# Respiration (1.3): Eduqas A Level Biology Exam Questions by Topic

20 questions · 43 marks · about 52 minutes. Answer in the spaces, then check the mark schemes at the end.

**Question 1 · A level Component 1 · Autumn 2020 · Q3(b)(i) · 2 marks**

*(b)* With reference to the production of ATP:

(i) state what is meant by substrate level phosphorylation; [2]

.....

.....

.....

.....

**Question 2 · A level Component 1 · June 2023 · Q3(b)(i) · 1 mark**

(b) Some ATP is produced directly in glycolysis. More ATP is produced as a result of glycolysis via the electron transport chain.

(i) Name the process by which ATP is produced directly in glycolysis. [1]

.....

**Question 3 · A level Component 1 · June 2023 · Q3(b)(iii) · 2 marks**

(iii) Identify **one** type of enzyme involved in the conversion of triose phosphate to pyruvate and state the function of this type of enzyme. [2]

.....

.....

.....

.....

**Question 4 · A level Component 1 · June 2023 · Q3(b)(iv) · 1 mark**

(iv) Describe what happens to pyruvate in animal cells under anaerobic conditions. [1]

.....

.....


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 5 · A level Component 1 · June 2017 · Q8(a)(i) · 2 marks**

**8.** Respiration is a process that takes place in all cells.

*(a)* (i) Describe the stage of the biochemical pathway in the cytoplasm which produces reduced NAD. [2]

.....

.....

.....

.....

**Question 6 · information from earlier in the question**

*(c)* NAD is a hydrogen acceptor used in many stages of respiration. Methylene blue can be used as an artificial hydrogen acceptor. It decolourises when reduced and can be used to give an indication of the rate of respiration.

An experiment was set up using isolated liver mitochondria extracted in ice-cold, isotonic buffer. The same volume and concentration of pyruvate, mitochondrial suspension and methylene blue was added to each experiment. The temperature was changed for each experiment and the experiment repeated three times. Thermostatic water baths were used throughout.

**Question 6 · A level Component 1 · June 2019 · Q4(c)(ii) · 2 marks**

(ii) Explain why pyruvate was used as the respiratory substrate and not glucose. [2]

.....

.....

.....

.....

.....

.....


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 7 · A level Component 1 · June 2022 · Q2(a)(iii) · 4 marks**

(iii) ATP acts as a common energy source for reactions in the cells of all living organisms. Most ATP in eukaryotic cells is synthesised in the mitochondria. Describe the role of NAD in the synthesis of ATP. [4]

**Question 8 · A level Component 1 · June 2017 · Q8(a)(ii) · 2 marks**

The energy budget for the complete oxidation of a single glucose molecule is frequently quoted as 38 ATP.

The majority of ATP produced in respiration is from the re-oxidation of the reduced NAD and reduced FAD, by the electron transport chain.

Some of the reduced coenzymes must be transferred from the cytoplasm into the mitochondrial matrix. This is done via two mechanisms in insect flight muscles.

**A** If levels of reduced NAD in the cytoplasm are high, the reduced NAD is transferred into the matrix through the outer and inner mitochondrial membranes.

**B** If cytoplasmic levels of reduced NAD are low, then an alternative pathway is used whereby the reduced NAD passes its electrons to FAD in the inner mitochondrial membrane.

(ii) Explain why the ATP yield per glucose molecule will be decreased if mechanism **B** is used. [2]


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 9 · A level Component 1 · June 2017 · Q8(a)(iii) · 2 marks**

(iii) Explain why mechanism **A** would be used in the muscle of flying insects. [2]

.....

.....

.....

