

# Life Sciences: Cellular respiration (Anaerobic)

## Grade 11

### Lesson 32

**Presenter: Dr. Grizelda van Wyk**



**GAUTENG**  
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# ANAEROBIC RESPIRATION

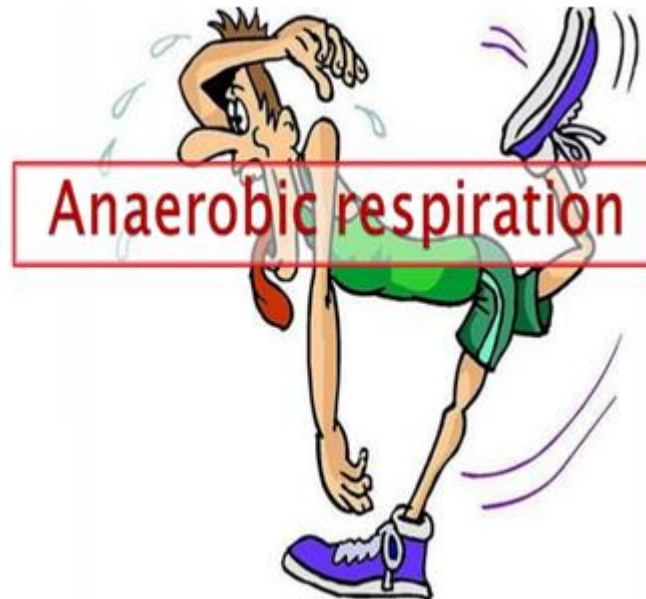
Anaerobic respiration takes place:

- **without oxygen** being present
- it occurs for short periods of time, mainly during **physical exercise**
- occurs differently in plants and animals
- produces less ATP than aerobic respiration



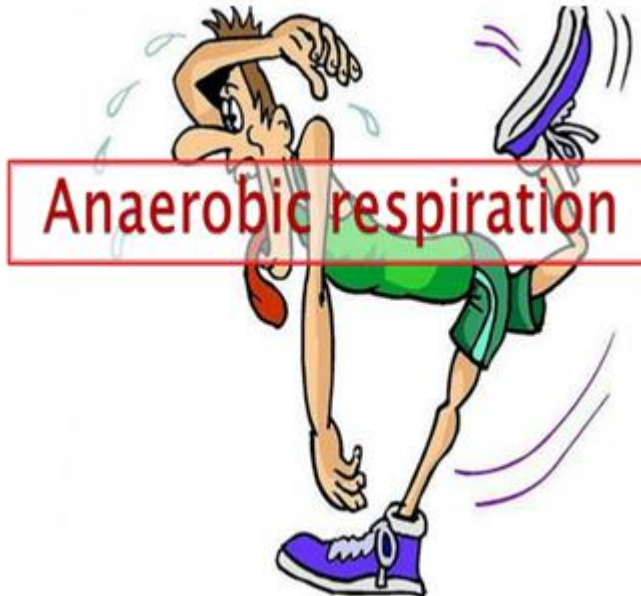
# ANAEROBIC RESPIRATION IN ANIMALS

- **Lactic acid fermentation**- breaking down of glucose in absence of oxygen to form lactic acid in animal cells
- Occurs in **muscles** during **intense exercise**
- Enables **glycolysis** in the cytoplasm of animal cells



