

Write your name here	
Surname	Other names
Pearson Edexcel GCE	Centre Number
	Candidate Number
Biology	
Advanced	
Unit 5: Energy, Exercise and Coordination	
Friday 20 June 2014 – Morning Time: 1 hour 45 minutes	Paper Reference 6BI05/01
You must have: A copy of the scientific article adapted from The Immortal Life of Henrietta Lacks (enclosed)	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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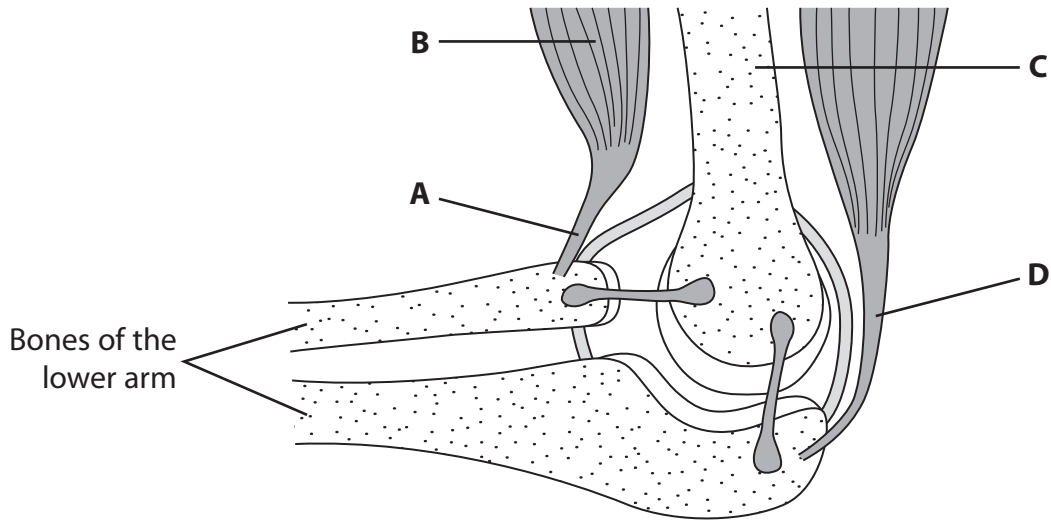
PEARSON

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 (a) The knee and the elbow are both hinge joints.

The diagram below shows an elbow joint.



For each of the following questions, place a cross in the box that identifies the structure.

(i) The tendon attached to the flexor muscle is

(1)

- A
- B
- C
- D

(ii) A ligament is attached to

(1)

- A
- B
- C
- D



(iii) The structure with cells containing many nuclei is

(1)

- A
- B
- C
- D

(b) Moderate exercise is good for the health of a person.

(i) Give **two** reasons why too little exercise may not be good for the health of a person.

(2)

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(ii) Give **two** reasons why too much exercise may not be good for the health of a person.

(2)

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(Total for Question 1 = 7 marks)



2 Scientists have investigated the influence of both nature and nurture on brain development. They used several pairs of identical twins and several pairs of non-identical twins.

(a) In one investigation, each twin was shown a number of human faces and then asked to identify them amongst a group of unfamiliar faces.

The agreement in face identification between each pair of twins was recorded.

The results were used to calculate the mean percentage agreement in face identification for the two types of twin. This is shown in the table below.

Mean percentage agreement in face identification (%)	
identical twins	non-identical twins
70	29

(i) From these results, the scientists concluded that face identification has a genetic component.

Explain how these results support this conclusion.

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(ii) This investigation was repeated using written words rather than faces. The mean percentage agreement in word identification for the two types of twin suggested that this involved an environmental component.

Suggest how the results of this investigation might differ from the results shown in the table.

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(b) Functional magnetic resonance imaging (fMRI) was used in another investigation. Brain activity was recorded whilst carrying out face identification.

Suggest why fMRI was used in this investigation.

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(Total for Question 2 = 9 marks)



3 The photograph below shows Usain Bolt, an elite sprinter. He won a gold medal in the 100 metre final at the 2012 Olympic Games in a time of 9.63 seconds.



(a) The skeletal muscles of elite sprinters are likely to have many fast twitch muscle fibres. Suggest why these muscles are less red in colour than muscles with many slow twitch muscle fibres.

(2)

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(b) The pH of the blood of a sprinter falls during a race and returns to its original level after the race.

(i) State the homeostatic control mechanism that returns the pH of blood to its original level.

(1)

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* (ii) Explain how the pH of the blood of a sprinter is returned to its original level after a race.

(5)



(iii) During the race, heat is generated and is lost from the body through the skin.

Describe how muscle, present in blood vessels in the skin, helps to increase heat loss from the body.

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(Total for Question 3 = 12 marks)



4 Dark chocolate contains a chemical called epicatechin.

An investigation was carried out to study the effect of epicatechin on mice.

Two groups of one-year-old male mice, group A and group B, were used in this investigation.

The mice in group A were given water containing epicatechin at a concentration of 1 mg per kg of their body mass, twice a day for 15 days. The mice in group B were given water without epicatechin added.

