

**ADVANCED GCE
HUMAN BIOLOGY**

Energy, Control and Reproduction
TUESDAY 19 JUNE 2007

2866

Morning

Time: 1 hour 30 minutes

Additional materials: Electronic calculator
Ruler (cm/mm)



* GCE / T 26274 *

Candidate
Name

Centre
Number

--	--	--	--	--

Candidate
Number

--	--	--	--

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- 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	18	
3	19	
4	12	
5	12	
6	10	
TOTAL	90	

This document consists of **19** printed pages and **1** blank page.

Answer all the questions.

1 The ability to exercise efficiently depends upon the fitness of the skeletal muscles.

Fig. 1.1 is a light micrograph of a longitudinal section through skeletal muscle tissue.



© Innerspace Imaging / Science Photo Library

Fig. 1.1

(a) (i) Name the structures labelled A and B.

A

B [2]

(ii) Calculate the width of the muscle fibre in micrometres (μm), between the points marked X and Y.

Show your working.

Answer = μm [2]

(b) Muscle fibres contain large numbers of mitochondria.

(i) Suggest why the mitochondria are not visible in Fig. 1.1.

.....
..... [1]

(ii) Explain why muscle fibres contain large numbers of mitochondria.

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

(c) Explain why skeletal muscle is described as a tissue.

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

(d) Muscle fibres contain stores of glycogen.

Describe how the structure of the glycogen molecule is adapted to its function.

.....
.....
.....
.....
.....
.....
.....[3]

(e) Participating in regular exercise over a period of time can improve the fitness of skeletal muscle and general aerobic fitness.

Outline a suitable weekly exercise programme to be followed by someone wishing to significantly improve his or her aerobic fitness.

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

- (f) If vigorous exercise continues for more than a few seconds, anaerobic respiration becomes the dominant form of respiration in the skeletal muscles.

Fig. 1.2 shows the average oxygen consumption by an athlete during and after a race.



time/min

© Astrand, 1970

Fig. 1.2

Using the information in Fig. 1.2, explain why there is an oxygen deficit and explain the reason for the excess post-exercise oxygen consumption (EPOC).

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

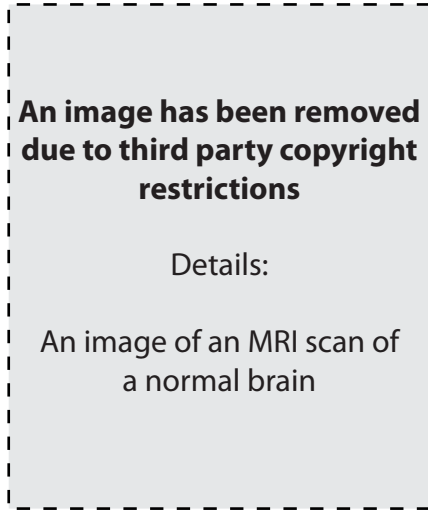
[Total: 19]

5
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

- 2 Opponents of boxing are often concerned with the incidence of traumatic brain injury (TBI) that occurs within the sport. A 1984 survey found that 87% of professional boxers had evidence of brain damage.

Fig. 2.1A shows an MRI scan of a normal brain.



© Scott Camazine / Science Photo Library

Fig. 2.1A

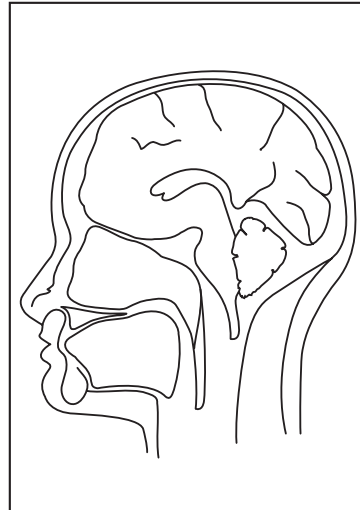


Fig. 2.1B

Punches that force the head up and back may cause damage to the cerebellum as the brain is squashed against the back of the skull.

- (a) (i) State the meaning of the term traumatic brain injury (TBI) .

