

# THINK ABOUT IT

We use oxygen to release chemical energy from the food we eat, but what if oxygen is not around?

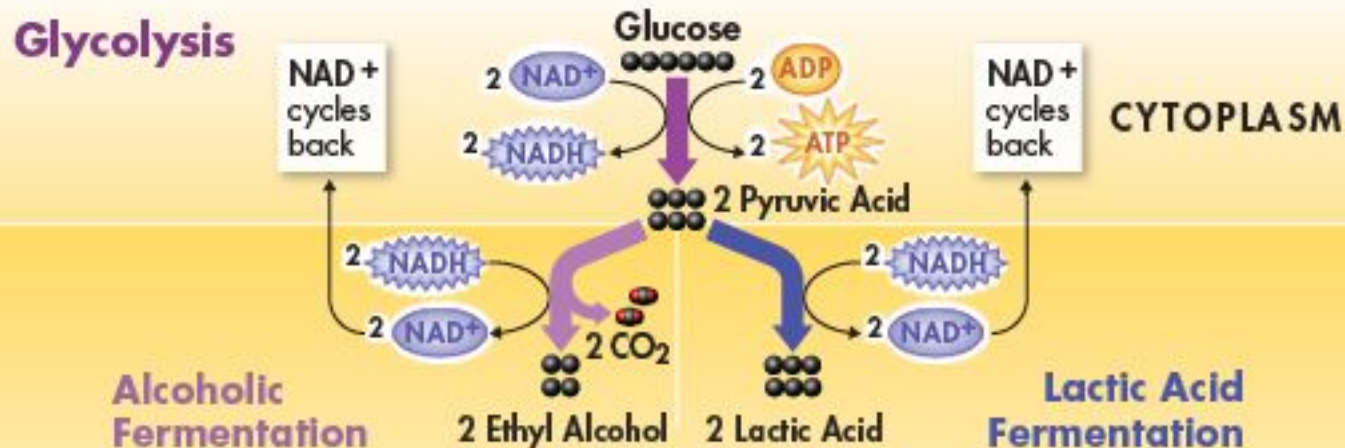
What is the name we use to describe conditions where oxygen is not present?



Students, write your response!

# Anaerobic Respiration

- If oxygen is not available, large organisms cannot produce enough **energy** to survive.
  - That's why we die if we cannot breathe.
- Even though there is no oxygen, some one-celled organisms such as **bacteria and fungi** can still digest sugars and make enough ATP energy to live and grow
  - This version of respiration is called **anaerobic respiration**.



# THINK ABOUT IT

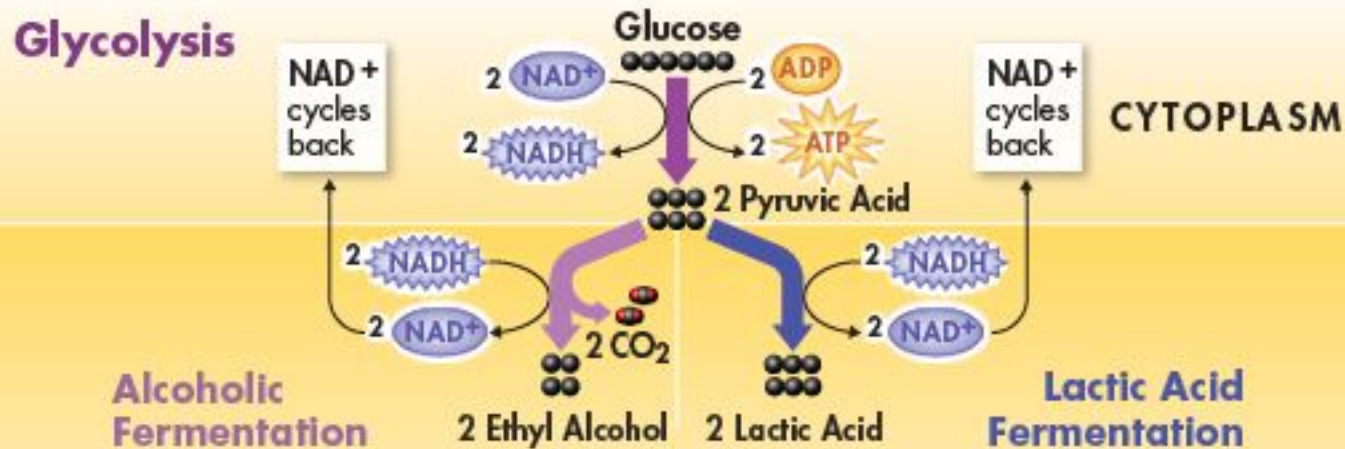
Which stages of cellular respiration would NOT be able to occur in anaerobic conditions?



Students, write your response!