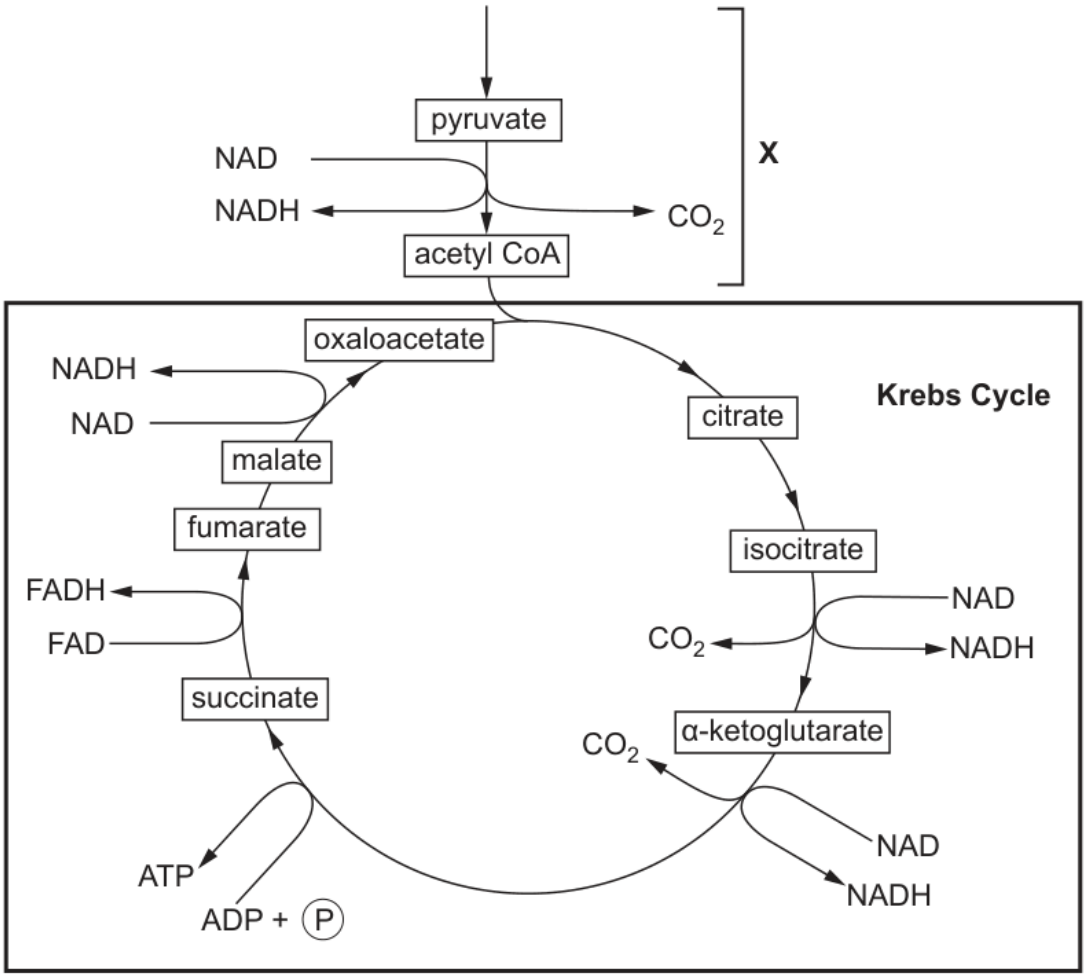
.....

.....

**Question 10 · information from earlier in the question**

**Image 5.1** shows the stages of respiration that take place in the mitochondria.

**Image 5.1**





Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 10 · A level Component 1 · June 2025 · Q5(a)(iv) · 2 marks**

(iv) Triacetin is a triglyceride that can be used as an alternative respiratory substrate to glucose. From each molecule of triacetin, four molecules of acetyl CoA are formed.
Use **Image 5.1** and your knowledge of aerobic respiration to calculate the number of molecules of ATP that could be synthesised as a result of the breakdown of one molecule of triacetin. [2]

Number of molecules of ATP = .....

**Question 11 · information from earlier in the question**

**4.** Respiration is a catabolic process during which glucose, lipids and proteins can be broken down to release energy. Some of the energy is transferred to chemical energy in the form of ATP.

(a) Theoretically, the energy released from one molecule of glucose by aerobic respiration is sufficient to produce 38 molecules of ATP. The removal of the terminal phosphate group from one ATP molecule by hydrolysis releases 30.6 kJ $mol^{-1}$. When glucose reacts directly with oxygen 2870.0 kJ $mol^{-1}$ are released.

**Question 11 · A level Component 1 · June 2022 · Q4(a)(ii) · 1 mark**

(ii) State what happens to the energy which is not used to generate ATP. [1]

.....

