AQA Biology A-level

5.2 - Respiration

Flashcards

Name the 4 main stages in aerobic respiration and where they occur.

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Glycolysis: cytoplasm

Link reaction: mitochondrial matrix

Krebs cycle: mitochondrial matrix

Oxidative phosphorylation via electron transfer chain: membrane of cristae

Outline the stages of glycolysis.

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1. glucose is phosphorylated to glucose phosphate by 2x ATP
2. glucose phosphate splits into 2x triose phosphate (TP)

2. 2x TP is oxidised to 2x pyruvate

Net gain of 2x reduced NAD & 2x ATP per glucose.

Draw a flowchart to represent what happens during glycolysis.

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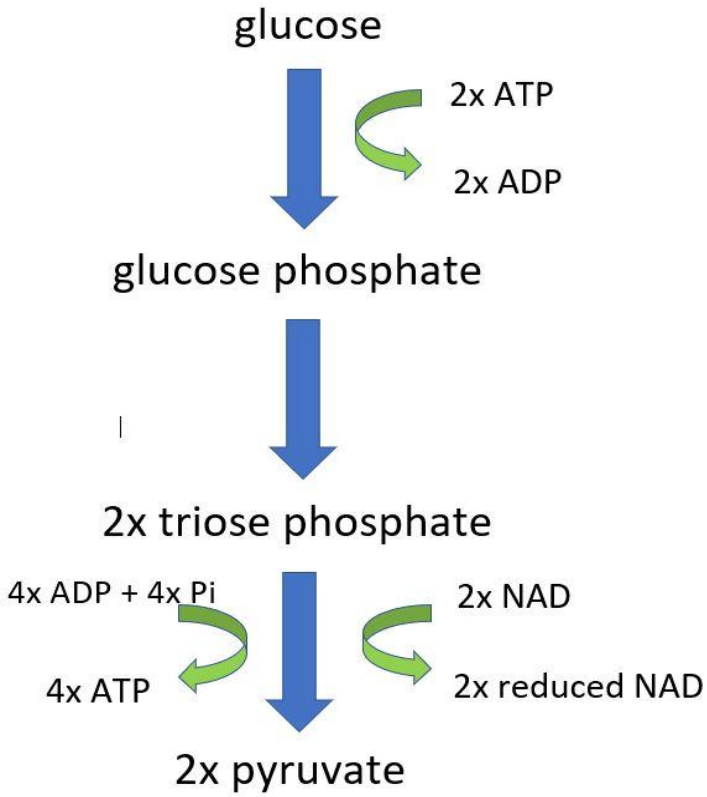

How does pyruvate from glycolysis enter the mitochondria?

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via active transport

What happens during the link reaction?

What happens during the link reaction?

1. Oxidation of **pyruvate to acetate**.

Per pyruvate molecule: net gain of **1xCO_2** (decarboxylation) & 2H atoms (used to **reduce 1xNAD**).

2. Acetate combines with coenzyme A (CoA) to form **acetylcoenzyme A**.

Give a summary equation for the link reaction.

Give a summary equation for the link reaction.

pyruvate + NAD + CoA

$\longrightarrow$

acetyl CoA + reduced NAD + CO_2

What happens in the Krebs cycle?

What happens in the Krebs cycle?

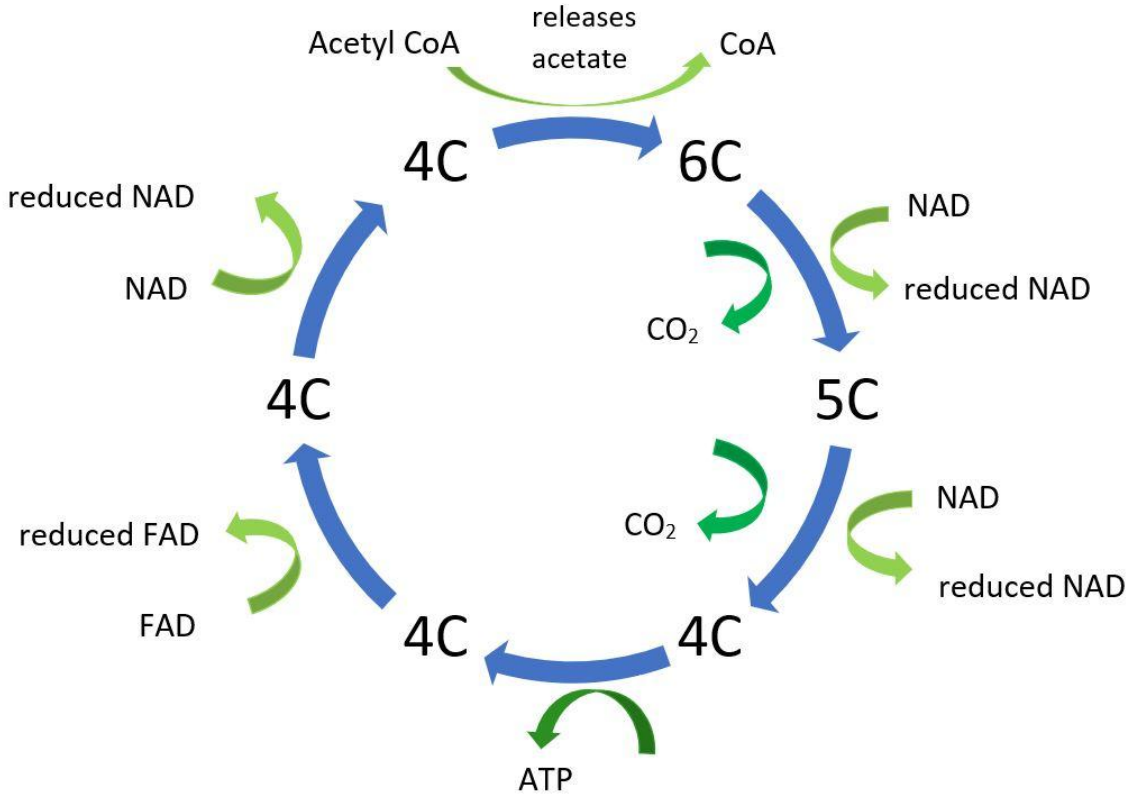
series of redox reactions produces:

- ATP by substrate-level phosphorylation.
- Reduced coenzymes.
- CO_2 from decarboxylation.

Outline the stages of the Krebs cycle.

Outline the stages of the Krebs cycle.

NB: the 6C compound i citrate



What is the electron transfer chain (ETC)?

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Series of carrier proteins embedded in membrane of the cristae of mitochondria.

Produces ATP through oxidative phosphorylation via chemiosmosis during aerobic respiration.

What happens in the electron transfer chain (ETC)?

What happens in the electron transfer chain (ETC)?

Electrons released from reduced NAD & FAD undergo successive redox reactions.

The energy released is coupled to maintaining proton gradient or released as heat.

Oxygen acts as final electron acceptor.

How is a proton concentration gradient established during chemiosmosis in aerobic respiration?

How is a proton concentration gradient established during chemiosmosis in aerobic respiration?

Some **energy released from the ETC** is **coupled** to the **active transport** of **H^+ ions** (protons) from the **mitochondrial matrix into the intermembrane space.**

How does chemiosmosis produce ATP during aerobic respiration?

How does chemiosmosis produce ATP during aerobic respiration?

H^+ ions (protons) move down their **concentration gradient** from the **intermembrane space into the mitochondrial matrix** via the channel protein **ATP synthase.**

ATP synthase catalyses ADP + Pi → ATP.

State the role of oxygen in aerobic respiration.

State the role of oxygen in aerobic respiration.

Final electron acceptor in electron transfer chain.

(produces water as a byproduct)

What is the benefit of an electron transfer chain rather than a single reaction?

What is the benefit of an electron transfer chain rather than a single reaction?

- energy is released gradually
- less energy is released as heat

Name 2 types of molecule that can be used as alternative respiratory substrates.

Name 2 types of molecule that can be used as alternative respiratory substrates.

- (amino acids from) proteins
- (glycerol and fatty acids from) lipids

How can lipids act as an alternative respiratory substrate?

How can lipids act as an alternative respiratory substrate?

lipid → glycerol + fatty acids

1. Phosphorylation of glycerol → TP for glycolysis.
2. Fatty acid → acetate.

a) acetate enters link reaction.

b) H atoms produced for oxidative phosphorylation.

How can amino acids act as an alternative respiratory substrate?

How can amino acids act as an alternative respiratory substrate?

Deamination produces:

1. 3C compounds → pyruvate for link reaction.
2. 4C/ 5C compounds → intermediates in Krebs cycle.

Name the stages in respiration that produce ATP by substrate-level phosphorylation.

Name the stages in respiration that produce ATP by substrate-level phosphorylation.

- Glycolysis (anaerobic)
- Krebs cycle (aerobic)

What happens during anaerobic respiration in animals?

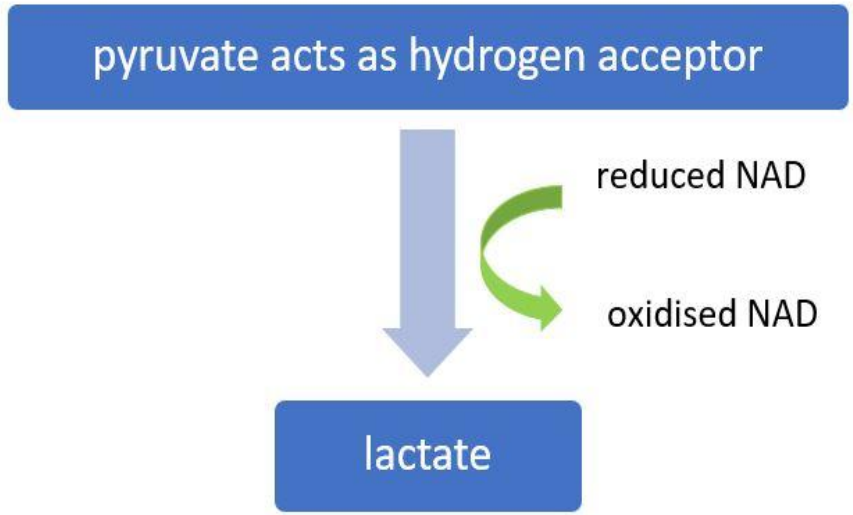
What happens during anaerobic respiration in animals?

