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Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced

Unit 5: Energy, Exercise and Coordination

Thursday 2 November 2017 – Morning
Time: 1 hour 45 minutes

Paper Reference
WBI05/01

You must have:
A copy of the scientific article (enclosed), calculator, HB pencil, ruler.

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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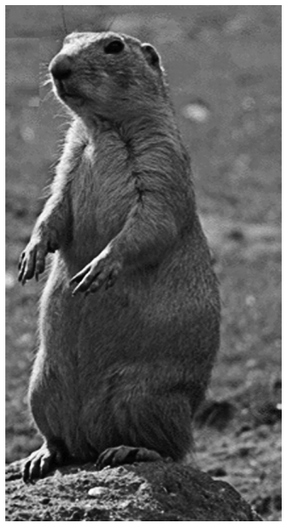
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Answer ALL questions.

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 (a) The photograph below shows a prairie dog.



Magnification ×0.2

Prairie dogs are well-adapted to predators. If a prairie dog sees a predator, it will give an alarm call to warn other prairie dogs.

(i) Put a cross ☒ in the box next to the part of the brain involved with the ability to see.

(1)

☒ **A** cerebellum

☒ **B** cerebral hemispheres

☒ **C** hypothalamus

☒ **D** medulla oblongata

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(ii) Prairie dogs that live near trails used by humans have become habituated to the presence of humans.

These prairie dogs do not give alarm calls when a human walks by.

Explain the importance of habituation to these prairie dogs.

(2)

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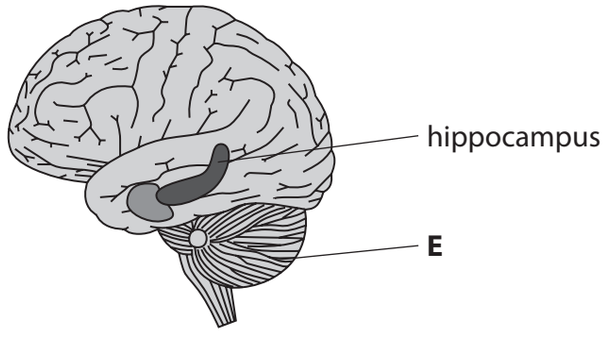
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(b) Some animals can become habituated to a particular smell.

A study on rats indicated that the part of the brain called the hippocampus could be involved in habituation to smell.

(i) The diagram below shows the position of the hippocampus in the brain.



Put a cross ☒ in the box next to the part of the brain labelled **E**.

(1)

☒ **A** cerebellum

☒ **B** cerebral hemispheres

☒ **C** hypothalamus

☒ **D** medulla oblongata

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(ii) Discuss the issues relating to the use of rats in such a study.

(2)

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(c) State **two** factors that determine how quickly an animal becomes habituated.

(2)

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(Total for Question 1 = 8 marks)

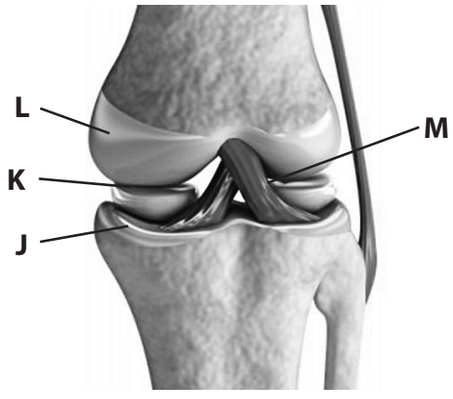
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2 The stifle joint in the hind leg of a dog has the same structure as the knee of a human.

(a) The diagram below shows a stifle joint.



Put a cross ☒ in the box next to the letter labelling a cruciate ligament.

(1)

