

Respiration in plants

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Respiration

Respiration is a metabolic process that occurs in all organisms.

In this process, the energy (ATP-Adenosine triphosphate) is produced by the breakdown of glucose which is further used by cells to perform various functions.

Why respiration is needed in plants



Humans breathe, animals breathe, but do plants also breathe?

Plants like other animals also respire.

Plants also need energy. The plants get energy through the process of respiration in which glucose food breaks down in the presence of oxygen to form carbon dioxide and water with the release of energy.



Respiration

Three important characteristics of Respiration

Breakdown is done by Enzymes.

- 1
- 2
- 3

Breakdown of Glucose.

Involves Two steps

I. Glycolysis 2. Kreb's Cycle

Energy is liberated in the form of ATP. 38 molecules of ATP is produced.

Adenosine

Triphosphate

Steps in Respiration

Glycolysis



Takes place in Cytoplasm

Kreb's cycle

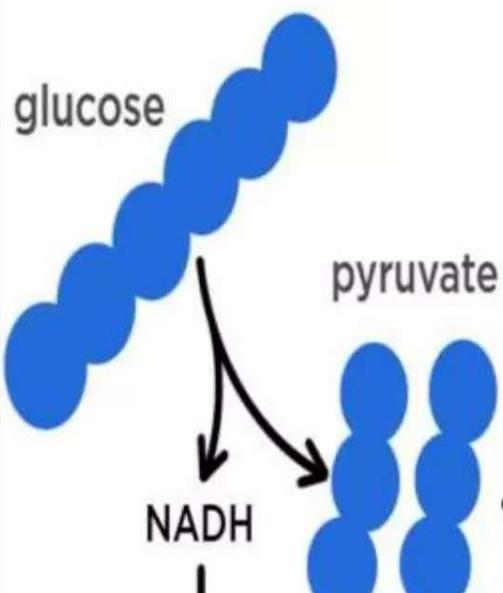


Takes place in mitochondria

What is Cellular Respiration?

