



**ADVANCED GCE
HUMAN BIOLOGY**

Energy, Reproduction and Populations

F224

Candidates answer on the Question Paper

OCR Supplied Materials:
None

Other Materials Required:

- Electronic calculator
- Ruler (cm/mm)

**Monday 25 January 2010
Afternoon**

Duration: 1 hour



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 **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 (a) The process of spermatogenesis involves cell division by mitosis and meiosis.

Identify the cells produced by the following types of cell division in the seminiferous tubule:

(i) mitosis [1]

(ii) meiosis [1]

(b) Fig. 1.1 shows a diagram of a human sperm cell.

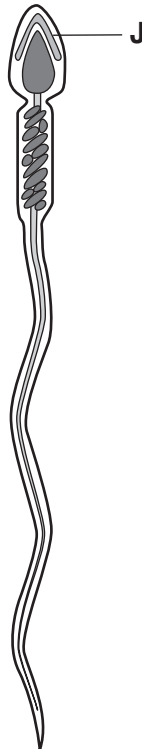


Fig. 1.1

Name structure **J**.

..... [1]

- (c) The following passage about fertilisation appeared in a magazine for non-scientific readers. The terms that have been highlighted and numbered have **not** been written using the correct scientific terminology.

When the sperm reaches the **egg** (1) its head releases **chemicals** (2) which digest the **outer layer** (3). Vigorous movements of the sperm's **tail** (4) enable the head of the sperm to bind to the **egg** (1). Only one sperm can enter because a **barrier** (5) is formed to stop other sperm. The two nuclei can now **join** (6) as fertilisation is completed.

Write the correct scientific terms in the numbered list below.

- 1
- 2
- 3
- 4
- 5
- 6 [6]

- (d) Most forms of contraception prevent ovulation or fertilisation from occurring. However, occasionally a woman needs to take an 'emergency contraceptive pill' or 'morning after pill'.

Discuss **two** possible **disadvantages** of using the 'morning after pill'.

-
-
-
- [2]

[Total: 11]

- 2 Athletes such as Chris Hoy, the 2008 Olympic cycling champion, increase their muscle mass and strength through a specialised training regime.

(a) Fig. 2.1 is a photomicrograph of a sarcomere from a skeletal muscle fibre.

