

**ADVANCED GCE
HUMAN BIOLOGY**

Energy, Control and Reproduction

WEDNESDAY 23 JANUARY 2008

2866

Morning

Time: 1 hour 30 minutes

Candidates answer on the question paper.

Additional materials: Electronic calculator
Ruler (cm/mm)



Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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.

FOR EXAMINER'S USE

Qu.	Max	Mark
1	19	
2	8	
3	16	
4	13	
5	18	
6	16	
TOTAL	90	

This document consists of **18** printed pages, **2** blank pages and an Insert.

Answer **all** the questions.

- 1 Having your eyes examined regularly can provide you with specific information about any eye problems you may have, as well as general information about your health.

Fig. 1.1 shows a diagram of a longitudinal section through the human eye.

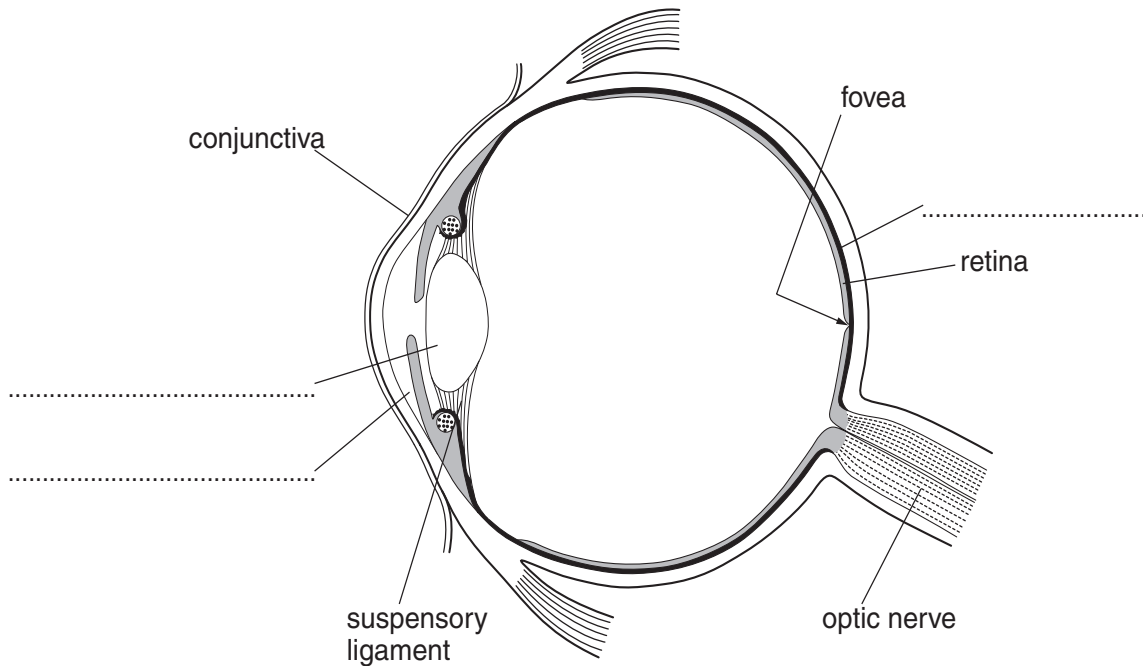


Fig. 1.1

- (a) (i) Complete Fig. 1.1 by writing the names of the structures in the spaces provided. [3]

- (ii) Table 1.1 lists some of the structures shown in Fig. 1.1.

Complete the table by writing in the function of each of the structures listed.

The first one has been done for you.

Table 1.1

structure	function
retina	contains the receptor cells
suspensory ligaments	
optic nerve	
fovea	
conjunctiva	

[4]

- (b) A window-cleaner has fallen off his ladder. Although initially knocked out, he regains consciousness after a few seconds and realises he is bleeding from a leg wound. An ambulance has been called.

- (i) Suggest what steps should be taken by the paramedics to prevent excessive blood loss from the leg wound.

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..... [3]

- (ii) The window-cleaner is taken to hospital by ambulance and loses consciousness again during the journey. Upon arrival, the duty doctor assesses the patient's level of consciousness by carrying out two eye tests:

- A pupil response test.
- A blink reflex test.

Explain how these two tests would be carried out to determine the patient's level of consciousness.

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..... [5]

- (c) Optometrists can carry out other tests on the eyes, such as a visual acuity test, as part of a routine eye examination.

Outline how visual acuity is assessed.

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..... [4]

[Total: 19]

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- 2 The Krebs cycle is the central phase of the aerobic respiration of glucose and was named after Sir Hans Krebs who discovered its main components.