Glycolysis

in cytoplasm

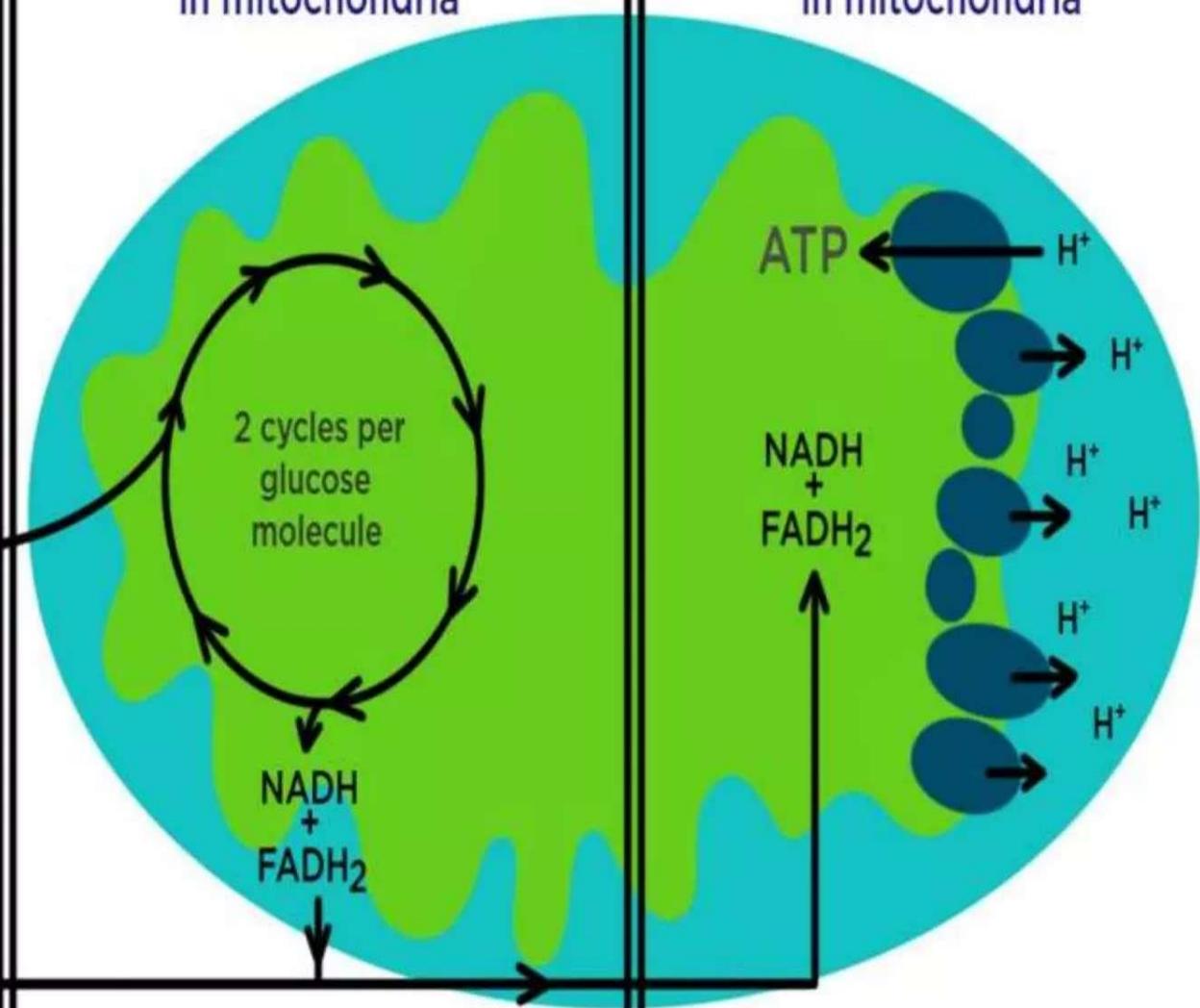


Krebs Cycle

in mitochondria

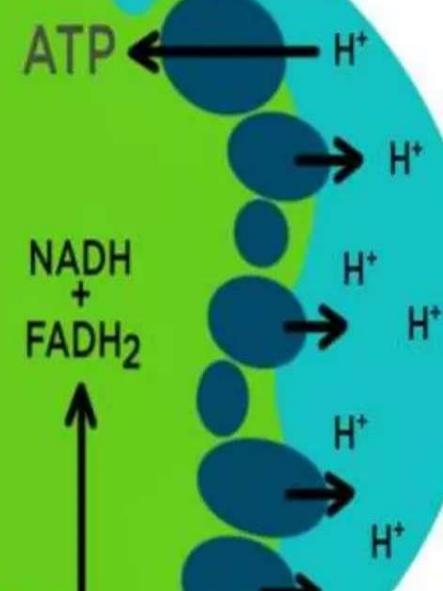
2 cycles per glucose molecule

NADH + FADH₂



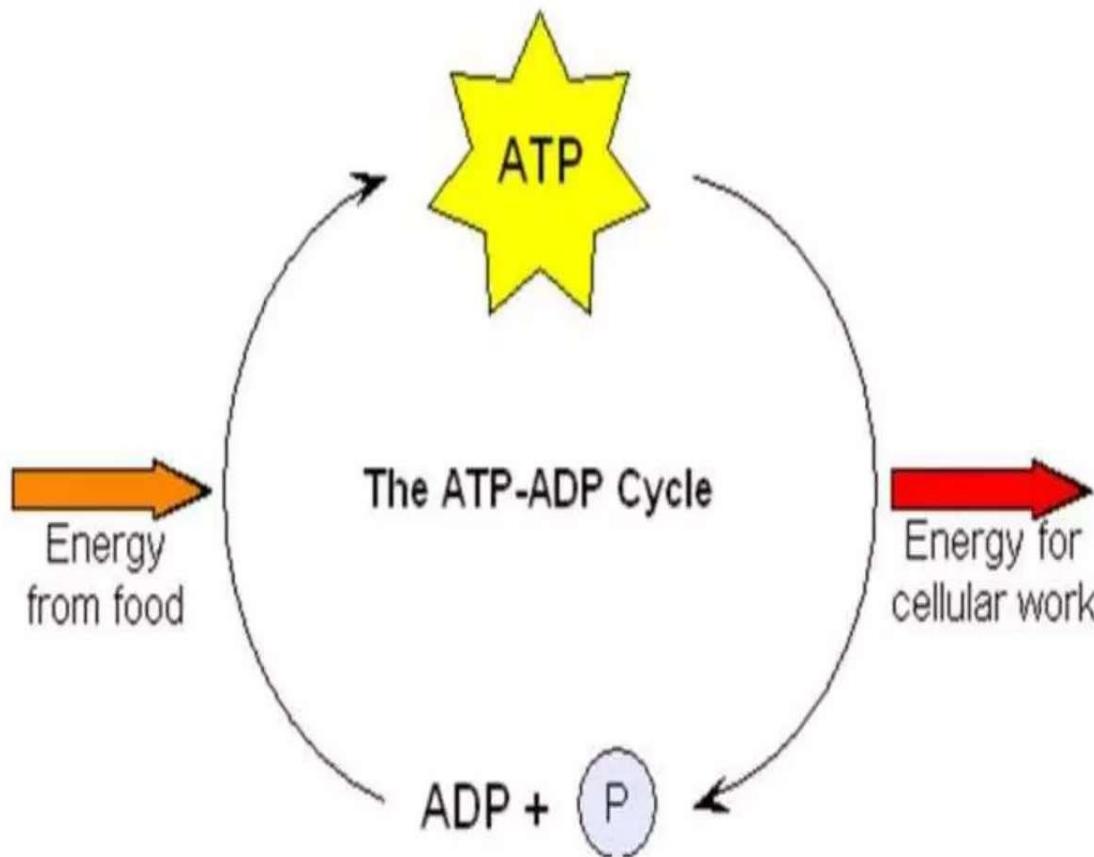
Electron Transport Chain

in mitochondria



Energy used in work

ATP ADP Cycle



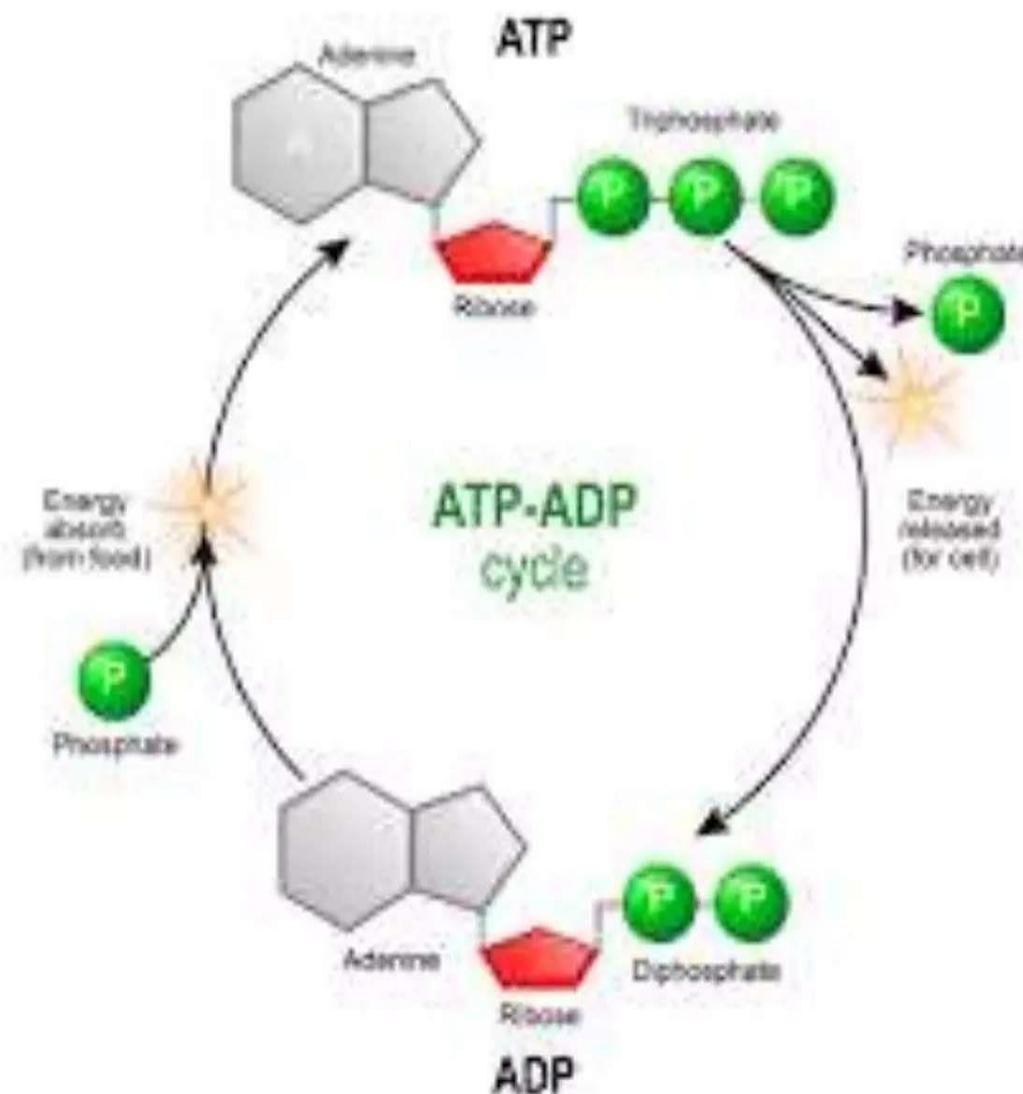
Energy currency of a cell

ATP – Adenosine triphosphate is called the energy currency of the cell.

It is the organic compound composed of the phosphate groups, adenine, and the sugar ribose. These molecules provide energy for various biochemical processes in the body. Therefore, it is called “Energy Currency of the Cell”. These ATP molecules are synthesized by Mitochondria, therefore it is called powerhouse of the cell.

The ATP molecule was discovered in the year 1929 by German chemist Karl Lohmann. Later in the year 1948, Scottish biochemist Alexander Todd was the first person to synthesized the ATP molecule.

Energy used in work



Two types of metabolic activities in living organisms

1. Anabolic
2. Catabolic

Anabolic process consumes energy.

It is called as constructive or biosynthetic process

Catabolism gives out energy for use by organisms

It is called as destructive or breaking down processes.

Respiration

Respiration is a breaking down process by which a living cell oxidises organic substances and releases CO₂, water and energy.

Respiration is a catabolic process of releasing energy from simple sugar glucose for carrying out life processes.

Respiration versus Burning

Respiration	Burning
Occurs in series of chemical steps.	Occurs in single step
Carried out by enzymes	Carried out by heat
Bio-chemical process	Physio-chemical process
