



Dr. Bbosa Science

Sponsored by
The Science Foundation College
Uganda East Africa
Senior one to senior six
+256 778 633 682, 753 802709
Based On, best for science

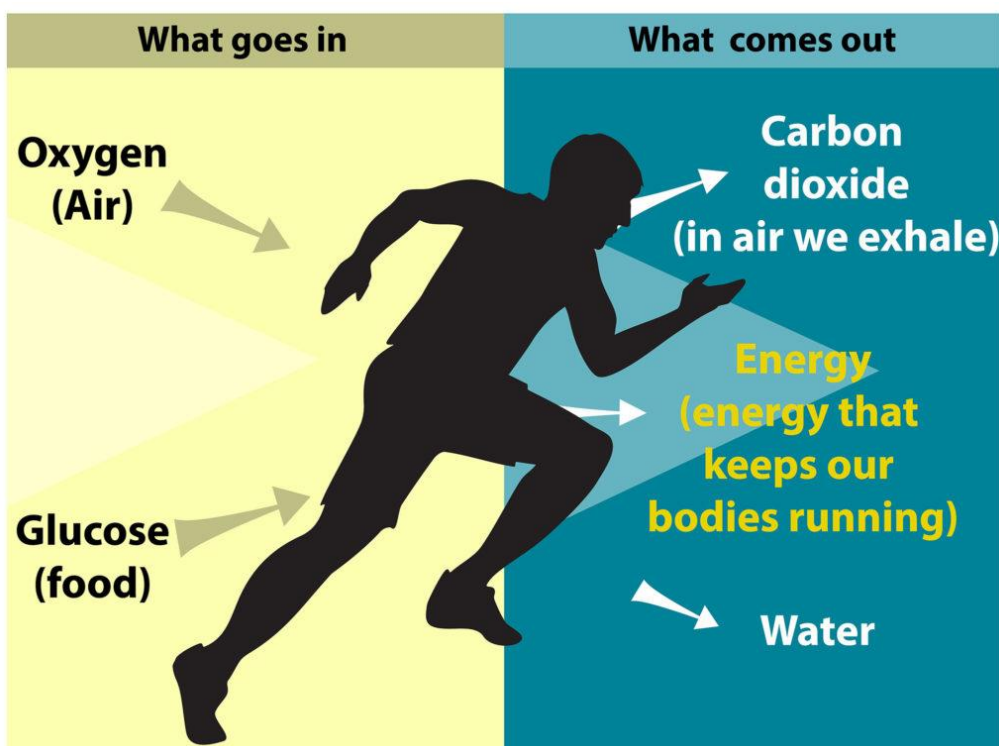
digitalteachers.co.ug



Nurture your dreams

Theme: Respiration in plants and animals

S3 New Curriculum Biology-Chapter 2– Aerobic and anaerobic respiration



Respiration

This is the oxidation of organic substance to liberate energy in the body.

Importance of respiration

Respiration produces energy in form of **adenosine triphosphate (ATP)**. requires to run body activities such as active transport, movement, secretion of materials, and building body structures.

Types of respiration

Aerobic respiration requires oxygen whereas

anaerobic respiration occurs in absence of oxygen.

Substrates for cellular respiration

Cell respiration involves oxidation of a substrate to yield chemical energy (ATP). Organic compounds which are used as substrates in respiration are carbohydrates, fats and proteins.

Carbohydrates:

These are usually the first choice of most cells. In fact, brain cells of mammals cannot use anything but glucose. Polysaccharides are hydrolysed to monosaccharides before they enter the respiratory pathway. For instance, starch in plant and glycogen in animals are first converted to glucose.

