

# 8.2 Cell Respiration

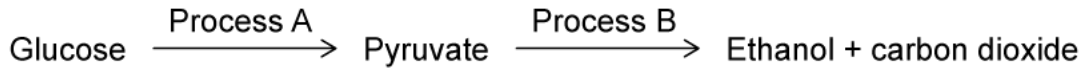
## Question Paper

Course	DP IB Biology
Section	8. Metabolism, Cell Respiration & Photosynthesis (HL Only)
Topic	8.2 Cell Respiration
Difficulty	Hard

**Time allowed:** 60  
**Score:** /48  
**Percentage:** /100

**Question 1a**

a)  
Most plants can respire aerobically and anaerobically. The diagram below shows a summary of anaerobic respiration.



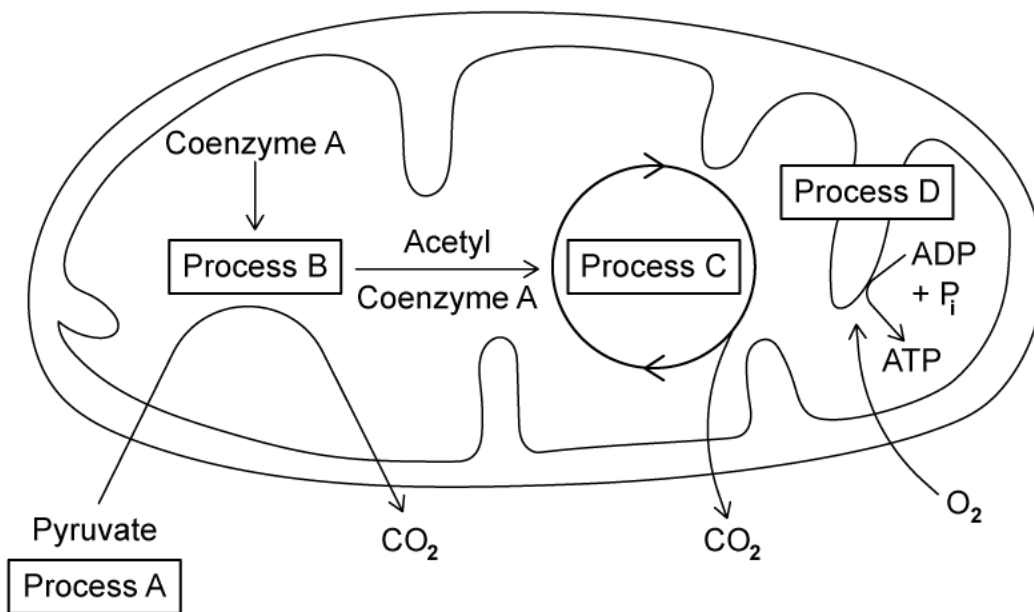
State precisely in the cell where Process A occurs.

[1 mark]

[1 mark]

**Question 1b**

b)  
The diagram below shows a summary of the processes involved in aerobic respiration.



Explain how Process D enables Process A to continue

[2 marks]

[2 marks]

### Question 1c

c)  
Aerobic respiration produces more ATP per molecule of glucose than anaerobic respiration.

Explain why.

[3 mark]

[3 marks]

### Question 1d

d)  
Different stages of respiration can be inhibited by a range of substances. DNP is a steroid drug used in the weight loss industry. It inhibits respiration by preventing a proton gradient being maintained across membranes. When added to isolated mitochondria it caused the following effects:

- Less ATP produced
- Increase in heat production
- No change in the uptake of oxygen

Explain how DNP caused these changes.

[3 marks]

[3 marks]

### Question 2a

a)

The Krebs cycle takes place in the mitochondrial matrix. The process releases hydrogen ions which provide a source of energy for the synthesis of ATP, using co-enzymes and carrier proteins.

Describe the role of co-enzymes and carrier proteins in the production of ATP.

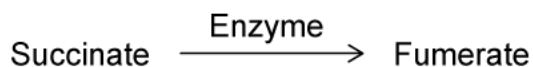
[3 marks]

[3 marks]

### Question 2b

b)

The following reaction takes place in the Krebs cycle.



A student investigated the effect of the enzyme inhibitor malonate on this reaction. The structure of malonate is similar to the structure of succinate.

In the investigation, the student added malonate and the respiratory substrate, pyruvate, to a suspension of isolated mitochondria. She also bubbled oxygen through the suspension.

Explain why the student used pyruvate and not glucose as a respiratory substrate.

[2 marks]

[2 marks]

### Question 2c

c)

Explain how malonate inhibits the formation of fumarate from succinate.

