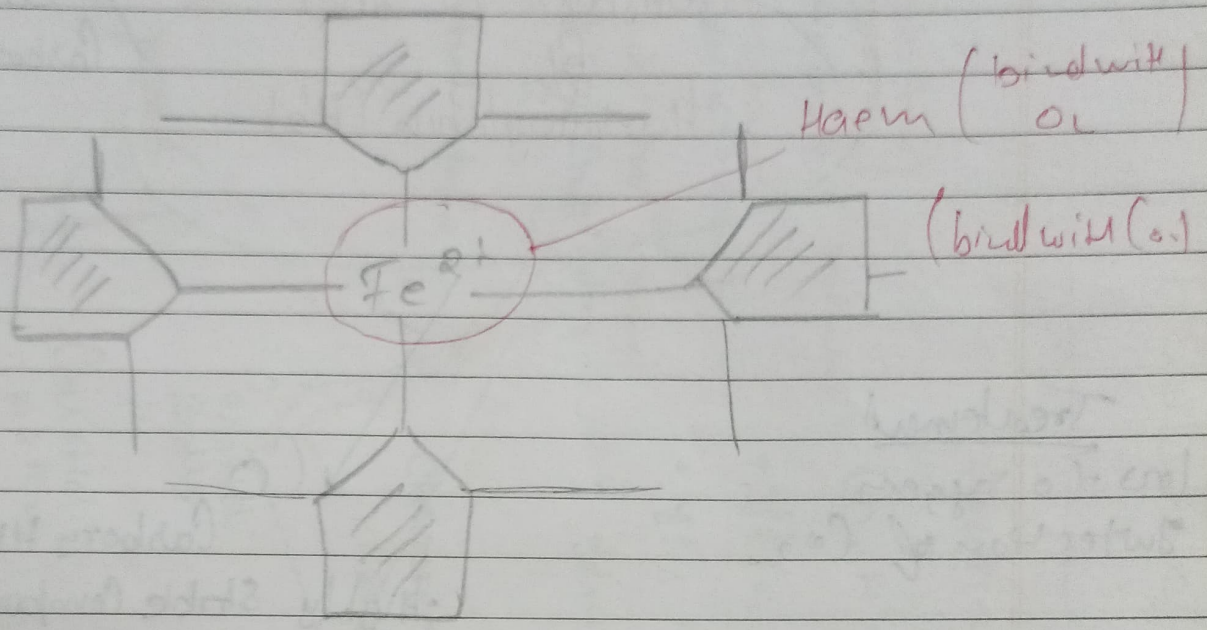
* Has very high affinity towards oxygen.
 * Shifts the curve on left hand side.

HbF : HbA-2 - HbA-1
 2 : 2 : 96



Glycemic acid

(Replaced with Valine Cause Sickle Cell Anaemia)



1 Haem carries = 1 O_2 molecules
4 / / / / = 4 O_2 molecules

\Rightarrow Sickle cell anaemia

- \rightarrow Autosomal Recessive Disorder
- \rightarrow GAG change to GUG in β -chain on the 6th position.
(Glycemic acid) (Valine)
- \rightarrow It results in Sickle shaped RBCs.
- 1) Blockage in capillaries
- 2) Surface Area \downarrow use.
- 3) Transport \downarrow use
- # Such people do not suffer from malaria

Nitrate
 • through drinking water
 • $Hb + NO_2^-$
 ↓
 Methemoglobin
 $Fe^{2+} \rightarrow Fe^{3+}$

O_2
 Oxy Hemo-
 erythrinoglobin
 [Hb O_2]

Transport of Gases
 by
 Haemoglobin (Hb)