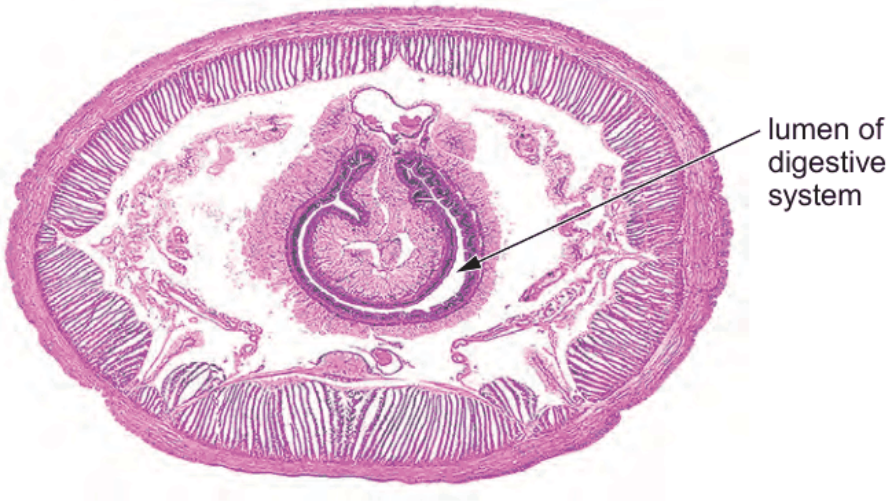
.....


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

*(c)* Earthworms are multicellular organisms that rely on their external body surface for gas exchange.

Figure 6.2 shows a cross-section of an earthworm at a magnification of ×40.

**Figure 6.2**




(i) Earthworms rely on glucose as their main respiratory substrate and can respire glucose both aerobically and anaerobically.

State the maximum yield of ATP from one molecule of glucose under the following conditions. [2]

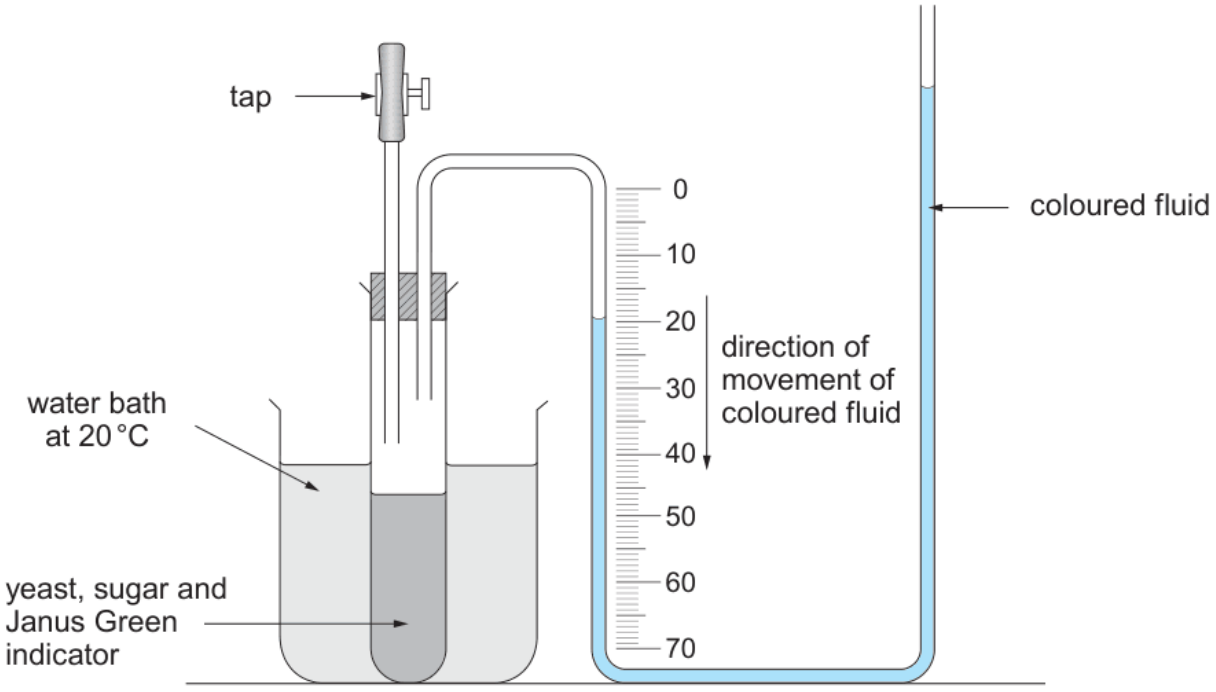
**aerobic** .....

