

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

Energy, Control and Reproduction

**FRIDAY 13 JUNE 2008**

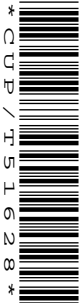
**2866**

Afternoon

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.
- 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	12	
2	14	
3	18	
4	12	
5	19	
6	15	
<b>TOTAL</b>	<b>90</b>	

This document consists of **15** printed pages and **1** blank page.

Answer **all** the questions.

- 1 (a) Every month, the lining of a woman's uterus (the endometrium) thickens to prepare for a possible pregnancy.

Cells making up the lining of the uterus divide by mitosis.

- (i) Describe the processes taking place in a cell during **interphase** as it prepares for mitosis.

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

- (ii) A population of cells dividing by mitosis remains genetically identical.

Explain the importance of this.

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

- (iii) At the start of a new menstrual cycle the concentration of oestrogen rises. This stimulates the endometrium to begin repairing itself.

State what causes this rise in the concentration of oestrogen.

..... [1]

(b) There are two types of cell division, mitosis and meiosis.

Complete the table below, listing **four** differences between mitosis and meiosis.

mitosis	meiosis
genetically identical daughter cells	genetically varied daughter cells

[4]

(c) Explain why women are asked if they are pregnant before they are given X-ray scans.

.....

.....

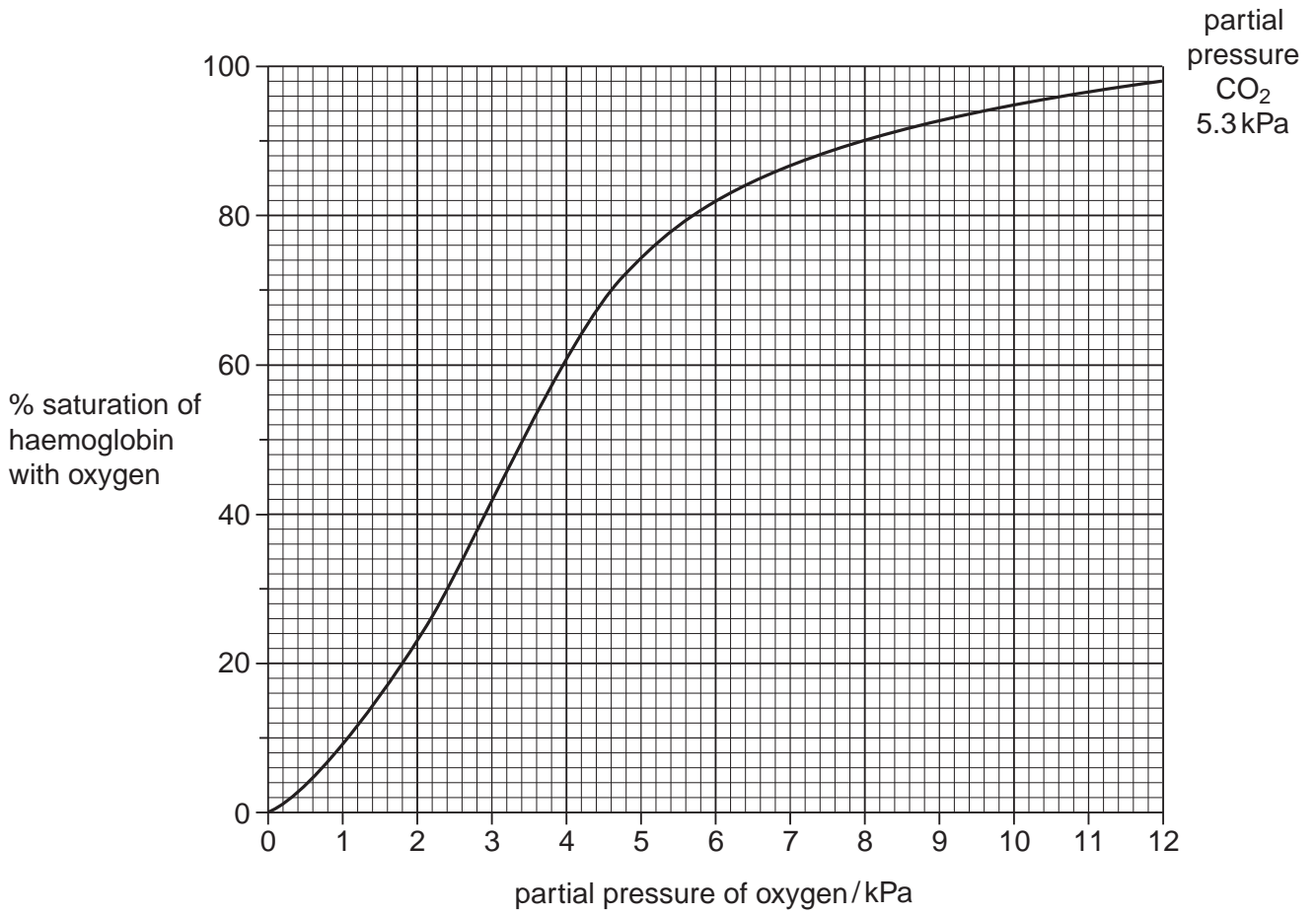
.....

