Importance of ATP (1.1): Eduqas A Level Biology Exam Questions by Topic

14 questions · 34 marks · about 41 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Component 1 · Autumn 2020 · Q3(b)(ii) · 3 marks

(ii) outline the process of chemiosmosis in an animal cell. [3]

Question 2 · A level Component 1 · June 2017 · Q6(a) · 2 marks

6. DNP is an insecticide which inhibits ATP production in mitochondria. DNP acts as an agent that can transport protons across biological membranes. It greatly decreases the proton gradient across mitochondrial membranes. Instead of producing ATP, the energy of the proton gradient is lost as heat.

(a) Following the establishment of an electrochemical gradient, describe the normal route that the protons would take in order to synthesise ATP. [2]

Question 3 · A level Component 1 · June 2025 · Q1(a)(ii) · 3 marks

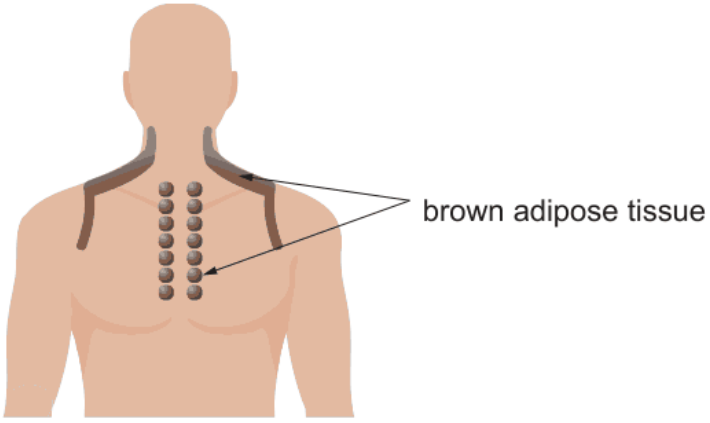
(ii) Describe the role of hydrogen ions in ATP synthesis. [3]

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(d) There are two types of adipose (fat) tissue in humans, white adipose tissue and brown adipose tissue (BAT).

The function of BAT is to generate heat. In adult humans it is found in the neck, shoulders and chest, as shown in **image 3.1**.

Image 3.1



In the inner mitochondrial membrane of BAT cells there is a protein which makes the membrane permeable to protons. When there is a fall in body temperature the concentration of this protein in the membrane increases and more heat is generated.
Capsaicin is a chemical found in red chili peppers. It makes the inner mitochondrial membrane of BAT cells more permeable to protons.

(i) Explain how capsaicin reduces ATP production by BAT cells. [2]

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(b) Some flowers are able to generate heat. The heat is used to evaporate chemicals. In flowers such as the titan arum, *Amorphophallus titanum*, shown in **Image 2.2**, the evaporated chemicals smell like rotting meat. These chemicals attract flies and other insects.

Image 2.2



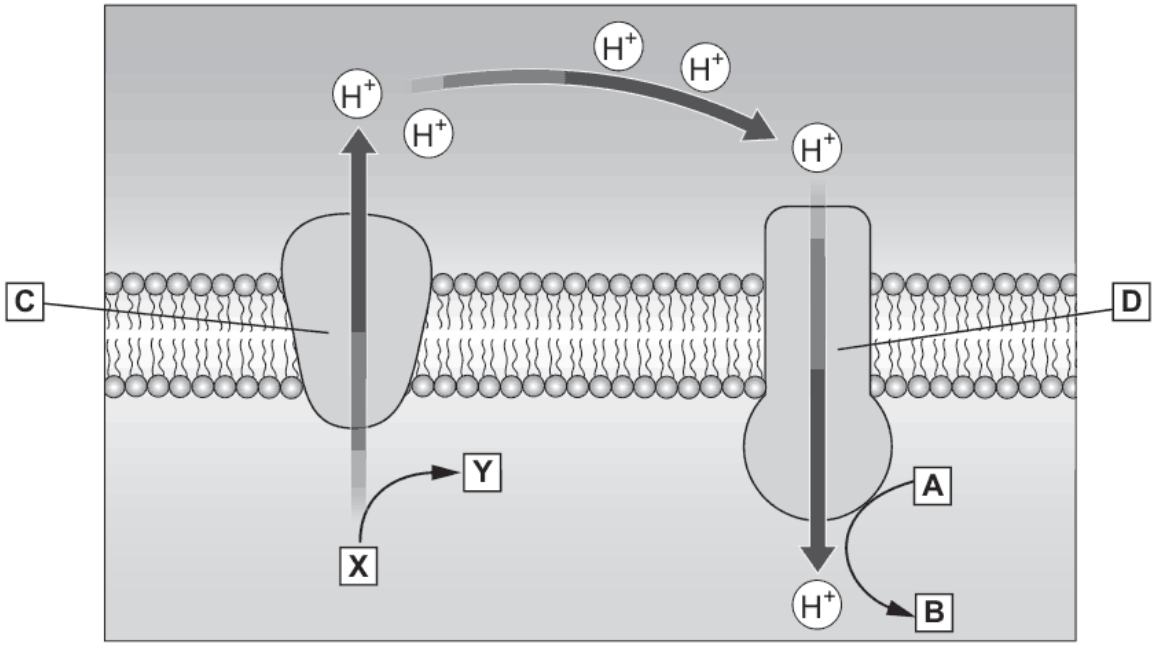
(i) The inner membranes of mitochondria in some cells of the flowers are permeable to protons. Using your knowledge of respiration in mitochondria, explain how this enables the flower to generate heat. [3]

