

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

Friday 20 June 2014 – 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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Answer ALL questions.

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

1 Muscles are important in the movement of the body.

(a) Place a cross ☒ in the box that completes each of the following statements.

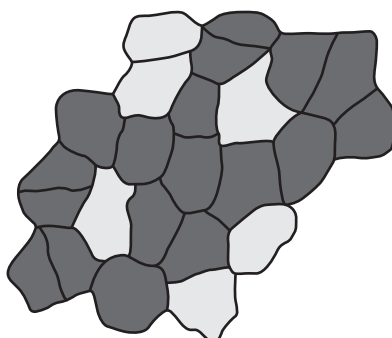
(i) Muscles are attached to bones by

(1)

- A bone
- B cartilage
- C ligaments
- D tendons

(ii) The diagram below shows a cross section through a muscle containing fast twitch and slow twitch fibres.

The fast twitch fibres have been stained darker than the slow twitch fibres.



The ratio of fast twitch fibres to slow twitch fibres in this section of muscle is

(1)

- A 1:4
- B 1:3
- C 4:1
- D 3:1

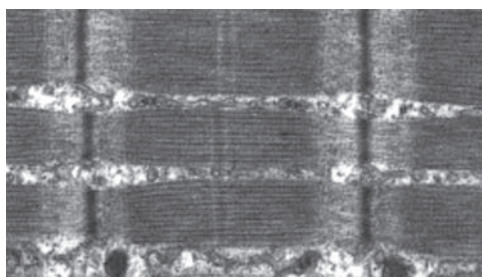


(iii) Fast twitch muscle fibres have

(1)

- A few mitochondria and few capillaries
- B few mitochondria and many capillaries
- C many mitochondria and few capillaries
- D many mitochondria and many capillaries

(iv) The electron micrograph below shows a section through muscle tissue.



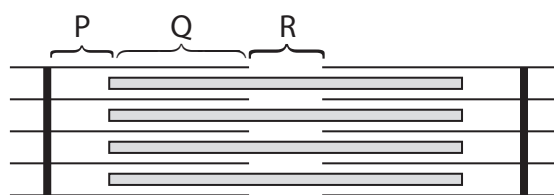
Magnification $\times 7000$

The number of myofibrils in this section is

(1)

- A one
- B three
- C six
- D nine

(v) The diagram below shows a sarcomere with regions labelled P, Q and R.



Actin is found in the region labelled

(1)

- A P only
- B Q only
- C P and Q
- D Q and R



(b) Explain how the size of the pupil is changed when the eye is exposed to dim light.

(3)

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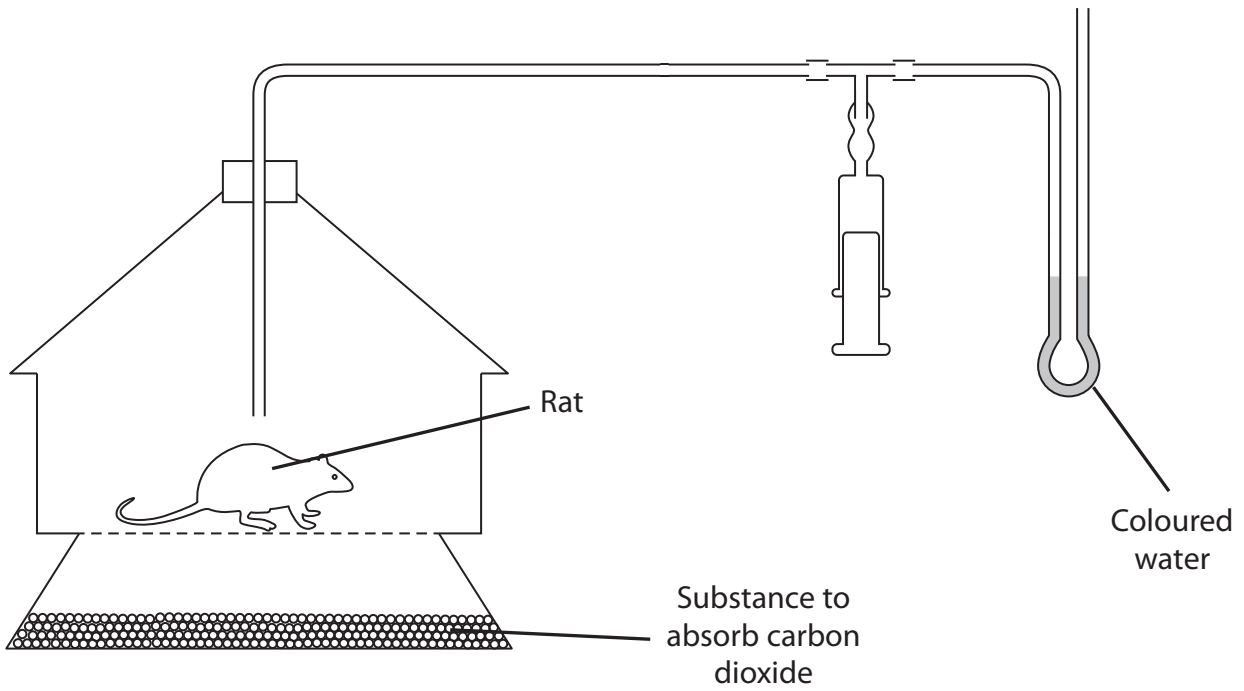
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(Total for Question 1 = 8 marks)