[2 marks]

[2 marks]

**Question 2d**

d)

The student measured the uptake of oxygen by the mitochondria during the investigation. The uptake of oxygen decreased when malonate was added.

Explain why.

[2 marks]

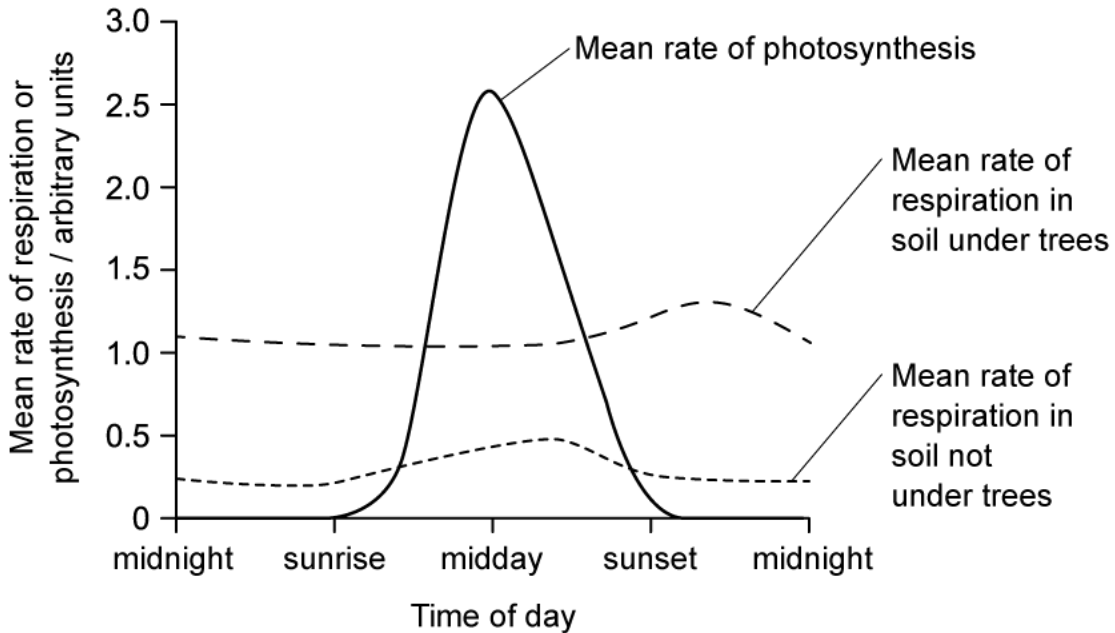
[2 marks]

**Question 3a**

a)

A group of scientists measured the mean rate of respiration in soil found under trees and soil that was not from under trees within the same woodland. The mean rate of photosynthesis in leaves was also measured. The measurements were taken throughout a 24 hour period during the summer.

The diagram below shows the scientists' results.



Suggest an explanation for the mean rate of respiration in soil not under the trees between midday and sunset.

[2 marks]

[2 marks]

**Question 3b**

b)

The mean rate of respiration is higher in soil under the trees throughout the 24 hours. The scientists suggested the mean rate of photosynthesis was the cause of this.

Suggest how the rise in the mean rate of photosynthesis could lead to the rise in the mean rate of respiration in soil under trees

[2 marks]

[2 marks]

**Question 3c**

c)

Suggest why there is a delay between the rise in the mean rate of photosynthesis and the rise in the mean rate of respiration.