.....
.....[1]

- (ii) Label the cerebellum on Fig. 2.1B with an X. [1]

- (iii) Suggest two symptoms that a boxer would show if the cerebellum was damaged.

1

.....

2

.....[2]

(b) (i) Describe how an MRI scan may be used to assess brain damage.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....[4]

(ii) Explain why MRI scans may be used in the assessment of some types of brain damage whilst CT scans are used for others.

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

3 According to the Office of Population, Censuses and Surveys, the overall incidence of multiple births in England and Wales started to increase in the early 1980s.

(a) Explain how multiple pregnancy may occur naturally.

.....
.....
.....
.....
.....
.....[3]

(b) When a woman becomes pregnant for the first time, a sample of her blood will be taken and tested in order to assess her blood group.

As well as determining which group of the **ABO** blood classification system she is in, the test will also detect whether she is Rhesus positive or Rhesus negative.

(i) There are four possible blood groups within the **ABO** system: **A**, **B**, **AB** and **O**.

Explain how the red blood cell surface membrane determines an individual's **ABO** blood group.

.....
.....
.....
.....
.....
.....[3]

(ii) Explain the potential dangers if a Rhesus negative mother is carrying a Rhesus positive baby.

.....
.....
.....
.....
.....[3]

(iii) Describe the treatment which would be offered during pregnancy to a Rhesus negative woman carrying a Rhesus positive baby.

.....

.....

.....

.....[2]

(c) In this question, one mark is available for the quality of use and organisation of scientific terms.

Fig. 3.1 shows changes in the concentration of hormones in the blood during pregnancy.

