

RESPIRATION

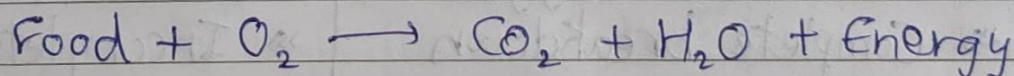
⇒ Process in which food taken through nutrients gets oxidized to release energy for performing various activities.

⇒ It is a bio-chemical oxidation of nutrients in the presence of specific enzymes at optimum temperature in the cells, to release energy for metabolic activities.

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<u>Catabolic</u> break down	<u>Anabolic</u> Build up
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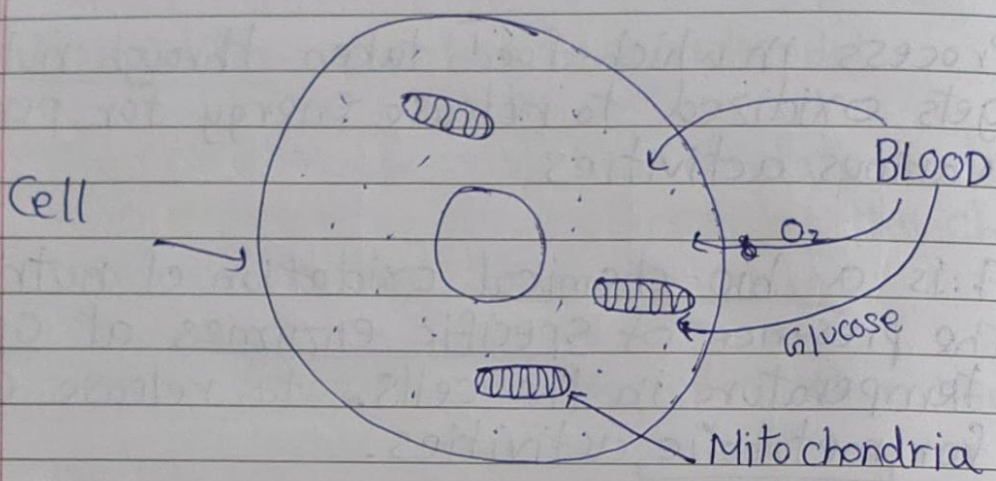
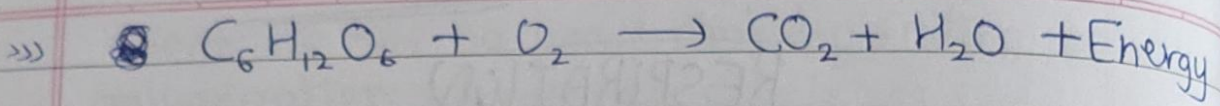
⇒ It is a catabolic process



⇒ Organic molecules (glucose), during break down, get converted into energy.

⇒ Breakdown of glucose [6 carbon molecules] $\xrightarrow[\text{process of b/d of glucose}]{\text{glycolysis}}$ Pyruvate [3 carbon molecules]

↓
Takes place in cytoplasm of the cell.



Types of Respiration

Aerobic	Anaerobic
<ul style="list-style-type: none"> »»» Presence of oxygen »»» Complete breakdown of glucose »»» Takes place in mitochondria »»» Large amount of energy generated »»» Products are carbon dioxide and water 	<ul style="list-style-type: none"> »»» Absence / Lack of oxygen »»» Incomplete breakdown of glucose »»» Takes place in yeast / muscle cells. »»» Less energy generated. »»» Products are ethanol and carbon dioxide / lactic acid.

Glucose [6C]

glycolysis
In cytoplasm

Pyruvate (3C)

Anaerobic
incomplete b/d
of glucose

Absence of O_2
In Yeast

Anaerobic
Alcohol Fermentation

Ethanol + CO_2 + Energy [2 ATP]
~~[38 ATP]~~

Lack of O_2
In muscle cells

Anaerobic

Lactic acid + Energy [2 ATP]

Anaerobic
Lactic acid
Formation

Presence of O_2
In mitochondria

Aerobic

CO_2 + H_2O + Energy [38 ATP]
(aerobic)

Aerobic
Complete b/d
of glucose

PATHWAYS OF RESPIRATION

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Pathways of Respiration

Anaerobic Respiration

(i) Alcohol Fermentation:

»» Incomplete bld of glucose

↓ into

Ethanol, CO_2 , and Energy

»» Occurs in Yeast → Baking / Brewing Industry
cakes, breads, wine, alcohol

»» Less energy production

»» 2 ATP

(ii) Lactic Acid Formation:

»» Incomplete bld of glucose

↓ into

Lactic acid, and Energy

»» Occurs in muscle cells

»» Less energy production

»» 2 ATP

»» In muscles, when there is temporary lack of enough oxygen, then during physical exercise, the glucose metabolises to form lactic acid, causing fatigue / cramps.