**[1 mark]****[1 mark]****Question 3d**

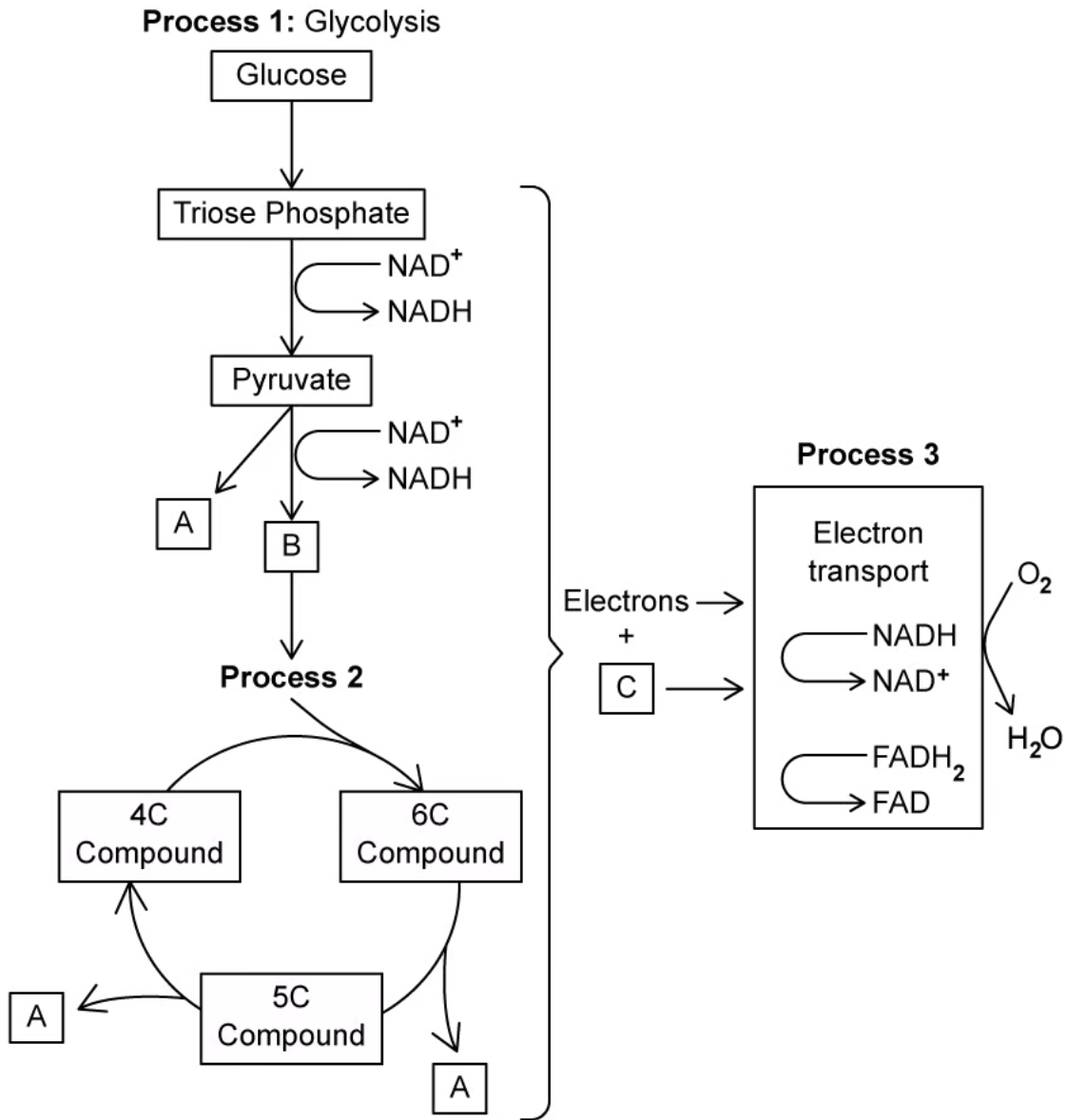
d)

State the measurements needed for the scientists to calculate the rate of carbon dioxide production.

**[2 marks]****[2 marks]**

**Question 4a**

a)  
The diagram below shows the main stages of aerobic respiration.



Name substances A, B and C

[3 marks]

[3 marks]



### Question 4b

b)

Annotate on the diagram,

- i) with an X, where oxidation occurs
- ii) with a Y, where decarboxylation occurs

[2 marks]

[2 marks]

### Question 4c

c)

State precisely where in the cell Process 2 is occurring.

[1 mark]

[1 mark]

### Question 4d

d)

Compare the roles of  $\text{NAD}^+$  and  $\text{NADH}$  in Process 1 and Process 3.

[2 marks]

[2 marks]

### Question 5a

One mark is available for clarity of communication throughout this question.

a)

A large number of disorders are being linked to mitochondrial disease, MD. MD can affect the skeletal muscles, causing fatigue and weakness. Some mitochondrial diseases are caused by mutations of mitochondrial genes inside the mitochondria. Most mitochondrial diseases are caused by mutations of genes in the cell nucleus that are involved in the functioning of mitochondria.

One form of MD is caused by a mutation of a mitochondrial gene that codes for a tRNA, which changes the anticodon on the tRNA. This results in the formation of a non-functional protein in the mitochondrion.

Suggest how a change in anticodon on the tRNA can lead to muscle weakness and fatigue.

[5 marks]

[5 marks]

### Question 5b

b)

A person with MD often has a decreased uptake of oxygen in their respiring cells. This has been attributed to an inhibitory compound of the Krebs cycle.

Explain why an inhibitor of the Krebs cycle would decrease the rate of oxygen uptake by cells.

[3 marks]

[3 marks]

**Question 5c**

c)

Explain the role of chemiosmosis in the process of oxidative phosphorylation

**[7 marks]****[7 marks]**