

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
ADVANCED GCE**

**F224**

**HUMAN BIOLOGY**

**Energy, Reproduction and Populations**

**MONDAY 24 JANUARY 2011: Afternoon**

**DURATION: 1 hour**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**Candidates answer on the question paper.**

**OCR SUPPLIED MATERIALS:**

**None**

**OTHER MATERIALS REQUIRED:**

**Electronic calculator**


**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.**
- **Answer ALL the questions.**

## **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.**

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**Answer ALL the questions.**

- 1 (a) Oogenesis, the production of female gametes, starts in the ovaries of a baby girl before she is born. By birth, she will have produced over one million primary oocytes.**

**Fig. 1.1, on page 5 opposite, outlines the sequence of events that occur during oogenesis.**

**With reference to Fig. 1.1:**

- (i) state what is happening to the cells during STAGE B;**

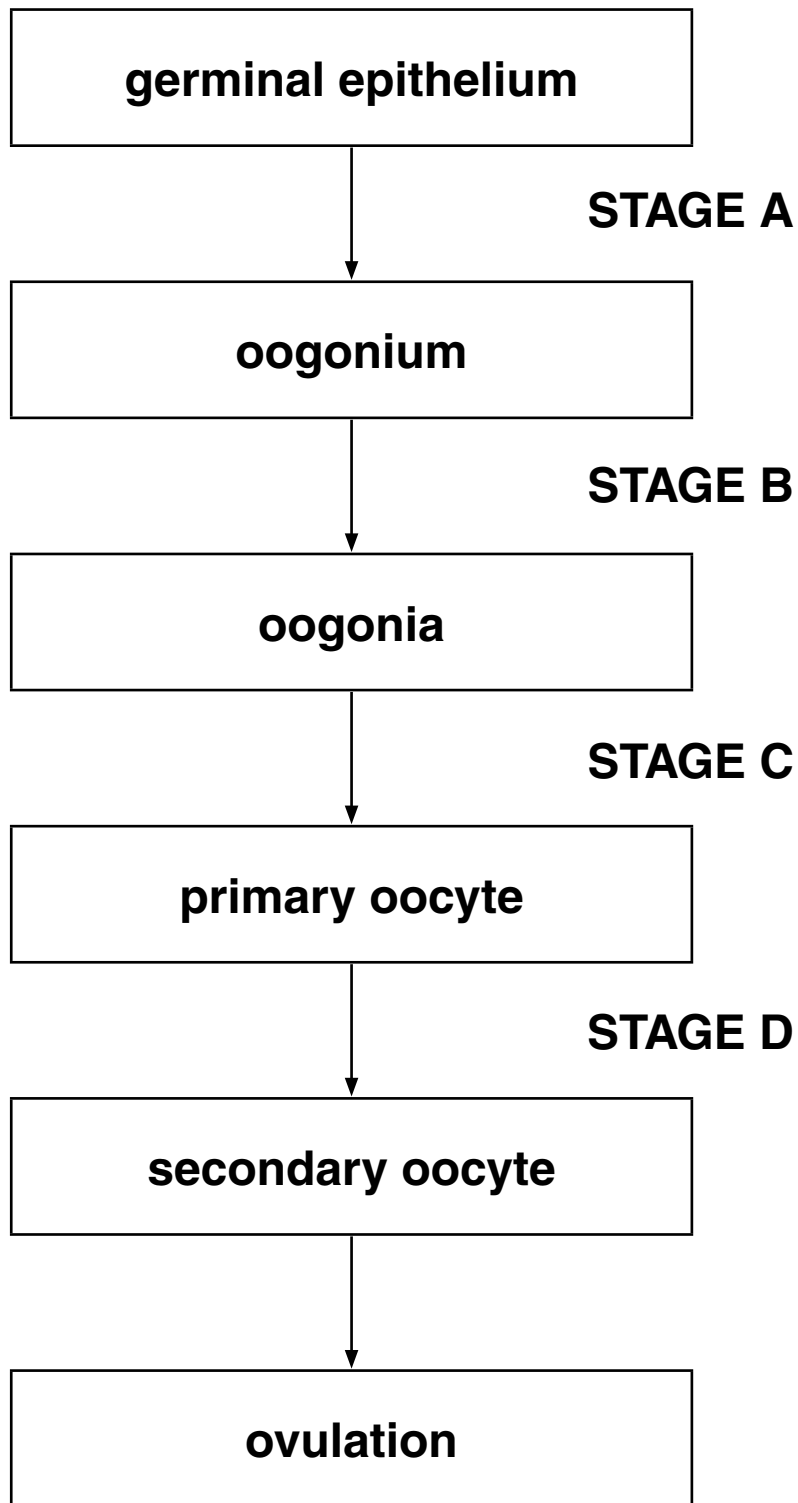
\_\_\_\_\_ [1]