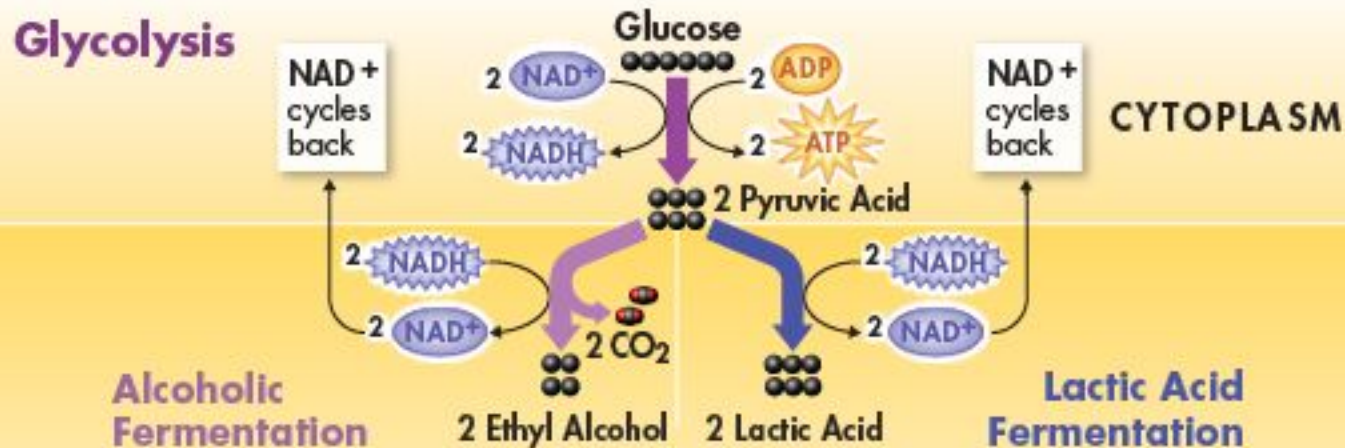
# Fermentation

- Under anaerobic conditions, the **Krebs cycle** and **electron transport chain** do NOT occur.
- Instead, a process called **fermentation** occurs after glycolysis.



# Fermentation

- Since the electron transport chain does not occur in anaerobic conditions, the electron carriers have no way to “drop off” electrons, which are needed to convert ADP to ATP
- Fermentation **uses electrons** and frees up the electron carriers so that glycolysis can continue



# Fermentation

- There are two types of fermentation:
  1. **Alcoholic fermentation**
  2. **Lactic acid fermentation**
    - The types are named based on their **waste-products**
- The ultimate goal of this process is to produce **ATP**, but humans have discovered that the waste products can be pretty useful when it comes to **food**

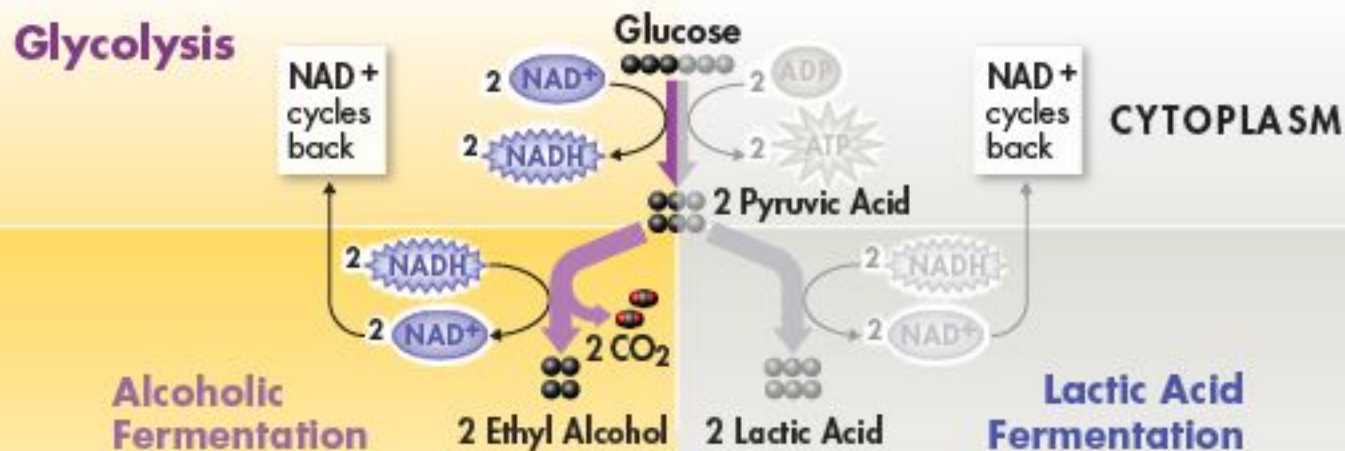
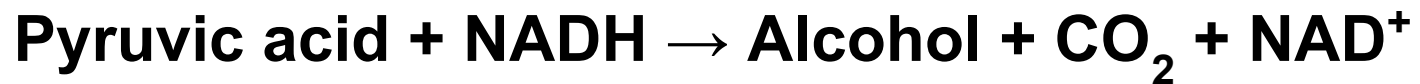
# Alcoholic Fermentation

- Yeast and a few other microorganisms use **alcoholic fermentation** that produces **ethyl alcohol** and **carbon dioxide**.
- This process is used to produce alcoholic beverages and causes bread dough to rise.



# Alcoholic Fermentation

- Chemical equation:





# Lactic Acid Fermentation

- Most organisms, including humans, carry out fermentation using a chemical reaction that converts **pyruvic acid to lactic acid**.
- Bacteria that produce lactic acid during fermentation are used to make cheese, yogurt, sour cream, pickles, sauerkraut, and more.



# Lactic Acid Fermentation

- Chemical equation:

