PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 5: ENERGY FOR BIOLOGICAL PROCESSES

OXIDATIVE PHOSPHORYLATION

SCORE	PERCENTAGE
/81	%

STEMUP

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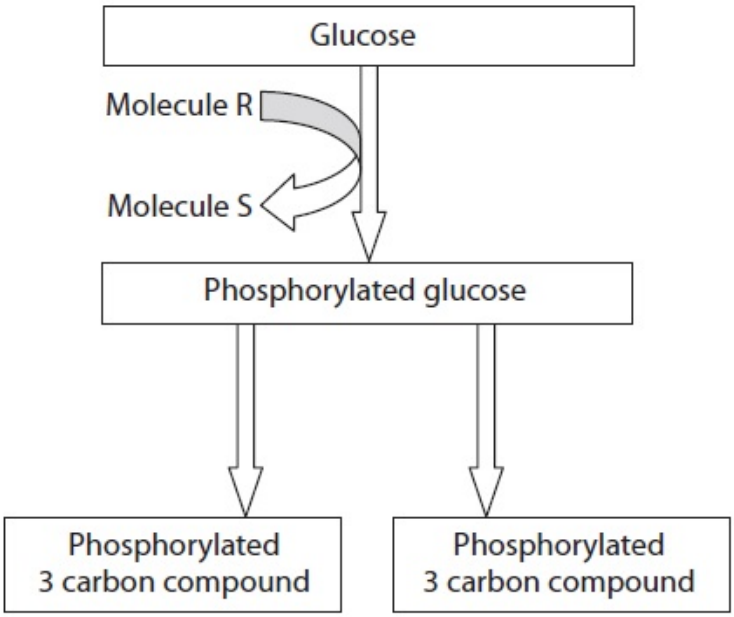
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Q1.

Respiration is a vital process in living organisms. All organisms carry out glycolysis. The Krebs cycle also occurs in some organisms.

(a) The diagram below shows some of the stages in glycolysis, using the hexose sugar glucose.



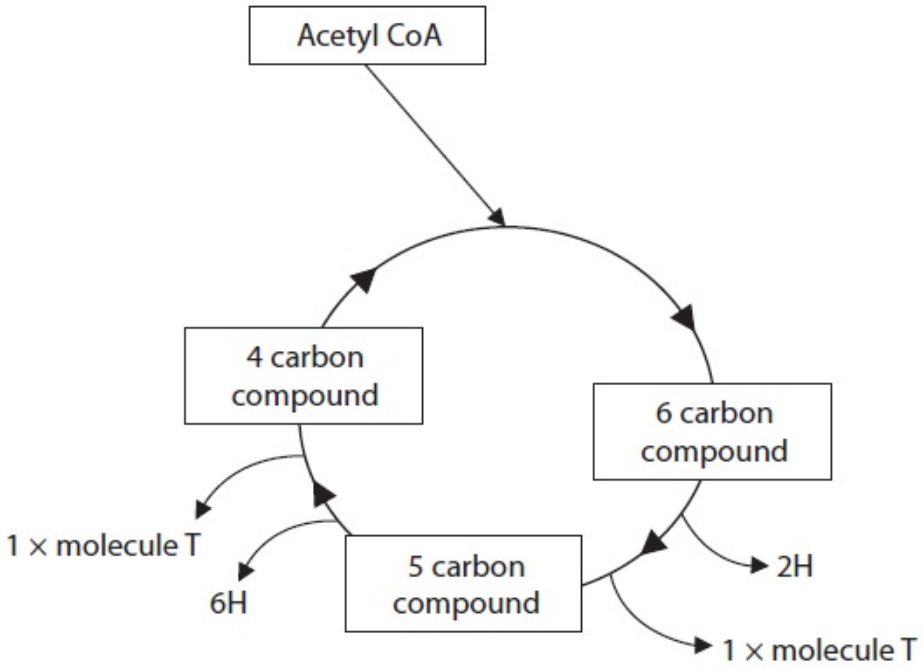
Name the molecules R and S shown in the diagram.