Fig. 2.1 shows a simplified diagram of the Krebs cycle.

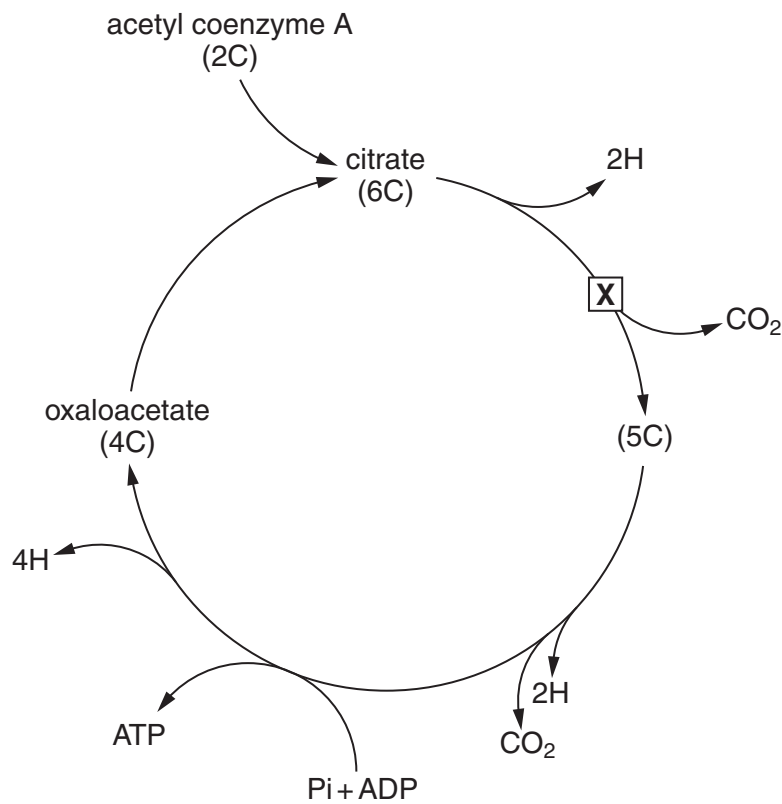


Fig. 2.1

- (a) State **precisely** where in a cell the Krebs cycle takes place.

..... [1]

- (b) Each of the steps in the Krebs cycle is catalysed by a specific enzyme.

- (i) Explain how the shape of an enzyme enables it to catalyse a specific metabolic reaction.

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..... [3]

(ii) Name the type of enzyme catalysing the reaction at point **X** on Fig. 2.1.

..... [1]

(c) Suggest the significance of the Krebs cycle being a cycle.

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..... [3]

[Total: 8]

- 3 ATP is the main energy carrier inside cells. Normally the body can replace ATP as fast as it is used, but if a sudden change from rest to exercise is made, the body takes a few minutes to adjust.

Anaerobic respiration is a mechanism that enables energy to be supplied to muscles at the required rate.



Anaerobic respiration uses glycogen stored in the muscles as a source of glucose.

- (a) Describe how glycogen, stored in muscles, is broken down into glucose.

.....

 [2]

- (b) Some athletes recover faster after strenuous exercise if they continue to exercise slowly. This is called 'warming down'.

- A cyclist exercised strenuously on an exercise bicycle for six minutes.
- She then rested for thirty-four minutes.
- When fully recovered, she cycled strenuously for another six minutes and then, instead of resting, cycled slowly for thirty-four minutes.

Blood samples were taken at intervals and analysed for the concentration of lactate.

The results are shown in Fig. 3.1.

