

**ADVANCED GCE****HUMAN BIOLOGY**

Energy, Control and Reproduction

**2866**

Candidates answer on the question paper

**OCR Supplied Materials:**

None

**Other Materials Required:**

- Electronic calculator
- Ruler (cm/mm)

**Thursday 22 January 2009****Afternoon****Duration:** 1 hour 30 minutes

Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **90**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **20** pages. Any blank pages are indicated.

**FOR EXAMINER'S USE**

Qu.	Max.	Mark
1	15	
2	21	
3	20	
4	12	
5	12	
6	10	
<b>TOTAL</b>	<b>90</b>	

Answer **all** the questions.

- 1** The process of ovulation is an important area of research.

In 2003, an investigation found that some women can ovulate more than once per menstrual cycle.

The investigation was carried out on 63 women aged between 18 and 40 years, all of whom had normal menstrual cycles.

The women were given an ultrasound scan of their ovaries before the investigation and then daily scans for six weeks during the investigation.

- (a) (i)** State **two** items of useful information that the researchers could gain from the ultrasound scan carried out **before the investigation**.

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2 .....

..... **[2]**

- (ii)** Explain why ultrasound scans were used instead of X-rays in this investigation.

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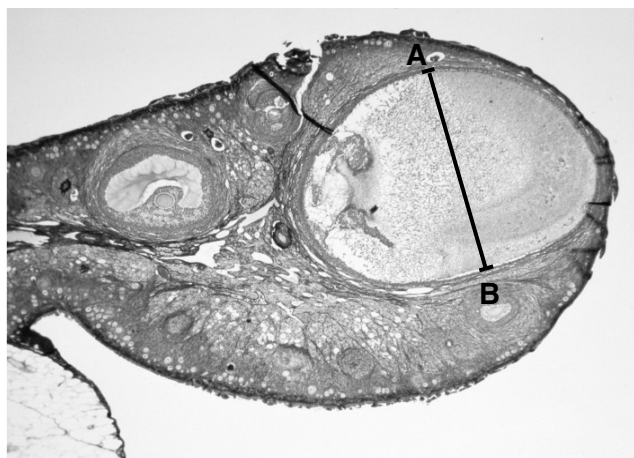
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..... **[2]**

- (b)** The ultrasound images obtained from the investigation were used to measure the size of every mature ovarian follicle in each woman's ovaries.

Fig. 1.1 is a photomicrograph showing a mature Graafian follicle within a human ovary.



× 2.3

© John Burbidge/Science Photo Library

**Fig. 1.1**

- (i) Calculate the actual size of the Graafian follicle, in millimetres, along the line **A** to **B** on Fig. 1.1.

Show your working and **give your answer to one decimal place.**

Answer = ..... mm [2]

- (ii) Suggest why measuring the diameters of the Graafian follicles was an important part of this investigation.

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 .....  
 ..... [2]

- (c) During the six weeks of the investigation the following results were obtained:

- 7 women did not ovulate at all
- 50 women ovulated once
- 6 women ovulated twice.

It was also observed that the activity of the follicles increased twice during the six weeks in 68% of the women and three times in 32% of the women.

- (i) Explain the most likely outcome of ovulating twice during the menstrual cycle.

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 ..... [2]

- (ii) Experts in reproductive physiology have suggested that these results could explain why some women may reach the menopause earlier than others.

Suggest why ovulating more than once in each menstrual cycle may lead to early menopause.

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 .....  
 .....  
 ..... [2]

(iii) Suggest how the **reliability** of this investigation could be improved.

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..... [2]

(d) This investigation raises the possibility of finding genes that are involved in the control of ovulation.

If such genes were discovered, useful information could be obtained about the control of the number of ovulations in each menstrual cycle.

Suggest **one** possible use of this information.

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..... [1]

[Total: 15]

2 An understanding of how blood pressure is controlled may help to reduce the risk of strokes.

(a) Explain why it is particularly important that a constant blood flow to **brain cells** is maintained.

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..... [2]

(b) The control of blood pressure is an autonomic reflex.

Explain what is meant by an *autonomic reflex*.

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..... [2]

(c) High blood pressure (hypertension) is a risk factor for strokes and coronary heart disease (CHD).

A stroke may be caused by a blood clot or a haemorrhage in an arteriole or a capillary in the brain.