☒ **A** J

☒ **B** K

☒ **C** L

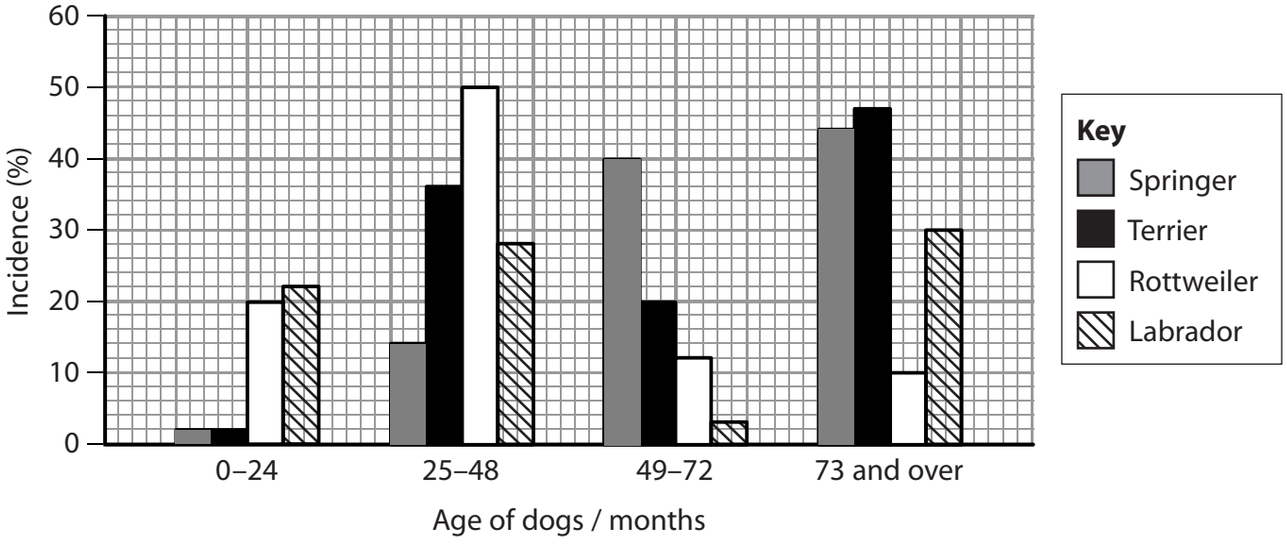
☒ **D** M

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(b) Damage to the cruciate ligament is the most common cause of hind limb lameness in some breeds of dog.

The graph below shows the incidence of hind limb lameness at different ages in four breeds of dog.

Incidence is determined as the percentage of dogs presenting with signs of lameness.



(i) Put a cross ☒ in the box next to the breed of dog that shows an increase in the incidence of lameness at each age.

(1)

☒ **A** labrador

☒ **B** rottweiler

☒ **C** springer

☒ **D** terrier

(ii) Put a cross ☒ in the box next to the breed of dog that has the greatest change in incidence of lameness between 25–48 months and 49–72 months.

(1)

☒ **A** labrador

☒ **B** rottweiler

☒ **C** springer

☒ **D** terrier

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(iii) Below are some statements about hind limb lameness in dogs:

- hind limb lameness is due to an interaction between genotype and the environment
- hind limb lameness is affected by the age of the dog
- all breeds of dog suffer from hind limb lameness
- dogs increase in mass as they get older and this increases the incidence of hind limb lameness.

Put a cross ☒ in the box next to the number of these statements that are supported by the data shown in the graph.

(1)

☒ **A** 1

☒ **B** 2

☒ **C** 3

☒ **D** 4

(c) Describe how cruciate ligaments can be repaired with minimum damage to the joint.

(2)

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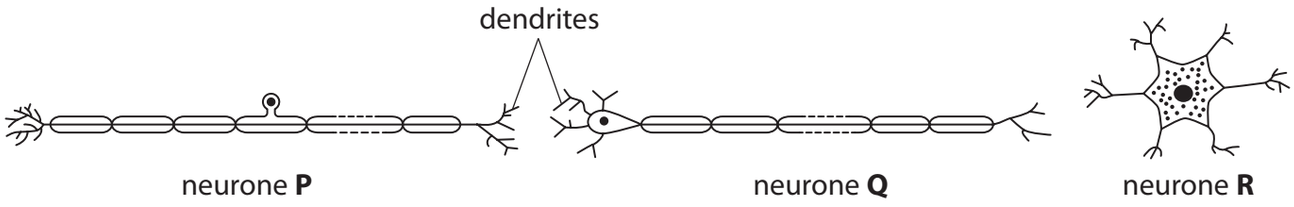
(Total for Question 2 = 6 marks)

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3 Some pesticides affect the nervous system of humans and insects.

Genetically modified plants can be developed to limit damage caused by insects, reducing the use of pesticides.

(a) The diagrams below show three different types of neurone, **P**, **Q** and **R**.



(i) Put a cross ☒ in the box next to the row in the table that identifies the neurones **P**, **Q** and **R**.

(1)

		neurone P	neurone Q	neurone R
☒	**A**	motor	sensory	relay
☒	**B**	sensory	motor	relay
☒	**C**	relay	sensory	motor
☒	**D**	sensory	relay	motor

(ii) Put a cross ☒ in the box next to the row in the table where the arrows show the direction of flow of a nerve impulse through each of the neurones **P** and **Q**.

(1)

		neurone P	neurone Q
☒	**A**	⇨	⇨
☒	**B**	⇦	⇦
☒	**C**	⇨	⇦
☒	**D**	⇦	⇨

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(b) Acetylcholine is synthesised in neurones from choline and acetyl CoA.