Energy is liberated in the form of ATP and some heat	Energy is liberated in the form light and heat
No light energy is produced	Light energy is produced
Cellular process	Non-Cellular process
Occurs at body temperature	Occurs at high temperature

Which part of the cell respire

- All parts of a plant respire
- Leaves, stem and roots
- Deepest placed cell in any region will respire

How the oxygen enters

- Oxygen from the atmosphere enters through three inlets'
 1. Stomata in leaves
 2. Lenticels in stem
 3. General surface of the roots

Stomata in leaves

- During daytime due to photosynthesis oxygen is produced. Some of them will be used for respiration.
- Remaining will be diffused out.
- The carbon dioxide produced during respiration serves as a raw material for photosynthesis.
- At night time oxygen is obtained only from the atmosphere and carbon dioxide is given out.

Stomata in leaves



Sleeping under tree during night and daytime

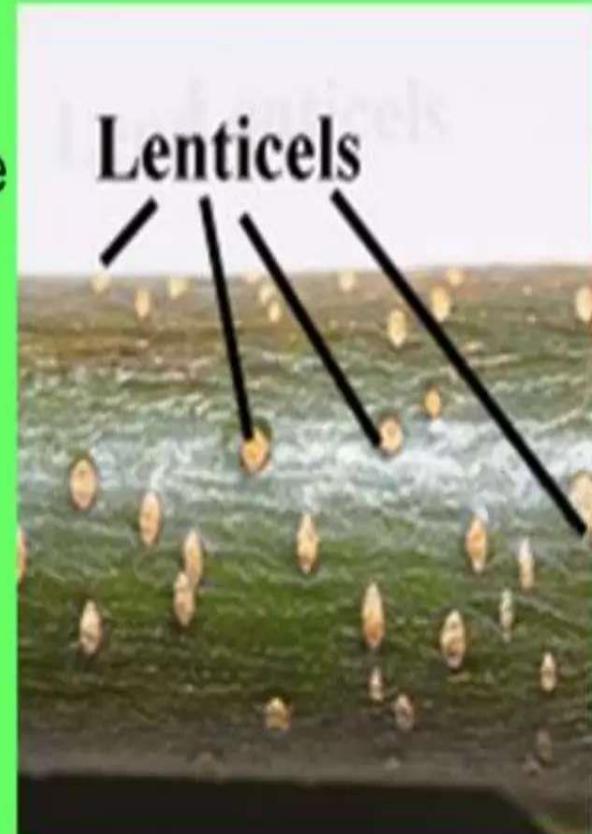
- Sleeping under a tree during hot mid day is definitely good
 1. Get oxygen due to photosynthesis
 2. Get coolness due to transpiration
- Sleeping under a tree at night



Lenticels in stem

Stem Anatomy

- Lenticels: spongy areas on the surface allow exchange of gases



General surface of the roots

- Ploughing of the soil creates tiny air spaces around the soil particles.
- This will provide oxygen for the roots.
- Sometimes due to some reason respiration of roots are affected.
 1. Water logging
 2. Compact soil

Kinds of Respiration

There are two kinds of Respiration

1. Aerobic respiration
2. Anaerobic respiration

Aerobic respiration

This type of respiration takes place only in the presence of oxygen.

