

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Edexcel GCE**

**Biology**

**Advanced**

**Unit 5: Energy, Exercise and Coordination**

Monday 21 January 2013 – Morning

**Time: 1 hour 45 minutes**

Paper Reference

**6BI05/01**

**You must have:**

A copy of the scientific article modified from New Scientist articles  
(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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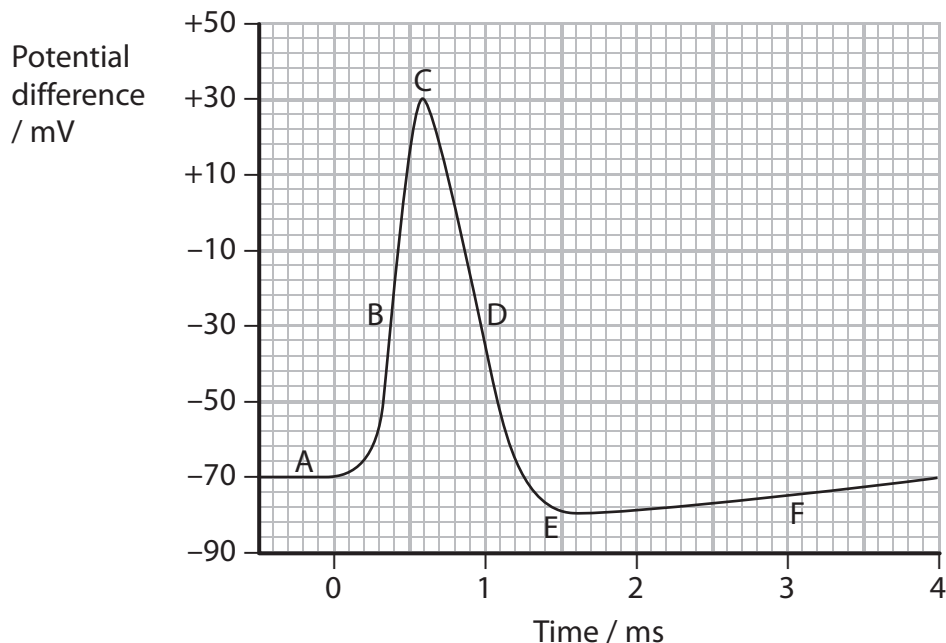


**PEARSON**

**Answer ALL questions.**

**Some questions must be answered with a cross 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 graph below shows the changes in potential difference across the membrane of a neurone after stimulation.



- (i) Using the information in the graph, state the maximum change in potential difference across the membrane of this neurone during depolarisation. (1)

..... mV

- (ii) The table below describes three of the stages shown in the graph.

Place a cross in the box (☒) below the letter that correctly links the description to one of the labels on the graph above.

(3)

Description	A	B	C	D	E	F
Stage when the concentration of positive ions is greatest inside the axon	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Stage when hyperpolarisation first occurs	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Stage showing the resting potential	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



\*(b) When a nerve impulse reaches a synapse, calcium ions enter the neurone through the pre-synaptic membrane. This causes a neurotransmitter, such as acetylcholine, to be released.

Describe and explain the sequence of events that occurs at the synapse, after a neurotransmitter has been released.

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**(Total for Question 1 = 9 marks)**