CO_2
 Carbamino Hb

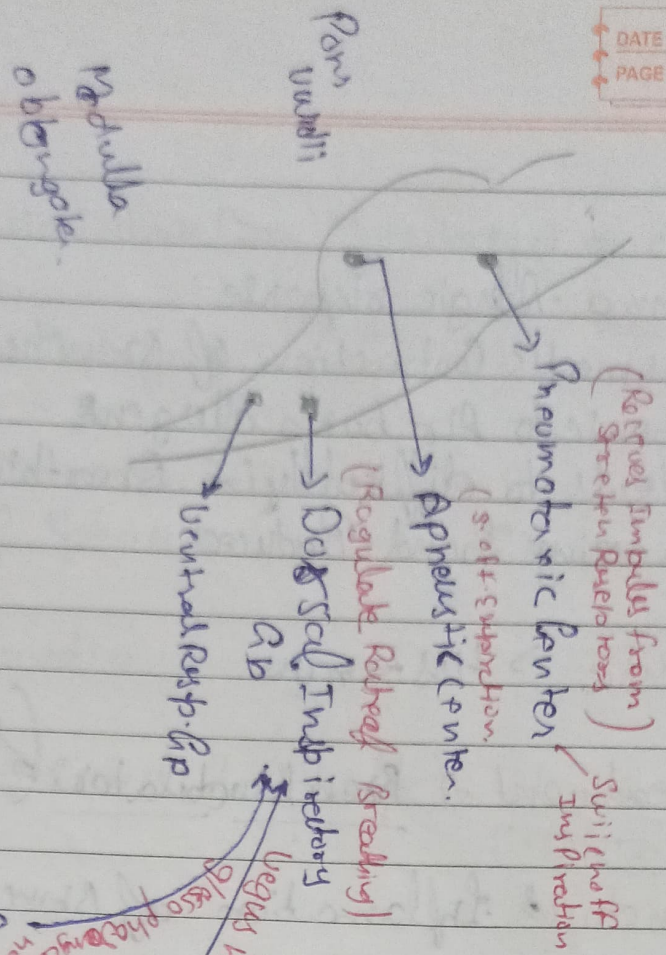
Treatment
 low O_2 xygen
 Injection of CO_2

CO
 Carboxy Hb

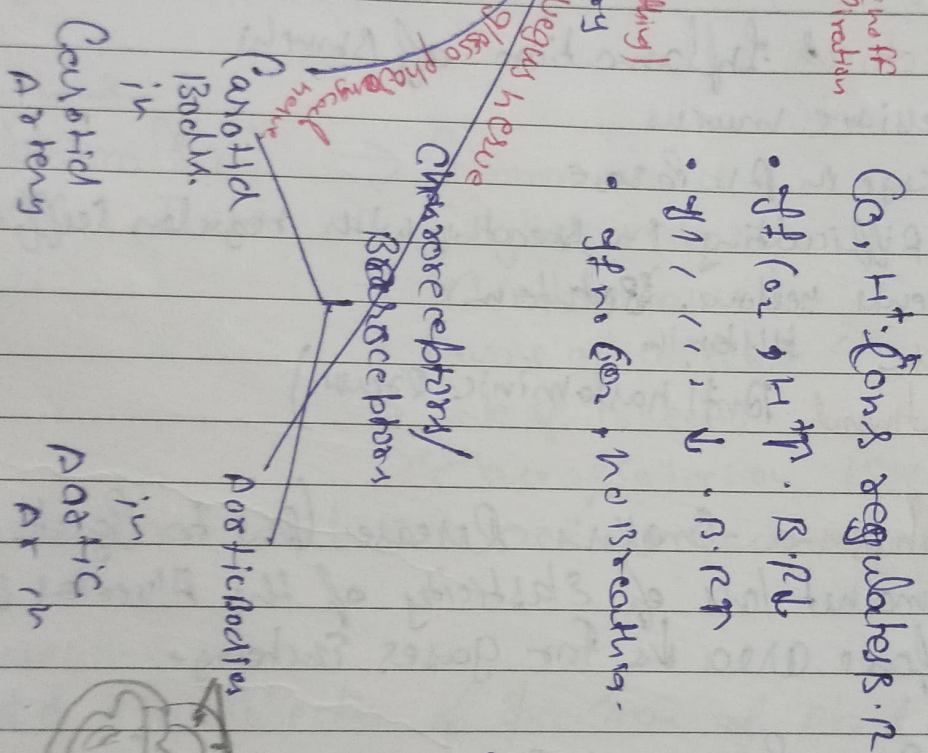
- Highly Stable Compound
- Prevents O_2 -Hb
- leads to hypoxic CO_2
- Result in Death
- > 0.1% CO_2 is sufficient to