Aerobic Respiration

(i) In mitochondria -

»» Complete bld of glucose
 ↓ into
 CO_2 , H_2O , and Energy

»» High energy production

»» 38 ATP

»» ATP - Adenosine tri phosphate
 (energy currency of the cells)

This energy produced is used as a fuel for endothermic reactions at cellular levels.

i.e. - Contraction of muscles,
 conduction of nerve impulses,
 protein synthesis, etc.

Q What is the common step between aerobic and anaerobic respiration?

»» Glycolysis - breakdown of glucose

Q Where does breakdown of pyruvate in the presence of oxygen?

»» In mitochondria

Stages of Respiration

(i) External Respiration:

(a) Breathing $\left\{ \begin{array}{l} \text{Inhalation [taking in } \text{O}_2\text{]} \\ \text{Exhalation [releasing } \text{O}_2\text{]} \end{array} \right.$

»» Starts from external nostrils till the terminal bronchioles.

(b) Gaseous exchange
 ↳ Takes place between blood and alveoli
 [Diffusion]

(ii) Internal Respiration:

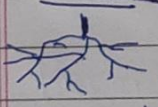
↳ Gaseous exchange between Arterial Blood and body cells.

Respiration in Plants

- ↳ Plants do not have any special organs for this.
- ↳ Roots, stems, leaves are involved in respiration
- ↳ Respiration is rapid in Meristematic tissues
 (growing tissues)
 as compared to Permanent tissues
 (mature)

* Gaseous exchange in:

A] Roots - Takes place through diffusion of O_2 from the air present b/w soil particles
 O_2 diffuses and passes through root hair and CO_2 moves out.



B] Stem Diffusion of O_2

<u>herbs</u>	<u>woody plants</u>	
Through stomata on the stem	Through small pores in the stem called <u>LENTICLES</u>	<u>Lenticles</u> [tiny openings in the bark], [found in old roots and stems]

c) Leaves - Diffusion of O_2 through stomata [pores present on the epidermis of the leaf]

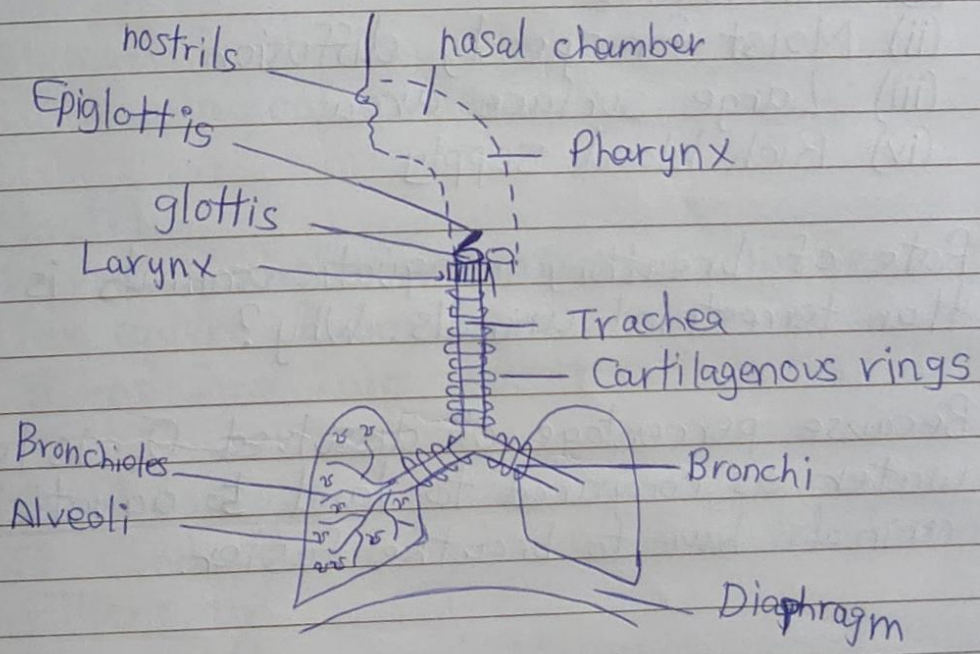


The direction of diffusion mainly depends on the environmental conditions and requirement of the plants

→ During day time
 photosynthesis occurs
 CO_2 ↑ used up ↓ O_2 released

→ During night time
 No photosynthesis occurs
 ↓ Only CO_2 is eliminated

Respiration in Animals



Human Respiratory System

Animals

Respiratory organ

Amoeba	Cell surface				
Planaria	Cell surface				
Earthworms	Moist skin				
Fish / Tadpole	Gills				
Grasshopper / Cockroach	Spiracles, tracheal tubes				
Frog	<table border="1"> <tr> <td>In water</td> <td>Skin</td> </tr> <tr> <td>On land</td> <td>Lungs</td> </tr> </table>	In water	Skin	On land	Lungs
In water	Skin				
On land	Lungs				

Terrestrial animals

Lungs

- ⇒ For efficient gaseous exchange the respiratory surface should be :
- (i) Thin walled
 - (ii) Moist for speedy diffusion
 - (iii) Large surface area
 - (iv) Rich blood supply

Q Rate of breathing in aquatic animals is faster than terrestrial animals. Why?