All other variables were kept constant.

- (a) Suggest why the mice in group A were given water containing epicatechin at a concentration of 1 mg per kg of their body mass rather than at a concentration of 1 mg per mouse.

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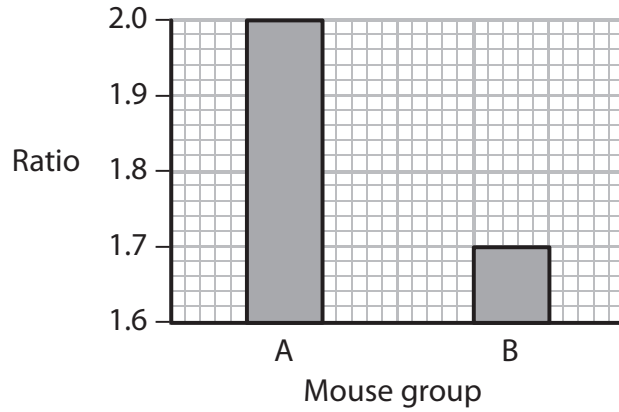


(b) After 15 days, skeletal muscle from the mice in the groups was compared.

- (i) Skeletal muscle cells contain mitochondria. The surface areas of the inner and outer membranes of the mitochondria were compared.

The surface area of the inner membrane was divided by the surface area of the outer membrane to obtain a ratio.

The bar chart below shows the ratios for the two groups of mice.



Use the information in the bar chart to describe the effect of epicatechin on the mitochondria.

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(ii) The ability of the skeletal muscle to contract was compared. The time taken for the muscle to start to fatigue (fail to contract) was recorded.

The results are shown in the table below.

Group	Mean time taken for skeletal muscle to start to fatigue / seconds
A	164
B	130

Using information from the bar chart and your knowledge of respiration, suggest an explanation for the results shown in the table.

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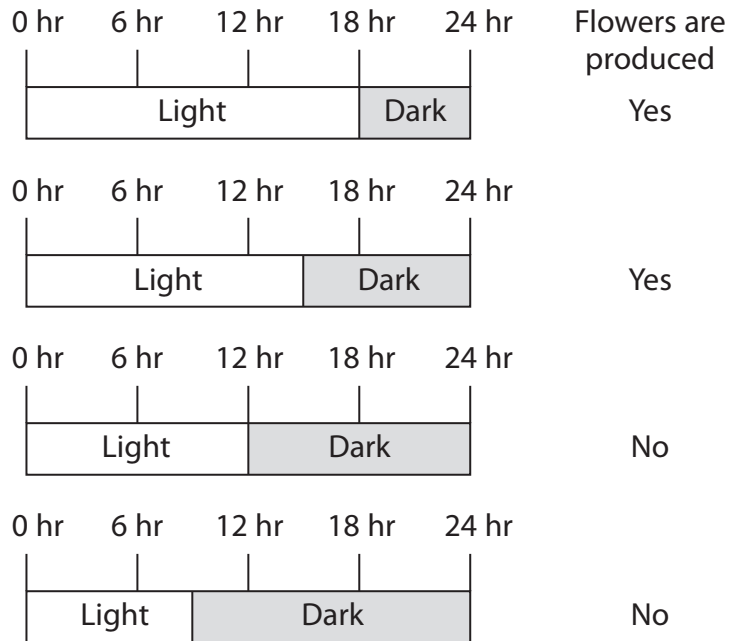
(Total for Question 4 = 10 marks)



5 Both plants and animals are able to respond to stimuli using photosensitive pigments.

(a) The photosensitive pigment in plants can be involved in a range of responses to environmental cues. This includes flower production in response to day length.

The diagram below shows the results of a study on the effect of day length on flowering in one species of plant.



(i) Place a cross ☒ in the box to complete the conclusion made using these results.

The critical amount of daylight needed for the production of flowers is

(1)

- A between 15 and 18 hours
- B between 12 and 15 hours
- C between 9 and 12 hours
- D between 6 and 9 hours



(ii) The photosensitive pigment involved in making this plant species produce flowers is likely to be (1)

- A IAA
- B chlorophyll
- C FAD
- D phytochrome

(iii) Suggest how the plants were grown to ensure this study was valid. (2)

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(iv) Suggest how this study could be changed to produce a more accurate conclusion. (1)

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(b) For some plant species, day length is not an environmental cue for the production of flowers. (1)

Suggest **one** environmental cue, other than day length, that could stimulate plants of these species to produce flowers.

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(c) Rhodospin is found in rod cells in the retina of mammalian eyes.

(i) State the location of rhodopsin within a rod cell.

(1)

(ii) In the table below, place a tick (✓) in the box if the statement applies to the description and place a cross (✗) in the box if the statement does not apply.

(3)

Description	Statement		
	Opsin binds to the rod cell membrane	Rhodopsin bleaches	ATP used
Rhodopsin responding to light			
Rhodopsin being reformed			

(Total for Question 5 = 10 marks)



6 The central nervous system (CNS) is made up of the brain and the spinal cord.

(a) The image below of a human head and neck shows part of the CNS.