**anaerobic** .....


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

6. **Image 6.1** shows the apparatus which can be used to measure the production or absorption of gases during respiration. The apparatus relies on changes in pressure to move the coloured fluid along the tube.

**Image 6.1**




A student used this apparatus to compare the rate of **anaerobic** respiration in yeast using different sugars as the respiratory substrate.

Janus Green indicator is blue if oxygen is present and pink if no oxygen is present.

- Janus Green indicator is added to the yeast and sugar in a test tube as shown above.
- The apparatus is left with the tap open for 5 minutes.
- After this time the tap is closed.
- Once the solution turns pink, the time for the meniscus to move 10 mm is recorded.
- The time for the meniscus to travel 10 mm is repeated a further four times.
- All controlled variables are the same for each sugar and for each repeat.

*(a)* Explain the following:


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 13 · A level Component 1 · Autumn 2020 · Q6(b) · 2 marks**

*(b)* Explain why you would expect the meniscus to move in the direction of the arrow. [2]

.....

.....

.....

.....

**Question 14 · A level Component 1 · Autumn 2020 · Q6(f) · 2 marks**

*(f)* Predict what would happen to the position of the meniscus if the yeast was only carrying out **aerobic** respiration. Explain your answer. [2]

.....

.....

.....

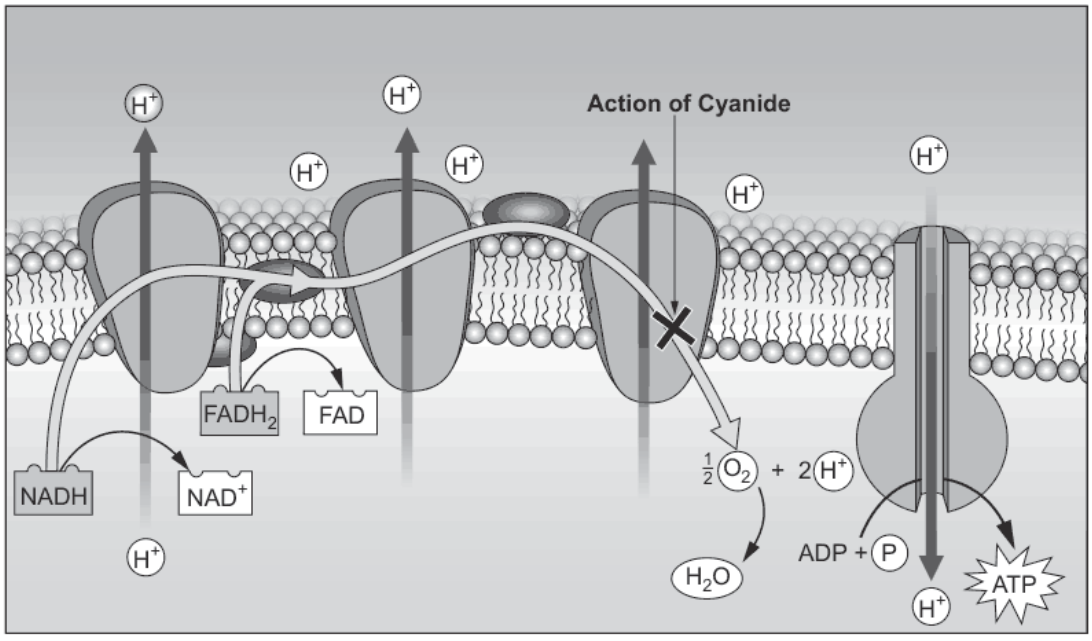
.....

**Question 15 · information from earlier in the question**

**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**





Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 15 · A level Component 1 · Autumn 2021 · Q6(a)(ii) · 3 marks**

(ii) Explain why blood lactate concentration rises as a symptom of cyanide poisoning. [3]

.....

.....

.....

.....

.....