Also called as **oxybiotic** respiration

Cellular respiration



**Aerobic
Respiration**

Anaerobic Respiration

- This kind of respiration takes place in the absence of oxygen.
- Sometimes certain part of the plant respire temporarily in the absence of oxygen.(fruit and seed)
- Glucose incompletely broken down to ethanol(Ethyl alcohol) and Carbon dioxide.
- Also called as **anoxybiotic** .
- Glucose--**cytoplasm**--→ Pyruvate----
mitochondria- -→Ethanol+CO₂+2ATP
- Yeast and Fungi respire anaerobically

Difference between aerobic and anaerobic respiration

Aerobic respiration	Anaerobic respiration
Proceeds in the presence of oxygen	Proceeds in the absence of oxygen
Complete breakdown of Glucose	Incomplete breakdown of Glucose
End products are carbon dioxide and water	End products are ethanol and carbon dioxide
38 molecule of ATP is liberated from one glucose molecule	2 molecule of ATP is liberated from one glucose molecule
Occurs normally throughout the life	Occurs temporarily.

Those who completed their homework



1. Chaitanya
2. Niriksha
3. Gamyा Vaishnavi
4. Khushi Sharma
5. Tanuja
6. Vindhya

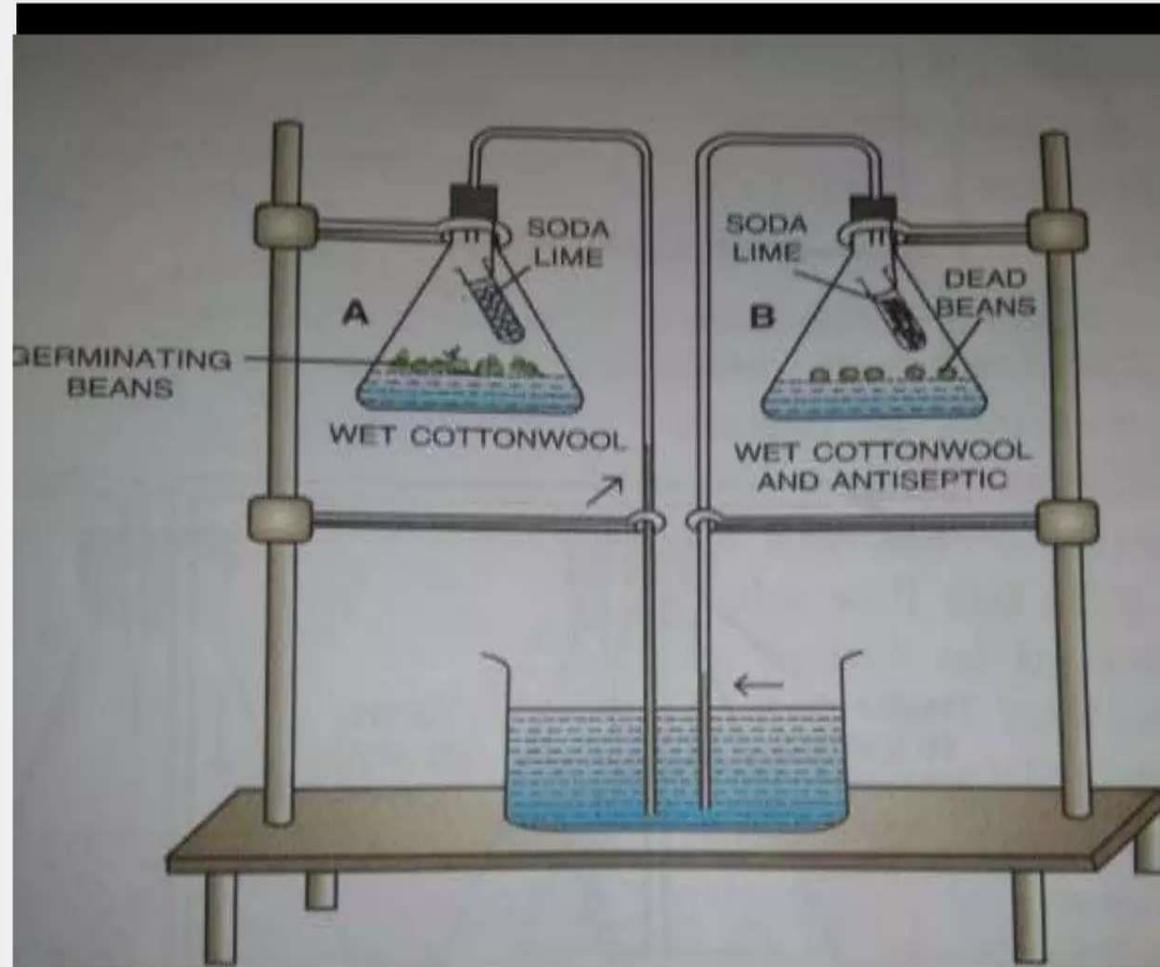
Experiments

- A proper experiment should contain two components.
- **Experimental set up**
- **Control set up**
- Both are identical in which every condition is the same except one.
- The set up in which the condition under study is missing is called **control set up.**

Experiment to show that utilization of oxygen in respiration

- Flask A contains germinating seeds
- Flask B contains dead (boiled seeds) with antiseptic to avoid bacterial decay.
- Wet cotton in both flasks provide water.
- A small tube containing soda lime is suspended in both the flasks.
- Soda lime is a mixture of sodium hydroxide and slaked lime (Calcium Hydroxide).
- Soda lime will absorb the carbon di oxide released after respiration.
- After a few days, you can notice the rise in water level in the delivery tube connected with flask A

Experiment to show that utilization of oxygen in respiration



Experiment to show that utilization of oxygen in respiration

- Remove the cork
- Introduce burning paper into each flask.
- The flame will -----immediately disappear-----
----- in flask A.
- The flame will -----continue for sometime-----
----- in flask B.
- This proves that oxygen was absent in flask A
- Volume of oxygen used up was indicated by
the rise of water level in the delivery tube.

Experiment to show that utilization of oxygen in respiration

Why is there a slight increase in the level of water in the delivery tube of flask A?



Experiment to show that utilization of oxygen in respiration

- The water rises in delivery tube due to the development of partial vacuum inside it .This happens because the carbon-dioxide released by the germinating seeds will be absorbed by soda lime present in the flask containing those seeds. This absorption of CO₂ will develop partial vacuum which sucks the water up and hence the water level rises.

