PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 5: ENERGY FOR BIOLOGICAL PROCESSES

AEROBIC RESPIRATION

SCORE	PERCENTAGE
/62	%

STEMUP

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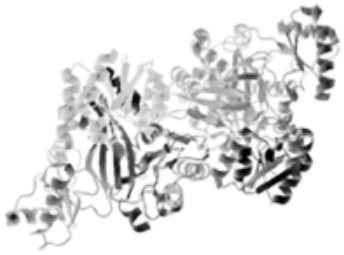
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Q1.

Acetyl CoA is produced in the link reaction when pyruvate is broken down.

The photograph shows a molecule of the enzyme acetyl CoA carboxylase.



This enzyme is involved in the conversion of acetyl CoA into fatty acids.

The enzyme is activated by citrate.

Citrate does not bind at the active site.

Citrate is produced in the Krebs cycle.

The enzyme is inhibited by long chain fatty acyl CoA molecules.

Fatty acyl CoA molecules have a longer carbon chain than acetyl CoA.

(i) Analyse the information to explain how the activity of the enzyme acetyl CoA carboxylase is controlled.

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(ii) Explain why inhibitors of this enzyme may be useful in treating obesity in humans.

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(Total for question = 7 marks)

Q2.

The scientific article you have studied is adapted from articles in New Scientist.

Use the information from the article and your own knowledge to answer the following questions.

(a) Suggest why 'incredibly efficient cellular mechanisms' can increase the chance of obesity (paragraphs 4 and 5).

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(b) A larger VO_2max means more oxygen can enter a mitochondrion and therefore more energy can be released from fuel (paragraph 8).

Name **two** substances, other than oxygen, that need to enter the mitochondrion to enable energy to be released from fuel.

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(c) Describe the structure of glycogen (paragraph 11).

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(d) Using the information in paragraphs 12 to 14, explain how lowered testosterone levels may help a cyclist to race harder on successive days.

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(e) Explain why Coyle suggests that greater muscle efficiency may be linked to an increase in the percentage of **slow twitch** muscle fibres (paragraph 20).

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*(f) Suggest how 'the development of a leak in a specific class of calcium channel in muscle cells' can lead to muscle fatigue (paragraph 23).

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(g) The ACE gene codes for the synthesis of angiotensin converting enzyme (ACE) (paragraph 25).

Complete the table by naming two nucleic acids involved in each of the processes described.

(2)

Process	Two nucleic acids involved in the process
Transcription of the ACE gene	1 ..... 2 .....
Synthesis of ACE at a ribosome	1 ..... 2 .....

(h) A variant of the APOE gene could put individuals at increased risk in contact sports. DNA profiling is a technique that can be used in genetic screening.

Suggest how DNA profiling could be carried out to identify this variant of the APOE gene (paragraph 27).

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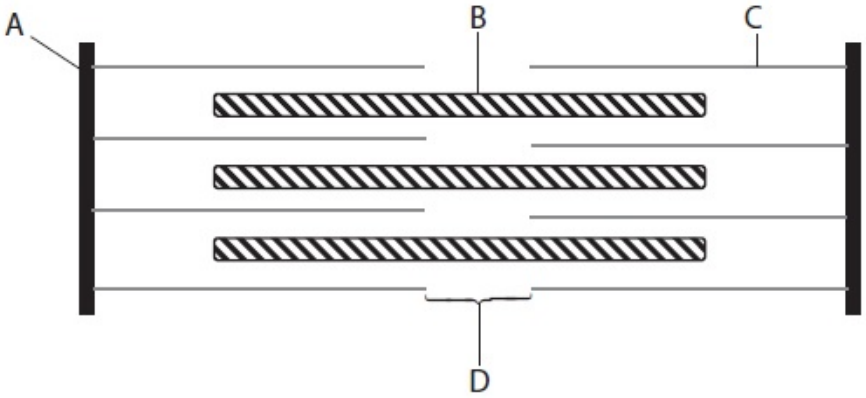
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(i) The titin gene produces a protein that attaches to myosin in a sarcomere (paragraph 30).



Place a cross (☒) in the box that identifies myosin shown in the diagram.

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(j) The colder the water Japanese Ama divers swim in, the higher their resting metabolic rate (paragraph 50).

Suggest and explain why this might be an advantage to these divers.

(3)

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(k) Pugh noticed the effects of climate change (paragraph 53).

Name **two** greenhouse gases that contribute to climate change. Give **one** source of each of these gases.

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(l) Using the information in paragraph 55, calculate the percentage increase in Pugh's core body temperature due to his "anticipatory thermogenesis".

Show your working.

(2)

Answer = ... %

(Total for question = 30 marks)

Q3.