(2)

Molecule R .....

Molecule S .....

(b) The diagram below shows some of the stages in the Krebs cycle.



(i) Name molecule T and use the information in the Krebs cycle diagram to give a reason for your answer.

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(ii) Using information in the diagram, suggest what would happen in the Krebs cycle if acetyl CoA became unavailable.

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(b) The hydrogen (H) from the Krebs cycle enters the electron transport chain and oxidative phosphorylation occurs.

Explain what is meant by the term **oxidative phosphorylation**.

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(Total for question = 10 marks)

Q2.

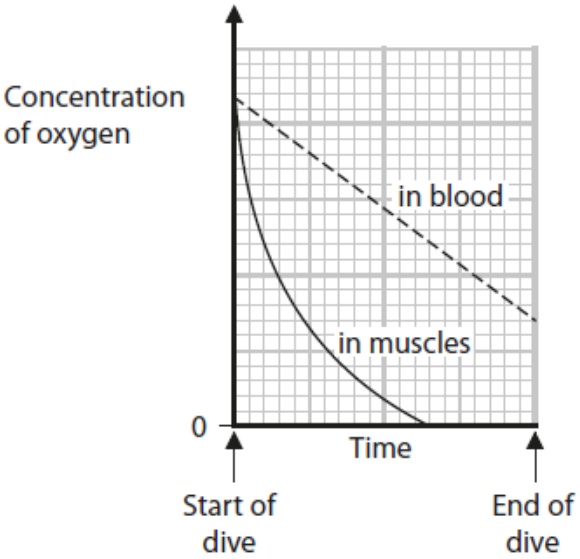
Weddell seals spend a lot of their time swimming underwater, diving to find food and diving to

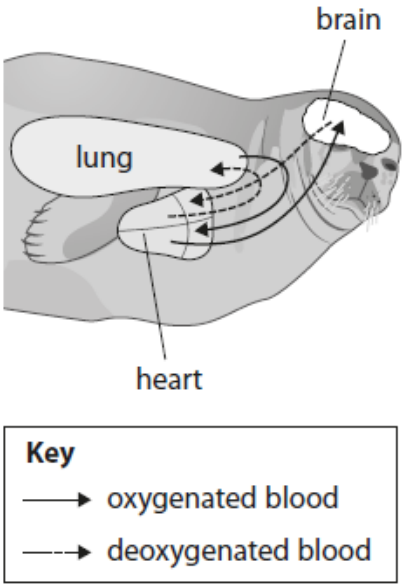
avoid predators.

However, they do have to come to the surface to breathe.

An investigation studied the change in the concentration of oxygen in the blood and muscles of a Weddell seal during a dive.

The graph shows the results of this investigation and the diagram shows part of the circulation of blood in the seal during the dive.





Analyse the data to explain these results.

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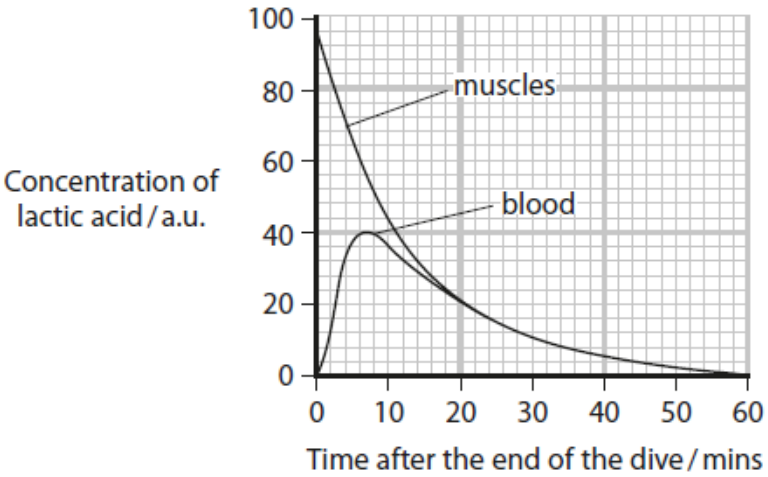
(Total for question = 3 marks)

Q3.