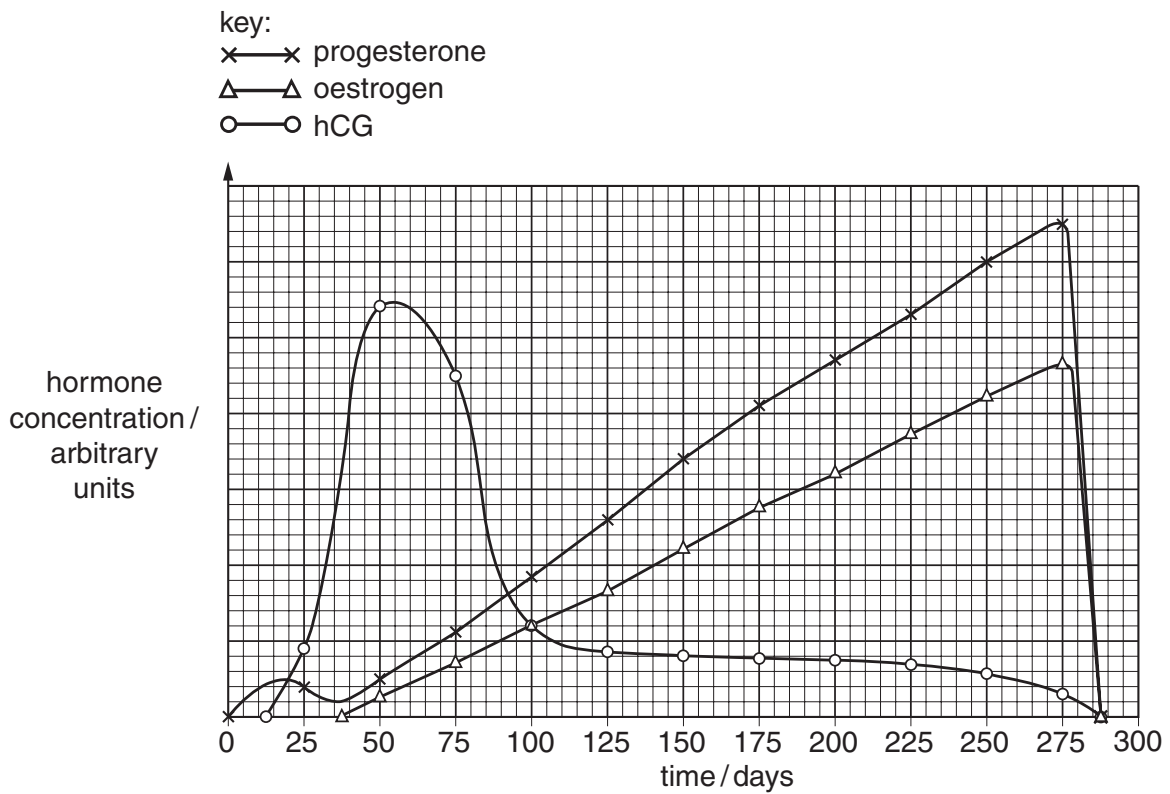


Fig. 3.1

- 4 Respiration is the process by which the energy in food molecules is made available for an organism to do biological work. The energy in the food molecules is transferred to molecules of ATP.

The basic structure of ATP is shown in Fig. 4.1.

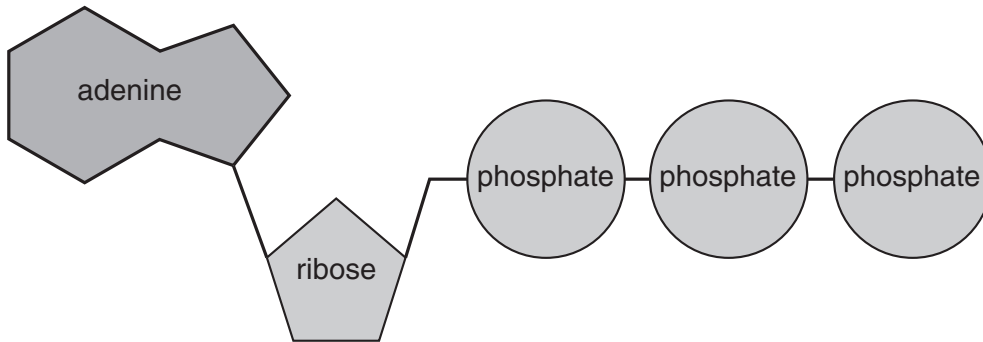


Fig. 4.1

- (a) ATP may be described as a phosphorylated nucleotide.

Describe **two** differences in structure between a nucleotide in DNA and ATP.

- 1
- 2 [2]

- (b) When ATP in solution is hydrolysed in a test tube, the release of energy quickly heats the surrounding water.

- (i) Suggest why this sudden release of heat energy would be dangerous inside a living cell.

.....

.....

.....

..... [2]

- (ii) Explain how the energy in ATP is used in order to prevent this happening inside a living cell.

.....

.....

.....

..... [2]

(c) Cyanide is a poison that prevents the production of ATP inside cells. If cyanide is added to cells in a culture before meiosis begins, the nucleus does not divide.

(i) Describe the events occurring inside a cell during prophase I of meiosis.

A labelled diagram may be used if it helps to explain your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

(ii) State **two** uses of ATP during meiosis.

1

2 [2]

[Total: 12]

5 (a) World population is on the increase and there are serious concerns among scientists and governments over how the increasing demands for basic commodities, such as food, are to be met in the near future.

- The world population increases annually by about 80 million.
- It has been predicted that the world population will reach the 8 billion mark within the next 20 years.

Fig. 5.1 shows the trend in world grain production up to the year 2000 and the predicted trend in grain production between the years 2000 and 2020. It also shows the yield that would be required to meet the predicted growth in world population.