..... [2]

[Total: 12]

2 The respiratory pigment haemoglobin (Hb) transports oxygen around the body.

Fig. 2.1 shows the haemoglobin dissociation curve.



**Fig. 2.1**

(a) (i) Describe the **shape** of the haemoglobin dissociation curve shown in Fig. 2.1.

.....

.....

.....

.....

.....

..... [3]

(ii) Using Fig. 2.1, state the concentration of oxygen at which haemoglobin is 50% saturated.

Concentration = ..... kPa [1]

(iii) Draw on Fig. 2.1 the haemoglobin dissociation curve that would be seen if a person exercised vigorously for twenty minutes. [2]

(iv) Explain why the haemoglobin dissociation curve changes when a person exercises vigorously.

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

(b) A second respiratory pigment, myoglobin, is also found in muscle tissue. Compared with haemoglobin, myoglobin has a higher affinity for oxygen.

Explain the importance of myoglobin's higher affinity for oxygen.

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

(c) Individuals who are anaemic may not be able to exercise vigorously for long periods.

Suggest why this is so.

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

[Total: 14]

3 (a) Altitude training is used by some endurance athletes to improve their performance.

(i) Explain why altitude training may improve the performance of endurance athletes.

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.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [5]

(ii) Explain why a 100 metre sprinter is unlikely to benefit from altitude training.

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

(b) To be effective, altitude training must:

- take place at least 1500 metres above sea level;
- for the first week consist of light exercise only.

Suggest why the first week of training at altitude should consist of light exercise only.

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

- (c) Another technique used by some endurance athletes to enhance their performance is carbohydrate loading.

Outline what is meant by the term *carbohydrate loading*.

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

- (d) During an endurance event, athletes often need to drink.

- (i) Explain why athletes need to drink **water** during an endurance event.

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

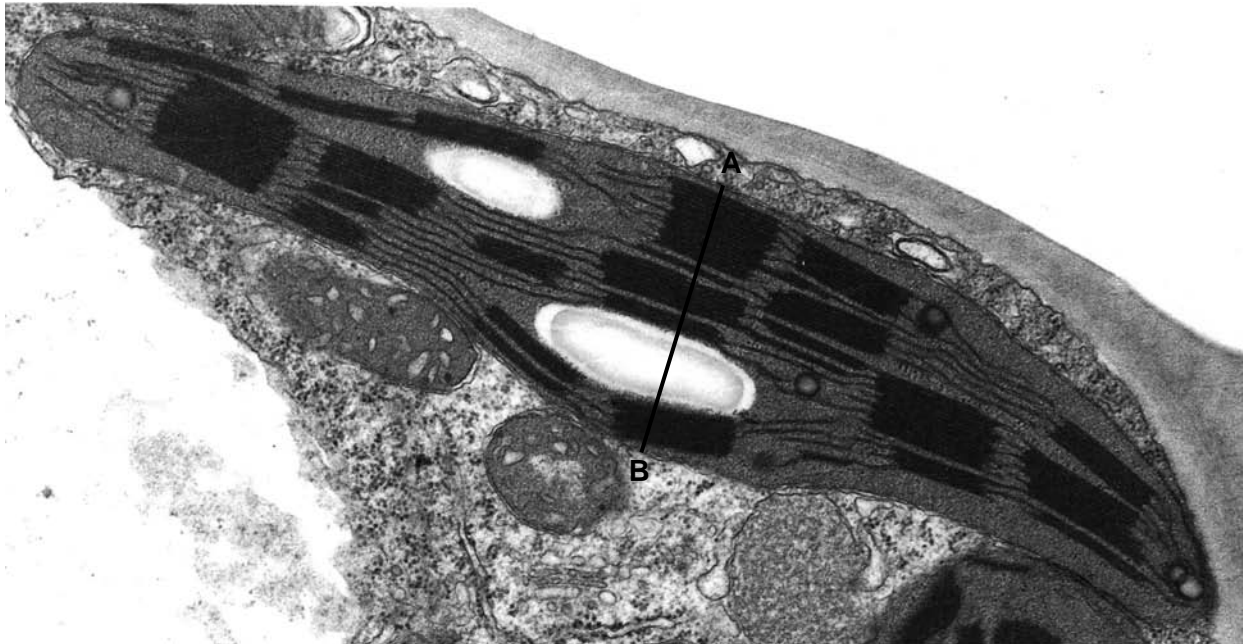
- (ii) Describe the benefits to athletes of drinking **isotonic drinks** rather than water during an endurance event.

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

[Total: 18]

- 4 (a) Sunlight reaches the cells on the upper surfaces of leaves, where the greatest density of chloroplasts is found.