Weddell seals spend a lot of their time swimming underwater, diving to find food and diving to avoid predators.

However, they do have to come to the surface to breathe.

The graph shows the changes in the lactic acid concentration in the muscles and blood of a Weddell seal, after a prolonged dive.



Explain the importance of these changes after the Weddell seal comes to the surface to breathe.

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(Total for question = 3 marks)

Q4.

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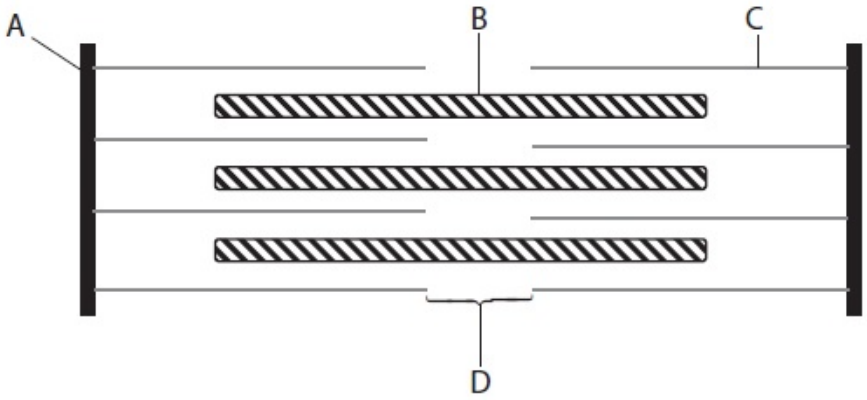
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(i) The titin gene produces a protein that attaches to myosin in a sarcomere (paragraph 30).



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.

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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)

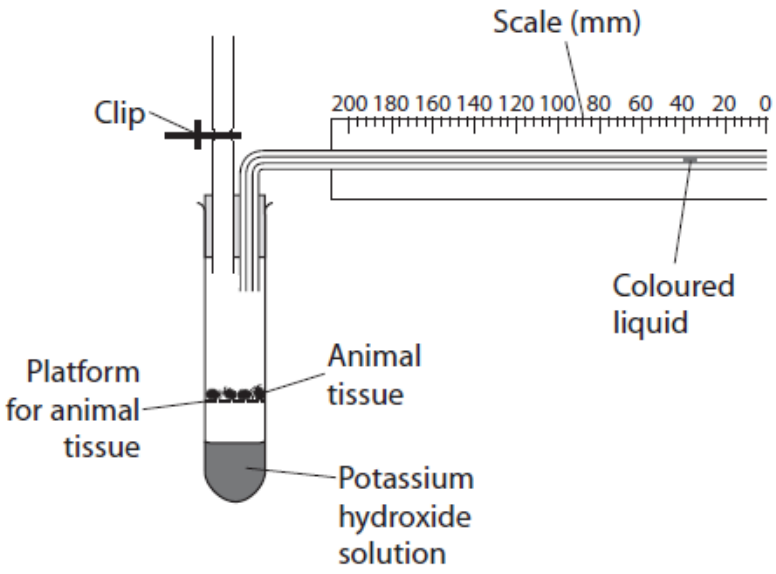
Q5.

The tissues of some animals can carry out anaerobic and aerobic respiration.

Three investigations were carried out to study respiration in an animal tissue, using the apparatus shown below.

The tissue used glucose as the respiratory substrate.

All other variables were kept constant.



The table below shows the three investigations that were carried out and the result for investigation 1.

Investigation	Type of respiration	Potassium hydroxide solution absent or present	Coloured liquid moved to the left	Coloured liquid moved to the right	Coloured liquid did not move
1	Anaerobic	Absent	☐	☐	☒
2	Aerobic	Absent	☐	☐	☐
3	Aerobic	Present	☐	☐	☐

(i) Complete the table by placing a cross in one box ☒ for each of investigations 2 and 3 to show the response of the coloured liquid.

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(ii) Explain why the coloured liquid did not move in investigation 1.