2 The diagram below shows the apparatus that could be used to measure the respiration rate of a rat.



*(a) Describe how this apparatus could be used to make a valid comparison of the respiration rates of male and female rats.

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(b) A systematic error would occur if the substance used to absorb carbon dioxide failed to work. Explain how this would affect the results obtained.

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(Total for Question 2 = 8 marks)



3 The brain is a part of the nervous system involved in the control and coordination of the body.

(a) Place a cross ☒ in the box that completes the following statement.

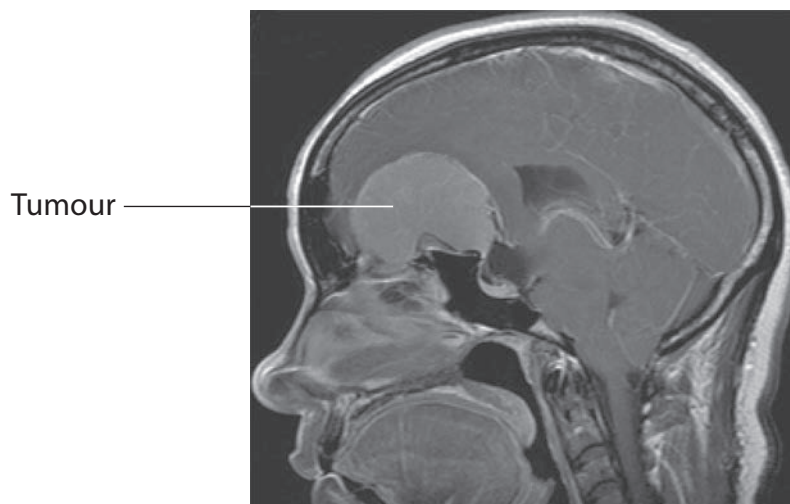
The part of the brain that has nervous control of the heartbeat is the

(1)

- A cerebellum
- B cerebral hemisphere
- C hypothalamus
- D medulla oblongata

(b) Magnetic resonance imaging (MRI) can be used to study brain structure.

The MRI scan below shows a human brain with a tumour.



Magnification $\times 0.3$

(i) State the part of the brain in which the tumour has grown.

(1)



(ii) Suggest the advantages of using MRI scanning to identify tumours, compared with using CT scanning.

(3)

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(c) Dopamine is a neurotransmitter in the brain.

The function of dopamine is affected by caffeine. Caffeine slows down the rate of dopamine reabsorption.

Suggest how caffeine might slow down the rate of dopamine reabsorption.

(3)

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- (d) A selective serotonin re-uptake inhibitor (SSRI) is a drug that reduces depression by inhibiting the reabsorption of serotonin.

Extracts of the plant St John's wort have been used to treat depression.

A double blind trial compared the effectiveness of treating depression using a SSRI, an extract of St John's wort, and a placebo.

Depression was measured using the Hamilton Rating Scale for Depression (HRSD). The higher the HRSD score the greater the depression.

The table below shows the results of this trial.

Time / weeks	HRSD score		
	SSRI	St John's wort	Placebo
0	16	16	17
1	14	15	15
2	13	14	12
3	12	13	12
4	10	13	12
5	9	12	11
6	8	12	11
7	7	11	12
8	6	12	12

- (i) State what is meant by the term **double blind**.

(1)

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(ii) Using the information in the table, compare the effectiveness of these three treatments for depression.

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(iii) Double blind trials give scientists confidence in the results collected.

Suggest **two** other ways in which this trial should have been designed, in order to increase confidence in the results.

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(Total for Question 3 = 13 marks)



4 Exercise and training programmes affect athletic performance and health.

- (a) The table below shows cardiovascular measurements for a person before and after training and for a marathon runner.

