

Write your name here

Surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Biology

Advanced

Unit 5: Energy, Exercise and Coordination

Wednesday 17 June 2015 – Morning

Time: 1 hour 45 minutes

Paper Reference

WBI05/01

You must have:

A copy of the scientific article (enclosed), calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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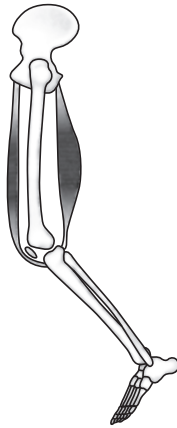
PEARSON

Answer ALL questions.

Some questions must be answered with a cross ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

1 Movement at a joint involves muscle contraction that requires a supply of ATP.

(a) The diagram below shows muscles that cause movement of bones in the leg.



Place a cross ☐ in the box next to the description of the muscles in this diagram.

(1)

- ☒ **A** the extensor muscle is contracted and the flexor muscle is relaxed
- ☒ **B** the extensor muscle and the flexor muscle are both contracted
- ☒ **C** the extensor muscle is relaxed and the flexor muscle is contracted
- ☒ **D** the extensor muscle and the flexor muscle are both relaxed



(b) The ATP needed for muscle contraction is produced by glycolysis, the Krebs cycle and oxidative phosphorylation.

(i) Place a cross ☒ in the box next to the final product of glycolysis.

(1)

- ☐ **A** acetyl CoA
- ☐ **B** citrate
- ☐ **C** glucose
- ☐ **D** pyruvate

(ii) Place a cross ☒ in the box next to products of the Krebs cycle.

(1)

- ☐ **A** ADP, ATP and oxidised NAD
- ☐ **B** ADP, oxidised NAD and reduced FAD
- ☐ **C** ATP, reduced NAD and oxidised FAD
- ☐ **D** ATP, reduced NAD and reduced FAD

(iii) Place a cross ☒ in the box next to the coenzyme involved in the Krebs cycle.

(1)

- ☐ **A** ATP
- ☐ **B** lactate
- ☐ **C** NAD
- ☐ **D** pyruvate



(iv) Place a cross ☒ in the box next to the location of glycolysis and the Krebs cycle in a muscle cell.

(1)

	Glycolysis	Krebs cycle
A	☒ cytoplasm	mitochondria
B	☒ cytoplasm	cytoplasm
C	☒ mitochondria	mitochondria
D	☒ mitochondria	cytoplasm

(v) Place a cross ☒ in the box next to the number of carbon dioxide molecules formed in the Krebs cycle from the oxidation of one glucose molecule.

(1)

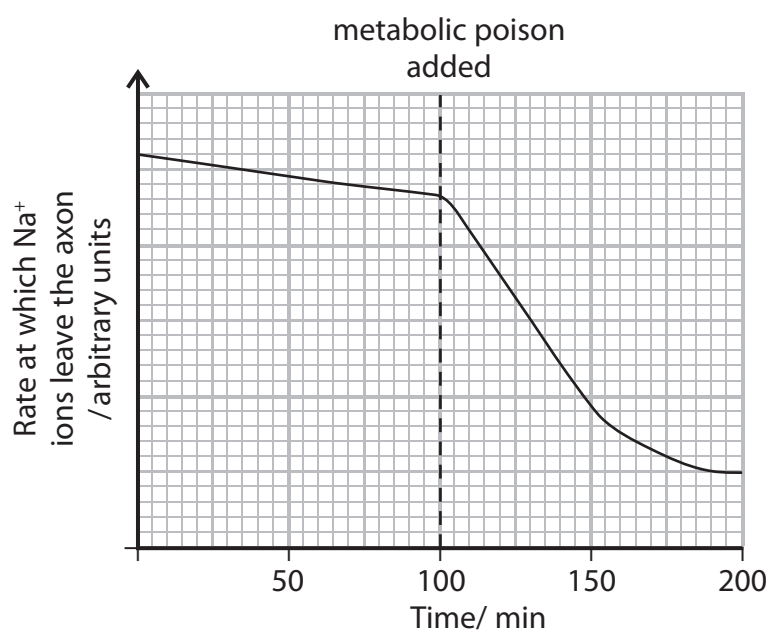
- ☒ **A** two
- ☒ **B** three
- ☒ **C** four
- ☒ **D** six

(c) Muscle contraction is stimulated by neurones. The axon of a neurone requires a supply of ATP to maintain the resting potential.

In an investigation, the rate at which sodium ions leave a resting axon was measured for a period of 200 minutes.

At 100 minutes, a metabolic poison was added. This poison inhibits oxidative phosphorylation.

The graph below shows the rate at which sodium ions (Na^+) left the axon during this investigation.



(i) Suggest how sodium ions leave the axon between 0 and 100 minutes.