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Question 6 · A level Component 1 · June 2023 · Q1(a)(i)I · 1 mark

1. ATP synthesis involves transferring energy from the flow of protons through an intrinsic protein complex. To enable the flow of protons through this protein complex, other structures are used to create a proton gradient across a membrane. This process is summarised in **Image 1.1**.

Image 1.1



(a) Use **Image 1.1** to answer the following questions.

(i) Name the following:

I. the **general** term for the protein labelled **C**. [1]

.....

Question 7 · A level Component 1 · June 2023 · Q1(a)(i)II · 1 mark

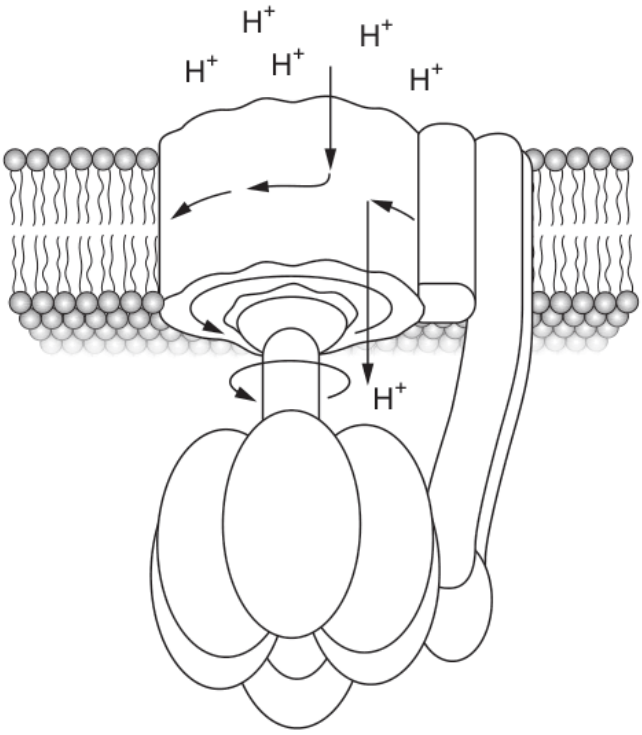
II. the enzyme found in protein complex **D**. [1]

.....

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(b) **Image 1.2** shows a model of the protein complex labelled **D** in **Image 1.1**. These structures are only found in two organelles of eukaryotic cells.

Image 1.2



(i) Name the **two** organelles in which structure **D** is found in eukaryotic cells and state precisely where it would be located in each of these organelles. [2]

Name of organelle	Location of structure **D**
.....	.....
.....	.....

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Question 9 · A level Component 1 · June 2024 · Q1(b)(iii) · 2 marks

In both mitochondria and chloroplasts ATP synthesis requires the movement of protons and electrons, which results in the transfer of energy to ATP molecules.