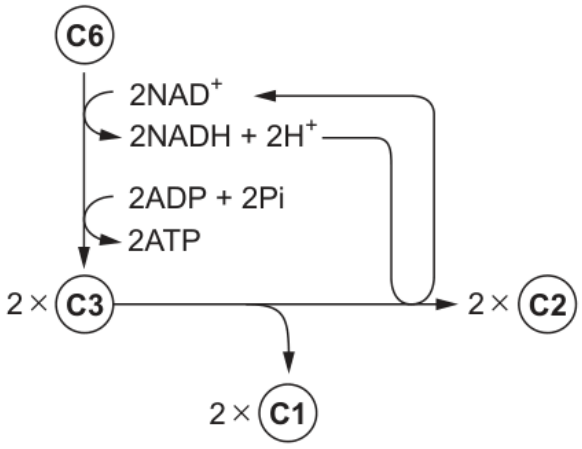
.....

.....

**Question 16 · information from earlier in the question**

**3.** Yeast (*Saccharomyces cerevisiae*) is a unicellular fungus that feeds saprotrophically on a range of substrates which are rich in sugars. Yeast is used extensively in the production of bread and sparkling (fizzy) wine through a process known as fermentation. Fermentation is summarised in **Image 3.1**.

**Image 3.1**




**Question 16 · A level Component 1 · June 2024 · Q3(a)(iii)I · 2 marks**

(iii) In **Image 3.1**, **C1**, **C2**, **C3** and **C6** indicate the number of carbon atoms in different organic molecules.

I. Name the molecules that contain 1, 2 and 3 carbon atoms. [2]

**C1** .....

**C2** .....

**C3** .....


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 17 · A level Component 1 · June 2024 · Q3(a)(iv) · 3 marks**

(iv) If yeast cells respire for a long time using the process summarised in **Image 3.1** they eventually die. When animal cells respire in a similar way it does not cause cell death. Explain these statements. [3]

**Question 18 · A level Component 2 · June 2019 · Q6(b) · 3 marks**

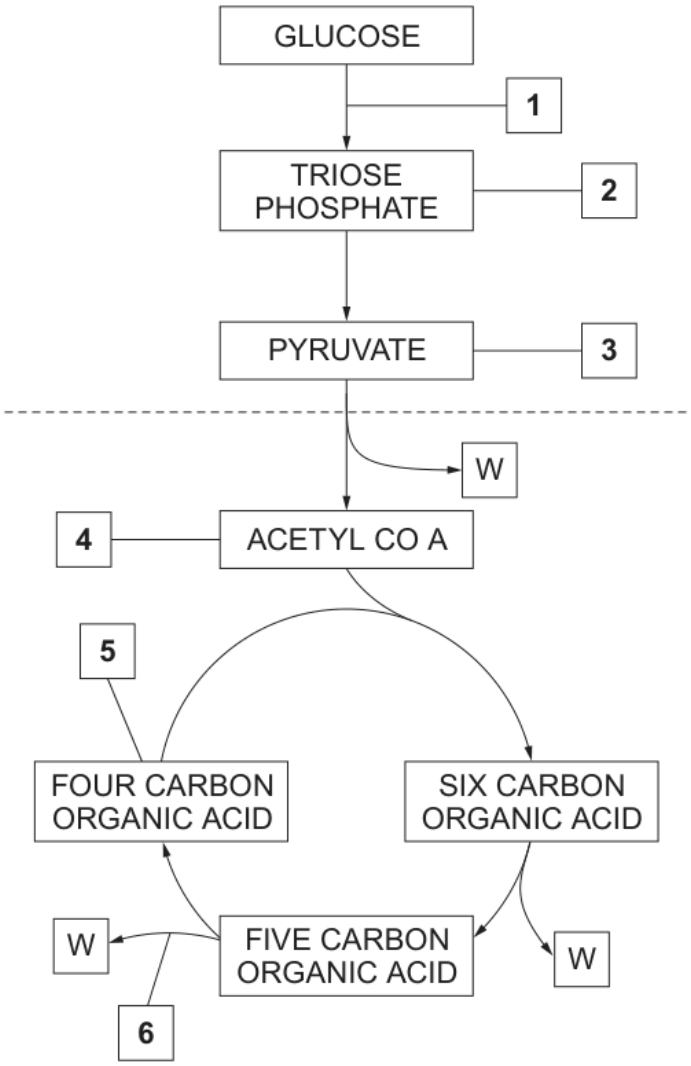
In the brewing process the sugars produced by the germinating grains are extracted and are used to provide yeast with their respiratory substrate.