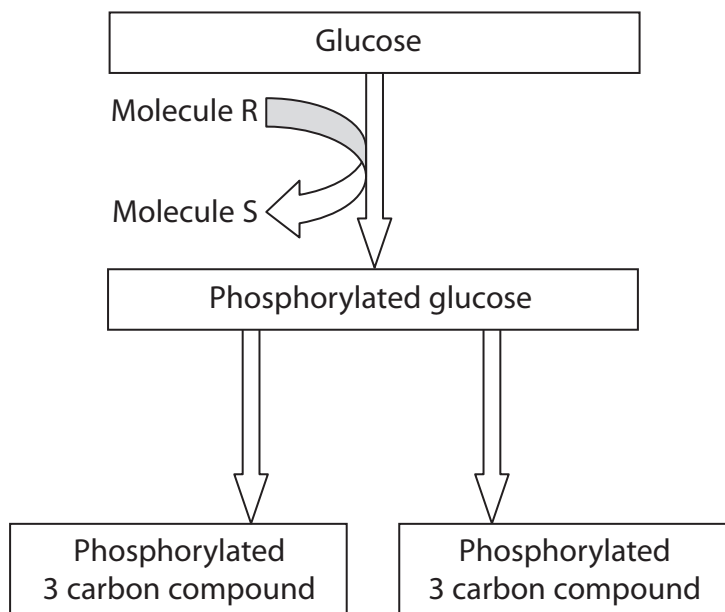


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2 Respiration is a vital process in living organisms.  
All organisms carry out glycolysis. The Krebs cycle also occurs in some organisms.

(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.

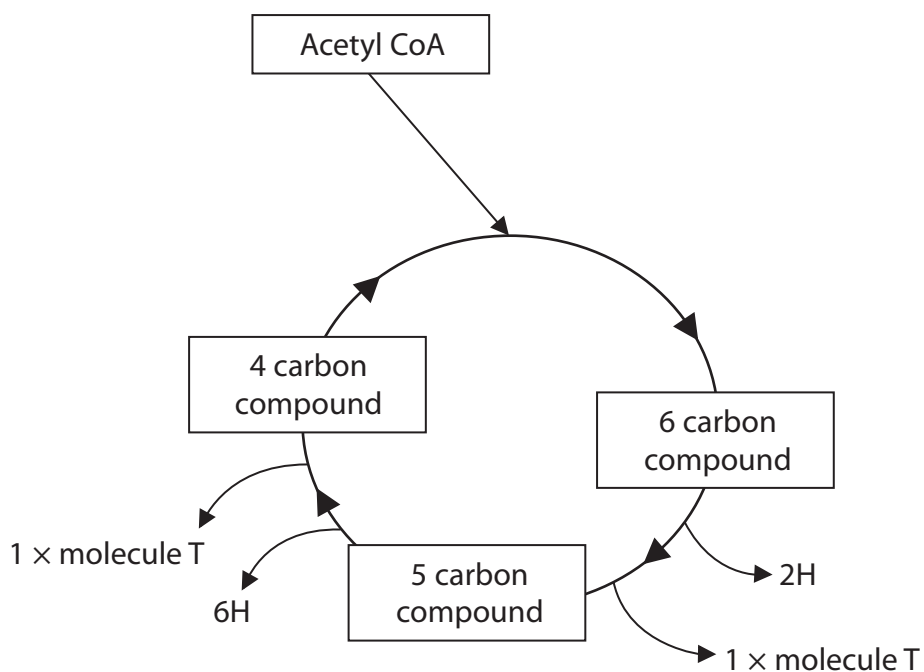
(2)

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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(c) 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 2 = 10 marks)**



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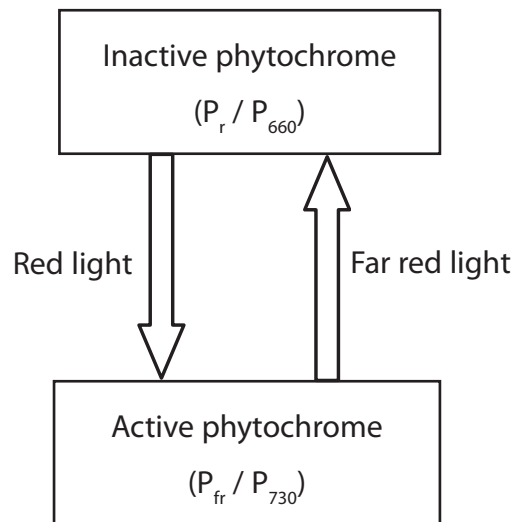
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3 Phytochromes are photoreceptors found in many plants.

(a) The diagram below shows the interconversion of inactive phytochrome ( $P_r / P_{660}$ ) and active phytochrome ( $P_{fr} / P_{730}$ ).



State **one** way in which the active form of phytochrome can be converted back to the inactive form, other than by exposing it to far red light.

(1)



- (b) A study was carried out to investigate the effect of red light and far red light on sunflower plants.