(2)

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(ii) Suggest an explanation for the effect of the metabolic poison on the rate at which sodium ions leave the axon.

(3)

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(Total for Question 1 = 11 marks)



2 Heart rate and body temperature are controlled in mammals.

The photograph below shows a wood mouse, *Apodemus sylvaticus*, which is a small mammal.



(Source: British Wildlife Guide)

Magnification $\times 1.5$

- (a) (i) Place a cross ☐ in the box next to the tissue in the heart that controls resting heart rate.

(1)

- ☐ **A** atrioventricular node
- ☐ **B** bundle of His
- ☐ **C** Purkyne tissue
- ☐ **D** sinoatrial node

- (ii) Place a cross ☐ in the box next to the term that describes what is measured by an electrocardiogram (ECG).

(1)

- ☐ **A** blood pressure
- ☐ **B** cardiac output
- ☐ **C** electrical activity
- ☐ **D** stroke volume

- (iii) Name the part of the brain that controls heart rate.

(1)



(b) Suggest how the wood mouse maintains a constant body temperature when in a cold environment.

(6)

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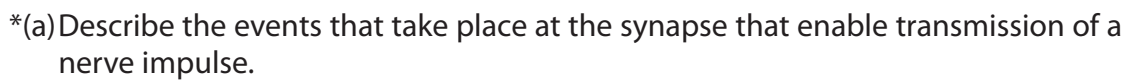
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(Total for Question 2 = 9 marks)



- The diagram below shows the release and uptake of dopamine by the presynaptic neurone.



(b) Cocaine is a drug that inhibits the uptake of dopamine by the presynaptic neurone.

Suggest how cocaine can help a person to have an increased sense of pleasure.

(3)

(Total for Question 3 = 9 marks)



- 4 Scientists investigated the effect of age on pupil dilation of the eye. They measured the pupil diameter in the dark from samples of people in different age ranges.

The table below shows the results of this investigation.

Age range / years	Number of people in sample	Mean pupil diameter / mm	Standard deviation
20 to 29	66	7.33	0.81
40 to 49	51	6.15	0.86
60 to 69	30	5.58	1.00
80 to 89	4	4.85	0.54

- (a) (i) Calculate the percentage difference in mean pupil diameter between the age ranges 20 to 29 years and 80 to 89 years. Show your working.

(2)

Answer %

- (ii) Compare the reliability of the data obtained for the age ranges 20 to 29 years and 80 to 89 years.

(2)

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(iii) Explain how the standard deviation can be used to interpret data.

(2)

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(b) Doctors use atropine drops to help diagnose problems inside the human eye.

Atropine is a drug that dilates the pupil. Atropine works by preventing the neurotransmitter acetylcholine stimulating some of the muscles of the iris of the eye.

The photograph below shows a person who has had atropine drops put into one eye.



© Spito

(i) Suggest why the pupil dilates when atropine is added to the eye.

(3)

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(ii) Explain why drugs, such as atropine, are tested on animals before being used on humans.

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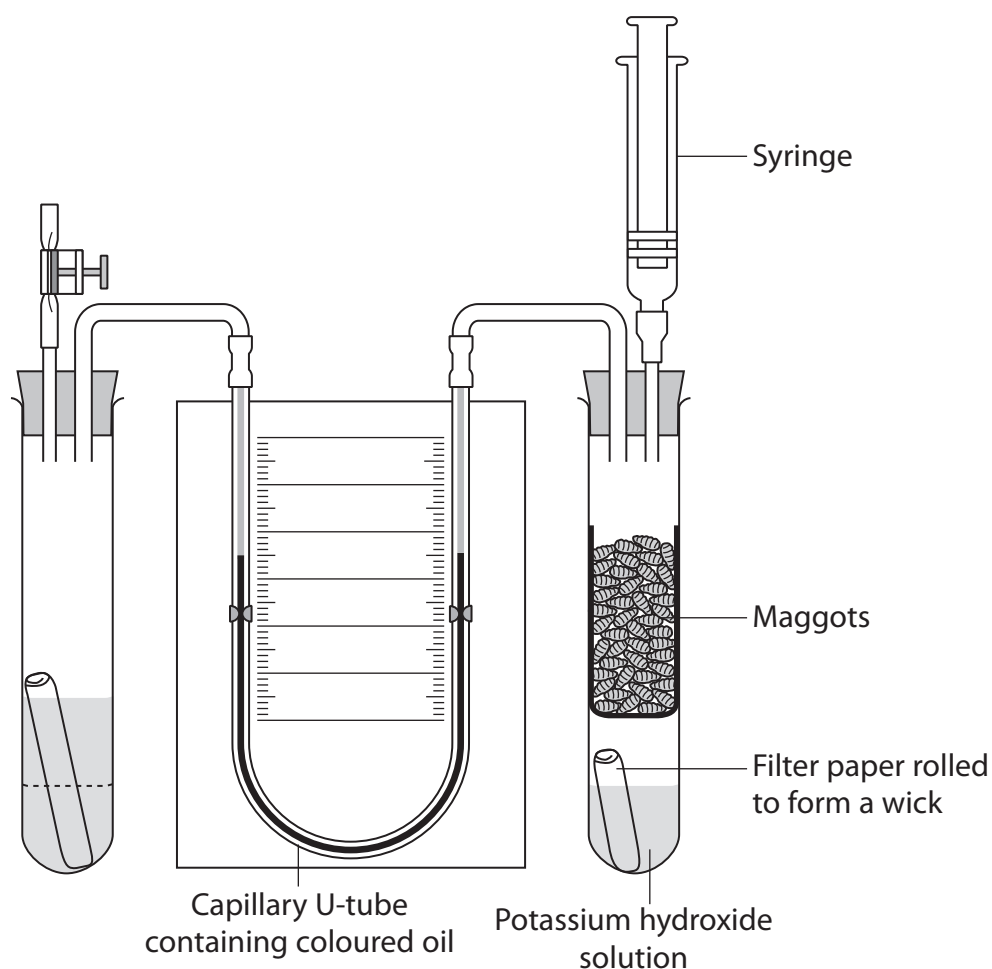
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(Total for Question 4 = 11 marks)