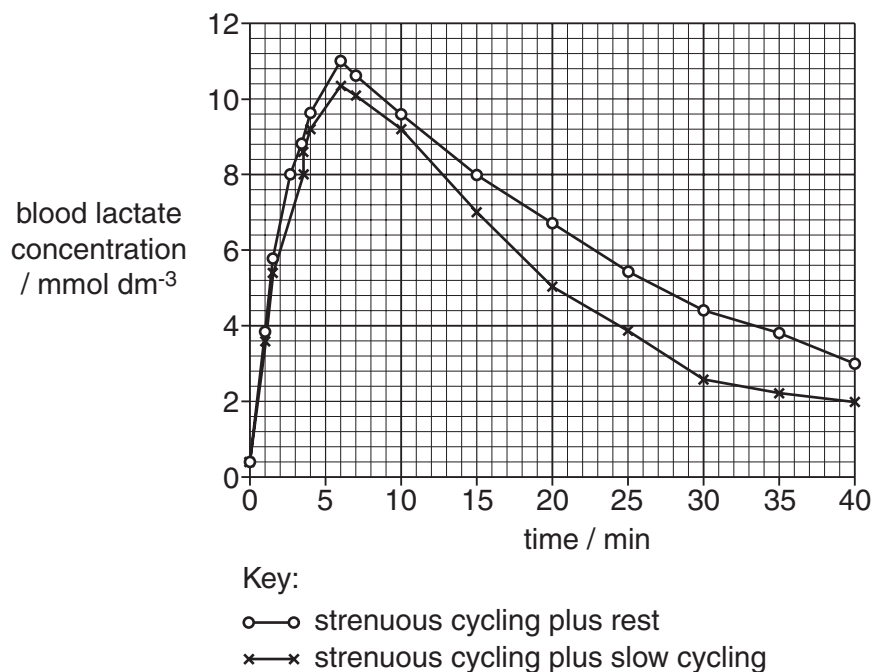


Fig. 3.1

With reference to Fig. 3.1,

- (i) describe the changes in lactate concentration in the blood when the cyclist exercised strenuously and then rested;

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..... [3]

- (ii) suggest how cycling at slow speed during the 'warming down' period helped to lower the concentration of lactate in the blood more quickly than resting completely.

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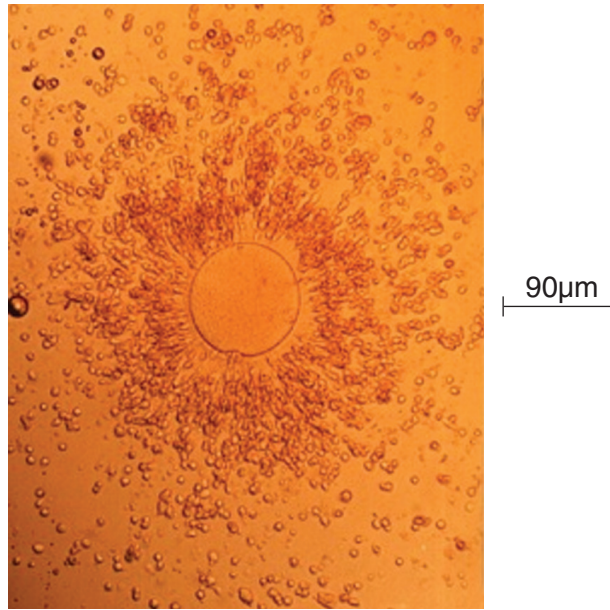
..... [2]

Discuss the implications of using steroids **and** of using EPO to enhance the physical and mental condition of athletes.

[8]

[Total: 16]

- 4 Fig. 4.1 shows a light micrograph of a human secondary oocyte after ovulation.



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Fig. 4.1

- (a) (i) Why is the structure shown in Fig. 4.1 correctly referred to as a secondary oocyte, rather than an ovum?

..... [1]

- (ii) Calculate the magnification of the secondary oocyte shown in Fig. 4.1.

Show your working.

Write your answer **to the nearest whole number**.

Answer = [2]

(b) Fig. 4.2 shows the human life cycle.

Complete the diagram by writing in the correct type of cell division (mitosis or meiosis) occurring at each stage.