Measurement	Person before training	Person after training	Marathon runner
Heart rate at rest / beats per minute	72	58	36
Stroke volume at rest / cm ³	64	79	128
Maximum stroke volume during exercise / cm ³	120	140	200

- (i) Calculate the cardiac output in dm³ per minute of the marathon runner at rest. Show your working.

(2)

Answer dm³ per minute

- (ii) Training improves the performance of marathon runners.

Explain how the information in the table supports this statement.

(2)

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(iii) Using the data in the table and your own knowledge, explain how training would increase the rate of oxidative phosphorylation in muscle cells during exercise.

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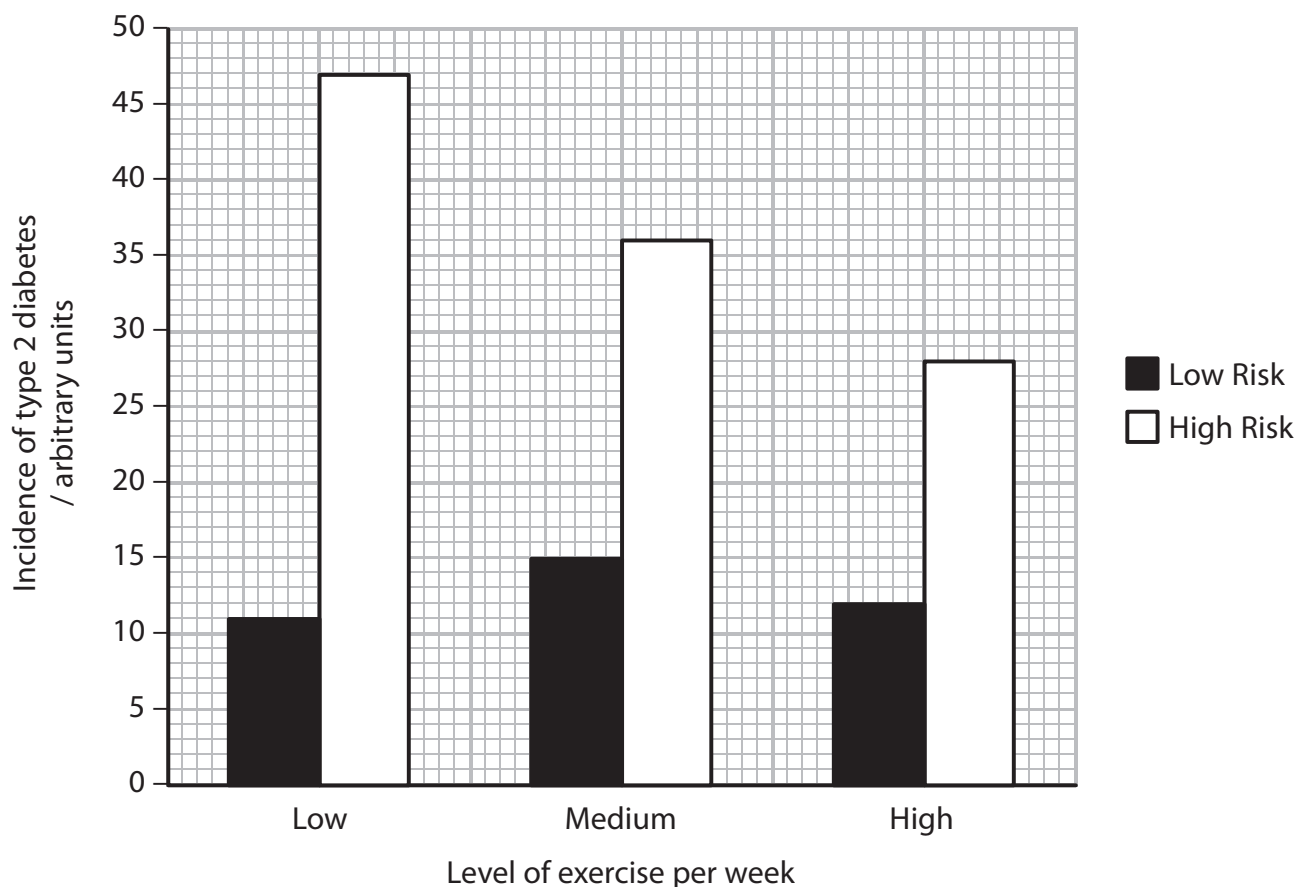


(b) The development of type 2 diabetes may be linked to lack of exercise.

The graph below shows the effect of exercise on the incidence of type 2 diabetes in two groups of men.

Men at low risk had no family history of developing type 2 diabetes. Men at high risk had a family history of developing type 2 diabetes.

The men were grouped according to their level of exercise per week.



Using the information in the graph and your knowledge of correlation and causation, discuss the relationship between the incidence of type 2 diabetes and the level of weekly exercise.