Experiment to show that utilization of oxygen in respiration

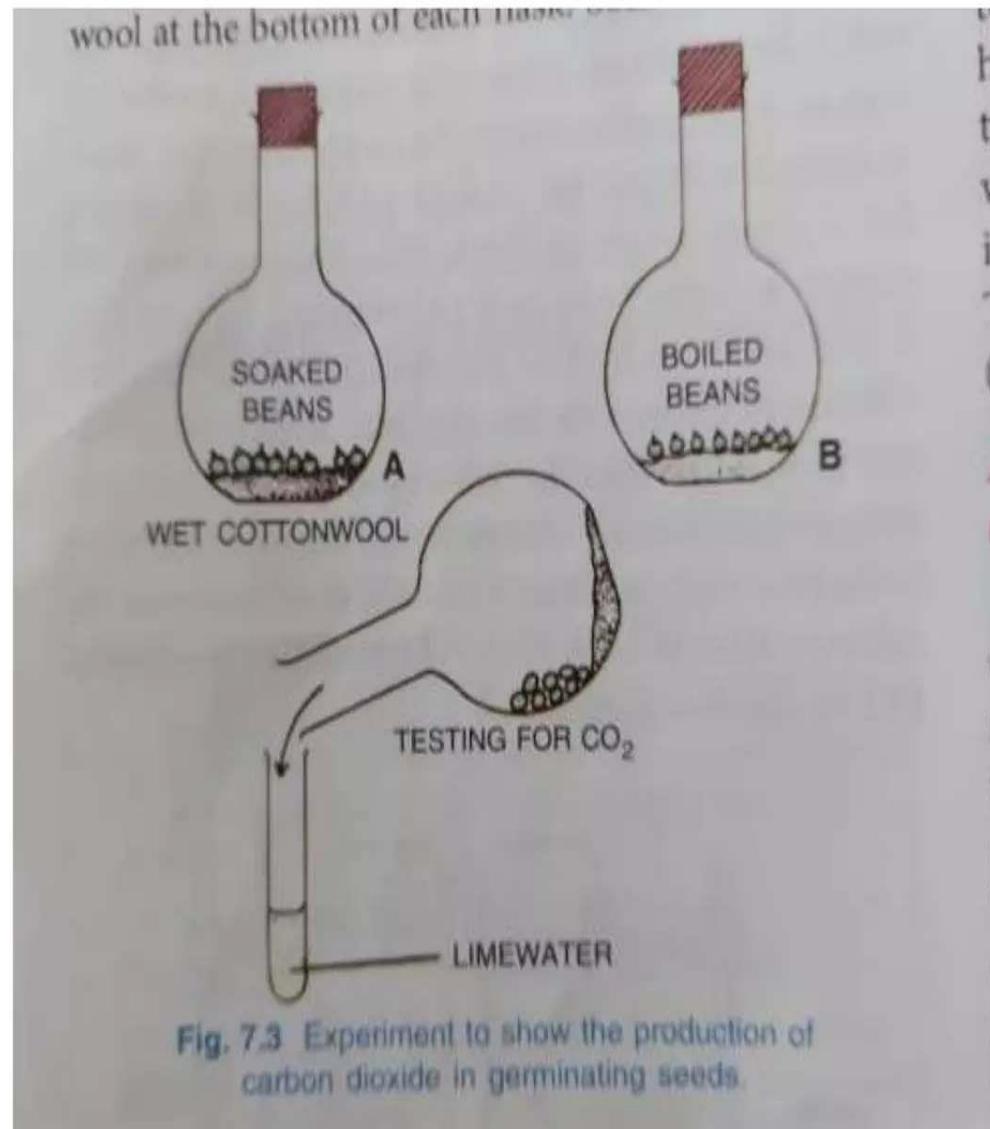
Which of the two flasks
acted as control?



Experiment to prove that carbon di oxide is produced during respiration in germinating seeds

- Flask A contain soaked pea or bean seed kept in wet cotton wool.
- Flask B contain boiled seeds with antiseptic(Carbolic acid) and also with wet cotton wool.
- Close the mouth of the flasks with Rubber cork.
- Keep it for few days.

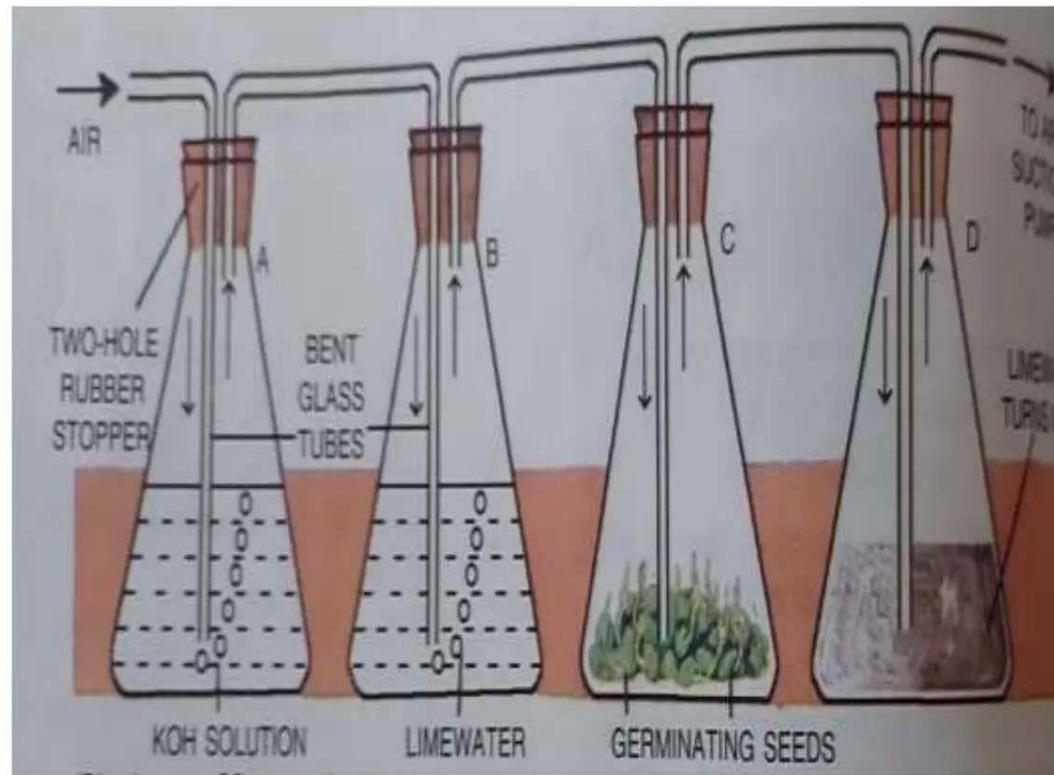
Experiment to prove that carbon di oxide is produced during respiration in germinating seeds