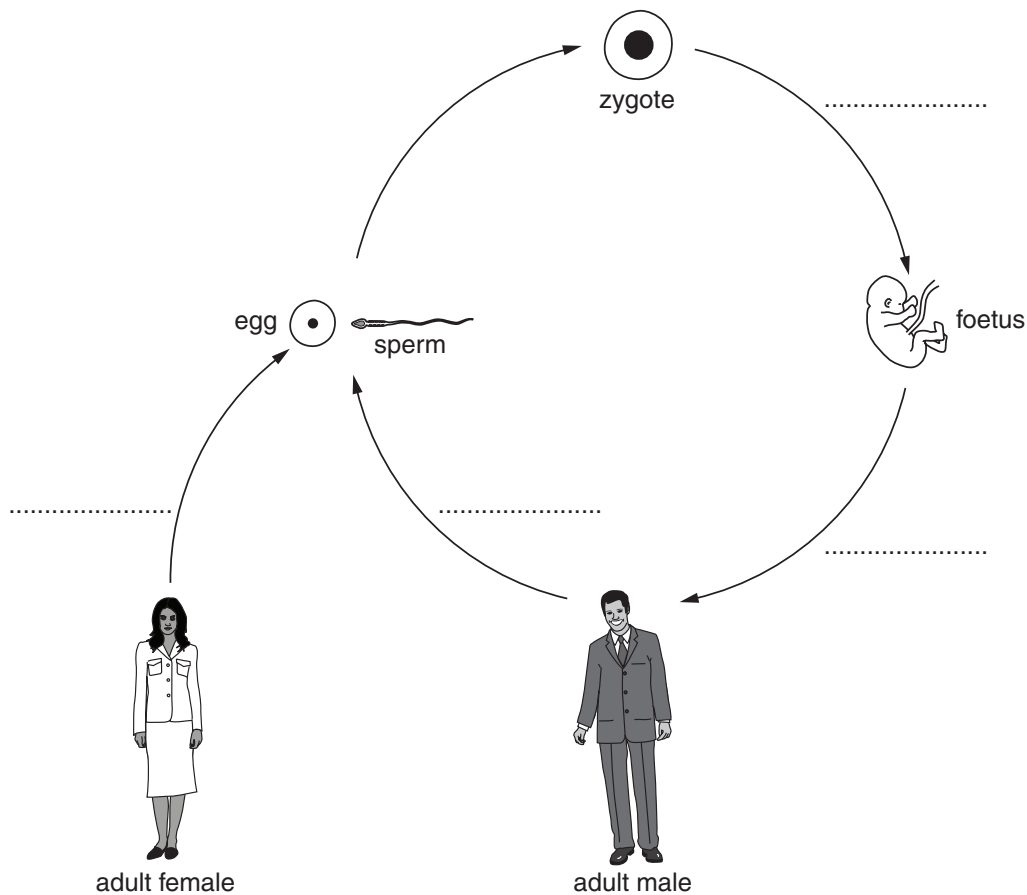


Fig. 4.2

[2]

(c) Table 4.1 shows estimates of the percentage of women likely to become pregnant whilst using a particular method of contraception for one year.

- 'Typical use rate' means that the method was not always used correctly or was not used with every act of sexual intercourse.
- 'Lowest expected rate' means that the method was always used correctly with every act of sexual intercourse.

Table 4.1

method	'typical use rate' of pregnancy / %	'lowest expected rate' of pregnancy / %
vasectomy	0.15	0.1
tubal ligation	0.5	0.5
Norplant®	0.05	0.05
DMPA®	0.3	0.3
oral contraceptive pill	5.0	0.1
male condom	14	3
no method	85	85

With reference to the data in Table 4.1,

- (i) explain why the 'typical use rate' of pregnancy for the male condom is significantly higher than the 'lowest expected rate';

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..... [2]

- (ii) suggest a reason why the 'typical use rate' and 'lowest expected rate' of pregnancy are the same for tubal ligation, but different for vasectomy;

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..... [2]

- (iii) estimate the number of women, out of one hundred, who are likely to become pregnant during one year whilst using DMPA as their method of contraception.

..... [1]

- (d) Incorrect functioning of the immune system may be involved in up to 20% of cases of couples with unexplained infertility.

Injury or disease affecting the testes may result in the formation of antibodies against a man's own sperm (antisperm antibodies).

Suggest how the presence of antisperm antibodies may cause infertility.

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..... [3]

[Total: 13]

- 5 Fig. 5.1, **on the insert**, shows an electron micrograph of part of a palisade mesophyll cell from a pea plant.

(a) Name the structures labelled **P** to **R**.

P

Q

R [3]

(b) During the process of photosynthesis, light energy is converted into chemical energy.

Fig. 5.2 shows an outline of some of the processes involved.

