

Stages of respiration: practice questions

8 questions • 28 marks • mark scheme at the back

For Pearson Edexcel International AS Biology XBI11 and International A Level Biology YBI11. **A Level only** is IA2 content (Units 4 to 6), not needed for the International AS.

Name

Total / 28

1 UNIT 5 STYLE [1 mark]

Which statement about substrate-level phosphorylation is correct?

- A. ☐ It needs the electron transport chain and ATP synthase.
- B. ☐ ATP is made by transferring a phosphate group directly from a substrate molecule to ADP.
- C. ☐ It only occurs in the mitochondria.
- D. ☐ It makes most of the ATP in aerobic respiration.

2 UNIT 5 STYLE [5 marks]

Describe the role of glycolysis in respiration.

3 UNIT 5 STYLE [4 marks]

Describe the link reaction.

4 UNIT 5 STYLE

[3 marks]

The table shows the number of molecules of reduced NAD formed in each stage of respiration. Calculate the total number of molecules of reduced NAD formed from one molecule of glucose by glycolysis, the link reaction and the Krebs cycle. Show your working.

Reduced NAD formed	
Stage	Reduced NAD formed
Glycolysis (per glucose)	2
Link reaction (per pyruvate)	1
Krebs cycle (per turn)	3

Answer = ...

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5 UNIT 5 STYLE

[5 marks]

Explain how the electron transport chain and ATP synthase produce ATP in a mitochondrion.

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6 UNIT 5 STYLE

[3 marks]

In a sprinter's muscle, oxygen supply is too low for the electron transport chain to work. Explain why the muscle cells can still make ATP for a short time when pyruvate is converted to lactate.

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7 UNIT 5 STYLE

[4 marks]

Describe what happens to lactate after a period of anaerobic respiration in a mammal.

8 UNIT 5 STYLE

[3 marks]

Cyanide stops the last electron carrier in the electron transport chain passing electrons to oxygen. Suggest why the Krebs cycle also stops in a cell poisoned with cyanide.

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B: ATP is made by transferring a phosphate group directly from a substrate molecule to ADP.

2. [5]

- occurs in the cytoplasm
- glucose / hexose is phosphorylated using 2 ATP
- hexose biphosphate splits into 2 triose phosphate
- triose phosphate is dehydrogenated / oxidised, forming reduced NAD
- 4 ATP made by substrate-level phosphorylation, so net gain of 2 ATP
- 2 pyruvate formed per glucose
- Max 5

3. [4]

- pyruvate enters the mitochondrion / matrix
- pyruvate is decarboxylated, so CO_2 is removed
- pyruvate is dehydrogenated, hydrogen passed to NAD to form reduced NAD
- the acetyl group (2C) combines with coenzyme A to form acetyl CoA

4. [3]

- 2 pyruvate per glucose, so link reaction $2 \times 1 = 2$ and Krebs cycle 2 turns, $2 \times 3 = 6$
- $2 + 2 + 6$
- 10 (reduced NAD); award 3 marks for correct answer with no working

5. [5]

- reduced NAD / reduced FAD donate hydrogen / electrons to the chain
- electrons pass along carriers in redox reactions, releasing energy
- energy used to pump protons (H^+) from the matrix into the intermembrane space
- proton gradient / high H^+ concentration in the intermembrane space
- protons flow back through ATP synthase (chemiosmosis)
- energy used to join ADP and P_i to form ATP
- oxygen is the final electron acceptor, forming water
- Max 5

6. [3]

- pyruvate accepts hydrogen from reduced NAD
- so NAD is regenerated
- so glycolysis can continue to make (net) ATP by substrate-level phosphorylation

7. [4]

- lactate diffuses out of muscle into the blood
- carried to the liver
- converted (back) to pyruvate when oxygen is available
- pyruvate respired aerobically / enters link reaction and Krebs cycle
- or converted to glucose / glycogen
- oxygen debt repaid / extra oxygen taken in after exercise
- Max 4

8. [3]

- electron transport chain stops / electrons cannot be passed on
- reduced NAD and reduced FAD cannot be oxidised / NAD and FAD are not regenerated
- the dehydrogenation steps of the Krebs cycle need NAD / FAD, so the cycle stops