(i) Explain why high blood pressure (hypertension) increases the risk of a stroke.

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..... [4]

(ii) State **two** risk factors for strokes **other than** high blood pressure.

1 .....

2 ..... [2]

- (d) An individual who has had a stroke may be given a CT scan of their brain soon after arriving at hospital and may receive follow-up scans a day or two later.

(i) Explain how a CT scan of the brain is obtained.

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(ii) What information can initial and follow-up CT scans of the brain provide about stroke damage?

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(e) (i) Some examples of the effects of strokes are listed below.

- A**    **loss of balance**
- B**    **loss of speech**
- C**    **paralysis**
- D**    **loss of memory**
- E**    **loss of control of heart rate**
- F**    **loss of cognitive skills**

These effects can result from damage to different parts of the brain.

Table 2.1 shows parts of the brain that may be damaged by strokes.

Indicate **one** effect (**A**, **B**, **C**, **D**, **E** or **F**) that a stroke may have on the parts of the brain shown in Table 2.1. The first one has been done for you.

Letters may be used once, more than once or not at all.

**Table 2.1**

part of brain damaged by stroke	effect
Broca's area	<b>B</b>
cerebellum	
cerebral cortex	
medulla oblongata	
hippocampus	

[4]

(ii) Suggest why the recovery from a stroke involves the use of alternative nerve pathways.

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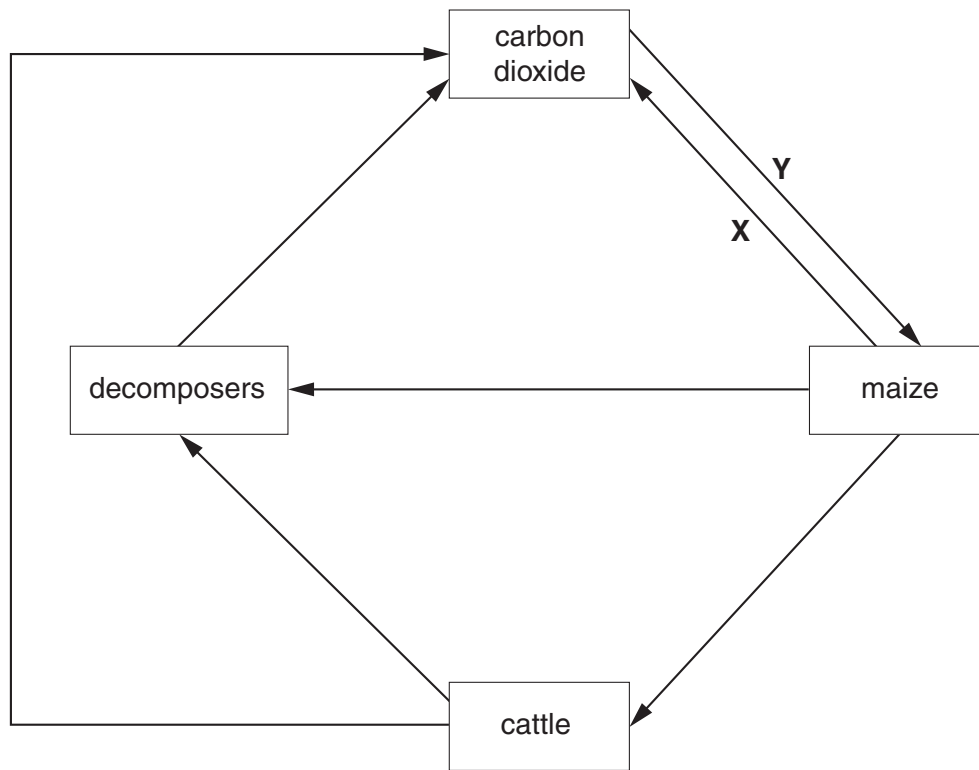
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..... [2]

[Total: 21]

- 3 Human activity may disturb the balance of carbon recycling in an ecosystem more than the activity of any other species.

Fig. 3.1 shows the recycling of carbon in an ecosystem.



**Fig. 3.1**

- (a) (i) Name the processes represented by the arrows labelled **X** and **Y**.

**X** .....

**Y** ..... [2]

- (ii) Explain **one** way in which human activity could disturb the balance of carbon recycling shown in Fig. 3.1.

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- (b) (i)** Explain the role of maize in the carbon cycle shown in Fig. 3.1.

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- (ii)** Describe the role of decomposers in the carbon cycle.

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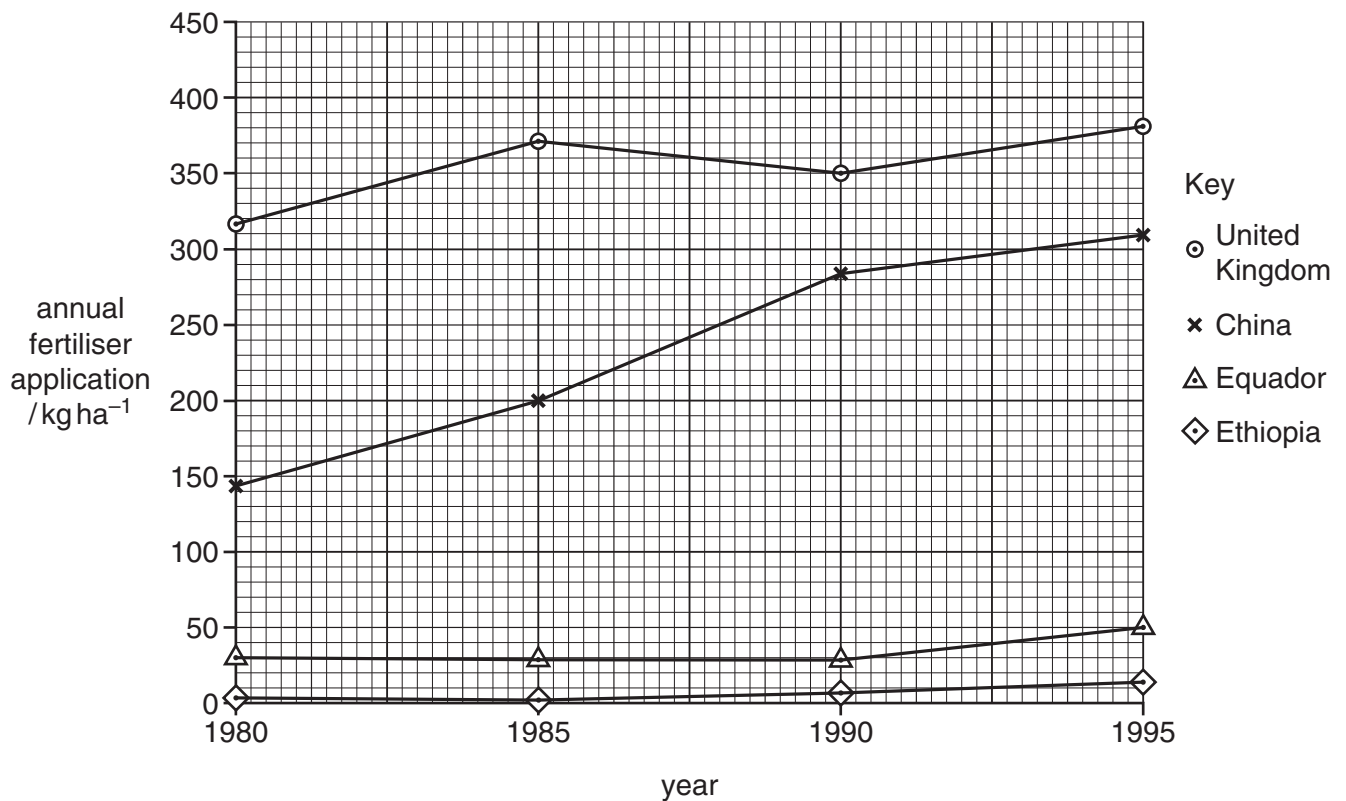
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Fig. 3.2 shows the annual fertiliser application in kilograms per hectare ( $\text{kg ha}^{-1}$ ) of cultivated land in four different countries between 1980 and 1995.



**Fig. 3.2**

- (c) In Ecuador, the percentage increase in annual fertiliser application from 1980 to 1995 is 66.7%.

Calculate the percentage increase in fertiliser application in China between 1980 and 1995.

Show your working and **give your answer to one decimal place.**

Answer = ..... % [2]

**(d)** In this question, one mark is available for the quality of spelling, punctuation and grammar.

Describe the data in Fig. 3.2 **and** suggest explanations for the trends shown.

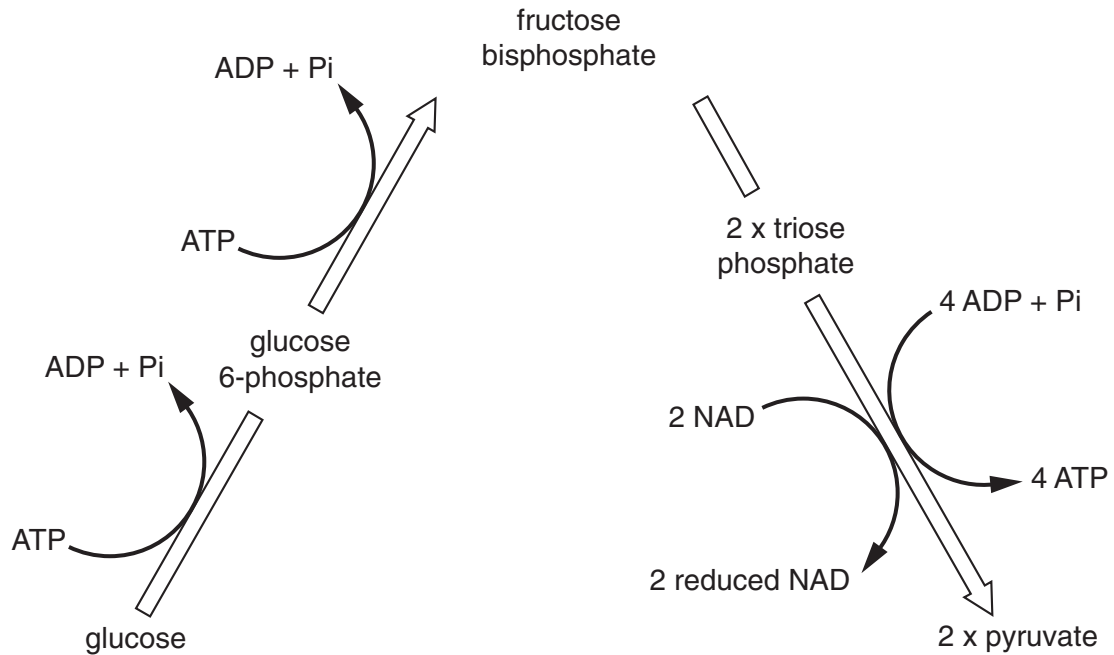
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Quality of Written Communication [1]

**[Total: 20]**  
**Turn over**

- 4 The aerobic respiration of glucose inside cells is a complex process that occurs in stages.

Fig. 4.1 shows an outline of the reactions occurring during **glycolysis**.



**Fig. 4.1**

- (a) Glucose molecules used in glycolysis may have been stored previously in the body as glycogen.

Describe how glycogen is converted into glucose molecules.

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..... [2]

- (b) With reference to Fig. 4.1,

- (i) state the purpose of phosphorylating glucose,

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..... [1]

- (ii) state the **net** gain of ATP molecules per molecule of glucose at the end of glycolysis.

..... [1]

- (c) The reactions in glycolysis are catalysed by enzymes.

Explain why the reactions in glycolysis could not occur in human cells without the presence of enzymes.

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..... [3]

- (d) In the later reactions of glycolysis, reduced NAD is formed.

Explain why the formation of reduced NAD is important.

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- (e) Pyruvate produced at the end of glycolysis moves through the mitochondrial membranes against a concentration gradient.

Describe how pyruvate enters mitochondria.

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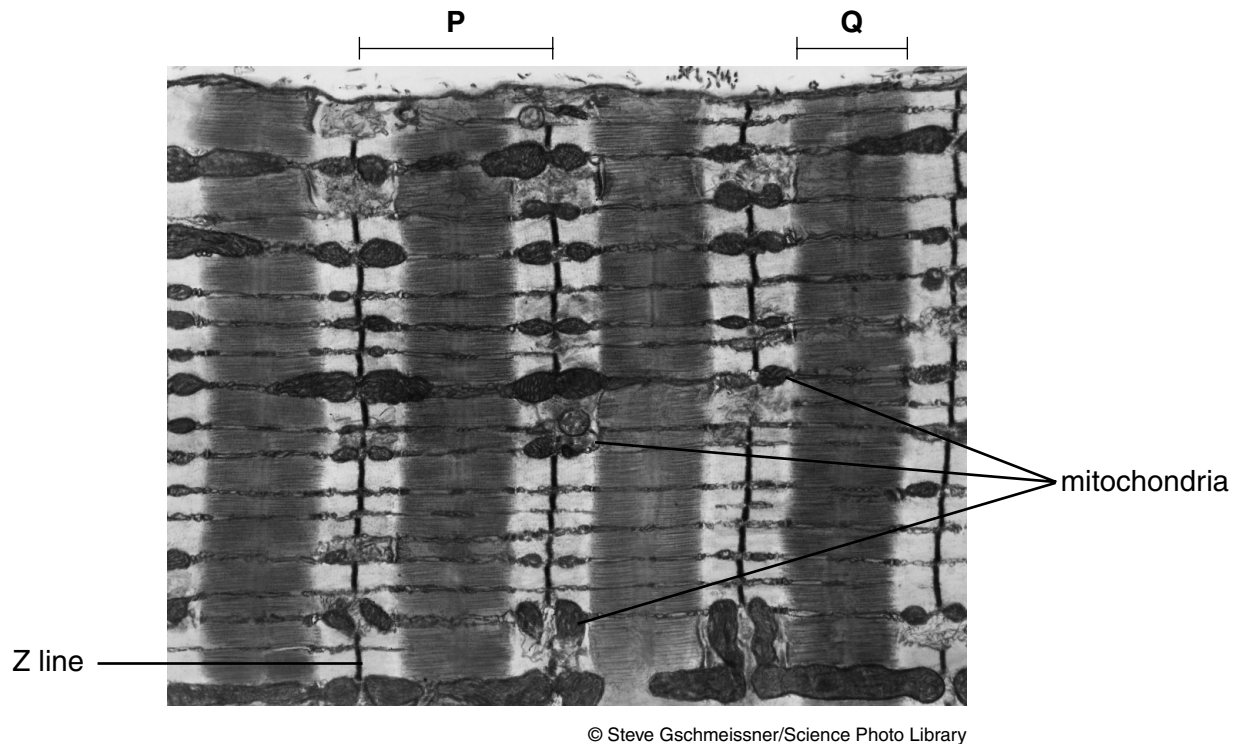
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..... [2]

[Total: 12]

- 5 Fig. 5.1 shows an electron micrograph of a longitudinal section through striated skeletal muscle.



**Fig. 5.1**

(a) With reference to Fig. 5.1,

- (i) explain why there are a large number of mitochondria within the muscle,

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.....

..... [2]

- (ii) name the areas labelled **P** and **Q**.

**P** .....

**Q** ..... [2]

- (b)** In this question, one mark is available for the use and organisation of scientific terms.

Describe the sliding filament theory of muscle contraction, starting with the release of calcium ions from the sarcoplasmic reticulum.

**Details of nervous stimulation are not required.**

..... [7]

Quality of Written Communication [1]

**[Total: 12]**

**Turn over**

- 6 A couple is described as infertile if they have failed to conceive despite having regular unprotected sex for a period of one year. Although one in seven couples has difficulty conceiving, the number of couples who are actually infertile is relatively low.

(a) According to the Human Fertilisation and Embryology Authority (HFEA), **endometriosis** accounts for 3% of infertility cases.

(i) Outline how endometriosis may cause infertility.

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..... [2]

(ii) Suggest **one** way in which infertility caused by endometriosis may be treated.

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..... [1]

(b) State **two** causes of female infertility **other than** endometriosis.

1 .....

2 ..... [2]



- (c) The HFEA states that male infertility is the single biggest cause of a couple's inability to conceive.

Many fertility treatments involve collecting samples of sperm that are then stored in a sperm bank. The sperm samples are kept for at least six months before being used for sperm donation.

- (i) Explain why the sperm samples are kept for **at least six months** before being used.

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..... [2]

- (ii) Frozen sperm are thawed and kept in an isotonic solution before being used in fertility treatments.

Explain why the sperm need to be kept in an isotonic solution.

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..... [3]

[Total: 10]

**END OF QUESTION PAPER**

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**19**  
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