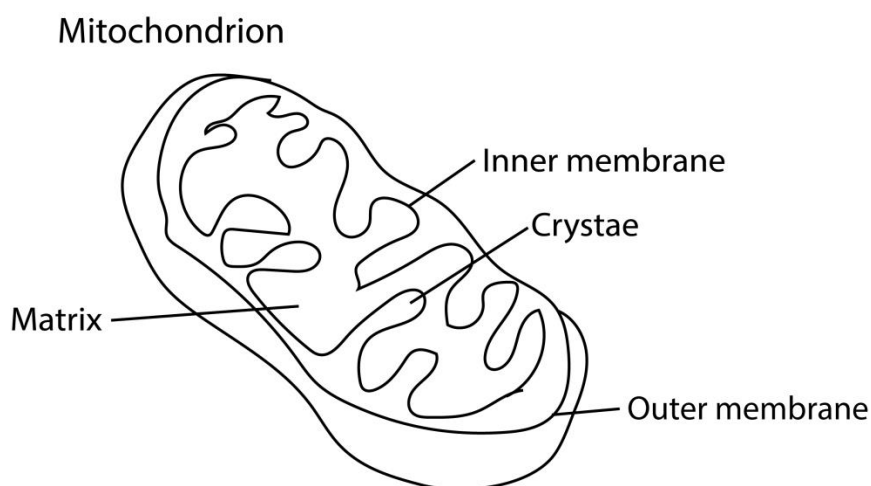
Fats/lipids.

They form the “first” reserve and are mainly used when carbohydrate reserves have been exhausted. However, in skeleton muscle cells, if glucose and fatty acids are available, these cells respire the acids in preference to glucose.

Lipids are better energy source than carbohydrates because they have a higher proportion of hydrogen and an almost insignificant proportion of oxygen compared with carbohydrates. Thus a given mass of lipids yields more energy on oxidation than an equal mass of carbohydrate.

Proteins.

Since proteins have other essential functions they are only used when all carbohydrate and fat reserves have been used up, as during prolonged starvation.



Function

Production of cellular energy, ATP

Adaptations

- Has extensive inner membrane to create a high surface area for enzymes that produce.
- have a small amount of mitochondrial DNA, allowing them to create mitochondrial proteins quicker than from nucleic genes.
- Have necessary enzymes for production of energy

Experiment to show that germinating seed need oxygen

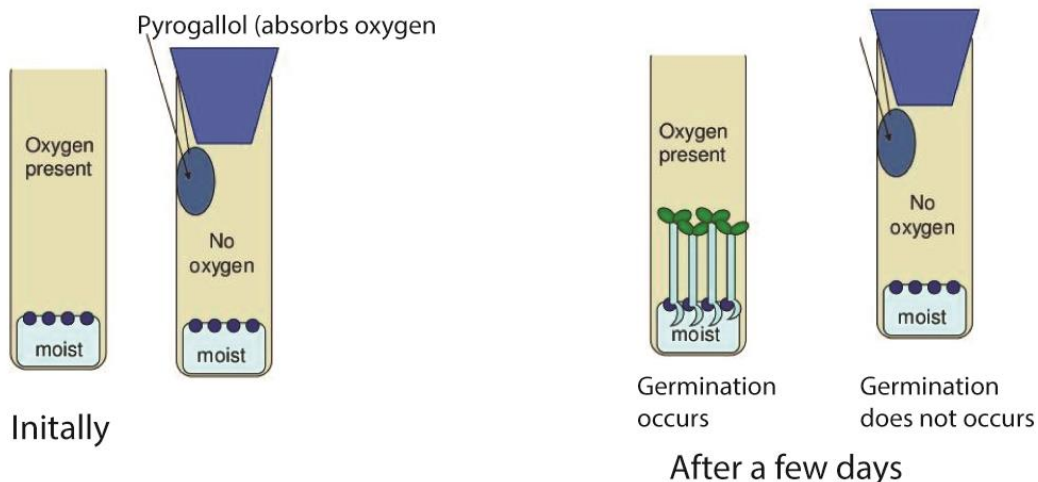
Materials Needed

- Two jars with lids
- Cotton or paper towel
- Water
- Seeds (e.g., beans or peas)
- Airtight seal (petroleum jelly or plastic wrap)

Procedure

1. **Prepare the jars:** Place a moist cotton pad or paper towel at the bottom of both jars.
2. **Add the seeds:** Put the same number of seeds in each jar.
3. **Control setup:** Leave the first jar open to the air.
4. **Oxygen restriction:** Seal the second jar completely using an airtight lid or wrap, preventing oxygen from entering. Pyrogallol may be added to absorb oxygen.
5. **Observe for several days:** Keep both jars in a warm place and check daily for signs of germination.

Experimental setup



Observation

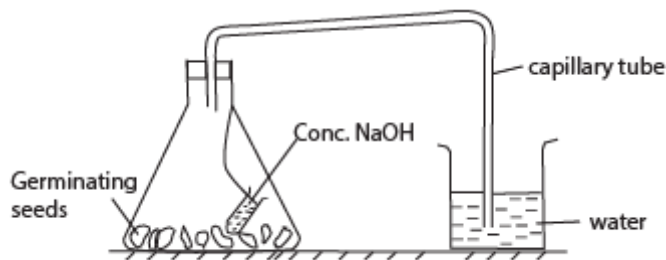
- The seeds in the open jar germinate normally.
- The seeds in the sealed jar will either not germinate or grow very poorly due to the lack of oxygen.

Conclusion

This experiment shows that oxygen is necessary for seed germination, as it helps in energy production during respiration. Without oxygen, the metabolic processes essential for growth cannot occur efficiently.

Alternatively

Set up



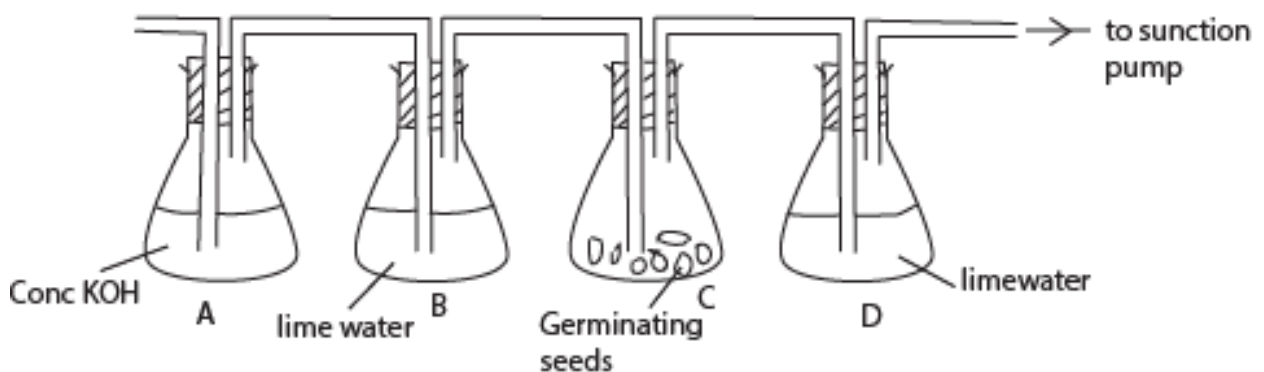
The experiment is allowed to stand for some time

Observations

Water rises in the capillary tube because seeds use up oxygen during respiration and carbon dioxide produced is absorbed by sodium hydroxide solution

An experiment to show that germinating seeds liberate carbon dioxide

Set up



Air is drawn over the germinating seeds using a suction pump for some time.

Observation

Lime water in conical flask D turns milky while that in flask B does not because carbon dioxide was removed by potassium hydroxide.

Conclusion

Carbon dioxide is produced by germinating seeds.

Anaerobic respiration

A variety of microorganism (anaerobes) employ anaerobic respiration as their major ATP yielding process. Organisms that survive only in absence of oxygen are termed **obligate anaerobes** e.g. C. Brotulium and C. tetani). Obligate anaerobe find oxygen poisonous.

Other organisms such as yeast and alimentary canal parasites (such as tape worms), can exist whether oxygen is available or not. These are called **facultative anaerobe**. Also, some cells that are temporarily deprived of with **no oxygen available to accept the hydrogen** oxygen (such as muscle cells) are able to respire anaerobically.

In Alcoholic fermentation the glucose is converted to ethanol and carbon dioxide



Alcoholic fermentation is the basis of brewing in which ethanol is an important product and baking industry in which carbon dioxide expands the dough.

Lactic fermentation occurs occasionally in animal cells during strenuous exercise and oxygen is insufficient. It allows animal to survive periods of insufficient oxygen. When oxygen is latter availed, lactic acid is oxidized to carbon dioxide and water or can be turned into carbohydrates. The amount of oxygen required to oxidize lactic acid accumulated in muscles is called the **oxygen debt**.

Differences in aerobic and anaerobic respiration

Aerobic Respiration	Anaerobic Respiration
Aerobic respiration uses oxygen.	Does not require oxygen
Aerobic respiration occurs in most cells.	Anaerobic respiration occurs mostly in prokaryotes
Produces a lot of energy	Produces little energy
Occurs in mitochondria	Occurs in cytoplasm
Does not produce ethanol	Produces ethanol

Importance of anaerobic respiration

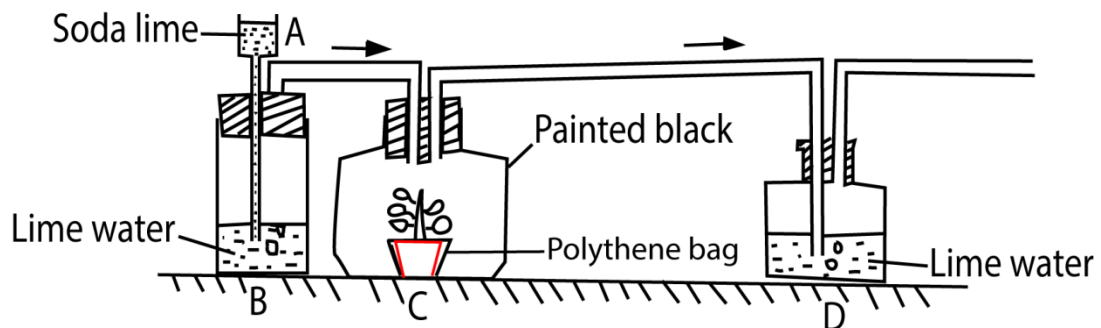
1. Cause decay and recycling of matter
2. Food production: cheese, yoghurt and vinegar, beers, etc.
3. Manufacturing process. E.g. making soap powder, tanning leather.

Differences between respiration and photosynthesis

	Cellular Respiration	Photosynthesis
1.	Produces energy	Uses energy
2	Produces carbon dioxide	Uses carbon dioxide
3	Does not require light	Can occur only in presence of sunlight
4	Aerobic respiration occurs in mitochondria	Occurs in chloroplasts
5	Does not release oxygen	Releases oxygen
6	Glucose is broken down	Glucose is synthesizes

Revision questions

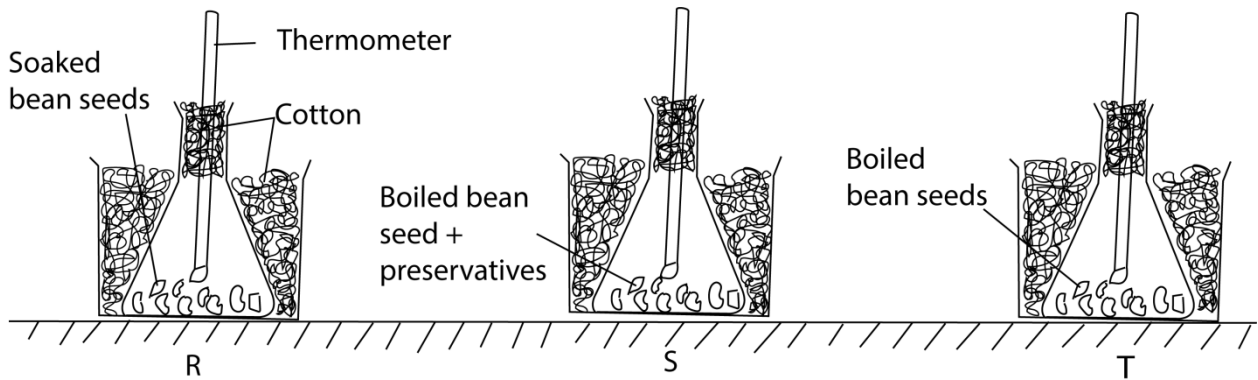
1. An experiment was carried out using a potted plant as shown below. Study the figure and use it to answer the questions below.



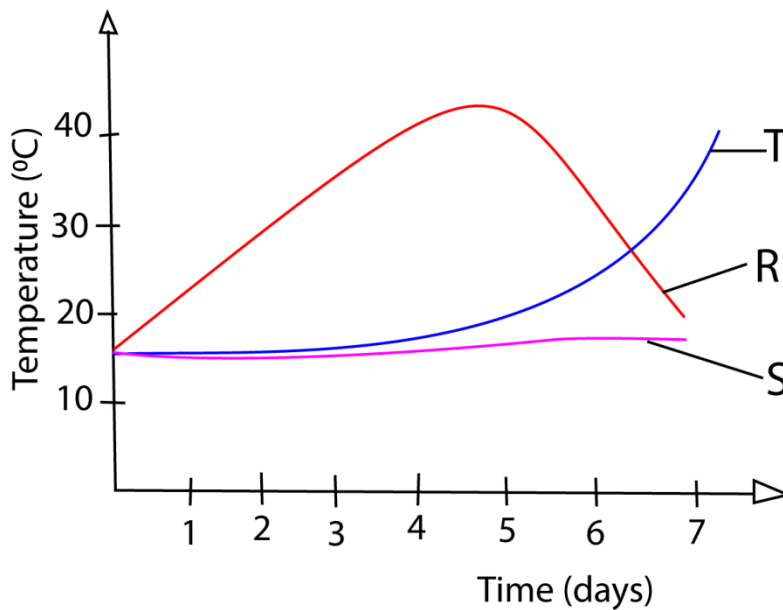
- (a) Suggest the aim of the experiment (01mark)
- (b) State the role of each of the following substances used in the experiment
 - (i) Soda lime A (01mark)
 - (ii) Lime water in B (01 mark)
- (c) Explain what is observed in
 - (i) Jar B (02 marks)
 - (ii) Jar D (02marks)
- (d) Explain why
 - (i) Jar C was painted black (02mark)

(ii) The port containing the plant was enclosed in polythene bag (01mark)

2. A student carried out an experiment using the set of apparatus below. In R, beans seed soaked in water were used. In S, boiled bean seeds sprinkled with a preservative were used while in T; boiled seeds without the preservative were used.



The temperature in each was recorded for a week. The results obtained are shown in the graph below



(a) State the aim of the experiment (02marks)

(b) Using the information provided, explain the changes in temperature in set R and T

(i) From 0 to 5 days (06 marks)

In R

In T

(ii) After day 5 (04marks)

In R

In S

- (c) Explain why there was no significant change in temperature in S for the whole week.
(02marks)
 - (d) Suggest one way for the above set up could be improved for better results. Give a reason for the suggested improvement.(02marks)
 - (e) What other changes would occur in the composition of air in set up R and T during the experiment? (04marks)
3. (a) Give five differences between respiration and photosynthesis.
- (b) Give three ways in which respiration is important to living things.
- (c) Name two commercial uses of anaerobic respiration

Suggested answers

1. (a) To show that carbon dioxide is produced during respiration
- (b) (i) absorbs carbon dioxide from air
 - (ii) to test for absence of carbon dioxide from air
- (c) (i) lime water does not turn milky because carbon dioxide is removed from air by sodium lime
- (ii) In D lime water turns milky because carbon dioxide is produced during respiration
- (d) (i) to prevent photosynthesis that would use carbon dioxide produced in respiration.
- (ii) To retain carbon dioxide by respiration of microorganism
2. (a) To show respiration in germinating seeds produce heat
- (b) (i) R – temperature rose rapidly because respiring seeds produced heat
 - T- temperature rose slowly because boiled seed do not respire however, they were invaded by respiring microorganisms that produced heat.
 - (ii) R – temperature dropped because food reserves got used up and the rate of respiration dropped
 - T- temperature rose rapidly due to accumulation of respiring microorganisms
- (c) preservative prevented invasion of respiring microorganisms.
- (d) should be carried out in the dark to prevent photosynthesis after germination

(e) R – concentration of carbon dioxide increase while that of oxygen decrease

T – composition of the air almost remained unchanged in first 5days, then
concentration of carbon dioxide rose while that of oxygen decreased

Please obtain free notes, exams and marking guides of Physics, chemistry, biology, history, from digitalteachers.co.ug website.

Thanks

Dr. Bbosa Science