A sunflower

Magnification  $\times 0.5$

One group of sunflower seedlings, group A, was grown under a lamp that emitted red light and far red light of the same intensity.

Another group of sunflower seedlings, group B, was grown in the same way, except that the lamp emitted a lower intensity of red light. The intensity of far red light was unchanged.

When the plants were fully grown, the mean dry mass of the flowers produced and the mean length of the plant stems were recorded.

This study was repeated using new groups of sunflower seedlings.

The results are shown in the table below.

Study	Mean dry mass of the flowers / g		Mean stem length / cm	
	Group A	Group B	Group A	Group B
Original	58	45	125	148
Repeat	43	38	124	142



(i) Using the mean dry mass of the flowers shown in the table, compare the results of group A with group B for both the original and repeat studies.

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(ii) The light conditions experienced by group B were similar to those found near ground level in woodland.

Using the mean stem lengths shown in the table, suggest the importance of these light conditions for a young seedling in the woodland.

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P 3 9 8 8 1 A 0 1 1 2 8

(iii) A statistical analysis of the data for mean stem length was carried out.

The analysis showed that there was a significant difference between the mean stem length data for groups A and B.

However, there was no significant difference between the data from the original study and the repeat study.

Suggest a conclusion for the effect of light on mean stem length and use the results of this statistical analysis to comment on the reliability of the data.

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**(Total for Question 3 = 10 marks)**



4 Physiological changes occur when a person carries out a period of exercise, such as running 800 metres.

(a) One physiological change will be an increase in cardiac output.

Describe the changes in the heart that bring about an increase in cardiac output.

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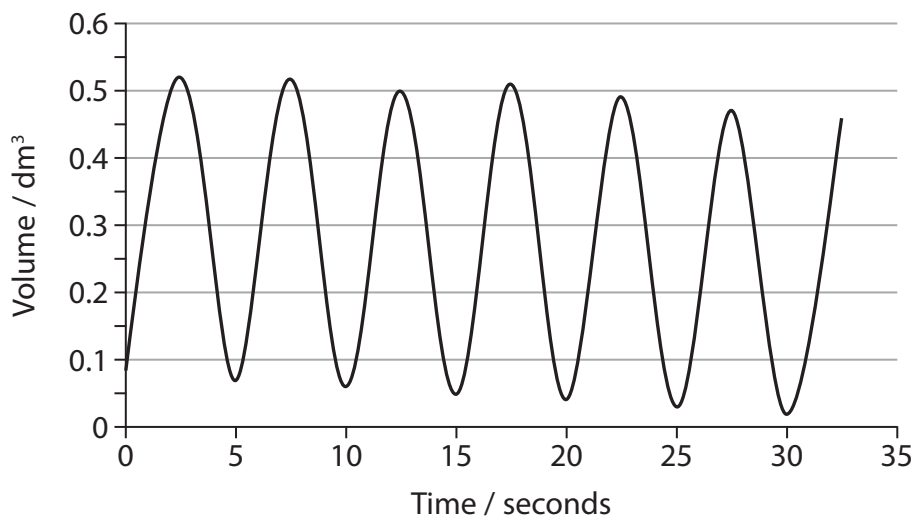
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- (b) The respiratory system will also undergo physiological changes during a period of exercise.

The spirometer trace shown below was recorded when an adult was at rest. This trace can be used to calculate the resting breathing rate and tidal volume of the adult.



- (i) Place a cross in the box (☒) that correctly identifies the approximate value for resting breathing rate and tidal volume for this adult.

(2)

Approximate value for	0.1 dm <sup>3</sup>	0.5 dm <sup>3</sup>	6 dm <sup>3</sup> min <sup>-1</sup>	6 breaths min <sup>-1</sup>	12 breaths min <sup>-1</sup>
Resting breathing rate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Resting tidal volume	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



(ii) Describe how a spirometer trace recorded immediately after a short period of exercise would differ from this trace.

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(c) A student used a spirometer to compare the resting breathing rate of musicians who play trumpets with musicians who play violins.

Suggest **two** variables the student should have considered when selecting the musicians, to make the study valid.

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**(Total for Question 4 = 10 marks)**



P 3 9 8 8 1 A 0 1 5 2 8

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5 The photograph shows a female gymnast on a narrow beam.



(a) The table below refers to two regions of the brain.

Complete the table by describing **one** role of each region of the brain, while she is on the beam.

(2)

Region of the brain	One role while she is on the beam
Cerebellum	
Medulla oblongata	



(b) This gymnast will generate a lot of heat while she is on the beam.

Describe and explain how changes in blood flow in the skin will help her to control her body temperature.

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(c) Gymnasts can damage their cruciate ligaments.  
This is an injury that can be repaired using keyhole surgery.

(i) Explain what is meant by the term **cruciate ligament**.

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(ii) A gymnast was offered keyhole surgery to repair her damaged cruciate ligament.

Suggest and explain **two** reasons why she might choose this type of surgery.

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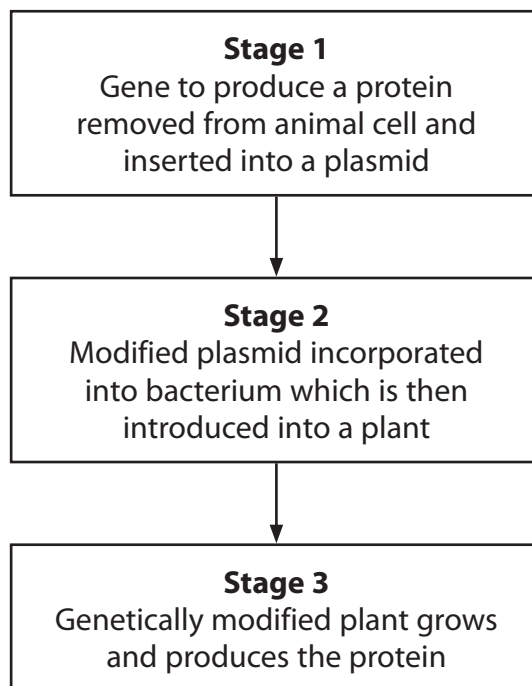
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**(Total for Question 5 = 10 marks)**



- 6 Some organisms have been genetically modified to produce proteins including hormones and vaccines.

The flow diagram below shows part of a process to produce a protein, using genetically modified plants.



- (a) Describe and explain the role of the enzymes involved in stage 1.

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(b) Describe the structure of the modified plasmid used in stage 2.

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(c) Suggest why plants rather than bacteria are used to produce the protein in stage 3.

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(d) Describe **two** risks associated with the use of genetically modified organisms.

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**(Total for Question 6 = 11 marks)**



P 3 9 8 8 1 A 0 2 1 2 8

7 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  $VO_2$ max 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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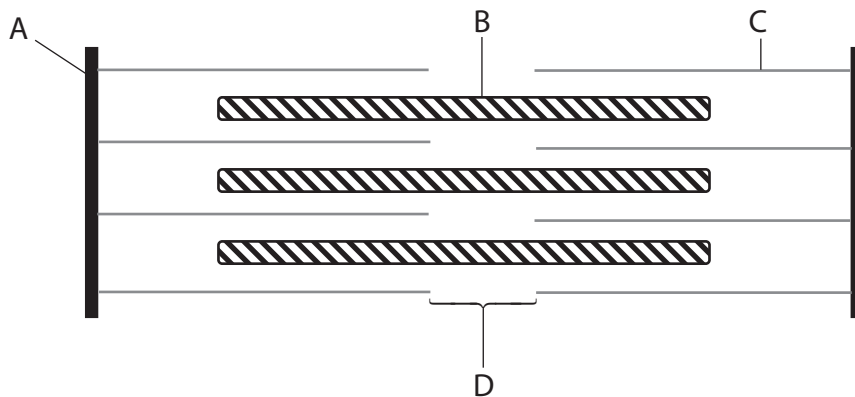
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- (i) The titin gene produces a protein that attaches to myosin in a sarcomere (paragraph 30).



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 7 = 30 marks)**

**TOTAL FOR PAPER = 90 MARKS**