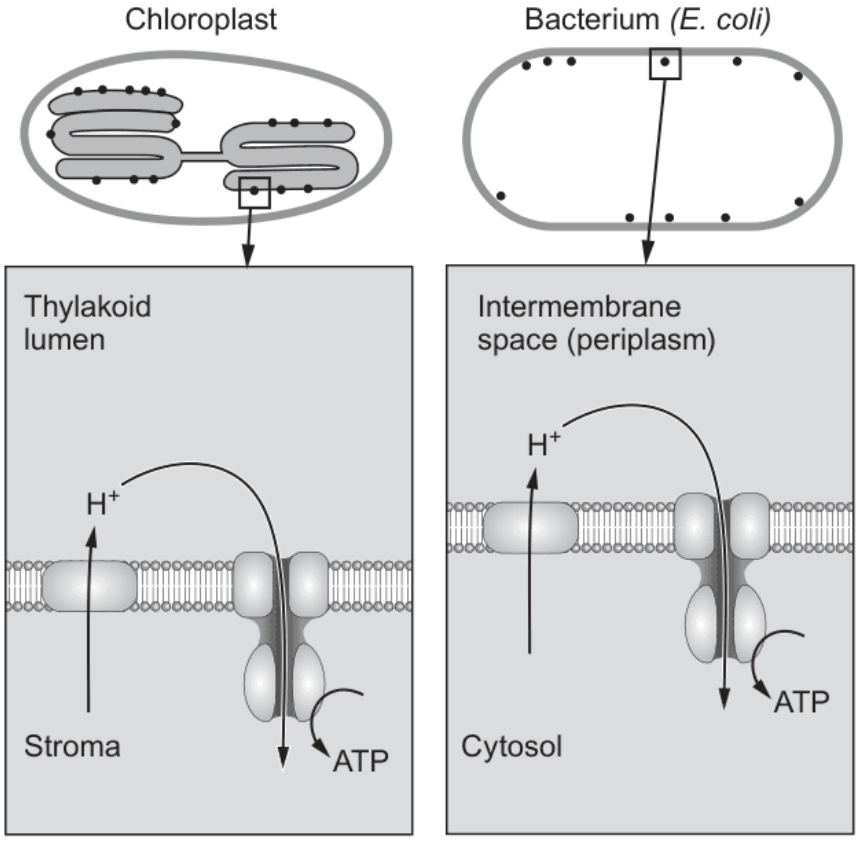
(iii) Complete the table below to identify **where** in chloroplasts and mitochondria the following processes in ATP synthesis take place. [2]

Process in ATP synthesis	Chloroplasts	Mitochondria
Protons are pumped across this membrane by proton pumps using energy from electrons.	.....	.....
A high concentration of protons is formed here.	.....	.....

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Question 10 · A level Component 1 · June 2018 · Q1(c) · 4 marks

(c) A simple diagram showing ATP synthesis in a chloroplast and a Gram negative bacterium is shown below.



State **four** similarities between the process of ATP synthesis in chloroplasts and the bacterium. [4]

Question 11 · A level Component 1 · Autumn 2021 · Q4(b)(ii) · 1 mark

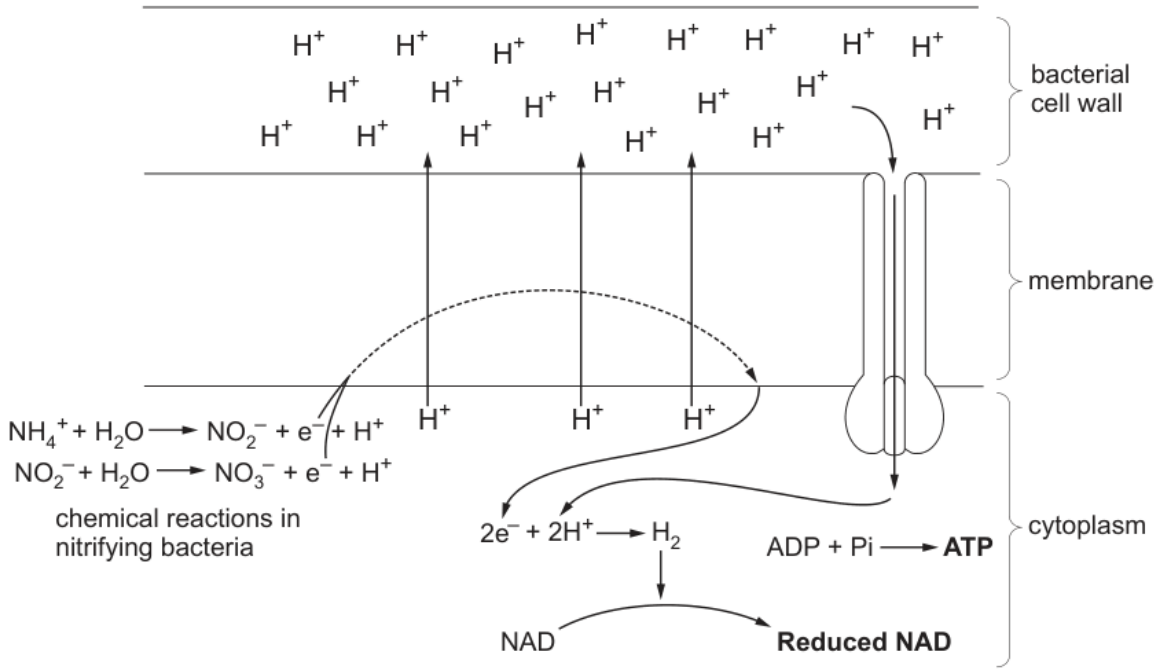
(ii) The electrons are passed along a series of molecules in the membrane. State the name given to this series of molecules. [1]