Using the image and your knowledge, complete the table below.

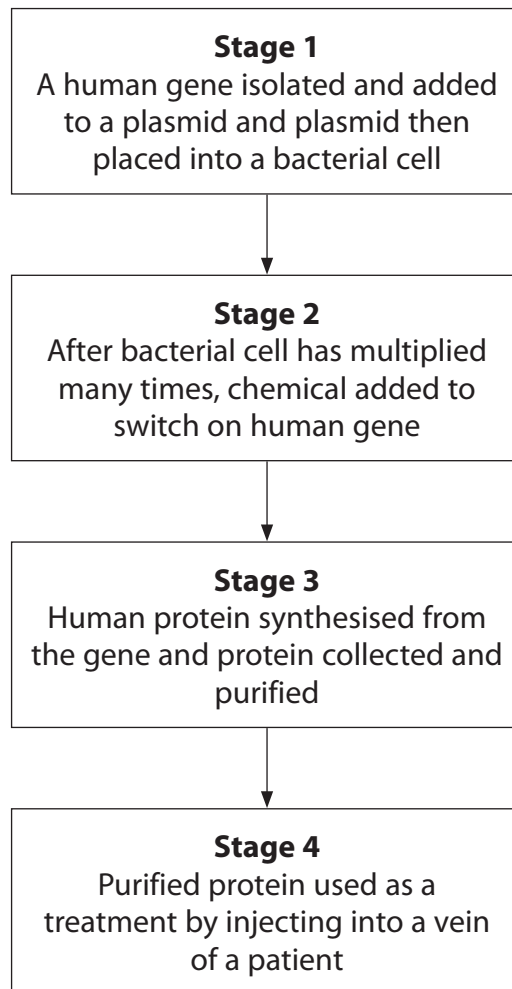
(4)

Labelled structure	Name of structure	One function
A		
		Feel emotions



(b) Some of the drugs used to treat human disorders are proteins. Some of these proteins can be synthesised by genetically modified bacteria.

The diagram below shows some stages in the production of one of these drugs.



(i) A restriction enzyme is used in Stage 1.

Explain why only one restriction enzyme is used in stage 1.

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(ii) Suggest how the addition of a chemical causes the human gene to be switched on in stage 2.

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(iii) Describe the structure of an organelle found in a bacterial cell that is involved in synthesising human protein in stage 3.

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(iv) Suggest **two** advantages of injecting the protein into a vein rather than an artery in stage 4.

(2)

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(Total for Question 6 = 12 marks)



7 The scientific article you have studied is adapted from the book called *The Immortal Life of Henrietta Lacks* by Rebecca Skloot. Published by Pan Books in 2011.

(a) Explain what is meant by the term **mitosis** (paragraph 7).

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(b) The genome makes sure that cells 'do their jobs, whether that's controlling your heartbeat or helping your brain understand the words on this page' (paragraph 10).

Describe how cells in the sino-atrial node (SAN) are involved in controlling heart rate.

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(c) Henrietta’s cells have ‘been used to study lactose digestion’ (paragraph 16).

Suggest how her cells may have digested lactose.

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(d) ‘Like guinea pigs and mice, Henrietta’s cells have become the standard laboratory workhorse’ (paragraph 16).

Suggest **two** reasons why it is preferable to use Henrietta’s cells in medical research, rather than using guinea pigs and mice.

(2)

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*(e) 'By the end of 1951, the world was in the midst of the biggest polio epidemic in history' (paragraph 19). This was caused by poliovirus which can lead to paralysis (paragraph 20).

The virus infects motor neurones which can stop skeletal muscles from working.

Suggest how an infection of motor neurones by the virus can stop the transmission of nerve impulses and lead to muscle paralysis.

(6)

Dotted lines for writing the answer.



(f) Poliovirus, like Human Immunodeficiency Virus, is a retrovirus. Poliovirus was able to infect HeLa cells (paragraph 25).

Give **three** similarities between the structure of the genetic material in poliovirus and the genetic material in HeLa cells.

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- (g) Scientists had studied genes by breeding plants 'then breeding their offspring to see how genetic traits are passed from one generation to the next' (paragraph 33).

When this was done using a smooth pea and a wrinkled pea, it was found that in the F₂ generation (second generation of offspring), 75% were smooth.

In the space below, draw genetic diagrams to describe and explain the genotypes of the parents and their offspring in the previous **two** generations.

(4)



(h) Explain what is meant by the term **human genome map** (paragraph 37).

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(i) Suggest how the 'p53 tumor suppressor gene' (paragraph 43) could stop a potential tumour cell forming.

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(j) Using paragraph 46, suggest what the 'specific DNA sequence from a blood cell' coded for.

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- (k) A human telomere (paragraph 60) contains 10 000 nucleotides. Using information from paragraph 58, state the number of telomere nucleotides lost per cell division.

(1)

Answer nucleotides

(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS