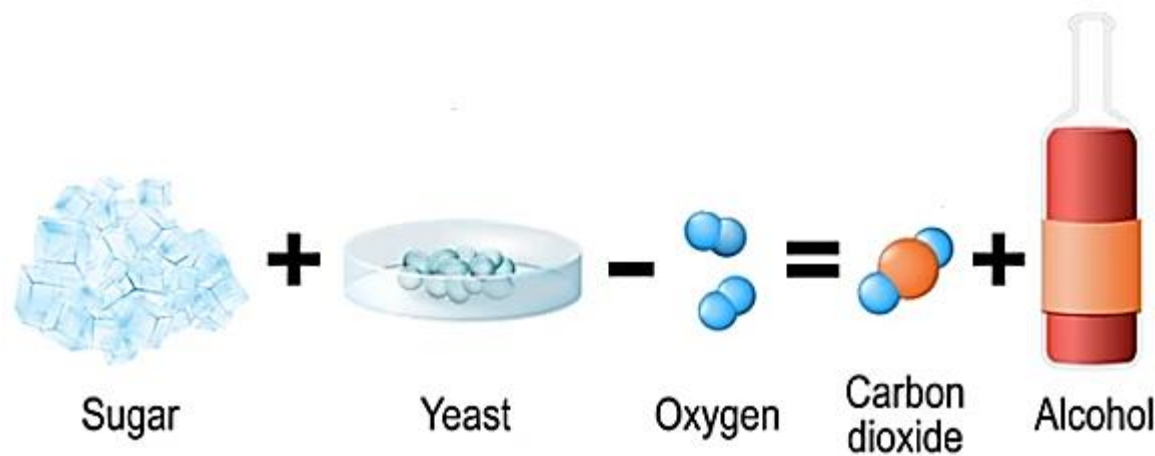
# ANAEROBIC RESPIRATION IN ANIMALS

- Results in the accumulation of **lactic acid** causing the **muscles** to become **tired and painful**
- Produces only a **small** amount of **ATP**
- The lactic acid can be converted back to pyruvic acid when the muscles receive oxygen



## ANAEROBIC RESPIRATION IN PLANTS

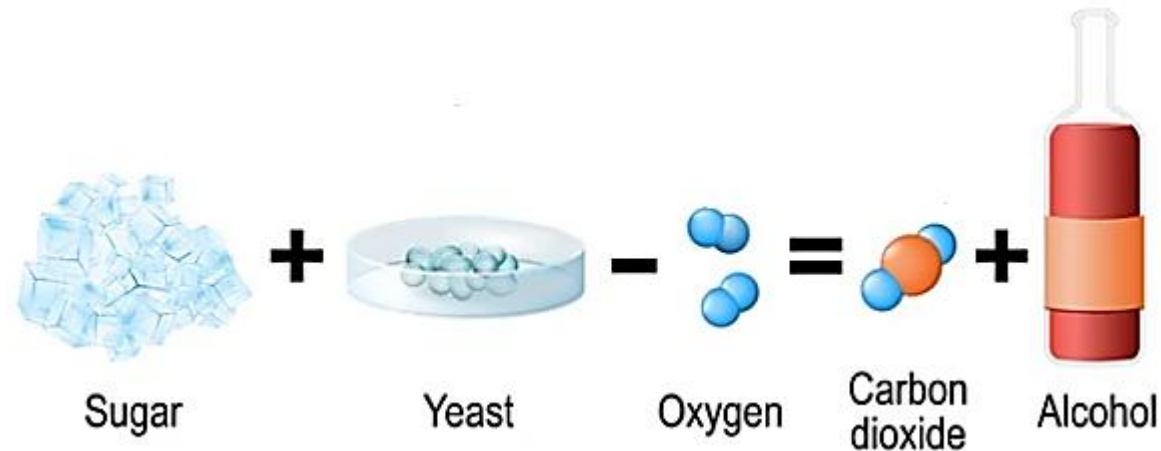
- **Alcoholic fermentation**- breaking down of glucose in absence of oxygen, to give rise to the production of alcohol in plant cells
- Enables **glycolysis** in the cytoplasm of plant cells



## ANAEROBIC RESPIRATION IN PLANTS

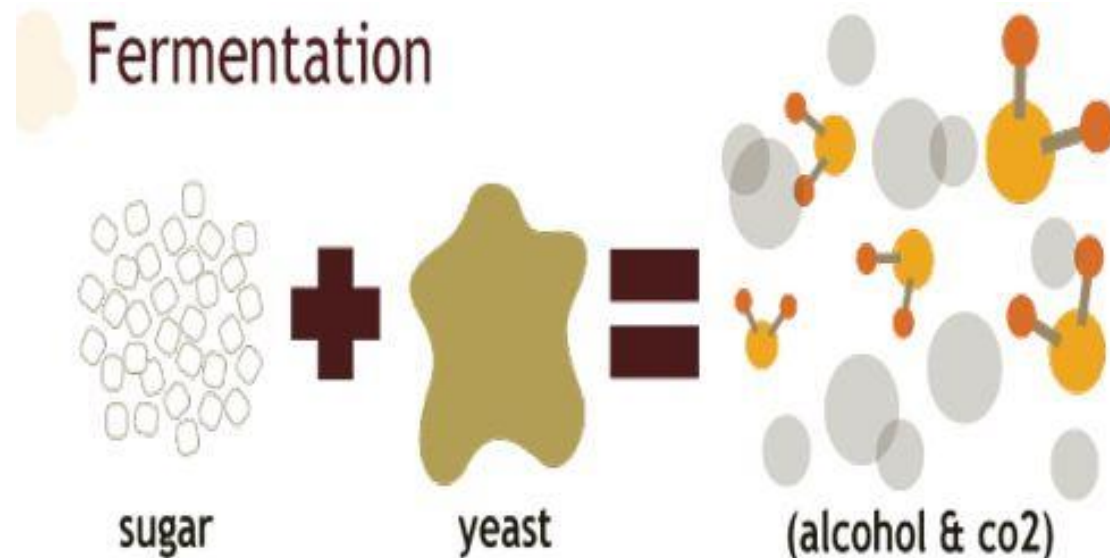
- Results in the **accumulation of pyruvic acid**
- **Breaks down pyruvic acid** forming **ethanol** (alcohol) and releasing **carbon dioxide** in the process