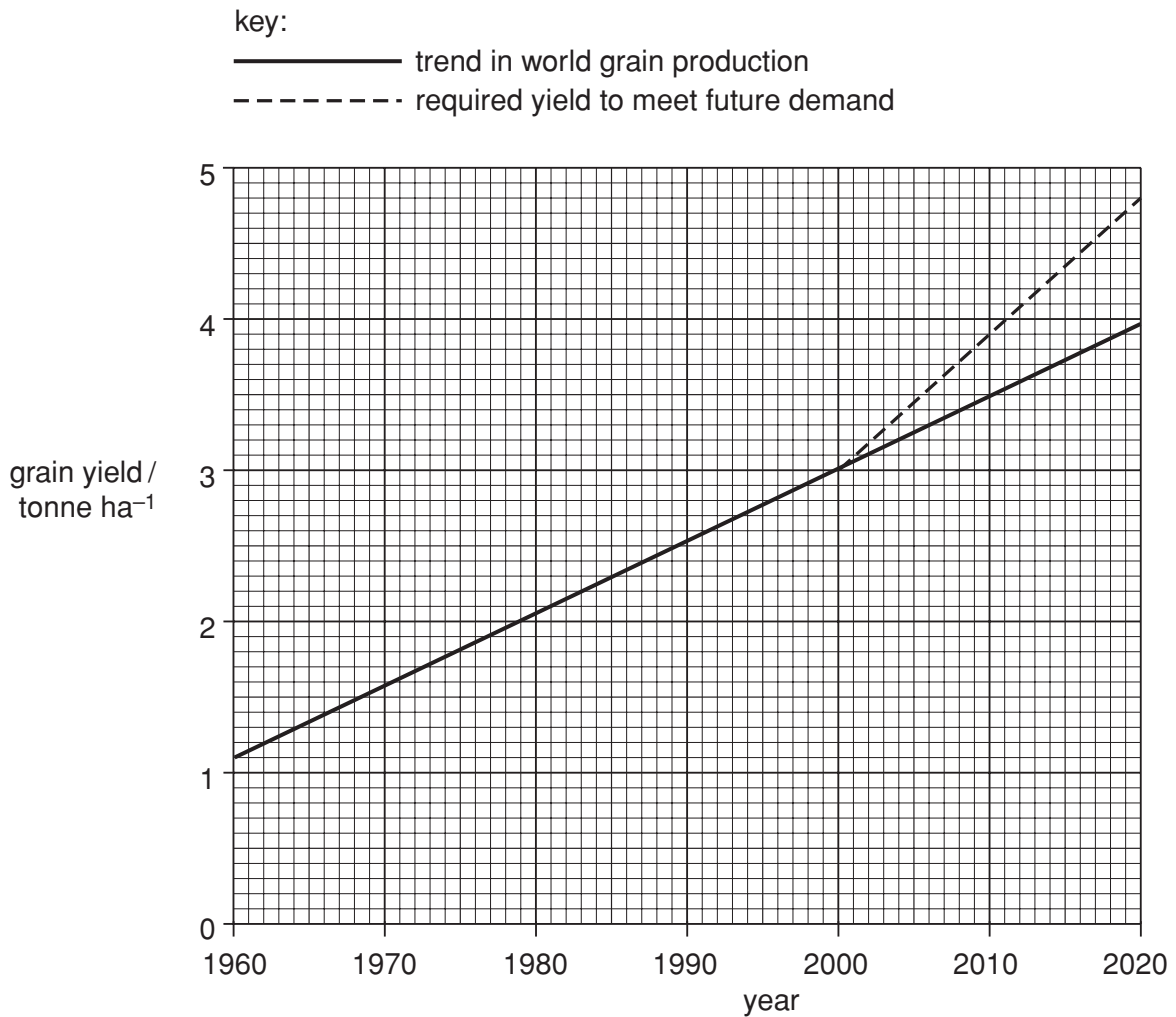


Fig. 5.1

(i) Using Fig. 5.1, calculate the predicted shortfall in world grain production by 2010, if the predicted trend in grain production is accurate.

Show your working.

Answer =[2]

(ii) State **two** conclusions that can be drawn from the data shown in Fig. 5.2.

1

.....

2

.....[2]

(iii) Some scientists believe that the long-term application of inorganic fertiliser is not a sustainable way of farming arable land.

Explain what is meant by the term *sustainable* in this context.

.....

.....

.....

.....[2]

[Total: 12]

- 6 (a) Conjunctivitis is an infectious disease of the eye caused by the bacterium *Haemophilus aegypticus*.

When an eye becomes infected, the conjunctiva and cornea become inflamed and phagocytes migrate to the area from the blood stream as part of the body's immune response.

- (i) Outline the purpose of the phagocytes in the infected eye.