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(iii) Reduced NAD (NADH + H^+) would be formed in investigations 2 and 3.

Describe the fate of reduced NAD in aerobic respiration.

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Q6.

The scientific article you have studied is adapted from articles in *Nature* and *Scientific American*.

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

Suggest how a lack of 'signals' (paragraph 36) could lead to muscle atrophy.

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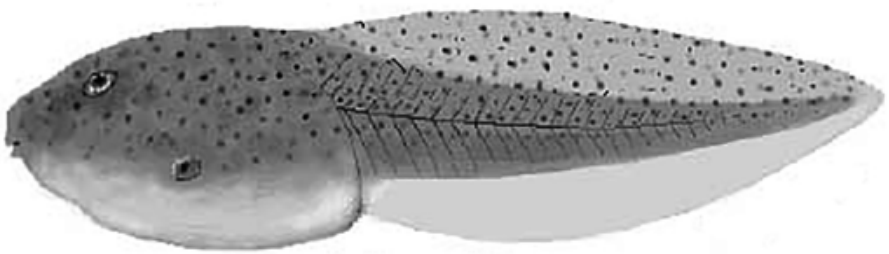
Q7.

The adult American bullfrog, *Rana catesbeiana*, can live in water or on land.

Adult frogs lay eggs in water where they are fertilised.

The fertilised eggs develop into tadpoles that live only in water.

The photograph shows a tadpole.



(i) Human activity can cause pollution that reduces the oxygen concentration in water.

Explain why a low oxygen concentration in the water would lower the pH of the blood of the tadpole.

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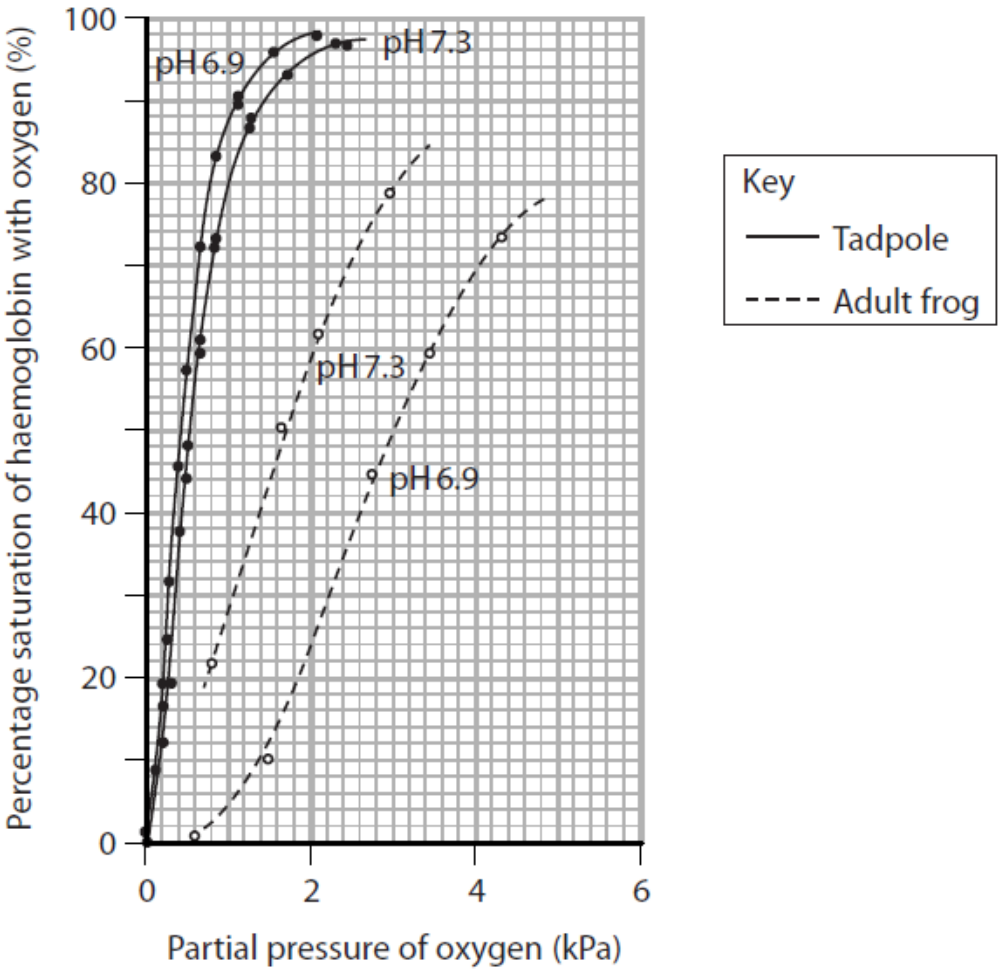
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*(ii) The graph shows the effect of pH on the oxygen dissociation curves of

