

Edexcel IAL Biology A-level

7.1-7.8 - Respiration

Flashcards

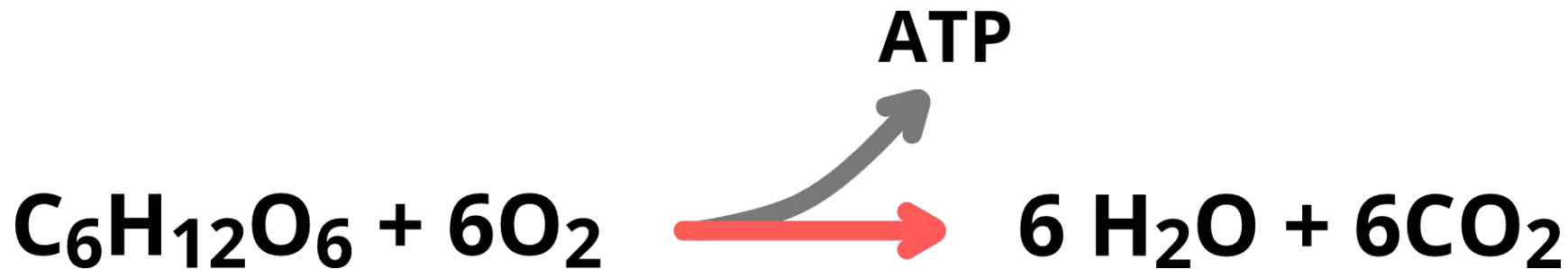
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What is the general chemical equation for respiration involving glucose?



What is the general chemical equation for respiration involving glucose?



What is respiration?



What is respiration?

- A set of metabolic reactions that take place in organisms and break down respiratory substances, such as glucose, into smaller inorganic molecules, like water and carbon dioxide
- Linked to the synthesis of ATP



Why is respiration described as a catabolic process?



Why is respiration described as a catabolic process?

Complex molecules (respiratory substrates) are broken down into smaller, simpler molecules



Why do organisms need to respire?



Why do organisms need to respire?

- Produces chemical energy in ATP for a variety of processes include active transport, metabolic reactions and muscle contraction
- Releases heat energy for thermoregulation

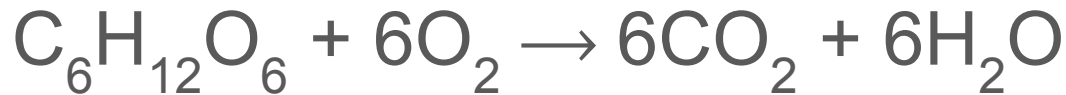


Define aerobic respiration



Define aerobic respiration.

A form of cellular respiration that takes place in the presence of oxygen and produces carbon dioxide, water and ATP. Overall:



Name the four main stages of aerobic respiration and state where they occur



Name the four main stages of aerobic respiration and state where they occur

- **Glycolysis** - cytosol
- **Link reaction** - mitochondrial matrix
- **Krebs cycle** - mitochondrial matrix
- **Electron transport chain** - inner mitochondrial membrane



What is substrate level phosphorylation?



What is substrate level phosphorylation?

Reactions which involve the direct generation of ATP from ADP without using the respiratory chain. This involves the enzyme-catalysed transfer of a phosphate group from an organic molecule to ADP



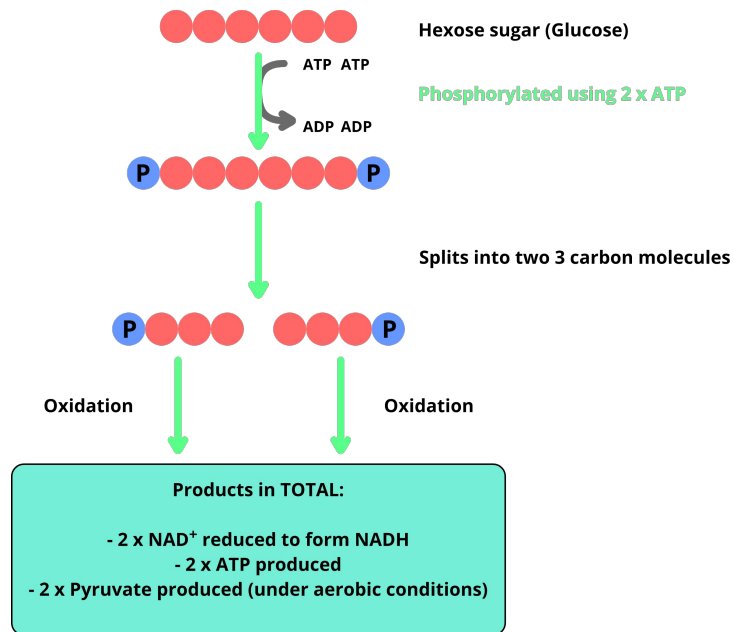
Outline the stages of glycolysis



Outline the stages of glycolysis

1. Glucose (hexose sugar) phosphorylated to hexose bisphosphate by 2× ATP
2. Hexose bisphosphate splits into two 3-carbon sugar molecules (trioses)
3. Each of these 3-carbon molecules is oxidised to 2× **pyruvate**

Net gain of 2× reduced NAD (NADH) and 2× ATP per glucose.