*(b)* Give the word equation for anaerobic respiration in yeast. Explain why it is less efficient than aerobic respiration for the yeast but essential to the brewing industry. [3]


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

(b) **Image 4.2** shows a summary of the stages involved in the aerobic respiration of glucose.

**Image 4.2**




(i) Lipids are digested into glycerol, a three carbon compound, and fatty acids. The fatty acids are then broken down further in the liver into two carbon fragments.

Using numbers from **Image 4.2** indicate where the products of fat digestion could enter the respiratory pathway. [2]

Glycerol .....

Fatty acids .....


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 20 · A level Component 1 · June 2017 · Q8(b) · 3 marks**

*(b)* If a human eats a diet low in nutrients, amino acids from muscle tissue can be used as an alternative respiratory substrate. The amino acids, when processed, produce nitrogenous waste.
Describe the production of nitrogenous waste and state where this takes place. [3]


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

## Mark schemes

**Question 1 · A level Component 1 · Autumn 2020 · Q3(b)(i) · 2 marks**

| | | | | |
|---|---|---|---|---|
| *(b)* | (i) | Energy is derived directly from a reaction/ break down of substrate (1)<br>to combine ADP and Pi (1) | 2 | 2 |

**Question 2 · A level Component 1 · June 2023 · Q3(b)(i) · 1 mark**

| | | | | | |
|---|---|---|---|---|---|
| (b) | (i) | Substrate-level phosphorylation (1)<br>Reject photophosphorylation | 1 | 1 | |

**Question 3 · A level Component 1 · June 2023 · Q3(b)(iii) · 2 marks**

| | | | | |
|---|---|---|---|---|
| (iii) | | dehydrogenase (1)<br>removal of hydrogen / oxidation of triose phosphate (1) reject reference to hydrogen molecules | 2 | 2 |

**Question 4 · A level Component 1 · June 2023 · Q3(b)(iv) · 1 mark**

| | | | | |
|---|---|---|---|---|
| (iv) | | (Pyruvate) {converted/ reduced} to lactate / lactic acid | 1 | 1 |

**Question 5 · A level Component 1 · June 2017 · Q8(a)(i) · 2 marks**

| | | | | | |
|---|---|---|---|---|---|
| **8** | (a) | (i) | Any 2 from:<br>From glycolysis (1) NOT link reaction/ Krebs<br>Oxidation/ dehydrogenation reaction/ action of dehydrogenase (1)<br>conversion of triose phosphate <u>to pyruvate</u> (1) | 2 | 2 |

**Question 6 · A level Component 1 · June 2019 · Q4(c)(ii) · 2 marks**

| | | | | | |
|---|---|---|---|---|---|
| | (ii) | | {Glucose hydrolysis/glycolysis} occurs in the cytoplasm (1)<br>Pyruvate is the substrate used {by mitochondria/ in the link reaction} (1) | | |

| | | | | | |
|---|---|---|---|---|---|
| | 2 | | 2 | | |


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 7 · A level Component 1 · June 2022 · Q2(a)(iii) · 4 marks**

| | | | | |
|---|---|---|---|---|
| (iii) | **Any four (x1) from:**<br>A. (NAD) becomes reduced/ owtte (during glycolysis, link and Krebs) (1)<br>B. Deliver H (atoms) to electron transport chain (1)<br>C. Electrons released provide energy for H+ to be pumped / fuel proton pumps (1)<br>D. (Protons pumped) into inter-membrane space (1)<br>E. Creates {H+ / electrochemical / chemiosmotic} gradient (1)<br>F. needed for ATP synthesis/ or description of (1) | 4 | 4 | |

**Question 8 · A level Component 1 · June 2017 · Q8(a)(ii) · 2 marks**

| | | | | |
|---|---|---|---|---|
| (ii) | Reduced FAD {passes its electrons to the second proton pump / only uses two proton pumps}(1)<br>Only 2 ATP are produced (per reduced FAD) (1) | 2 | 2 | |

**Question 9 · A level Component 1 · June 2017 · Q8(a)(iii) · 2 marks**

| | | | | |
|---|---|---|---|---|
| (iii) | {More respiration/ more ATP} required for muscle contraction(1)<br>the cells use the mechanism which yields {more ATP/ 3 ATP per reduced NAD} (1) | 2 | 2 | |

