

Exercise walk-through

3.5

Cellular Respiration

AP Biology

Cellular respiration

In the **mitochondrion**, glucose is broken down to make ATP:

Overall



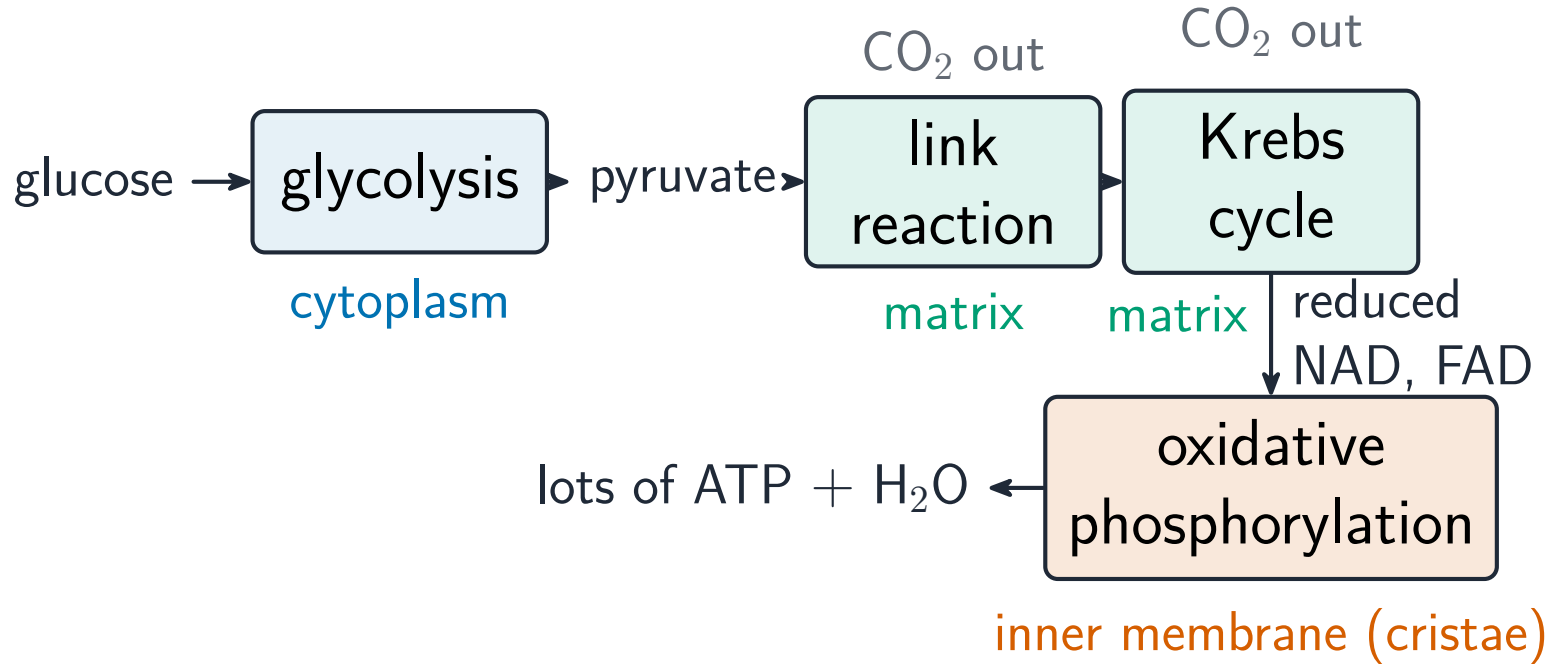
glycolysis → Krebs → oxidative phosphorylation; aerobic $\approx 30\text{--}32$ ATP.

Chemiosmosis: H^+ flows back through ATP synthase.



Mitochondria oxidise fuel to make ATP

The stages of aerobic respiration and where



The stages of aerobic respiration and where in the cell they happen

The stages of cellular respiration

glycolysis

in the cytosol: glucose to two pyruvate, with a small net ATP yield and NADH

the Krebs cycle

in the mitochondrial matrix: carbon leaves as CO_2 , and the coenzymes are loaded with electrons

the electron transport chain

on the **inner membrane**: those electrons pump protons across it

chemiosmosis

the protons flow back through ATP synthase – which makes **most of the ATP**

the final acceptor

oxygen, which becomes water – and without it the chain backs up and stops

without oxygen

fermentation regenerates NAD^+ so glycolysis alone can continue

Oxygen's only job is to accept the electrons at the end. That is why its absence stops the chain, the Krebs cycle, and nearly all the ATP.

Exam tips

- An **enzyme lowers the activation energy** and is not used up; its **active site** is specific to one substrate (lock and key).
- Rate rises with temperature only up to the **optimum** – beyond it the enzyme **denatures** and the rate falls (unlike an ordinary reaction).
- Know the $\text{ATP} \leftrightarrow \text{ADP}$ cycle: breaking a phosphate **releases** energy to power the cell.
- Write the overall equations: photosynthesis **stores** energy (builds glucose); respiration **releases** it (breaks glucose down) – they are opposites.
- Match each stage to its location and whether it needs oxygen.

Exercises 2.1-2.3

2.1 Write the overall equation for cellular respiration.

[2]

2.2 Name the three stages of respiration.

[3]

2.3 What is the role of oxygen in respiration?

[1]

Exercises 2.1-2.3

2.1 Write the overall equation for cellular respiration.

[2]

2.1

- $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} (+ \text{ATP})$

2.2 Name the three stages of respiration.

[3]

2.2

- Glycolysis, the Krebs cycle, the electron transport chain

2.3 What is the role of oxygen in respiration?

[1]

2.3

- It is the final electron acceptor in the electron transport chain

Exercise 3.1

3.1 Most of the ATP in cellular respiration is made in the

[1]

☐

A glycolysis stage

B Krebs cycle

C electron transport chain

D cytoplasm

Exercise 3.1

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A glycolysis stage

B Krebs cycle

C electron transport chain

D cytoplasm

3.1 C

- the electron transport chain

Exercise 3.2 (a)

3.2 A cell is respiring aerobically.

(a) State where glycolysis occurs and its main product.

[2]

Exercise 3.2 (a)

3.2 A cell is respiring aerobically.

(a) State where glycolysis occurs and its main product.

[2]

(a)

- Glycolysis occurs in the cytoplasm; its product is pyruvate

Exercise 3.2 (b)

3.2 A cell is respiring aerobically.

(b) Explain what happens to ATP production if oxygen runs out.

[2]

Exercise 3.2 (b)

3.2 A cell is respiring aerobically.

(b) Explain what happens to ATP production if oxygen runs out. [2]

(b)

- Without oxygen the electron transport chain stops, so most ATP production halts and the cell relies on the small amount from glycolysis (fermentation)

Exercise 3.3

3.3 Explain the relationship between photosynthesis and respiration in terms of their reactants and products. [2]

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3.3

- They are opposites – photosynthesis uses CO_2 and water to make glucose and O_2 ; respiration uses glucose and O_2 to make CO_2 and water – so the products of one are the reactants of the other