(i) Explain the role of acetylcholine in the transmission of a nerve impulse.

(2)

(ii) Pesticides are chemicals that are sprayed onto crop plants to protect them from being damaged by insects.

Some pesticides are inhibitors of acetylcholinesterase.

Acetylcholinesterase is an enzyme that breaks down acetylcholine.

Suggest how these pesticides could affect the nervous system of the insects and the person spraying the plants.

(2)

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(c) Suggest how plants can be genetically modified to be resistant to damage by insects.

(4)

(Total for Question 3 = 10 marks)

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4 The photograph below shows a 13-lined ground squirrel.



Magnification $\times 0.5$

This squirrel hibernates when the environmental temperature is very low for several months.

Every three weeks during hibernation, the squirrel moves slightly and shivers.

During hibernation, its heart rate decreases, its body temperature falls and the proportion of muscle fibre types changes.

(a) (i) The heart rate of a non-hibernating squirrel is 300 beats per minute. During hibernation, the heart rate decreases by 97%.

Calculate the heart rate of a hibernating squirrel.

Show your working.

(2)

Answer ..... bpm

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(ii) Suggest how the heart rate could be decreased during hibernation.

(3)

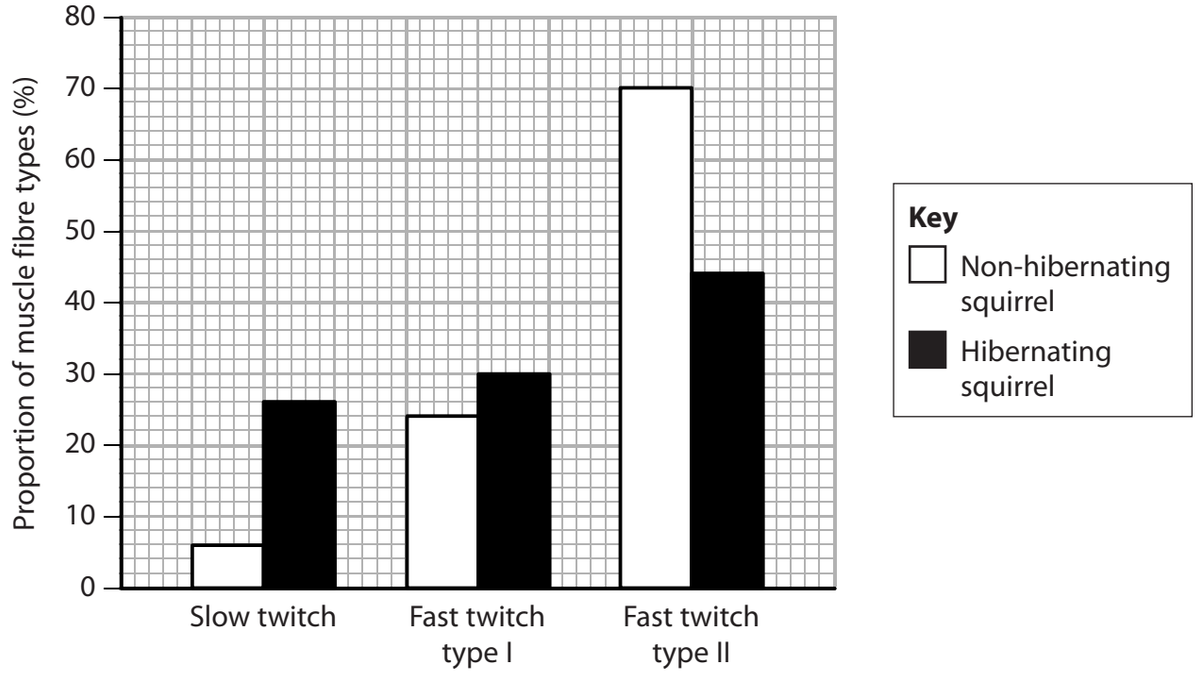
(b) Suggest the advantage to the squirrel of shivering at regular intervals during hibernation.

(1)

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(c) The graph below shows the proportion of muscle fibre types in a non-hibernating squirrel and in a hibernating squirrel.



(i) Using the information in the graph, describe the changes in muscle fibre types that take place when the squirrel hibernates.

(2)

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(ii) Distinguish between the structure of slow twitch muscle fibres and fast twitch muscle fibres.

(3)

(iii) Suggest why there is a change in the proportion of muscle fibre types when the squirrel hibernates.

(2)

(Total for Question 4 = 13 marks)

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5 When a person is exercising, there is a change in the levels of hormones released into their bloodstream.

Some of these changes are essential for homeostasis.

(a) State the meaning of the term **homeostasis**.