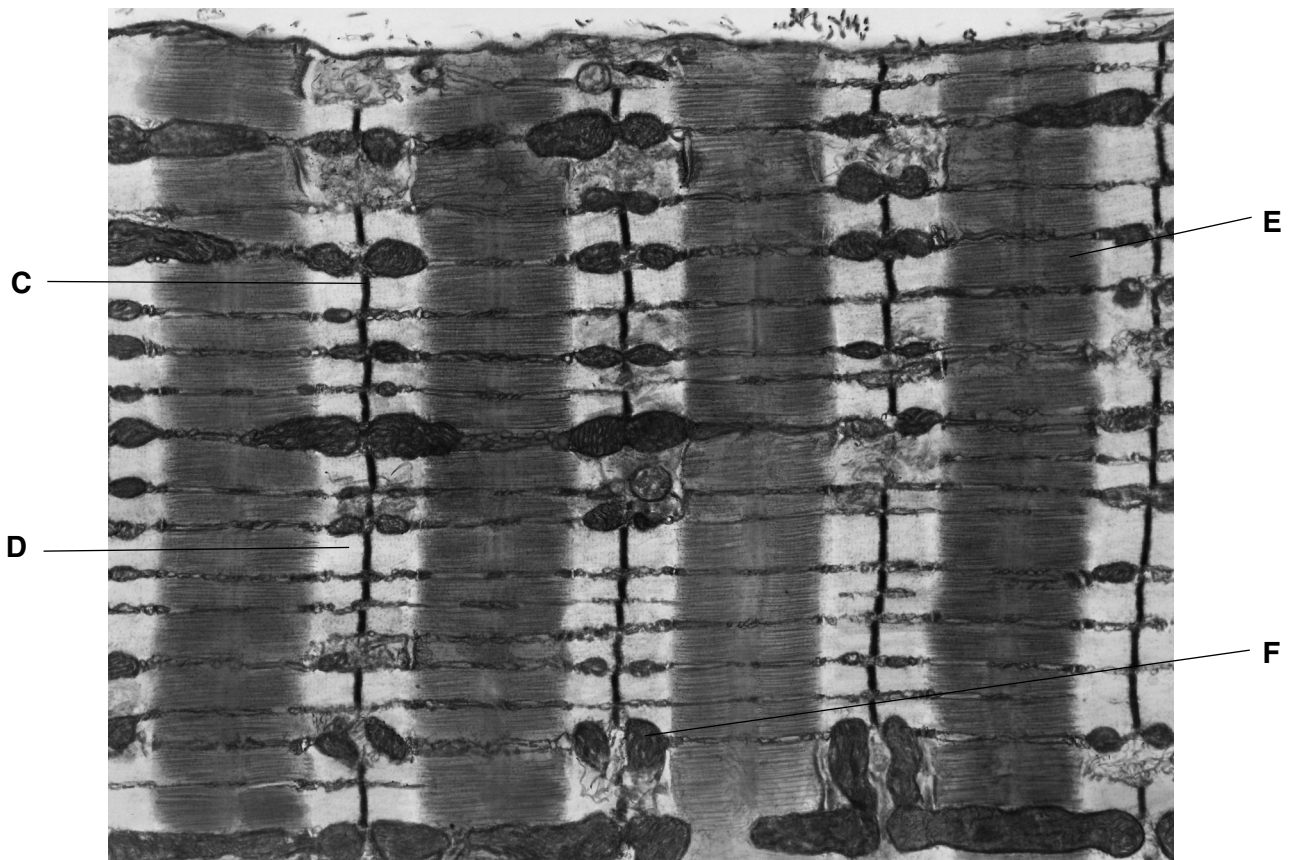


Fig. 2.1

On Fig. 2.1, four features have been labelled **C**, **D**, **E** and **F**.

State **one** label letter that represents:

- (i) an area containing only actin filaments [1]
- (ii) an area containing both actin and myosin filaments [1]

(b) Outline the role played by calcium ions in the contraction of the sarcomere.



In your answer you should use the appropriate technical terms, spelt correctly.

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[5]

(c) Training increases the circumference of the biceps muscles.

A 10-week investigation was carried out to assess the effect of a **dietary supplement** on the increase in the circumference of the biceps muscles.

- Two groups of 10 men were chosen, groups **G** and **H**.
- Group **G** was given placebo tablets each day.
- Group **H** was given the dietary supplement in tablet form each day.
- Both groups had the circumferences of their biceps muscles measured before and after the investigation.
- During the investigation a standard set of arm exercises was carried out by both groups each day.

Fig. 2.2 summarises the results of the investigation.

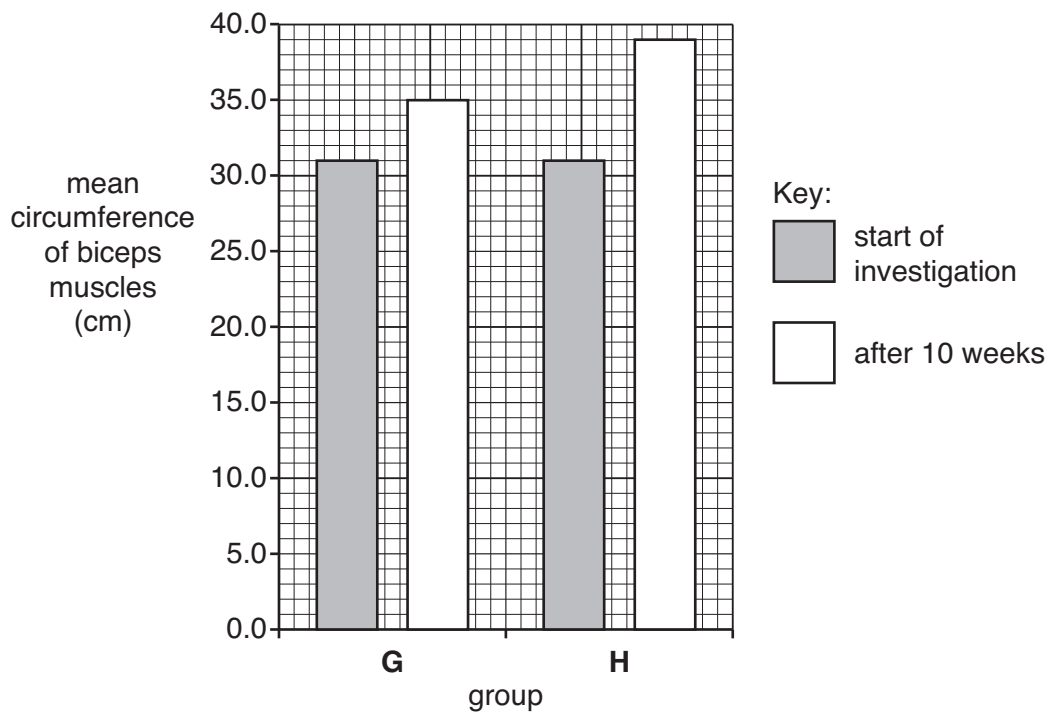


Fig. 2.2

(i) Calculate the percentage increase in the mean circumference of the biceps muscles in group **H**.

Show your working.

Answer = % [2]

- (ii) Suggest **two** factors, **other than gender**, that needed to be taken into account when designing this investigation.

.....

 [2]

- (iii) Suggest **one** active ingredient of the dietary supplement **and** describe how it may have produced the results shown for group H.

.....

 [2]

[Total: 13]

- 3 (a) All cells require ATP for energy-demanding processes in the body.

Fig. 3.1 is a diagram of the structure of an ATP molecule.

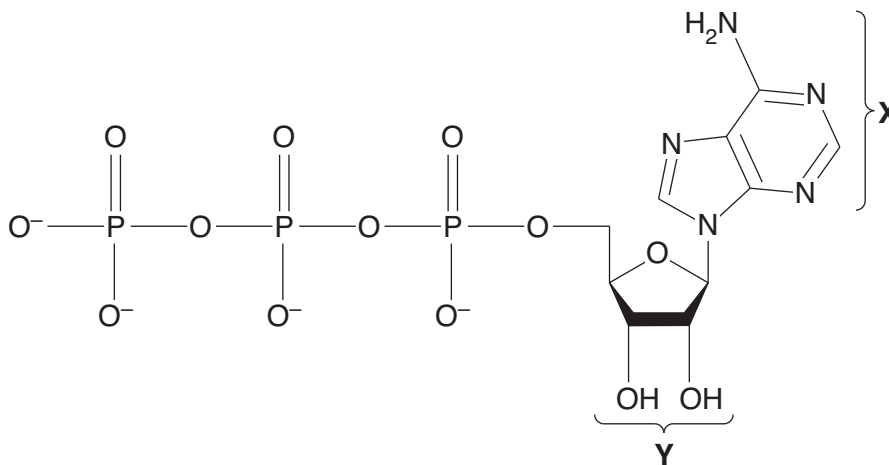


Fig. 3.1

- (i) Name the base labelled X [1]
 (ii) Name the sugar labelled Y [1]

(b) ATP is produced in three main stages of aerobic respiration.

Fill in the table below to show **two** products of each stage, **other than ATP**.

stage	products
glycolysis	1
	2
Krebs cycle	1
	2
oxidative phosphorylation	1
	2

[3]

(c) Carbohydrates and lipids are sources of energy in the diet. Both substances are used as respiratory substrates.

Table 3.1 shows the energy density of carbohydrates and lipids.

Table 3.1

respiratory substrate	energy density (kJ g ⁻¹)
carbohydrate	15.8
lipid	39.4

Explain why lipids have a higher energy density than carbohydrates.

.....

.....

.....

..... [2]

(d) Aerobic respiration uses oxygen and produces carbon dioxide as a waste substance. Respiration in humans can be investigated by calculating the respiratory quotient (RQ).

(i) State how the RQ is calculated.

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..... [2]

(ii) Give the typical RQ values obtained from the respiration of carbohydrates and lipids.

carbohydrate

lipid [2]

(iii) Suggest what happens to the RQ value when respiration becomes **anaerobic**.

.....
 [1]

[Total: 12]

4 (a) Most couples conceive a child within a year of trying, but some couples have difficulty conceiving. This could be due to a problem with either the male or female reproductive systems.

IVF is a widely used treatment for infertility.

At one IVF clinic, over 1 000 treatment cycles were monitored. The number of live births was recorded as a percentage of the number of treatment cycles. The results were recorded against the age of the women and are shown in Table 4.1.

Table 4.1

age of women (years)	percentage of live births per treatment cycle
under 34	27.6
34 to 36	22.3
37 to 39	18.3
40 to 42	10.0
above 42	less than 5.0

The data in Table 4.1 show that there is a decrease in the percentage of live births per treatment cycle with increasing age.

Explain this trend.

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 [3]

(b) Two other fertility treatments that use the same principles as IVF are GIFT and ICSI.

Outline how each of these treatments works.

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..... [3]

[Total: 6]

- 5 (a) The world's population has doubled in the 38 years leading up to 1999. As a consequence there has been an increase in demand for food. This includes an increased demand for maize and wheat.

Plants such as maize and wheat use the Calvin cycle to generate intermediate compounds such as GP and TP.

Fig. 5.1 shows an outline diagram of the Calvin cycle.

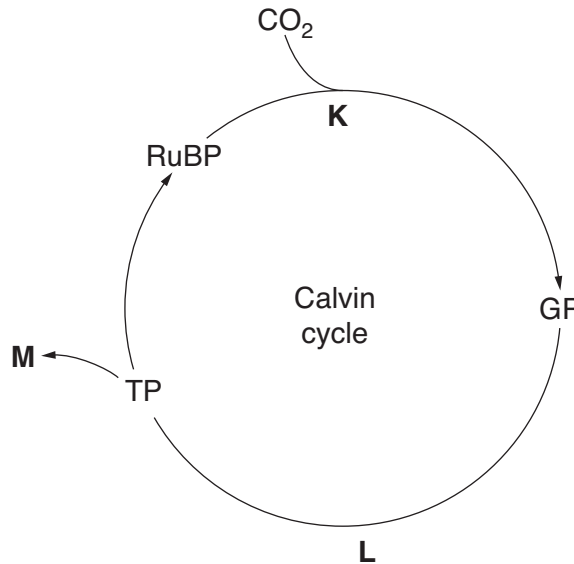


Fig. 5.1

- (i) Name the enzyme involved at stage K.
 [1]
- (ii) Name **two** compounds produced in the light-dependent stage that are used in the conversion of GP to TP at stage L.
 1
 2 [2]
- (iii) Only some of the TP produced is used to regenerate RuBP so that the Calvin cycle can continue. The remaining TP, at stage M, may be used to synthesise carbohydrates such as glucose, starch and cellulose.

Suggest **two** other types of molecule that can be synthesised using TP.

.....
 [2]

- (b) Plants are often grown to feed animals such as cattle. Untreated animal waste is sometimes released into rivers or lakes.

Lakes can undergo rapid increases in the number of algae present. Algae are microscopic aquatic plants. These increases are called 'algal blooms'.

Fig. 5.2 shows the increase in algae in a freshwater lake over a 20-day period in the summer. The dissolved oxygen concentration of the lake over the same period is also shown.