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Question 12 · information from earlier in the question

(b) **Image 4.1** represents the production of ATP and reduced NAD by nitrifying bacteria.

Image 4.1



Use the information in **image 4.1** and your own knowledge to answer the following.

Question 12 · A level Component 1 · Autumn 2021 · Q4(b)(iii) · 3 marks

(iii) Describe how the energy released from the movement of these electrons is used. [3]

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Question 13 · A level Component 1 · Autumn 2021 · Q4(b)(iv) · 3 marks

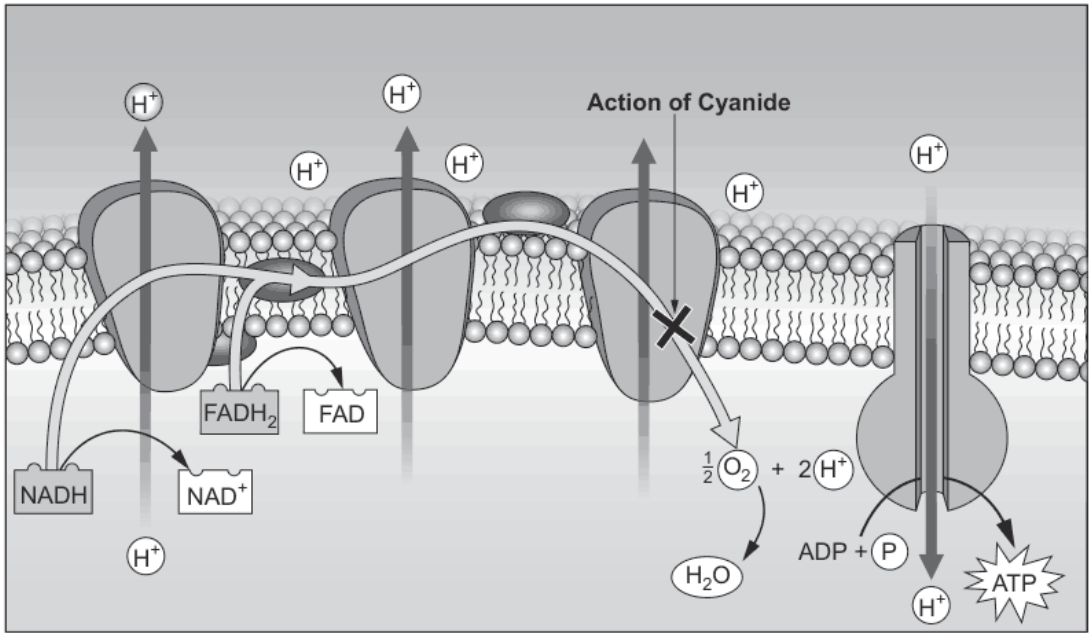
(iv) Describe how ADP is phosphorylated as a result of the reaction shown in **image 4.1**. [3]

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6. Cyanide is an extremely poisonous chemical that affects aerobic respiration in mitochondria. The symptoms of cyanide poisoning include an increase in heart rate, breathing problems and eventually death.

Image 6.1 shows the site of action of cyanide.