.....
.....
.....
.....
.....
.....
.....[3]

- (ii) Suggest a suitable treatment for conjunctivitis.

.....
.....[1]

- (b) Fig. 6.1 shows a longitudinal section through a human eye.

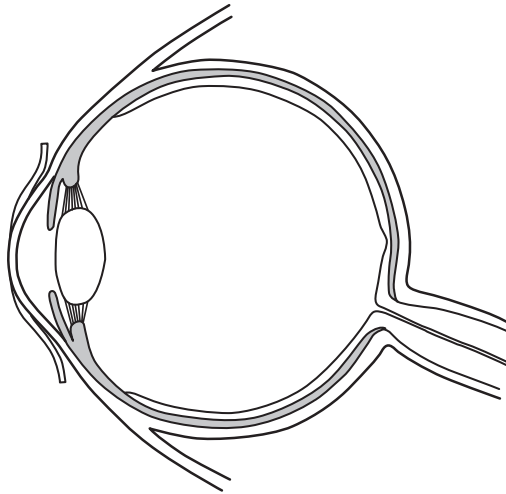


Fig. 6.1

- (i) Describe how light rays are bent by the eye, as they pass from the outside of the eye to the retina.

You may draw on Fig. 6.1 if it helps you explain your answer.

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

(ii) State the correct term for the bending of light rays by the eye.

.....[1]

(c) Degenerative diseases of the retina, such as retinitis pigmentosa and macular degeneration, are among the most common forms of blindness in developed countries. These diseases affect the photoreceptor cells at the back of the retina, but the nerve cells in front of them usually remain intact.

Fig. 6.2 shows the arrangement of neurones in the retina.

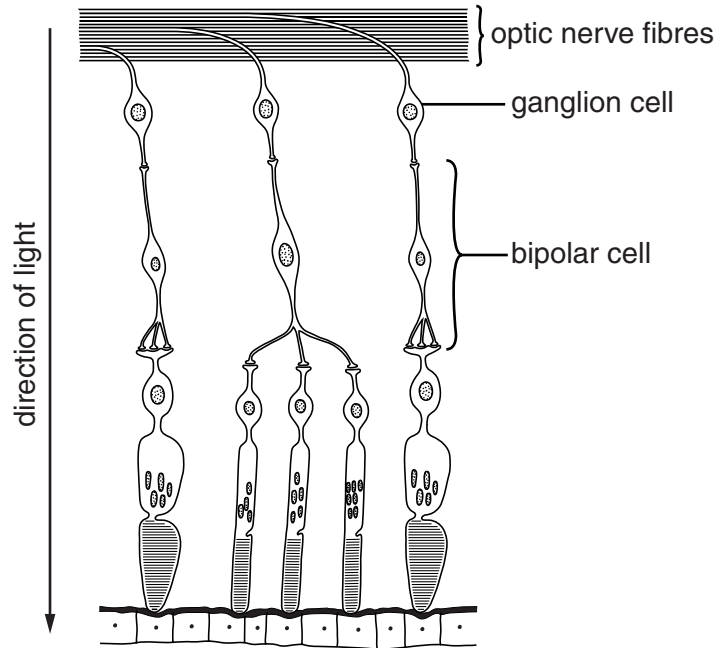


Fig. 6.2

(i) Name the types of photoreceptor cells at the back of the retina.

.....[1]

- (ii) A team of scientists working in America hopes to improve the sight of blind people by implanting proteins from spinach leaves into their eyes.

When light falls on the proteins, it creates an electrical voltage, which could stimulate healthy regions of the retina and produce meaningful images.

Suggest how, when light falls on them, the implanted spinach proteins could stimulate healthy regions of the retina.

.....

.....

.....

.....

.....

.....

.....[2]

[Total: 10]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

Copyright Acknowledgements:

Fig. 1.1 © Innerspace Imaging / Science Photo Library
Fig. 1.2 © Astrand, 1970
Fig. 2.1A © Scott Camazine / Science Photo Library
Fig. 5.2 © Yara International ASA, www.yara.com

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (OCR) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

OCR is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.