haemoglobin for adult frog blood and tadpole blood.



The adult frog can either live on land or in water. The tadpole always lives in water.

Discuss how the shape and position of the dissociation curves reflect the habitat in which these animals live.

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(Total for question = 12 marks)

Q8.

Hypoxia is an inadequate supply of oxygen to tissues and cells that restricts their function.

The body responds to hypoxia by releasing hypoxia-inducible transcription factors (HIF).

Investigations have shown that one effect of HIF is an increase in the rate of glycolysis in the affected cells.

(i) Explain how HIF could result in an increase in the rate of glycolysis.

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(ii) Explain why cells need to respond to hypoxia with an increase in the rate of glycolysis.

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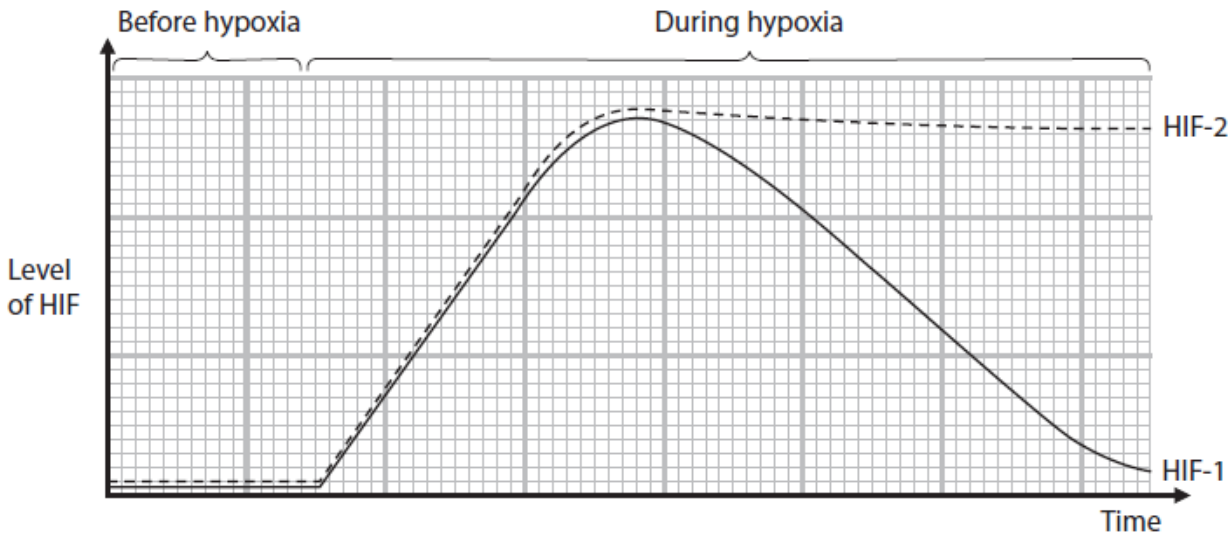
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(iii) The graph shows the changes in levels of two HIFs, HIF-1 and HIF-2, before and during hypoxia.



Compare and contrast the changes in the levels of HIF-1 and HIF-2 during hypoxia.

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(iv) Explain the changes in levels of HIF-1 and HIF-2 during hypoxia.

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(Total for question = 10 marks)