Image 6.1



(a) (i) With reference to **image 6.1** explain how cyanide would prevent the process of aerobic respiration. [4]

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Mark schemes

Question 1 · A level Component 1 · Autumn 2020 · Q3(b)(ii) · 3 marks

(ii)	Any **three** (×1) from H^+ flow from intermembrane space to matrix (1) through stalked particle/ protein channels (1) Energy provided to ATP synthase (1) ADP + Pi = ATP (1)	3	3

Question 2 · A level Component 1 · June 2017 · Q6(a) · 2 marks

6	(a)	From the intermembrane space into the matrix (1) Via (a stalked particle containing) ATP synthase (1)	2	2

Question 3 · A level Component 1 · June 2025 · Q1(a)(ii) · 3 marks

(ii)	**Any three (x1) from** • protons {flow / move / diffuse / travel} down a (concentration / electrochemical / owtte) gradient (1) • from inter-membrane space to matrix (1) • through ATP {synthetase / synthase} (1) • provide energy for {ADP + Pi → ATP / description of} (1)	3	3

Question 4 · A level Component 1 · Autumn 2020 · Q3(d)(i) · 2 marks

(d)	(i)	less proton gradient (1) therefore there are less protons to ATP synthetase so produce less ATP (1)	2	2

Question 5 · A level Component 1 · June 2022 · Q2(b)(i) · 3 marks

	(b)	(i)	**Any three (x1) from:** A. no proton gradient produced (1) B. {Less/no} Protons flow through {stalked particles/ ATP synthetase} (1) C. {Less/No ATP} produced (via ATP synthase) therefore any energy released is lost as heat. (1) D. So increased respiration rate (1)	3	3

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Question 6 · A level Component 1 · June 2023 · Q1(a)(i)I · 1 mark

1	(a)	(i)	I	Proton pump / carrier protein (1) Reject channel protein	1			1		

Question 7 · A level Component 1 · June 2023 · Q1(a)(i)II · 1 mark

		II	ATP synthetase / synthase (1) Reject ATPase	1			1		

Question 8 · A level Component 1 · June 2023 · Q1(b)(i) · 2 marks

(b)	(i)	Mitochondria + inner <u>membrane</u> (1) Ignore cristae Chloroplasts + thylakoid <u>membrane</u> (1) Ignore chlorophyll	2	2

Question 9 · A level Component 1 · June 2024 · Q1(b)(iii) · 2 marks

(iii)

Process in ATP synthesis	Chloroplasts	Mitochondria
Protons are pumped…	thylakoid (membrane)	inner (mitochondrial) (membrane) / cristae
A high concentration	thylakoid space / lumen Ignore inter	<u>inter</u>-membrane space Reject inner / intra

All 4 correct = 2 marks; 3 or 2 correct = 1 mark;

2 2

Question 10 · A level Component 1 · June 2018 · Q1(c) · 4 marks

	(c)	Any four (x1) from: 1. Both involve proton pumps/ protons are pumped(1) 2. {Driven/ powered} by {electron (energy)/ redox reactions of ETC}(1) 3. Creation of {electro chemical/ proton/ chemiosmotic} gradient (1) 4. {Diffusion/ flow} of {hydrogen ions/ protons}/ protons {travel down/ pass through} {stalked particle/ carrier protein}/ chemiosmosis(1) 5. {through/ use} ATP synthase (synthesising ATP) (1) Accept synthetase	4	4

Question 11 · A level Component 1 · Autumn 2021 · Q4(b)(ii) · 1 mark

(ii)	electron transport {chain/ system} Accept electron carriers	1	1

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Question 12 · A level Component 1 · Autumn 2021 · Q4(b)(iii) · 3 marks

(iii)	**Any three (×1) from:** Pumping protons (1) against concentration gradient (1) from cytoplasm into (bacterial) cell wall (1) creating proton gradient (1)	3	3	

Question 13 · A level Component 1 · Autumn 2021 · Q4(b)(iv) · 3 marks

(iv)	Protons flow down concentration gradient (1) Through {stalked particle/ ATP synthase/ ATP synthetase} (1) Provide energy to join ADP and Pi (1)	3	3	

Question 14 · A level Component 1 · Autumn 2021 · Q6(a)(i) · 4 marks

6	(a)	(i)	**Any four (×1) from:** A. ATP synthesis via electron transport chain stops (1) B. Because cyanide stops transfer of an electron to final electron acceptor (1) C. Electrons cannot be accepted by electron carriers / cytochromes along ETC (1) D. Flow of electrons stops (1) E. Electron donors $NADH_2$ and $FADH_2$ cannot be oxidised (1)	3	1	4

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