5 A respirometer can be used to measure the uptake of oxygen by living organisms.

The diagram below shows a respirometer used by a student to investigate the effect of temperature on the rate of oxygen consumption of maggots (blowfly larvae).



- (a) (i) Place a cross ☒ in the box next to the reason why oxygen consumption by maggots can be measured using this respirometer.

(1)

- ☐ **A** oxygen consumption equals carbon dioxide production
- ☐ **B** oxygen consumption is greater than carbon dioxide production
- ☐ **C** the maggots produce carbon dioxide
- ☐ **D** the carbon dioxide produced by the maggots is absorbed



(ii) Explain the purpose of the syringe in this investigation.

(2)

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(b) The student placed the respirometer in a water bath at different temperatures.

The table below shows the results of this investigation.

Temperature of water bath / °C	Mean oxygen consumption / cm ³ g ⁻¹ hr ⁻¹
10	3.6
15	7.2
20	10.2
25	15.0
30	18.0
35	16.2

(i) During this investigation, the student found that 2.0 g of maggots consumed 4.5 cm³ of oxygen in 20 minutes.

Use this information to calculate the temperature of the water bath most likely to produce this result. Show your working.

(2)

Answer °C



(ii) Suggest how this investigation could be modified to find a more accurate optimum temperature for respiration in maggots.

(1)

(c) The student did not use temperatures higher than 35 °C because of the effect this would have on enzyme-controlled respiratory processes such as chemiosmosis.

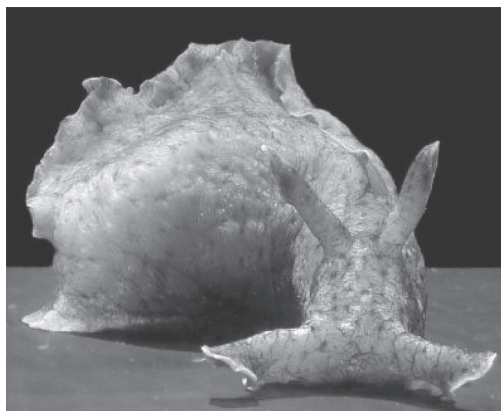
Explain the effect that a high temperature has on chemiosmosis.

(3)

(Total for Question 5 = 9 marks)