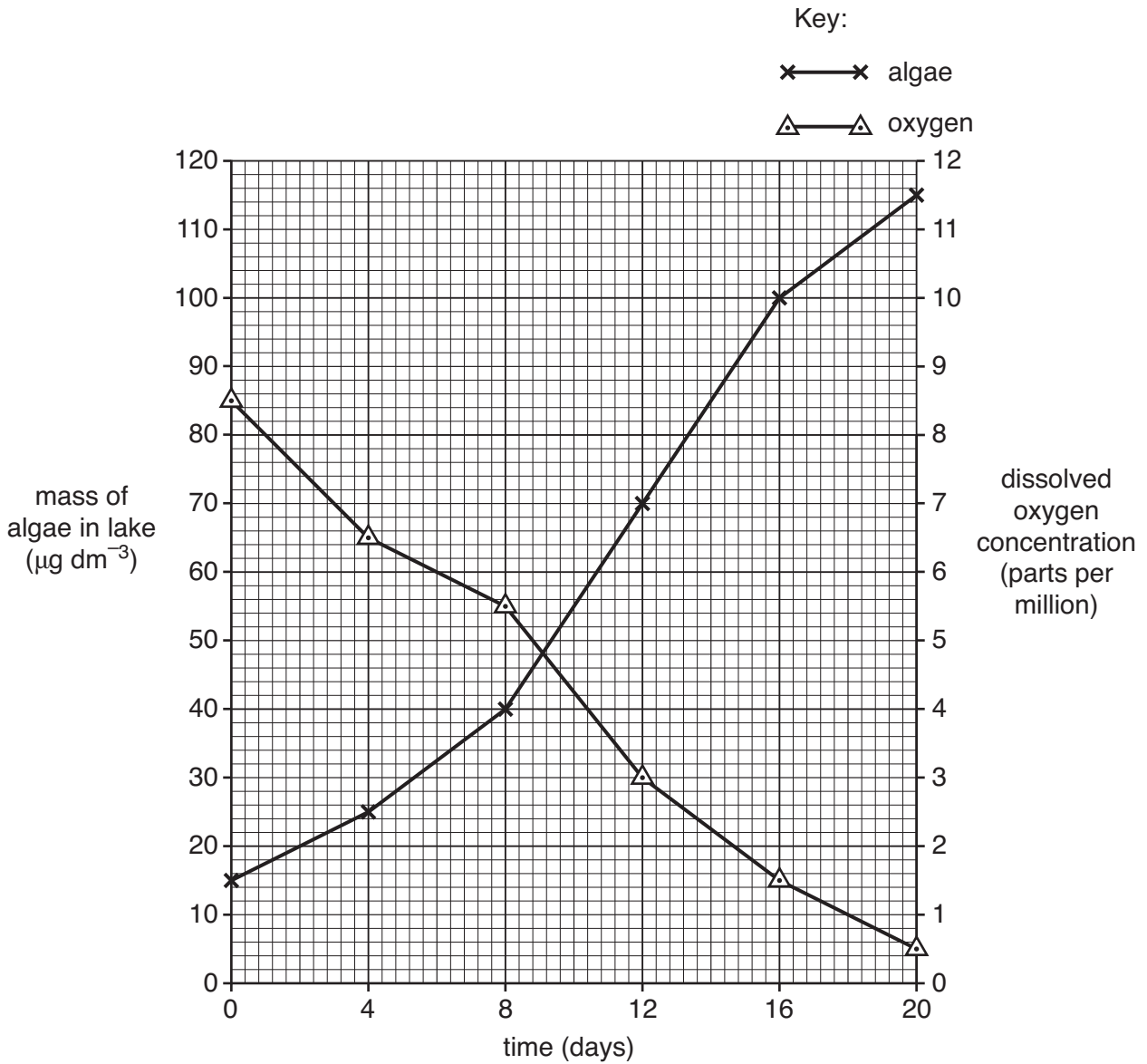


Fig. 5.2

- (i) **Describe** the relationship between the mass of algae and the concentration of dissolved oxygen in the lake shown by the data in Fig. 5.2.

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..... [2]

(ii) **Explain** why the mass of algae increases over the 20-day period.

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..... [2]

(iii) **Explain** what has caused the change in oxygen concentration between day 0 and day 20.

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..... [3]

[Total: 12]

- 6 (a) Almost half of the amount of tropical deforestation that occurs is caused by activities on a local level by people who simply use the rainforests' resources for their survival.

Fig. 6.1 represents part of a tropical rainforest ecosystem.

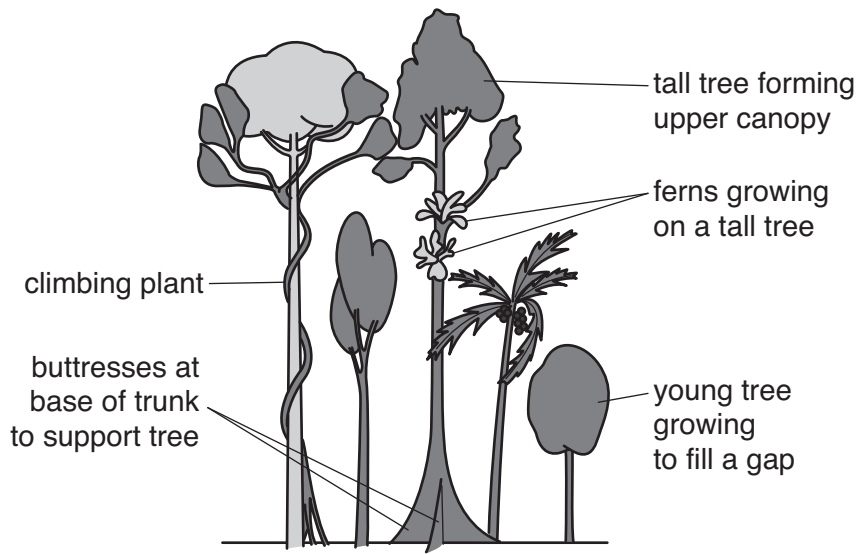


Fig. 6.1

With reference to Fig. 6.1, explain the meaning of the term *ecosystem*.



In your answer you should use the appropriate technical terms, spelt correctly.

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[3]

(b) Give **three** benefits to human society of conserving tropical rainforests.

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..... [3]

[Total: 6]

END OF QUESTION PAPER

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