**Question 10 · A level Component 1 · June 2025 · Q5(a)(iv) · 2 marks**

| | | | | |
|---|---|---|---|---|
| (iv) | 48 (2)<br>**If incorrect award 1 mark for:**<br>12 x 4 (1)<br>12 ATP per Krebs cycle (1)<br>9 + 2 + 1 [Description of how 12 ATP per cycle achieved]<br>(9 (from NADH), 2 (from FADH), + 1 (from SLP)) (1)<br>36 + 8 + 4 [Description of how 48 ATP per 4 cycles achieved] (36 (from NADH), 8 (from FADH), + 4 (from SLP)) (1) | 2 | 2 | 2 |

**Question 11 · A level Component 1 · June 2022 · Q4(a)(ii) · 1 mark**

| | | | |
|---|---|---|---|
| (ii) | {Lost as/ released as} heat | 1 | 1 |

**Question 12 · A level Component 3 · June 2019 · Q6(c)(i) · 2 marks**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *(c)* | (i) | C1 | **aerobic** = 38 (accept between 32-38) 2<br>**anaerobic** = 2 | | 2 | 2 | | |


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 13 · A level Component 1 · Autumn 2020 · Q6(b) · 2 marks**

| | | | | |
|---|---|---|---|---|
| *(b)* | $CO_2$ levels go up. (1)<br>Pressure goes up/ pushes {meniscus/ fluid} down (1) | 2 | 2 | 2 |

**Question 14 · A level Component 1 · Autumn 2020 · Q6(f) · 2 marks**

| | | | | |
|---|---|---|---|---|
| *(f)* | Would not move (1)<br>Equal volumes of carbon dioxide produced as oxygen used/ no net change in volume (1) | 2 | 2 | 1 |

**Question 15 · A level Component 1 · Autumn 2021 · Q6(a)(ii) · 3 marks**

| | | | |
|---|---|---|---|
| (ii) | **Any three (×1) from:**<br>NADH (from glycolysis) cannot pass H to Krebs (1)<br>H given to pyruvate to make lactate (1)<br>So that NAD regenerated (1)<br>So that glycolysis can continue and make ATP anaerobically (1) | 3 | 3 |

**Question 16 · A level Component 1 · June 2024 · Q3(a)(iii)I · 2 marks**

| | | | | | |
|---|---|---|---|---|---|
| (iii) | I | C1 = carbon dioxide / $CO_2$<br>C2 = ethanol Reject ethanal<br>C3 = pyruvate<br>3 correct = 2 marks<br>2 correct = 1 mark<br>0/1 correct = 0 marks | 2 | 2 | |

**Question 17 · A level Component 1 · June 2024 · Q3(a)(iv) · 3 marks**

| | | | |
|---|---|---|---|
| (iv) | • Ethanol {is toxic / cannot be converted to non-toxic substances/ cannot be broken down} (1)<br>• Anaerobic respiration in animals produced {lactate / lactic acid} (1)<br>ignore $CO_2$ produced<br>Reject if refer to mitochondria<br>• Lactate can be {removed in presence of (excess) oxygen / Broken down (in liver)} /<br>Production of lactate is reversible (1) | 3 | 3 |


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

**Question 18 · A level Component 2 · June 2019 · Q6(b) · 3 marks**

| | | | | | |
|---|---|---|---|---|---|
| *(b)* | | Glucose ⟶ Ethanol + Carbon dioxide (1)<br>{less {energy/ ATP}/ 2ATP} is released/ glucose is not completely broken down (1) NOT energy produced<br>{Alcohol/ethanol} is needed for {beer / alcoholic drinks/ products/ owwte} (1) | 3 | 3 | |

**Question 19 · A level Component 1 · June 2022 · Q4(b)(i) · 2 marks**

| | | | | | |
|---|---|---|---|---|---|
| (b) | (i) | | (glycerol) 2 (1) Accept 3<br>(fatty acids) 4 (1) | 2 | 2 |

**Question 20 · A level Component 1 · June 2017 · Q8(b) · 3 marks**

| | | | | | |
|---|---|---|---|---|---|
| (b) | | Removal of {amino/ amine/ $NH_2$} group/ deamination/ formation of {keto acids/ammonia} (1)<br>Combining of amino group with carbon dioxide/formation of urea (amino/ amine/ $NH_2$ group)(1)<br>In the liver (1) | 3 | | 3 |


Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).