



Cell respiration: practice questions

8 questions • 25 marks • mark scheme at the back

For IB Diploma Biology, Standard Level and Higher Level (first assessment 2025). **HL only** is additional higher level content, for HL students only.

Name

Total / 25

1 PAPER 1A STYLE

[1 mark]

Which statement about ATP is correct?

- A. ☐ It is a nucleotide containing deoxyribose.
- B. ☐ Energy is required to hydrolyse it to ADP and phosphate.
- C. ☐ It is a nucleotide, and its hydrolysis to ADP and phosphate releases energy.
- D. ☐ It moves freely out of cells through the plasma membrane.

2 PAPER 1A STYLE

[1 mark]

Which feature is shared by aerobic and anaerobic cell respiration in humans?

- A. ☐ Both produce carbon dioxide.
- B. ☐ Both require mitochondria.
- C. ☐ Both can use glucose as the substrate.
- D. ☐ Both produce lactate.

3 PAPER 1A STYLE

[1 mark]

HL only

How many decarboxylations and oxidations occur in one turn of the Krebs cycle?

- A. ☐ One decarboxylation and two oxidations
- B. ☐ Two decarboxylations and four oxidations
- C. ☐ Two decarboxylations and three oxidations
- D. ☐ Four decarboxylations and two oxidations

4 PAPER 1B STYLE**[5 marks]**

A respirometer containing 3.0 g of maggots and soda lime was kept at three temperatures. The distance moved by the liquid drop in 5 minutes was recorded. The capillary tube has a cross-sectional area of 0.80 mm^2 . The data are for practice. (a) Calculate the rate of oxygen uptake per gram at 25°C , in $\text{mm}^3 \text{ g}^{-1} \text{ min}^{-1}$. Show your working. [2] (b) Identify the independent and the dependent variable. [1] (c) Explain the trend shown in the data. [2]

Distance moved by the drop in 5 minutes

Temperature / $^\circ\text{C}$	Mean distance moved / mm
15	11
20	17
25	24

Answer =

5 PAPER 2A STYLE**[3 marks]**

(a) State two processes in cells that use energy from ATP. [2] (b) Distinguish between cell respiration and gas exchange. [1]

6 PAPER 2A STYLE

[4 marks]

HL only

(a) Outline the stages of glycolysis. [2] (b) Explain why yeast converts pyruvate to ethanol and carbon dioxide in anaerobic conditions. [2]

7 PAPER 2A STYLE

[3 marks]

HL only

Explain why lipids yield more energy per gram than carbohydrates in cell respiration, and why fatty acids cannot be used in anaerobic respiration.

8 PAPER 2B STYLE

[7 marks]

HL only

Explain how ATP is produced by the electron transport chain and chemiosmosis in the mitochondrion.

Mark scheme

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

1. [1]

C C [1]

2. [1]

C C [1]

3. [1] **HL only**

B B [1]

4. [5]

- (a) volume = $0.80 \times 24 = 19.2 \text{ mm}^3$ [1]
- (a) $19.2 \div 5 \div 3.0 = 1.28 \text{ mm}^3 \text{ g}^{-1} \text{ min}^{-1}$ / 1.3 [1]
- (b) independent: temperature; dependent: distance moved by drop / rate of oxygen uptake (both needed) [1]
- (c) rate of oxygen uptake / respiration increases with temperature [1]
- (c) respiration is catalysed by enzymes; more kinetic energy so more frequent substrate-active site collisions [1]
- (c) (temperatures are below the optimum so) no denaturation [1]
- (c) [max 2]

5. [3]

- (a) active transport across membranes [1]
- (a) synthesis of macromolecules / anabolism [1]
- (a) movement of the whole cell (e.g. muscle contraction, flagella) / movement of chromosomes [1]
- (a) [max 2]
- (b) cell respiration produces ATP from carbon compounds inside cells, whereas gas exchange is diffusion of O_2 and CO_2 between organism and environment OWTTE [1]

6. [4] **HL only**

- (a) phosphorylation of glucose using ATP [1]
- (a) lysis into two triose phosphates (3C) [1]
- (a) oxidation / removal of hydrogen, reducing NAD [1]
- (a) ATP formed; net yield 2 ATP (and 2 pyruvate) per glucose [1]
- (a) [max 2]
- (b) to regenerate NAD / reduced NAD is oxidised [1]
- (b) so glycolysis can continue producing (2) ATP [1]
- (b) no oxygen so reduced NAD cannot be oxidised by the electron transport chain [1]
- (b) [max 2]

7. [3] HL only

- lipids contain less oxygen / more oxidisable hydrogen and carbon (per gram) [1]
- so more reduced NAD (and ATP) produced per gram [1]
- fatty acids broken into acetyl groups that enter via acetyl CoA / bypass glycolysis [1]
- anaerobic respiration depends on glycolysis, which only uses carbohydrate / acetyl groups are oxidised only in the Krebs cycle, which needs oxygen (via the electron transport chain) to regenerate NAD [1]
- [max 3]

8. [7] HL only

- reduced NAD (from glycolysis, link reaction and Krebs cycle) passes a pair of electrons to the first carrier [1]
- NAD is regenerated [1]
- electron transport chain / carriers located in the inner mitochondrial membrane / cristae [1]
- electrons pass from carrier to carrier, releasing energy [1]
- energy used to pump protons from matrix into intermembrane space [1]
- proton gradient / high H^+ concentration in intermembrane space [1]
- protons diffuse back into matrix through ATP synthase (chemiosmosis) [1]
- ATP synthase couples energy from proton flow to phosphorylation of ADP [1]
- oxygen is the terminal electron acceptor [1]
- oxygen accepts electrons and protons forming (metabolic) water [1]
- allows continued flow of electrons along the chain [1]
- [max 7]