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## Respiration in Plants

### Notes

All living organisms require energy to perform life activities such as growth, repair, transport, absorption, synthesis of substances, and cell division.

Plants obtain this energy by the breakdown of food (mainly glucose) during the process of respiration.

Respiration takes place in all living cells of plants, both day and night.

### Respiration:

Respiration is a catabolic process in which glucose is oxidised inside living cells to release energy, with carbon dioxide and water as by-products.

Overall Equation of Aerobic Respiration:-  
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy (ATP + heat)}$$

### Characteristics of Respiration:-

- Breakdown of glucose occurs in a series of enzyme-controlled steps.
- Each step is controlled by a specific enzyme.
- Energy is released gradually and stored mainly as ATP.
- Respiration is a continuous process.

ATP - Energy currency of the cell :-  
ATP (Adenosine triphosphate) is the immediate source of energy for all cellular activities. When ATP breaks into ADP, energy is released.  
ADP is ~~to~~ reconverted into ATP when energy is available.

Stages of Respiration :-  
Respiration occurs in 2-main stages :-

- (A) Glycolysis
- Occurs in the cytoplasm.
  - Does not require oxygen.
  - One glucose molecule is converted into 2 molecules of pyruvic acid.
  - ~~Small~~ Small amount of energy is released.
- Energy yield: 2 ATP
- Glycolysis is common to both aerobic and anaerobic respiration.

- (B) Krebs Cycle (Citric Acid Cycle)
- Occurs in the mitochondria.
  - Takes place only in aerobic respiration.
  - Pyruvic acid is completely oxidised.
  - Produces carbon dioxide, water, and a large amount of ATP.
- Total energy from one glucose molecule: ~~38~~ 38 ATP.
- The Krebs cycle is responsible for maximum energy release.

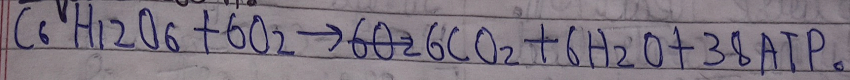
Type  
(A) Aerobic  
• Occurs  
• Comp  
• End  
• Ener  
Equ  
C<sub>6</sub>H  
  
(B) Anaerobic  
• Occ  
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### Types of Respiration :-

#### (A) Aerobic Respiration :-

- Occurs in the (presence of oxygen).
- Complete breakdown of glucose.
- End products: Carbon dioxide and water.
- Energy released: 38 ATP.

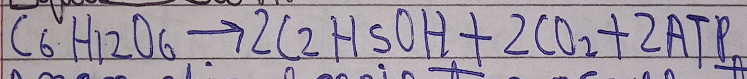
Equation:



#### (B) Anaerobic Respiration :-

- Occurs in the (absence of oxygen).
- Incomplete breakdown of glucose.
- End products # in plants: ethyl alcohol and carbon dioxide.
- Energy released: 2 ATP.

Equation:



Anaerobic respiration occurs temporarily in germinating seeds, fruits, and in certain microorganisms.

### Difference between Aerobic and Anaerobic Respiration

Aerobic Respiration	Anaerobic Respiration
• Oxygen required.	• Oxygen not required.
• Complete oxidation.	• Incomplete oxidation.
• $CO_2$ and $H_2O$ formed.	• Alcohol and $CO_2$ formed.
• 38 ATP released.	• 2 ATP released.
• Occurs normally.	• Occurs temporarily.

## Difference between Respiration and Burning

Respiration	Burning
<ul style="list-style-type: none"> <li>Cellular process.</li> <li>Occurs at body temperature.</li> <li>Stepwise reaction.</li> <li>Enzyme-controlled</li> <li>Energy stored as ATP.</li> </ul>	<ul style="list-style-type: none"> <li>Non-cellular process.</li> <li>Occurs at high temperature.</li> <li>Single step.</li> <li>Heat-controlled</li> <li>Energy lost as heat and light</li> </ul>

### Entire Plant Respires

All parts of a plant respire:

- Leaves.
- Stem.
- Roots.
- Seeds.

### Entry of Oxygen:-

- Through stomata in leaves.
- Through lenticels in stem.
- Through general surface of roots.

## Experiment on Respiration in Plants

Experiment 1: To show that oxygen is used during respiration.  
Aim: To show that oxygen is used during respiration.

~~Control. Seed time time is keep to absorb carbon dioxide. The flasks are sealed and connected to water.~~

~~Observation. The water level rises in the flask with germinating seeds.~~

~~Conclusion. Oxygen is used during respiration.~~

### Experiment on Respiration in Plants

#### Experiment 1: ~~1~~

Aim: To show that oxygen is used during respiration.

Procedure: Germinating seeds are kept in one flask and boiled seeds in another see as control. Soda lime absorbs carbon dioxide.

Observation: Water level rises in the flask with germinating seeds.

Conclusion: Oxygen is used during respiration.

#### Experiment 2:

Aim: To show that carbon dioxide is released during respiration.

Procedure: Gas from germinating seeds is passed into lime water.

Observation: Lime water turns milky.

Conclusion: Carbon dioxide is produced during respiration.

#### Experiment 3:

Aim: To prove that green plants respire.

Procedure: A green plant is kept in darkness and air is passed into limewater.  
 Observation: limewater turns milky.  
 Conclusion: Green plants release carbon dioxide during respiration.

Experiment 4:

Aim: To show that respiration releases heat.

Procedure: Germinating seeds are kept in a thermos flask with a thermometer.

Observation: Heat energy is released during it.

Conclusion: Temperature rises.

Conclusion: Heat energy is released during respiration.

Experiment 5:

Aim: To show respiration without oxygen.

Procedure: Seeds are kept under mercury to cut off oxygen.

Observation: Gas is produced.

Conclusion: Anaerobic respiration occurs.

Difference between Respiration and Photosynthesis

Photosynthesis	Respiration
• occurs in light	• occurs day and night
• uses CO <sub>2</sub>	• uses oxygen
• produces glucose	• breaks down glucose
• stores energy	• releases energy

- Respiration
- Plant
- Animal
- blood
- Anaerobic
- Plant
- Animal

\* Why Night  
 P No  
 Risk  
 bird  
 sleep  
 is  
 can

## Respiration in Plants vs Animals

- Plant respire ~~to~~ by diffusion.
- Animals have respiratory organs and blood transport.
- Anaerobic end product:  
Plants: ethyl alcohol.  
Animals: lactic acid.

\* Why one should Not Sleep Under a Tree at Night?

Not due to carbon dioxide.

Risk is due to insects, snakes, and bird droppings.

Sleeping under a tree in daytime is safe due to oxygen release and cooling.