⇒ Because percentage of dissolved O_2 is less in water as compared to land ~~to~~ aquatic animals have to breathe faster.

Difference between Breathing and Respiration

Breathing	Respiration
A mechanism in which	A complete process which

organisms obtain O_2 from the environment and release CO_2

consists of transport of gases and oxidation of food material.

Physical process

Bio-chemical process

No enzymes required

Several enzymes involved

Utilizes energy

Utilizes and releases energy

Only certain organs take part in breathing and is extra-cellular phenomena

It is cellular respiration and both extra and intra cellular phenomena

Human Respiratory System Chronological order

1. Nostrils

- ⇒ Pair of nostrils for gaseous exchange
- ⇒ Air enters from here
- ⇒ It has fine hair and mucus to trap dust, dirt

2. Nasal passage

- ⇒ It conducts air from nostrils to pharynx
- ⇒ Filters air
- ⇒ Warms the air [Thermoregulation]
- ⇒ Humidifies the air [add moisture]

3. Pharynx

- ⇒ Common opening for digestion and respiration
- ⇒ It passes the air to the larynx through the opening -

"glottis"

→ While swallowing, glottis gets covered by cartilagenous aperture - "Epiglottis"

4. Larynx

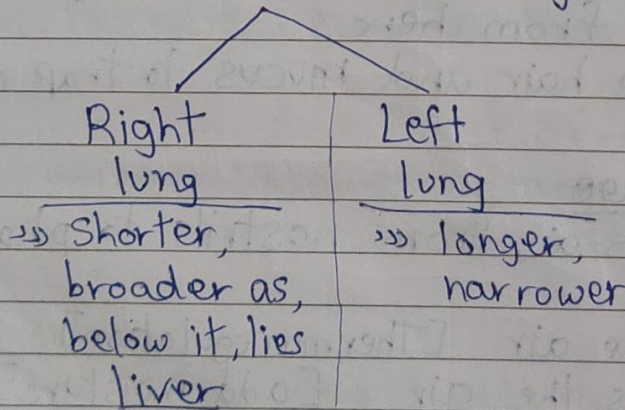
- Located in neck
- also known as Voice box
- Contains vocal chords
- Sound is produced here due to vibrations

5. Trachea (wind pipe)

- has incomplete C-shaped cartilagenous rings.
- Behind trachea is oesophagus
- C-shaped rings keep the trachea open, allowing passage of air to the lungs and also protects it from collapsing

6. Lungs

- Pinkish, soft, spongy [gets darker as we get old]
- Primary respiratory organs



→ Lungs are placed in the rib cage in the thoracic cavity.

As lungs are not muscular at all, so that is why they need the help of inter-costal muscles, ribs, and diaphragm for expansion and contraction.

7. Bronchi

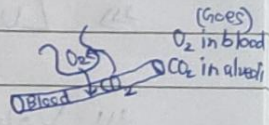
Trachea divides into two smaller tubes on entering the thoracic cavity which enters into the lungs. [These tubes are bronchi].

8. Bronchioles

Bronchi are sub-divided into bronchioles. Each bronchiole finally terminates into Alveoli.

9. Alveoli

150 million alveoli in each lung
Balloon-like structures located inside the lungs.
Increase the surface area for exchange of gases.



10. Ribs

12 pair of ribs
Protects heart and lungs
Intercostal muscles are attached to the ribs and helps in breathing.
These ribs are joined at sternum.

11. Diaphragm

Muscular partition between thoracic and abdominal cavity.
During inhalation, it flattens and increases the chest ~~area~~ cavity.
• Thereby increasing the volume.
• Thus, creating low pressure

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Mechanism of Breathing

Inhalation

⇒ Diaphragm gets flattened.

⇒ Ribs move outward and forward.

~~⇒ Volume of the lungs~~

⇒ Lungs inflate

⇒ Volume of lungs increases

⇒ Pressure (of lungs) decreases

$$\left[\because P \propto \frac{1}{V} \right]$$

⇒ Movement of oxygenated air from outside (higher concentration) to inside the lungs (lower concentration)
[Outside $\xrightarrow{O_2}$ Inside]

Exhalation

⇒ Diaphragm gets back to normal.

⇒ Ribs move inward and backward.

⇒ Lungs deflate

⇒ Volume of lungs decreases

⇒ Pressure of lungs increases

$$\left[\because P \propto \frac{1}{V} \right]$$

⇒ Movement of deoxygenated air from inside the lungs (higher concentration) to outside (lower concentration).
[Inside $\xrightarrow{CO_2}$ Outside]