Only glycolysis continues

reduced NAD + pyruvate

→

oxidised NAD (for further glycolysis) + lactate



What happens to the lactate produced in anaerobic respiration?

What happens to the lactate produced in anaerobic respiration?

Transported to liver via bloodstream, where it is oxidised to pyruvate.

Can enter link reaction in liver cells or be converted to glycogen.

What happens during anaerobic respiration in some microorganisms e.g. yeast and some plant cells?

What happens during anaerobic respiration in some microorganisms e.g. yeast and some plant cells?

Only glycolysis continues.

Pyruvate is decarboxylated to form ethanal.

Ethanal is reduced to ethanol using reduced NAD to produce oxidised NAD for further glycolysis.

Draw a flowchart to show how ethanol is produced during anaerobic respiration.

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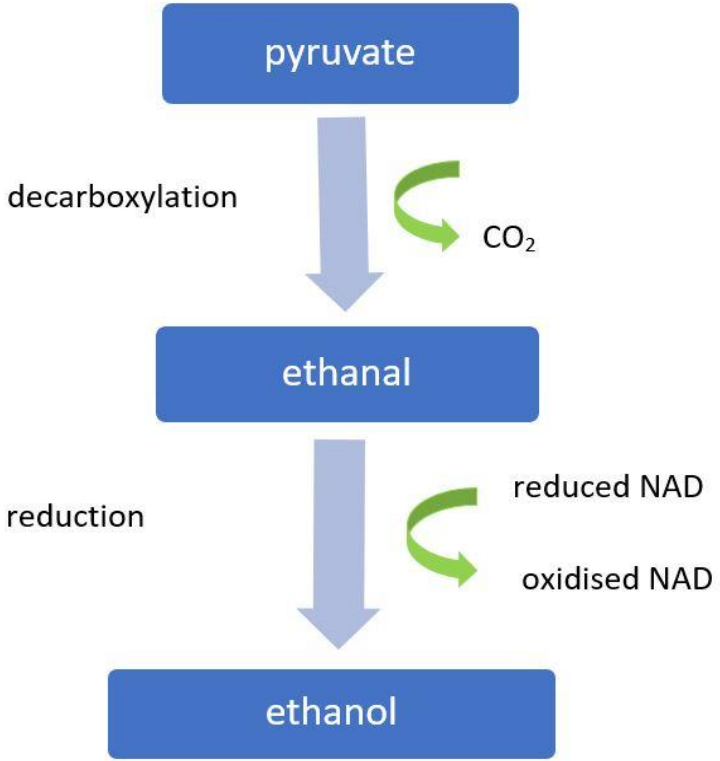

What is the advantage of producing ethanol/ lactate during anaerobic respiration?

What is the advantage of producing ethanol/ lactate during anaerobic respiration?

Converts reduced NAD back into NAD so glycolysis can continue.

What is the disadvantage of producing ethanol during anaerobic respiration?

What is the disadvantage of producing ethanol during anaerobic respiration?

- Cells die when ethanol concentration is above 12%.
- Ethanol dissolves cell membranes.

What is the disadvantage of producing lactate during anaerobic respiration?

What is the disadvantage of producing lactate during anaerobic respiration?

Acidic, so decreases pH.

Results in muscle fatigue.

Compare aerobic and anaerobic respiration.

Compare aerobic and anaerobic respiration.

- Both involve glycolysis
- Both require NAD
- Both produce ATP

Contrast aerobic and anaerobic respiration.

Contrast aerobic and anaerobic respiration.

Aerobic

- produces ATP by substrate-level phosphorylation AND oxidative phosphorylation
- produces much more ATP
- does not produce ethanol or lactate

Anaerobic

- substrate-level phosphorylation only
- produces fewer ATP
- produces ethanol or lactate

Suggest how a student could investigate the effect of a named variable on the rate of respiration of a single-celled organism.

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1. Use respirometer (pressure changes in boiling tube cause a drop of coloured liquid to move).
2. Use a dye as the terminal electron acceptor for the ETC.

What is the purpose of sodium hydroxide solution in a respirometer set up to measure the rate of aerobic respiration?

What is the purpose of sodium hydroxide solution in a respirometer set up to measure the rate of aerobic respiration?

Absorbs CO_2 so that there is a net decrease in pressure as O_2 is consumed.

How could a student calculate the rate of respiration using a respirometer?

How could a student calculate the rate of respiration using a respirometer?

Volume of O_2 produced or CO_2 consumed/ time x mass of sample

Volume = distance moved by coloured drop x (0.5 x capillary tube diameter)^2 x π