**glucose → ATP + pyruvic acid → ethanol + carbon dioxide**

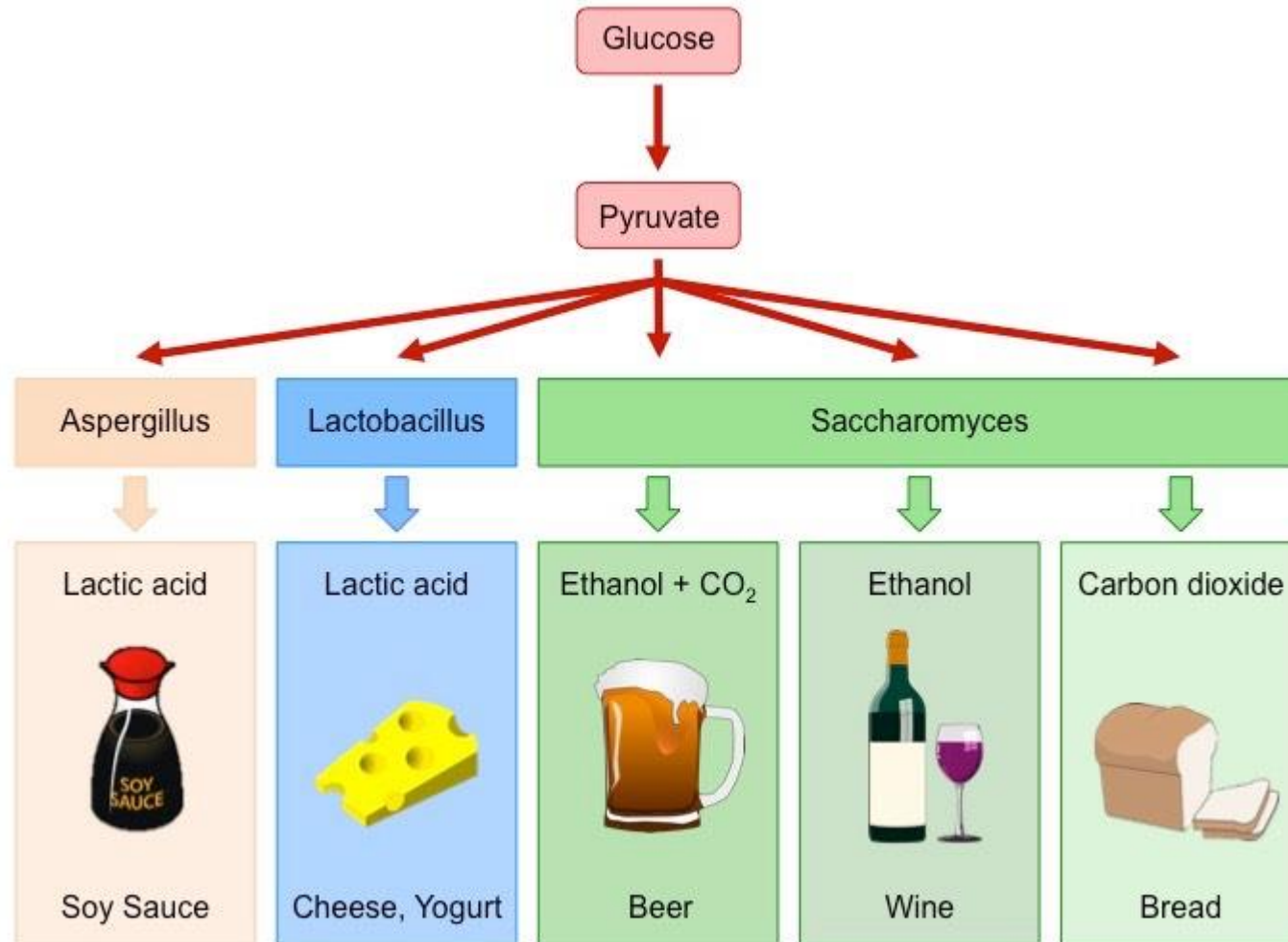


## USES OF ANAEROBIC RESPIRATION IN INDUSTRY

- **Yeast and other fungi respire anaerobically** and are used to **produce alcoholic beverages** such as beer and wine.
- Yeast cells are also used to cause **bread to rise** during the baking process.
- Bacterial cultures can also undergo fermentation to produce a variety of food products.
- **Yogurt / Cheese** – Bacteria produce lactic acid anaerobically, which modifies milk proteins to generate yogurts and cheeses



# USES OF ANAEROBIC RESPIRATION IN INDUSTRY



# The differences between aerobic and anaerobic respiration

| Aerobic                                                                   | Anaerobic                                                                  |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------|
| oxygen is required                                                        | oxygen is not required                                                     |
| products: carbon dioxide + water                                          | products: lactic acid or carbon dioxide + alcohol (plants /yeast)          |
| occurs in the cytoplasm and mitochondria                                  | occurs in the cytoplasm                                                    |
| large amount of ATP energy is released, glucose is completely broken down | small amount of ATP energy released, glucose is only partially broken down |

## ACTIVITY 1.1

Study the following extract and answer the questions which follow.

Many food and beverage industries are entirely dependent on the fermentation process to manufacture their products. Some of the products manufactured are being distributed and sold locally while the others are exported to foreign countries.

Name one food or beverage product which makes use of the fermentation process in its manufacture. (1)

Cheese, yoghurt, wine, beer, whisky, brandy. ✓

## ACTIVITY 1.1

Study the following extract and answer the questions which follow.

Many food and beverage industries are entirely dependent on the fermentation process to manufacture their products. Some of the products manufactured are being distributed and sold locally while the others are exported to foreign countries.

**Explain one way in which the production of foods and beverages made by fermentation benefit the South African economy.**

- Products are exported ✓ and earns foreign exchange ✓
- Jobs are created ✓ and reduces unemployment ✓
- Company profit increases ✓ and government earns more revenue as taxes ✓



## ACTIVITY 1.1

Study the following extract and answer the questions which follow.

Many food and beverage industries are entirely dependent on the fermentation process to manufacture their products. Some of the products manufactured are being distributed and sold locally while the others are exported to foreign countries.

**Describe how yeast cells benefit from the fermentation process?**

**(2)**

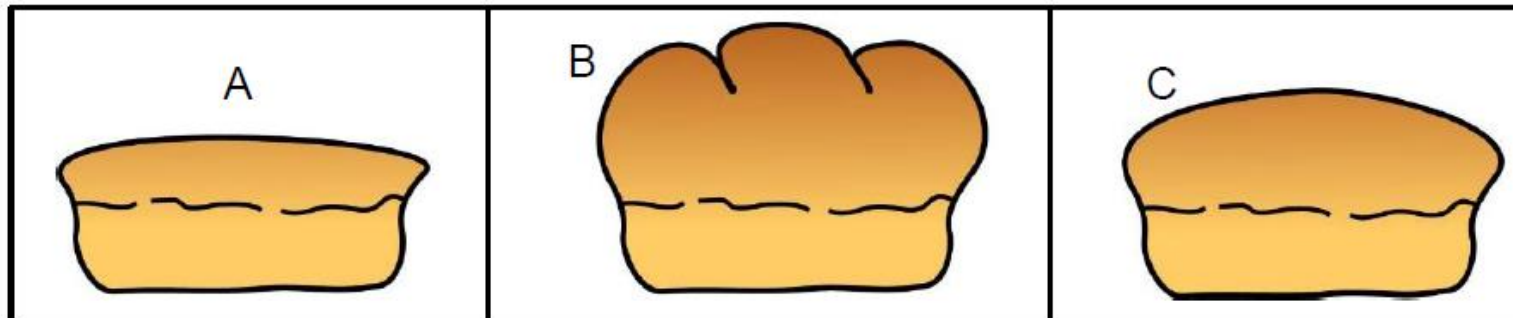
Obtains energy ✓ for cellular activities ✓