6 The photograph below shows a sea slug, *Aplysia californica*.



© Genny Anderson / Marine Science

Magnification $\times 1$

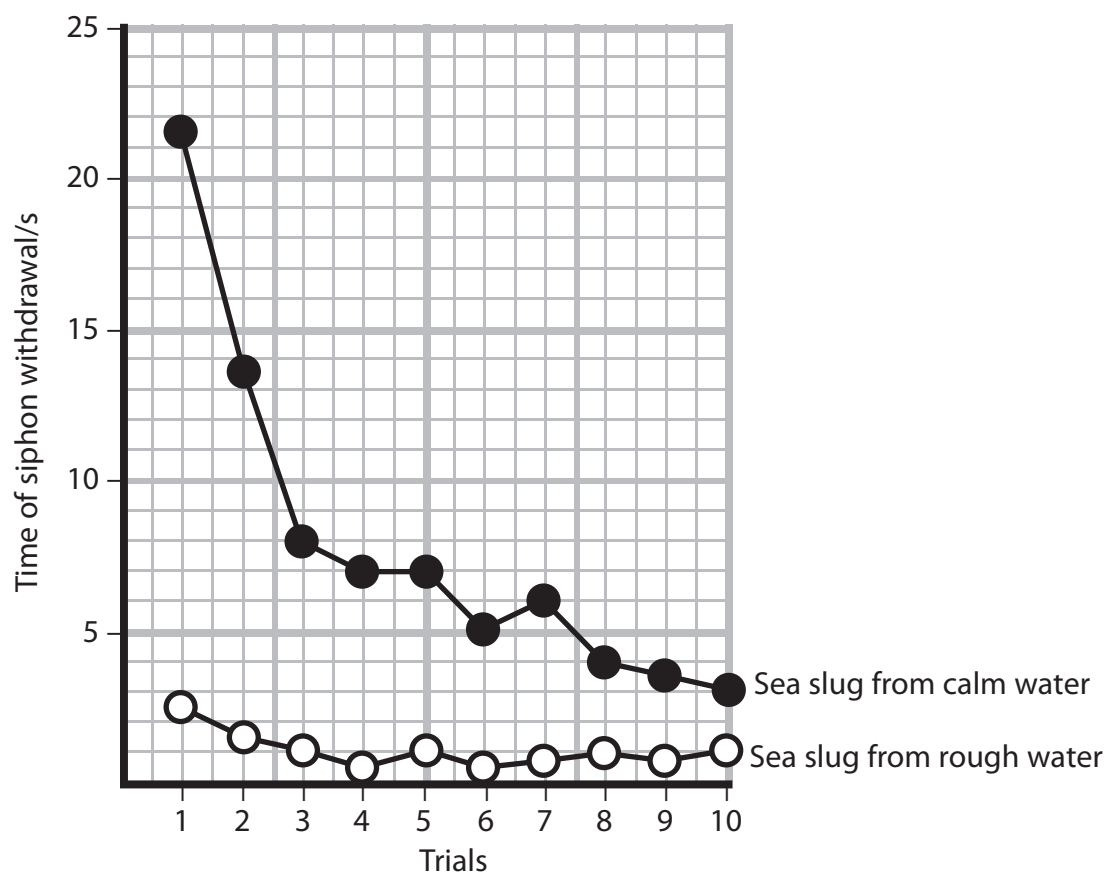
A sea slug uses a tube called a siphon to help with gas exchange. When the siphon is touched, it is withdrawn into the body of the sea slug.

An investigation was carried out to compare the behaviour of a sea slug living in calm water with a sea slug living in rough water.

A squirt of seawater from a syringe was directed towards the siphon of each sea slug. The time that the siphon remained withdrawn in the body was recorded.

Ten successive trials were carried out for each sea slug.

The graph below shows the results of this investigation.



(4)

[illegible]

(2)

[illegible]

- (c) Functional magnetic resonance imaging (fMRI) can be used to observe the activity of the human brain in response to repeated stimuli.

Explain how fMRI can be used to observe activity in the human brain in response to repeated stimuli.

(5)

[illegible]

(Total for Question 6 = 11 marks)



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7 The scientific article you have studied is adapted from several sources.

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

(a) Beta blockers are antihypertensives.

Suggest why beta blockers might impair the performance of an endurance athlete (paragraph 7).

(2)

(b) Suggest what would happen if ligaments were injected with steroids (paragraph 14).

(2)

(c) Explain the reasons for banning the use of diuretics by athletes (paragraph 15).

(2)



- (d) Autologous transfusion means the blood is from the same person (paragraph 19).
Explain why the blood must be from the same person.

(2)

- (e) Anabolic steroids promote muscle growth and protein synthesis (paragraph 21).

- (i) Name **two** proteins, other than actin and myosin, that are synthesised in muscle tissue and are involved in muscle contraction.

(2)

- (ii) The diagram below shows part of a sarcomere.

Complete the diagram by drawing and labelling where actin and myosin are found.

(2)



- (f) Testosterone is an endogenous substance (paragraph 22).
Suggest what is meant by the term **endogenous**.

(1)



*(g) Mice can run about 900 metres before exhaustion. In tests, mice given GW1516 (paragraph 25) were able to run 1800 metres before exhaustion.

GW1516 works by changing the proportion of slow twitch to fast twitch muscle fibres.

Explain why this change in proportion would benefit endurance athletes.

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- (h) The article refers to the use of recombinant erythropoietin (paragraph 19) and recombinant GH or growth hormone (paragraph 29). These human proteins can be made using genetically modified plants.

Describe how plants can be genetically modified to produce human proteins.

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- (i) Explain the risks of the use of blood doping and EPO by athletes (paragraphs 44 and 46).

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- (j) Suggest why a ban on the use of blood doping and EPO by athletes is difficult to enforce (paragraph 44).

(2)

- (k) In the future, tests may need to be carried out on muscles to detect if gene therapy has been used (paragraph 47).

Describe how gel electrophoresis could be used to identify a new gene in the muscle tissue of an athlete.

(4)

(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS

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