Experiment to prove that carbon di oxide is produced during respiration in germinating seeds

- In Flask A seeds are germinated.
- In Flask B seeds are not germinated.
- Test the gases present in two flasks by slightly tilting the flask over a test tube containing lime water.
- Flask A contains carbon di oxide and it turns lime water milky.
- Flask B does not turn limewater milky.

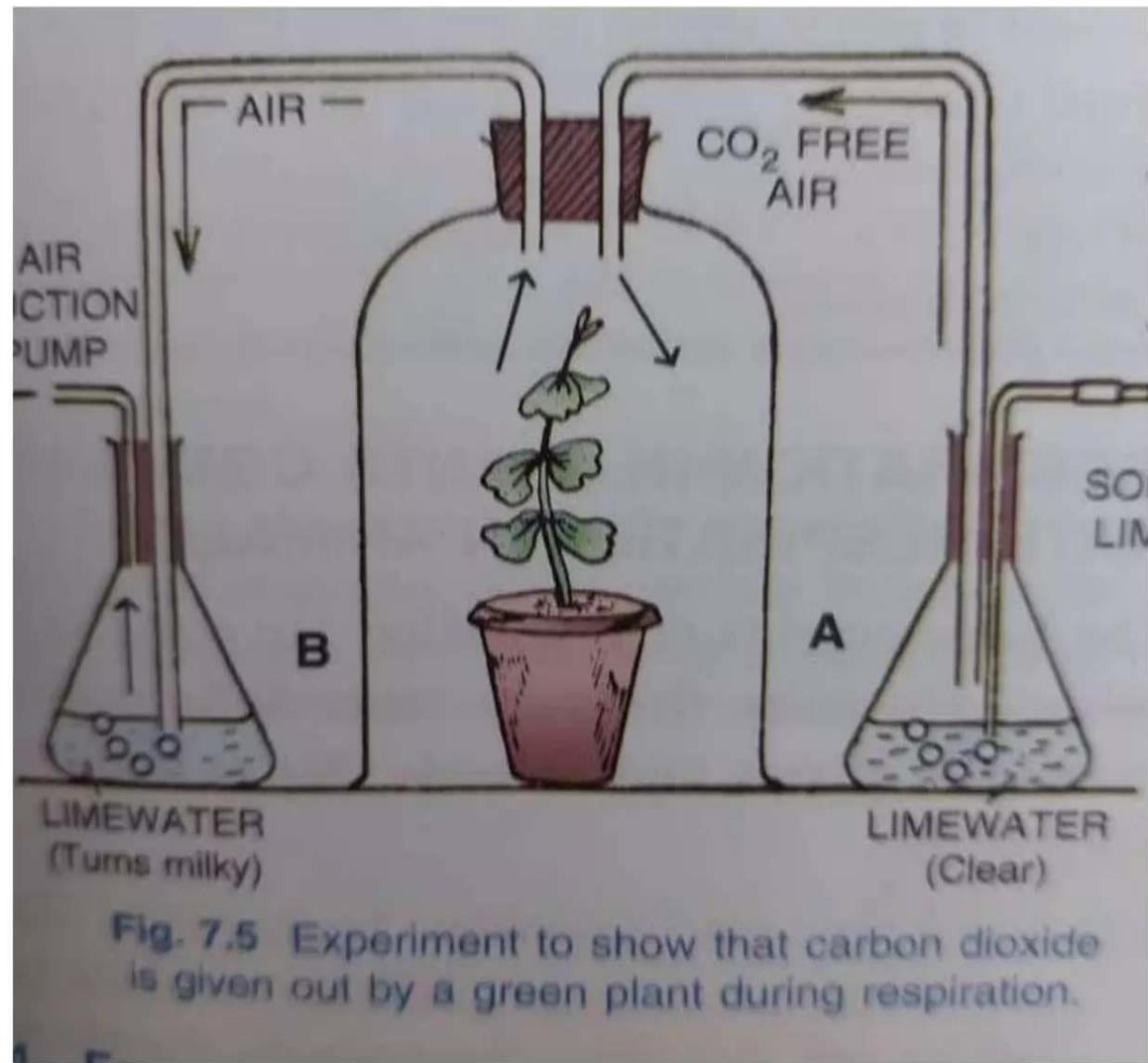
Experiment to prove that carbon di oxide is produced during respiration in germinating seeds



Experiment to prove that carbon di oxide is produced during respiration in germinating seeds

- KOH present in flask A absorbs all carbon di oxide.