Regulation of Breathing

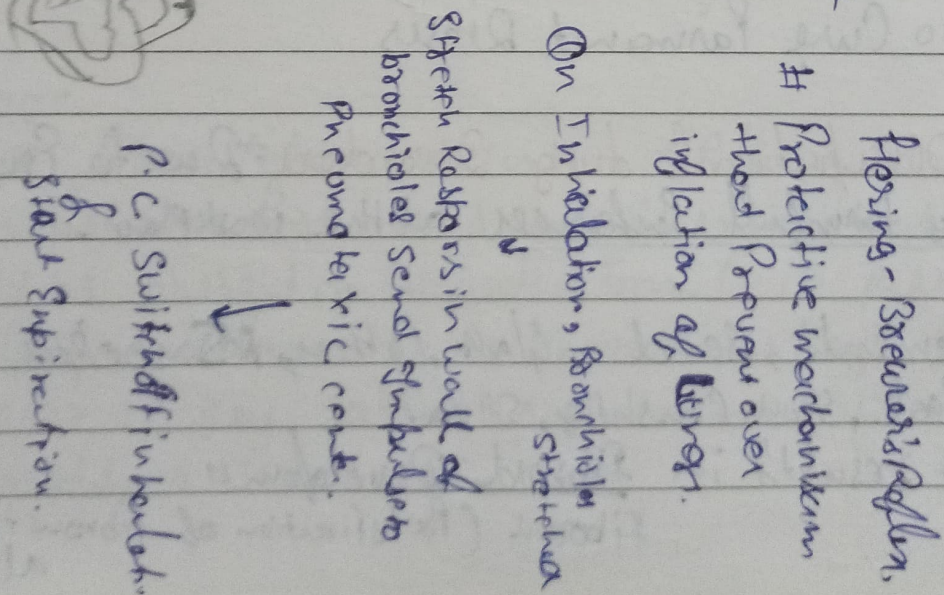
Nervous



Chemical



Mechanical



(Terminal Bronchioles)
↑

1.) Asthma - Allergic response

- Sudden \rightarrow Spasmodic Contraction of Bronches & Bronchioles in response to Air-borne allergens.
- It leads to difficulty in Breathing Specially Exhalation.
- Wheezing Sound Produced.

• Cause \rightarrow Histamine

• Treatment \rightarrow Bronchodilators (Anti histamin) Steroids (asthacort)

2.) Bronchitis - Inflammation of Bronchi

- Excessive mucus
- Blockage in Air Passes
- ~~It~~ Difficulty in Breathing with regular Coughing of Greenish yellow. (Sputum)

Cause \rightarrow Histamine

Treatment Anti histaminic Drugs.

3.) Emphysema - Smoker's Disease. (Du to Cigarette Smoking)

- Permanent loss of Elasticity of the Alveolar walls. Surface area \downarrow s for gases Exchange.

∇ No Cure Permanent Disease.

4.) Occupational Lung Disorders \Rightarrow Due to Exposure of Potentially harmful Substances at the workplace.

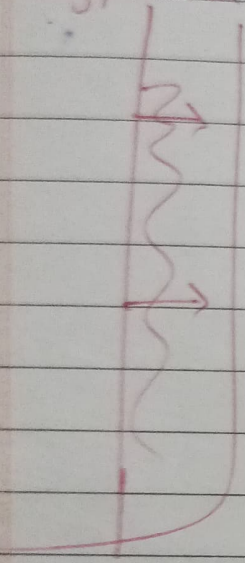
\rightarrow Cement, Sand, Glass, Cotton, Asbestos, Fire Cracker Coal, Stone Crushing, Silica.

It results in Fibroid Development Fibrosis. (Proliferation of fibrous tissue in alveoli)

Asbestos - Asbestosis
Silica - Silicosis

* Acc. to factory Act. Worker must wear mask while working

5) Hypoxia Shortage of Oxygen Supplies to the Tissue



↓
Hypoxic Hypoxia
due to PO₂
e.g. At high altitude

↓
Stagnant Hypoxia
due to low B.P / Blockage in Blood vessel.

↓
Cytotoxic / Histotoxic Hypoxia
due to toxic e.g. Cyanide Poisoning.

↓
Anaemic Hypoxia →
due to low BP & Low RBC

↓
Ischaemic Hypoxia
due to Blockage in blood vessel

6) Anoxia - no O₂ in air (to tissue)

7) Hyper Capnea - ^{High} CO₂ in Blood.

8) Hypocapnea - low CO₂ in ()

Terms:

- (1) Eupnea - Normal Breathing
- (2) Apnoea - " " "
- (3) Dyspnoea - Painful " " "
- (4) Orthopnoea - Difficulty in breathing in horizontal pos.

(a) Pneumonia (Streptococcus pneumoniae) (Bacteria)

- > chills, High fever.
- > Diplococcus

(b) Whooping Cough / Kali Khan / Pertussis
Bacteria Bordetella pertussis.