Where does glycolysis occur?



Where does glycolysis occur?

In the cytoplasm



Write an equation to summarise
glycolysis



Write an equation to summarise glycolysis.



How does pyruvate from glycolysis enter the mitochondria?



How does pyruvate from glycolysis enter the mitochondria?

Via active transport

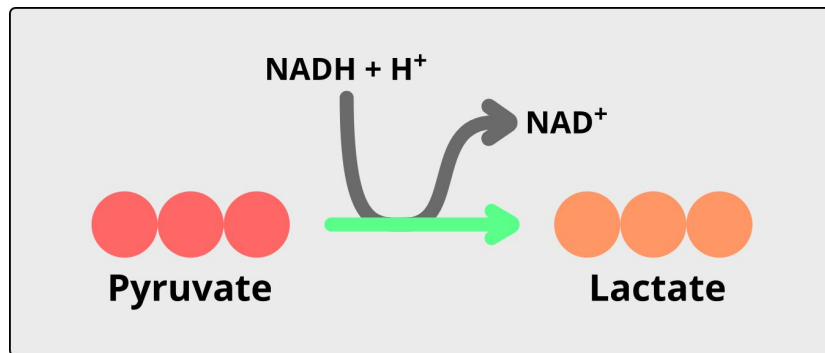


What molecule is produced during **anaerobic** glycolysis from the reduction of pyruvate?



What molecule is produced during **anaerobic glycolysis** from the reduction of pyruvate?

Lactate



What is the link reaction?



What is the link reaction?

The process which forms Acetyl CoA from pyruvate for use in the citric acid cycle

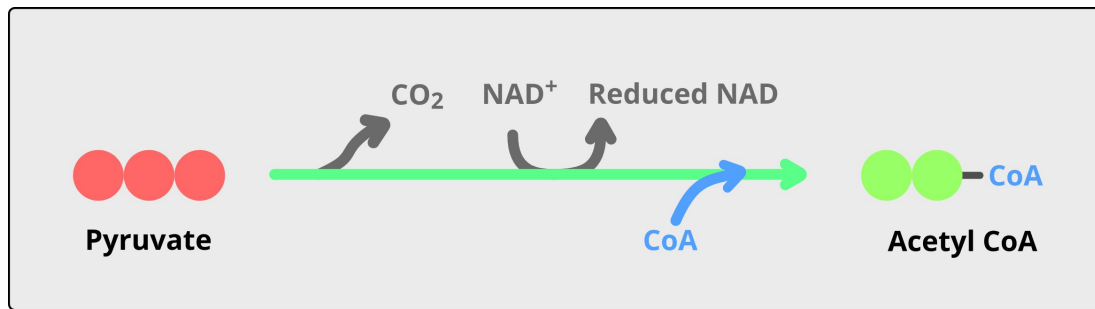


Describe the link reaction



Describe the link reaction

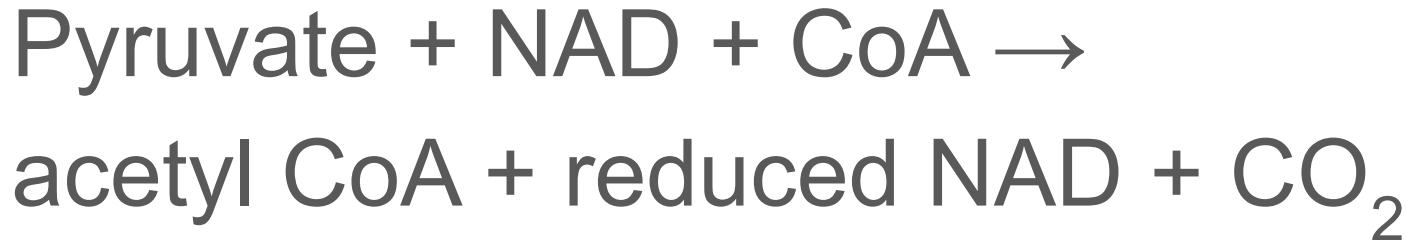
- 1) One molecule of pyruvate is **oxidatively decarboxylated** and **dehydrogenated** to make acetate
- 2) This is then combined with **Coenzyme A** to produce **acetyl CoA**



Write an equation to summarise the
link reaction



Write an equation to summarise the link reaction



Where does the link reaction occur?



Where does the link reaction occur?

In the mitochondrial matrix



What is the Krebs cycle?



What is the Krebs cycle?

A series of oxidation-reduction reactions in the matrix of the mitochondria in which acetyl coenzyme A is oxidised, generating reduced NAD, reduced FAD, ATP and carbon dioxide



What is the function of the Krebs cycle?



What is the function of the Krebs cycle?

It is a means of releasing energy from carbon bonds to provide ATP, reduced NAD and reduced FAD (with the release of CO₂)



Where does the Krebs cycle occur?



Where does the Krebs cycle occur?

In the mitochondrial matrix



What is a decarboxylation reaction?



What is a decarboxylation reaction?

A reaction which removes one carbon and two oxygen atoms from a molecule in the form of a molecule of carbon dioxide (CO_2)



Briefly outline the process of the Krebs cycle



Briefly outline the process of the Krebs cycle

A series of enzyme catalysed reactions that **oxidise Acetyl CoA** and produce many reduced cofactors (reduced NAD and reduced FAD) through dehydrogenation reactions



What is a dehydrogenation reaction?



What is a dehydrogenation reaction?

A reaction where hydrogen is removed from a molecule



What are the products of the Krebs cycle?



What are the products of the Krebs cycle?

1 x ATP (produced by substrate level phosphorylation)

3 x Reduced NAD

1 x Reduced FAD

2 x CO₂

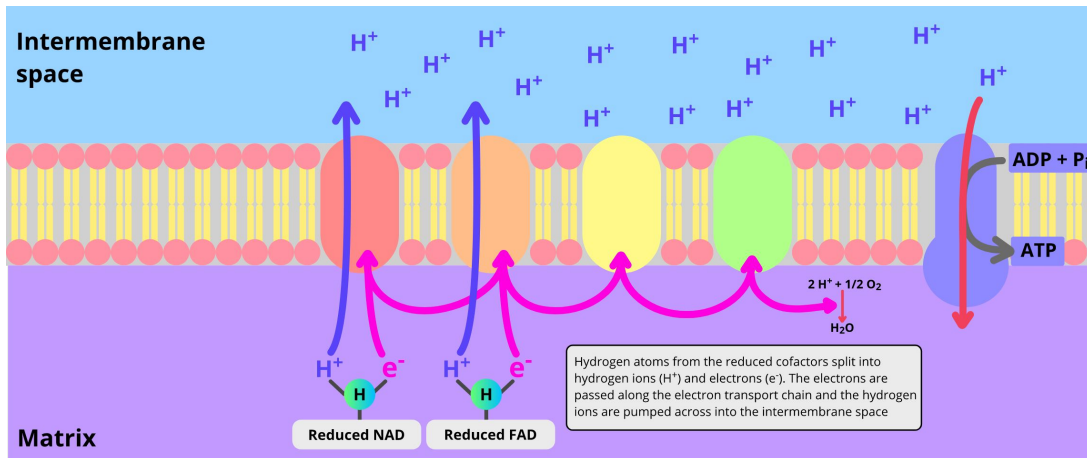


What is the electron transport chain?



What is the electron transport chain?

A series of electron carrier proteins that transfer electrons in a chain of oxidation-reduction reactions, releasing energy in the form of ATP

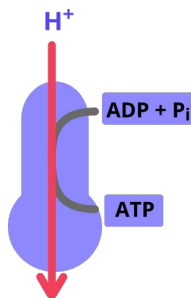


What is ATP synthase?



What is ATP synthase?

An enzyme found on the inner mitochondrial membrane which catalyses the formation of ATP from ADP and inorganic phosphate (P_i) using energy from chemiosmosis of H^+ ions



Define chemiosmosis



Define chemiosmosis

The passive diffusion of protons from a high concentration to a lower concentration across a partially permeable membrane used in oxidative phosphorylation



How does chemiosmosis produce ATP during aerobic respiration?



How does chemiosmosis produce ATP during aerobic respiration?

- Protons flow down their concentration gradient from the intermembrane space into the mitochondrial matrix via **ATP synthase**
- ATP synthase phosphorylates ADP to form ATP as protons flow through it



Why is oxygen known as the terminal electron acceptor?



Why is oxygen known as the terminal electron acceptor?

Oxygen accepts the electrons at the end of the electron transport chain to form water



Describe the role of reduced NAD and reduced FAD in the electron transport chain



Describe the role of reduced NAD and reduced FAD in the electron transport chain

They are a source of electrons and protons



How many ATP are produced per oxidised NAD in aerobic respiration?



How many ATP are produced per oxidised NAD in aerobic respiration?

3 ATP



How many ATP are produced per oxidised FAD in aerobic respiration?



How many ATP are produced per oxidised FAD in aerobic respiration?

2 ATP



What happens to lactate after a period of anaerobic exercise?



What happens to lactate after a period of anaerobic exercise?

It is transported in the blood to the liver where it is converted (under aerobic conditions) back to pyruvate and then to glucose



What is the respiratory quotient (RQ)?



What is the respiratory quotient (RQ)?

A ratio of the carbon dioxide production and the oxygen uptake of an organism. It can be used to determine what class of biomolecule is being used as the primary respiratory substrate



How is the respiratory quotient (RQ) calculated?



How is the respiratory quotient (RQ) calculated?

$$\text{RQ} = \frac{\text{CO}_2 \text{ produced}}{\text{O}_2 \text{ consumed}}$$