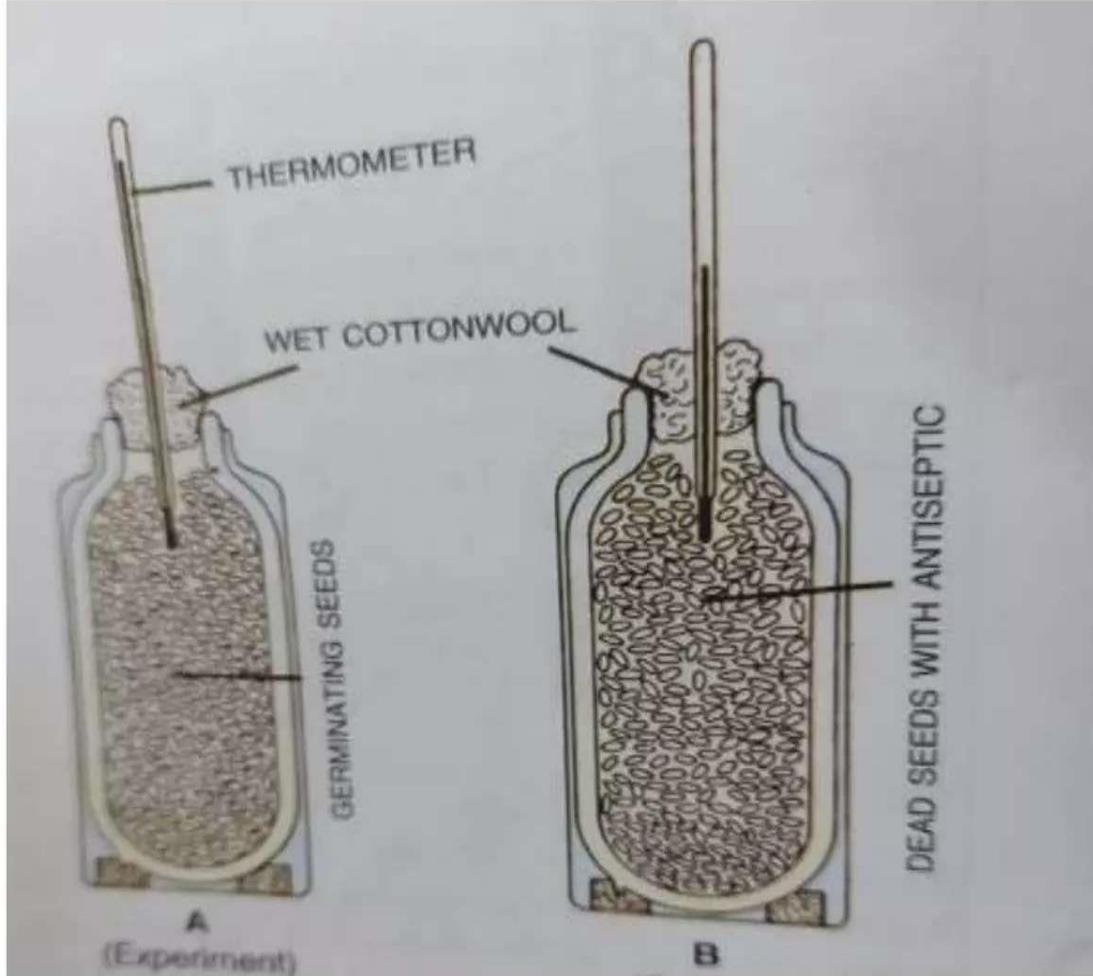
Experiments
to show that
carbon di
oxide is given
out by a
green plant
during
respiration



Experiments to show that carbon di oxide is given out by a green plant during respiration

- Germanium plant is taken
- The glass jar should be placed on a glass sheet and its rim and other connections should be sealed with Vaseline.
- Outside air is drawn with the help of air pump.
- It has to cross through soda lime.
- This experiment is completely done in dark.
- We can cover the bell jar with black paper to prevent photosynthesis.

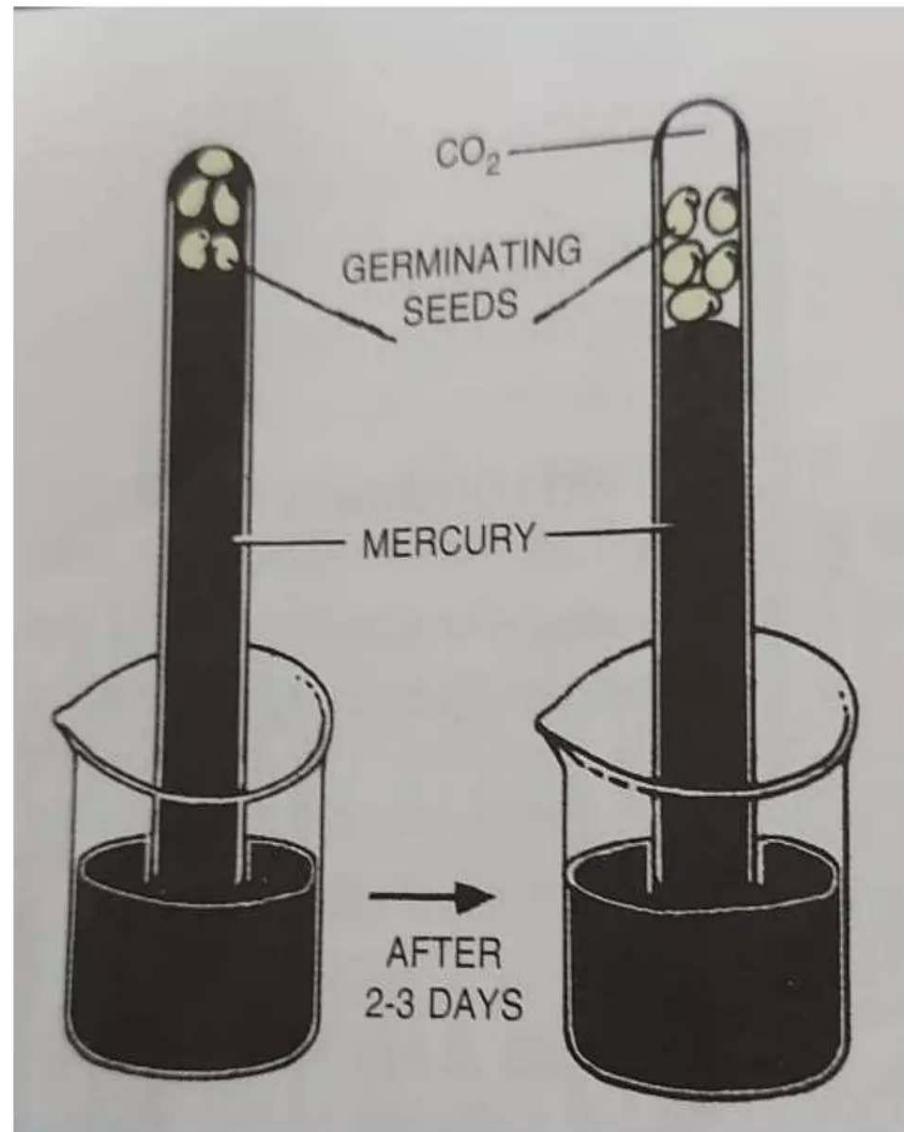
Experiment to show that heat is liberated during respiration



Experiments to show anaerobic respiration

- Take 8 to 10 soaked pea seeds.
- Peel off the seed coat of the germinating seeds to hasten the outward diffusion of gas.
- Push them into the mouth of a test-tube filled with mercury.
- Invert the test-tube in a beaker of mercury.
- After about 2 days, the level of mercury in the test-tube will fall.
- The liberated gas will be found to be carbon di oxide.