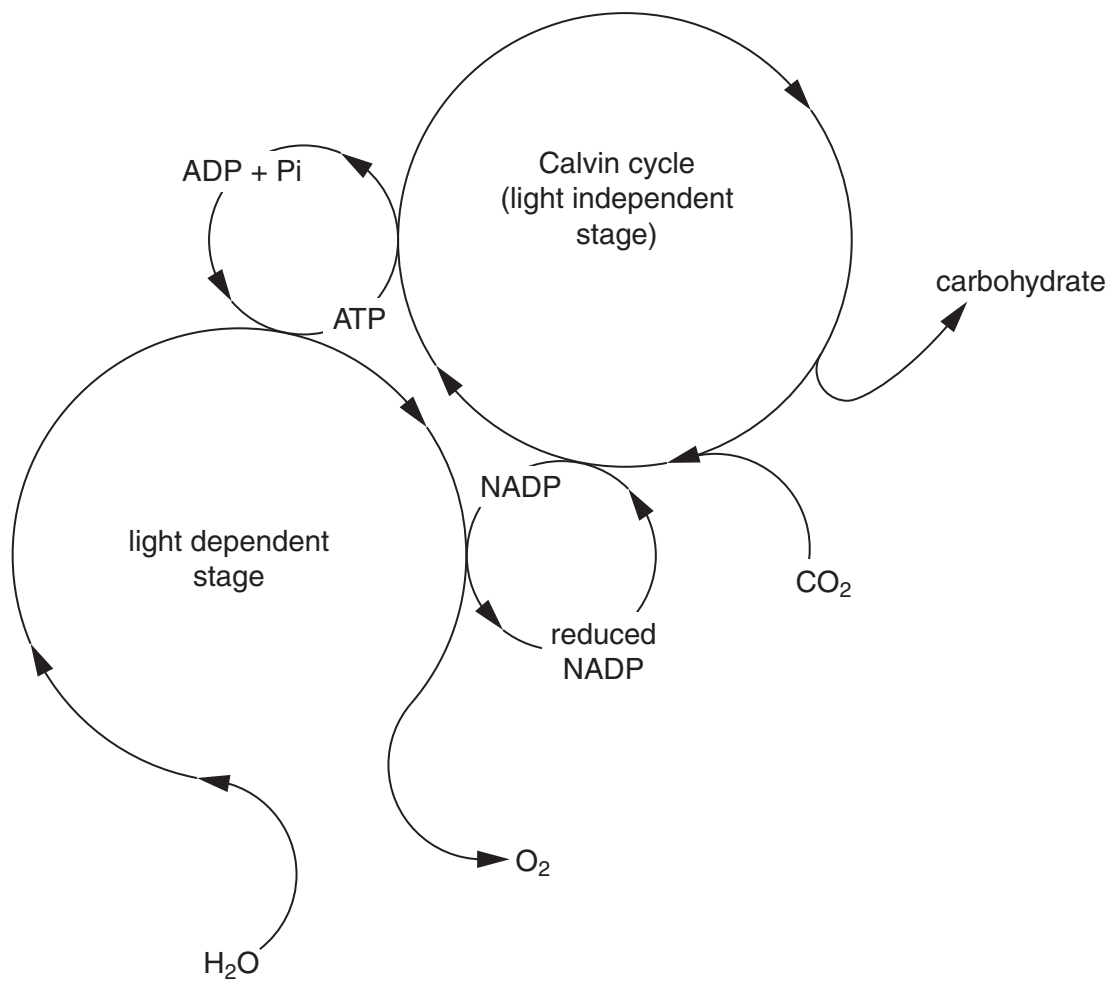


Fig. 5.2

- (i) As light hits chlorophyll molecules in the leaf cells, some of its energy is transferred to electrons in the chlorophyll.

Describe how this energy is used to make ATP.

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..... [3]

- (ii) Oxygen is produced inside leaf cells and is released from the leaf as a waste product of photosynthesis.

Suggest **and** explain the **process** by which oxygen moves from inside the leaf cell to outside the leaf.

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..... [2]

- (iii) The carbohydrate produced as a result of photosynthesis may be converted into other important substances, such as lipids for cell membranes.

Describe the roles of lipids in cell membranes.

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..... [2]

- 6 When an injury such as a paper-cut to the skin occurs, the first sensation we are likely to perceive is a sharp pain, followed soon afterwards by a dull ache. These different sensations of pain involve impulses that are transmitted by different types of neurones.

Table 6.1 contains information about two of the different types of neurone involved.

Table 6.1

type of neurone	speed of transmission / metres per second
A–delta	5 – 30
C	0.5 – 2.0

- (a) (i) Using the information above, state which type of neurone is responsible for the first sharp pain.

..... [1]

- (ii) Explain why some neurones are able to transmit nerve impulses faster than others.

.....

 [3]

- (b) Sometimes the body responds to a painful stimulus before the pain is felt, for example, the rapid withdrawal of a hand from touching a hot plate.

Explain how this is possible.

.....

 [4]

- (c) Fig. 6.1, **on the insert**, shows an MRI scan of the brain of a stroke patient, taken from below the brain. The stroke was caused by an embolism (a travelling blood clot).

An area of dead tissue is seen in the right hemisphere.

- (i) Explain how a stroke may lead to the development of an area of dead tissue within the brain.

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..... [2]

- (ii) Explain why a diet high in salt is one of the risk factors for strokes.

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..... [4]

- (iii) State **two other** factors that increase the risk of strokes.

1

2 [2]

[Total: 16]

END OF QUESTION PAPER

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