Fig. 4.1 shows a transmission electron micrograph of a chloroplast from a leaf cell.



x 16000

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Fig. 4.1

- (i) Calculate the width of the chloroplast in micrometres ( $\mu\text{m}$ ) from **A** to **B**.  
Show your working.

Answer = .....  $\mu\text{m}$  [2]

- (ii) State two features, **other than chloroplasts**, typical of eukaryotic cells that are **visible** in Fig. 4.1.

1 .....

2 ..... [2]



**(b)** Chloroplasts are enclosed by a double membrane similar to the cell surface (plasma) membrane, through which raw materials and waste products must pass.

**(i)** Describe the process by which oxygen moves through the outer membrane of a chloroplast into the cytoplasm.

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

**(ii)** The chloroplast contains highly folded membranes stacked into grana. These stacks are continuous with the inner chloroplast membrane.

Suggest why the membrane is highly folded, rather than being a single sheet.

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

- (c) Table 4.1 shows three stages in a food chain and some statements on the ways in which energy is passed through it.

For each stage in the food chain show whether the statement is true or false.

Use a tick (✓) if the statement is true and a cross (✗) if the statement is false for each stage.

The first one has been done for you.

**Table 4.1**

statement	stage in a food chain		
	producer e.g. maize	primary consumer e.g. beef cattle	secondary consumer e.g. human
can use energy from the sun	✓	✗	✗
consumes most energy			
uses energy to synthesise essential chemicals e.g. vitamins			
wastes the least energy			

[3]

[Total: 12]

5 A synapse is a microscopic gap between one neurone and another. There is no physical contact between the neurones. Many common drugs, such as diamorphine (heroin), act on the nervous system at synapses.

(a) (i) State **three** roles of synapses.

- 1 .....
- .....
- 2 .....
- .....
- 3 .....
- ..... [3]

(ii) Explain why large numbers of mitochondria are found in synaptic knobs.

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

(b) Explain how diamorphine (heroin) can:

(i) reduce pain by acting at a synapse;

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

(ii) induce a psychological dependency.

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



**PLEASE DO NOT WRITE ON THIS PAGE**

**TURN TO PAGE 14 FOR QUESTION 6**

6 Human reproduction has been the focus of much research in recent years.

Fig. 6.1 is a diagram of the female reproductive organs.

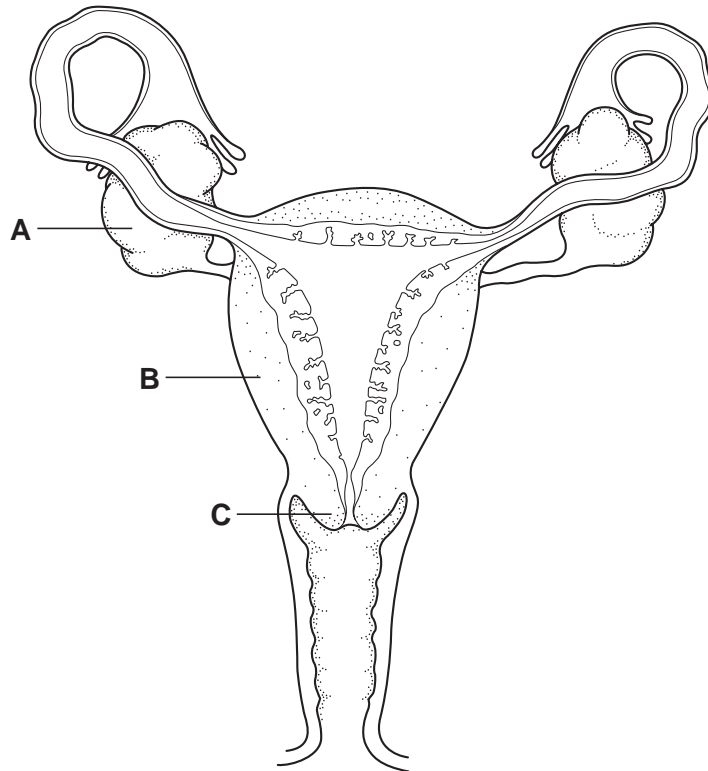


Fig. 6.1

(a) (i) Name A to C.

A ..... [1]

B ..... [1]

C ..... [1]

(ii) Label the diagram with an X to show where fertilisation normally takes place. [1]

(b) Pregnancy may be detected by using a pregnancy testing kit containing a type of monoclonal antibody.

(i) State the name of the hormone that the pregnancy test is designed to detect.

..... [1]



(c) Sometimes multiple pregnancies occur. Both mothers and babies are at greater risk during multiple pregnancies compared with single pregnancies.

(i) State what is meant by the term *multiple pregnancy*.

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

(ii) Outline **two** risks that are more likely to occur in multiple pregnancies.

1 .....  
.....  
2 .....  
..... [2]

[Total: 15]

**END OF QUESTION PAPER**

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