Experiments to show anaerobic respiration



Experiments to show anaerobic respiration

- The gas can be tested by introducing KOH into the test tube.
- KOH will float up through mercury.
- When it contact with the gas, will absorb the carbon di oxide and the level of mercury will again rise.
- Control can be some by killed seeds.
- No gas will be liberated in the control.

Experiments to show anaerobic respiration

- Instead of mercury, can we use water?



Experiments to show anaerobic respiration

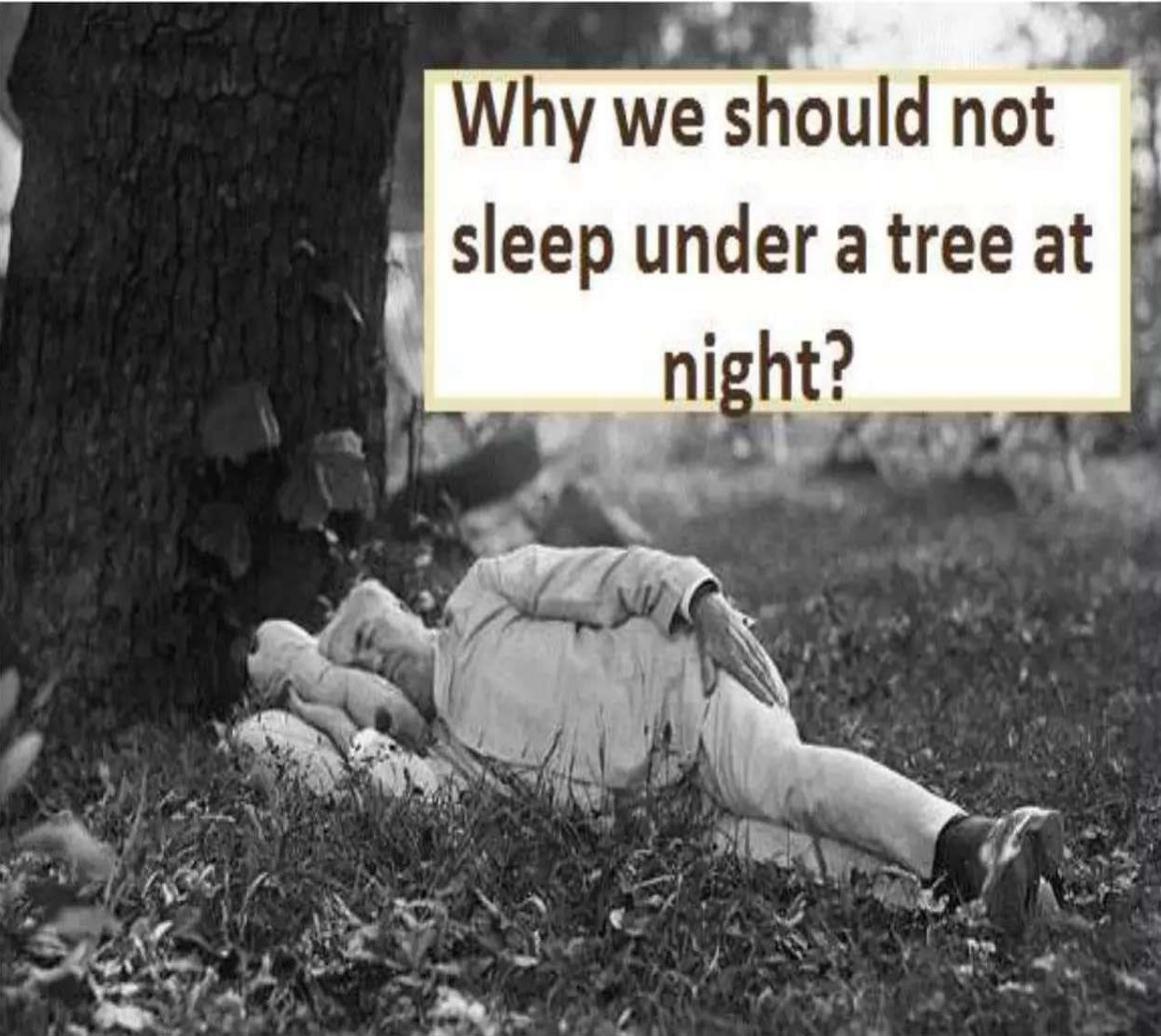
- Instead of mercury, can we use water?
- Mercury is used in experiments on anaerobic respiration because it does not contain dissolved oxygen, this maintaining an oxygen-free environment so anaerobic respiration can be carried out. Water, on the other hand, contains dissolved oxygen.

Difference between photosynthesis and respiration

Photosynthesis	Respiration
Occurs only in the presence of chlorophyll	Occurs in all living cells
Occurs only in the presence of light	Occurs at all times
Use carbon dioxide and water	carbon dioxide is released as end product.
Light energy is converted to chemical energy and stored.	Chemical energy is partly converted to heat remaining as energy
Results in gain in weight	Results in weight loss
Anabolic process	Catabolic process

Comparison of respiration in plants and animals

- In plants there is no respiratory transport – simple diffusion.
- In animals blood transports respiratory gases.
- One of the end products of respiration is ethanol
- In animals, the end product is lactic acid.
- In plants the process produces little heat as compared to animals.



Why we should not
sleep under a tree at
night?