## ACTIVITY 1.2

A baker is testing a new recipe in order to bake the perfect loaf of bread. The two main ingredients in the bread dough are flour and yeast. She divides the dough into three equal parts and subjects the loaves to different treatments before baking.

- **Loaf A:** She immediately bakes the bread.
- **Loaf B:** She covers the dough with a damp cloth, leaves it in a warm area for an hour before baking it.
- **Loaf C:** She covers the dough with a damp cloth and leaves it in the fridge for an hour before baking it.
- After baking the three loaves she measured the height which each loaf rose. The results are shown below:



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**Formulate a hypothesis for this investigation. (2)**

The bread dough will rise better in warm conditions than in cold conditions ✓✓ OR  
Yeast cells respire more under warm conditions than cold conditions ✓✓.



## ACTIVITY 1.2

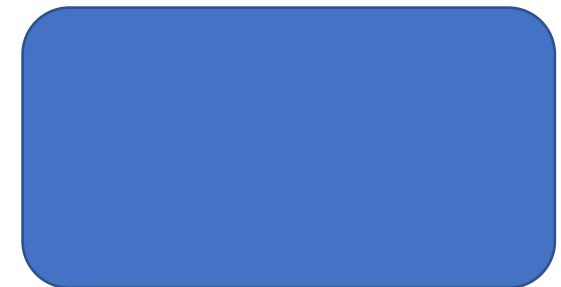
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**Identify:**

**a) the dependent variable**

How much the dough/loaf rises ✓.



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**Identify:**

**b) the independent variable**

Temperature ✓



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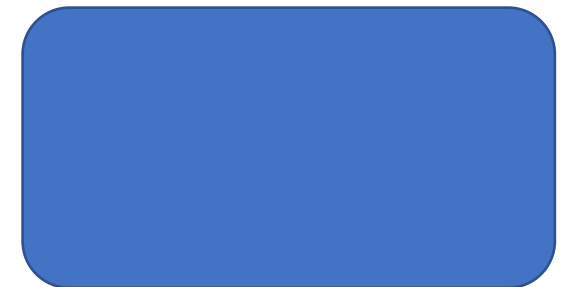
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**Identify:**

**c) one controlled variable**

Time allowed for the dough to rise ✓, amount of dough ✓,  
ingredients of the dough ✓



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**Which loaf do you consider to be the control for this experiment?**  
**Give a reason for your answer.**

A ✓ because it was baked immediately ✓ all other factors were the same, except that there was no time allowed for the dough to rise.



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**Name the function of the yeast in this investigation.**

It respire which allows the dough to rise. ✓

**Which biochemical process allows the yeast to perform its required function?**

Anaerobic respiration ✓



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**Why is the dough of loaves B and C covered with a damp cloth?**

To provide moist (optimum) conditions ✓ so that the yeast can respire and reproduce. ✓



## ACTIVITY 1.3

Indicate whether each of the descriptions in Column I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in Column II. Write **A only**, **B only**, **both A and B** or **none** next to the question number.

| Column I                                                                                              | Column II                    |
|-------------------------------------------------------------------------------------------------------|------------------------------|
| 1.3.1 The end product of anaerobic respiration in humans                                              | A: lactic acid<br>B: ethanol |
| 1.3.2 A product of cellular respiration which supplies energy needed for metabolic reactions in cells | A: ATP<br>B: oxygen          |
| 1.3.3 The fuel required for cellular respiration                                                      | A. glycogen<br>B. glucagon   |
| 1.3.4 Molecule that stores energy                                                                     | A: ADP<br>B: ATP             |

NONE



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**THANK YOU**