Compare and contrast the way in which ATP is synthesised in mitochondria and in chloroplasts.

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Q4.

ATP is involved in a wide variety of biological processes such as active transport and muscle contraction.

A typical adult human body has a mass of 62 kg.

It contains approximately 250 g of ATP and has approximately 3.7×10^{13} cells.

(i) Calculate the mean mass of ATP in one cell of a typical human.

Express your answer in standard form.

(2)

Answer ..... g

(ii) Explain why this calculation does **not** give an accurate estimate of the mass of ATP in a nerve cell.

(2)

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Q5.

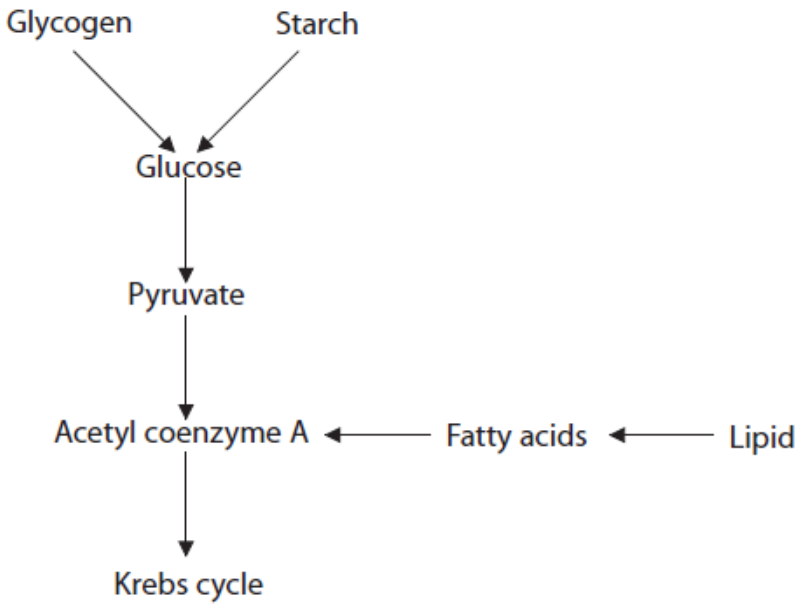
Answer the question with a cross in the box you think is correct ☒. If you change your

mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Lipids and carbohydrates are used as respiratory substrates.

The respiration of lipids generates more ATP than the respiration of carbohydrates.

The diagram shows some steps in the respiration of carbohydrates and lipids.



(i) Where in a cell does the conversion of pyruvate to acetyl coenzyme A take place?

(1)

☒ **A** cytoplasm

☒ **B** matrix

☒ **C** stroma

☒ **D** tonoplast

(ii) Explain why lipids can be respired only in aerobic conditions.

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(Total for question = 4 marks)

Q6.

Lipids and carbohydrates are used as respiratory substrates.

The respiration of lipids generates more ATP than the respiration of carbohydrates.

The respiratory quotient (RQ) can indicate which substrate is being used in respiration.

The formula used to calculate RQ is

$$\text{RQ} = \frac{\text{volume of carbon dioxide produced}}{\text{volume of oxygen used}}$$

(i) State why the RQ for carbohydrate is 1.0.

(1)

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(ii) The table shows the formula for calculating the volume of oxygen used and the volume of carbon dioxide produced in the respiration of lipids.

The number of carbon atoms in the lipid is represented by n.

Volume of oxygen used / a.u.	Volume of carbon dioxide produced / a.u.
4.5n + 3.75	3n + 6

Calculate the RQ for a lipid containing 21 carbon atoms.

(2)

Answer .....

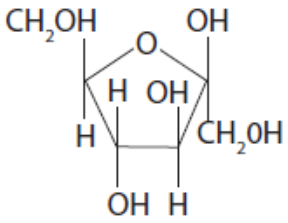
(Total for question = 3 marks)

Q7.

Sperm cells are released into the female genital tract in seminal fluid.

Seminal fluid contains fructose instead of glucose.

The diagram shows the structure of fructose.



(i) Compare and contrast the structure of fructose with the structure of glucose.

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(ii) Explain the advantages of the presence of fructose in seminal fluid.

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(Total for question = 6 marks)

Q8.

Lipids and carbohydrates are used as respiratory substrates.

The respiration of lipids generates more ATP than the respiration of carbohydrates.

The respiratory quotient (RQ) can indicate which substrate is being used in respiration.

The formula used to calculate RQ is

$$\text{RQ} = \frac{\text{volume of carbon dioxide produced}}{\text{volume of oxygen used}}$$

Explain why an insect has an RQ of 1.0 at rest and an RQ of 0.7 during flight.

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