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(Total for Question 4 = 13 marks)

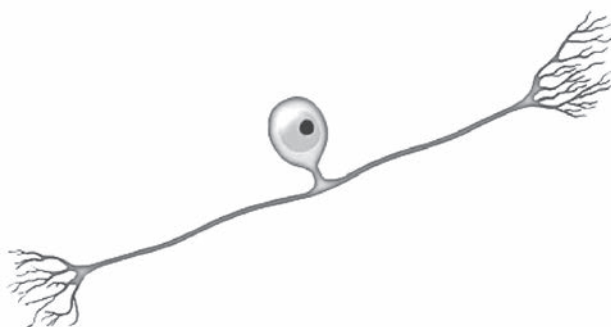


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5 The nervous system contains myelinated and unmyelinated neurones.

(a) The diagram below shows a myelinated sensory neurone.



Give **one** feature, shown in the diagram, that identifies this cell as a sensory neurone.

(1)



(b) The table below shows the conduction velocity of a nerve impulse along myelinated and unmyelinated neurones of different diameters.

Axon diameter / μm	Conduction velocity / m s^{-1}	
	Myelinated	Unmyelinated
1	2.2	2.2
2	8.3	3.2
3	15.0	3.8
4	20.0	4.4
5	25.0	5.0

Using the information in the table, compare the axon diameter and conduction velocity of these neurones.

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(c) Explain why myelination affects the conduction velocity of a nerve impulse along an axon.

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(d) Acetylcholine is broken down by the enzyme acetylcholinesterase.

Sarin is a chemical that inhibits this enzyme.

Suggest the effect that sarin has on the transmission of nerve impulses.

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(Total for Question 5 = 12 marks)



6 Plants are able to detect light and respond to environmental cues.

- (a) In an investigation, plants were exposed to five different periods of light and dark. The production of flowers by these plants was recorded.

The table below shows the results of this investigation.

Number of hours of light	Number of hours of dark	Flowers produced
18	6	No
15	9	No
12	12	No
9	15	Yes
6	18	Yes

- (i) Place a cross in the box that completes the following statement.

Flower production in these plants is stimulated when there is

(1)

- A** less than 9 hours of light
- B** more than 9 hours of light
- C** less than 12 hours of dark
- D** more than 18 hours of light

- (ii) Suggest how different periods of light and dark could stimulate these plants to flower.

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(b) When a plant shoot is illuminated from one side, it grows towards the light.

Place a cross ☒ in the box that completes each of the following statements.

(i) The substance involved in this response is

(1)

- A florigen
- B IAA
- C phytochrome
- D rhodopsin

(ii) The substance produced in this response

(1)

- A accumulates in the shoot tip
- B moves downwards by osmosis
- C moves away from the illuminated side
- D moves towards the illuminated side

(Total for Question 6 = 6 marks)



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7 The scientific article you have studied has been adapted from an NHS website.

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

(a) (i) Using your knowledge of the properties of gas exchange surfaces, suggest why one of the symptoms of COPD is breathlessness (paragraph 6). (3)

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(ii) Suggest why the loss of normal elasticity in lung tissue might also contribute to the symptom of breathlessness (paragraph 6). (1)

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(iii) Oxygen treatment relieves the symptoms of breathlessness (paragraphs 48 and 49).
Explain how this treatment would affect the ventilation rate. (2)

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(b) The article states that '10–25% of smokers develop COPD' (paragraph 8).

The population of the UK is approximately 60 million and 20% of the population smoke.

Calculate the maximum number of people in the UK who are likely to develop COPD. Show your working.

(2)

Answer

(c) Discuss how nature and nurture might affect the development of COPD.

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(d) (i) Suggest **one** difference in the alleles of the 'abnormal variants' (paragraph 14).

(1)

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(ii) Two heterozygous parents, MS and MZ, had children (paragraph 15). Use a genetic diagram to state the probability of the children of these parents having A1AT deficiency.

(2)

Probability

*(e) Suggest the steps taken by scientists to produce Tracey, 'the first ever transgenic sheep' (paragraph 19).

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(f) The volume of air you can breathe out in one second is called the FEV_1 (paragraph 25).

Suggest how the FEV_1 of a person with COPD might differ from that of a person without COPD. Give a reason for your answer.

(2)

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(g) Suggest how bronchodilators reduce some of the symptoms of COPD (paragraphs 40, 41 and 42).

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(h) Suggest why theophylline is used to treat COPD only after bronchodilators have been tried.

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(i) Suggest how an anti-pneumococcal vaccination helps to provide immunity to people with COPD (paragraph 62).

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(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS



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