(1)

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(b) The table below shows the roles of some hormones and the change in level of these hormones during exercise.

hormone	role of hormone	change in level during exercise
adrenaline	stimulates glycolysis	increase
ACTH	stimulates the conversion of proteins or lipids to glucose	increase
glucagon	stimulates the hydrolysis of glycogen in the liver stimulates the conversion of proteins or lipids to glucose	increase
insulin	stimulates the liver to absorb glucose from the blood	decrease
aldosterone	causes sodium ions to be taken up into the blood	increase
ADH	increases water take up into the blood	increase

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(i) Explain how glycogen is hydrolysed.

(2)

*(ii) Using the information in the table, explain the role of these hormones during exercise.

(6)

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(iii) Explain how transcription factors cause the changes in the levels of some of these hormones in the bloodstream.

(4)

(Total for Question 5 = 13 marks)

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6 Animals and plants use photoreceptors to detect light.

(a) Describe how light is detected in mammals.

(5)

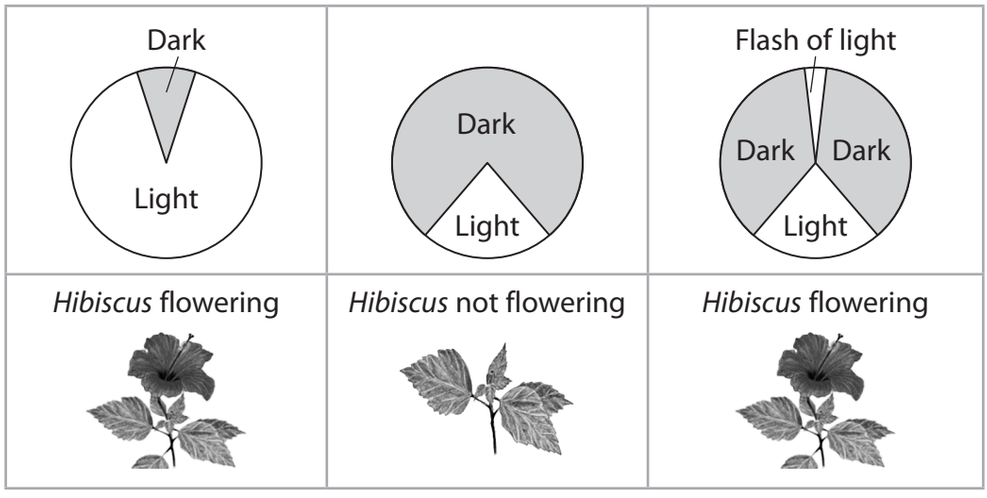
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(b) The time of year that a plant flowers depends on the relative proportion of time the plant is exposed to light and dark.

The diagram below shows how the hours of light and dark, during each 24-hour period, affect the flowering of *Hibiscus* plants.



Using your knowledge of plant photoreceptors, explain how the relative proportion of time the plant is exposed to light and dark determines flowering in *Hibiscus* plants.

(5)

(Total for Question 6 = 10 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) One symptom of multiple sclerosis (MS) is a lack of muscle coordination.

Explain how a lack of muscle coordination could result from the destruction of the myelin (paragraph 1).

(2)

(b) State the meaning of the term 'autoimmune disorder' (paragraph 2).

(1)

(c) Explain why magnetic resonance imaging (MRI) can be used in the diagnosis of MS (paragraph 3).

(2)

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(d) It is thought that MS results from 'a genetic predisposition to immune dysfunction' (paragraph 6).

Distinguish between a disease that results from a genetic predisposition and a disease that is a genetic disorder.

(2)

(e) Suggest why 'the risk of infection is greatest in team sports' (paragraph 21).

(2)

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(f) Describe how 'Bacteria and viruses can do harm to our body and make us sick' (paragraph 23).

(3)

(g) Explain why the oxygen uptake in active muscles increases during endurance exercise (paragraph 24).

(4)

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*(h) Antioxidants are widely used as ingredients in dietary supplements. However, 'clinical trials have failed to clearly express an advantage of these dietary supplements' (paragraph 26).

Suggest how a clinical trial should be designed to investigate the advantage of using antioxidants in dietary supplements.

(6)

(i) Suggest how the action of enzymatic antioxidants differs from that of non-enzymatic antioxidants (paragraphs 27 and 28).

(1)

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(j) A number of studies have investigated the effect of exercise on immunity.

The author of this article suggests that the results of these studies should be interpreted with care (paragraph 34).

Suggest why the results of these studies should be interpreted with care.

(2)

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(k) Using the information in paragraphs 34 and 35, explain why the graphs in Figures 1 and 2 are different shapes.

(2)

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(l) Explain why the bone marrow has been referred to as a storage pool (paragraph 38).

(3)

(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS

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