- (ii) state the stage in which cell division by meiosis takes place;**

\_\_\_\_\_ [1]

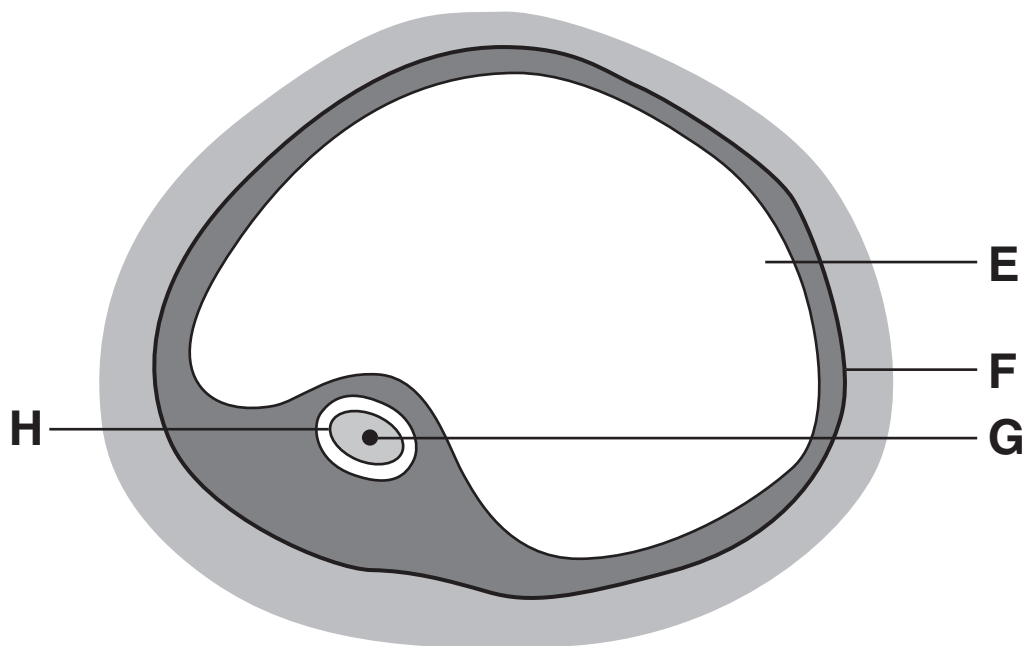
- (iii) state what is happening to the cells during STAGE C.**

\_\_\_\_\_ [1]



**Fig. 1.1**

**(b) Fig. 1.2 shows a section through a mature (Graafian) follicle in a human ovary.**



**Fig. 1.2**

**Table 1.1 opposite lists a number of specific statements about the mature follicle. Each statement refers to one of the structures shown in Fig. 1.2.**

Complete the table using the letters E, F, G or H.

Table 1.1

<b>statement</b>	<b>structure</b>
<b>contains protective fluid</b>	_____
<b>produces oestrogen</b>	_____
<b>has glycoprotein receptors</b>	_____
<b>contains 23 chromosomes</b>	_____

[4]

[Total: 7]

- 2 Prolactin, a female hormone, is a polypeptide chain of 199 amino acids. The chain of amino acids includes regions which are coiled and then folded into a specific tertiary structure.

Fig. 2.1 shows a diagram of a molecule of prolactin.



Fig. 2.1

- (a) Describe the bonds that hold the TERTIARY structure of prolactin together.

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[4]

**(b) Prolactin has a specific tertiary structure to allow it to bind to receptors on the cell surface membranes of its target tissues.**

**Name one target tissue AND state the function of prolactin in that target tissue.**

**target tissue** \_\_\_\_\_

**function of prolactin** \_\_\_\_\_

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[2]

**[Total: 6]**

- 3 (a) The hormone human chorionic gonadotrophin, HCG, is produced during early pregnancy. The concentration of HCG in a woman's body can be detected about 10 days after conception.**

**Table 3.1 shows the mean concentration of HCG in the blood during pregnancy.**

**Table 3.1**

<b>weeks of pregnancy</b>	<b>mean concentration of HCG (arbitrary units)</b>
<b>2</b>	<b>25</b>
<b>6</b>	<b>25 000</b>
<b>12</b>	<b>160 000</b>
<b>20</b>	<b>85 000</b>
<b>40</b>	<b>60 000</b>

**Explain how the changes in the mean concentration of HCG shown in Table 3.1 are linked to the role of HCG in pregnancy.**

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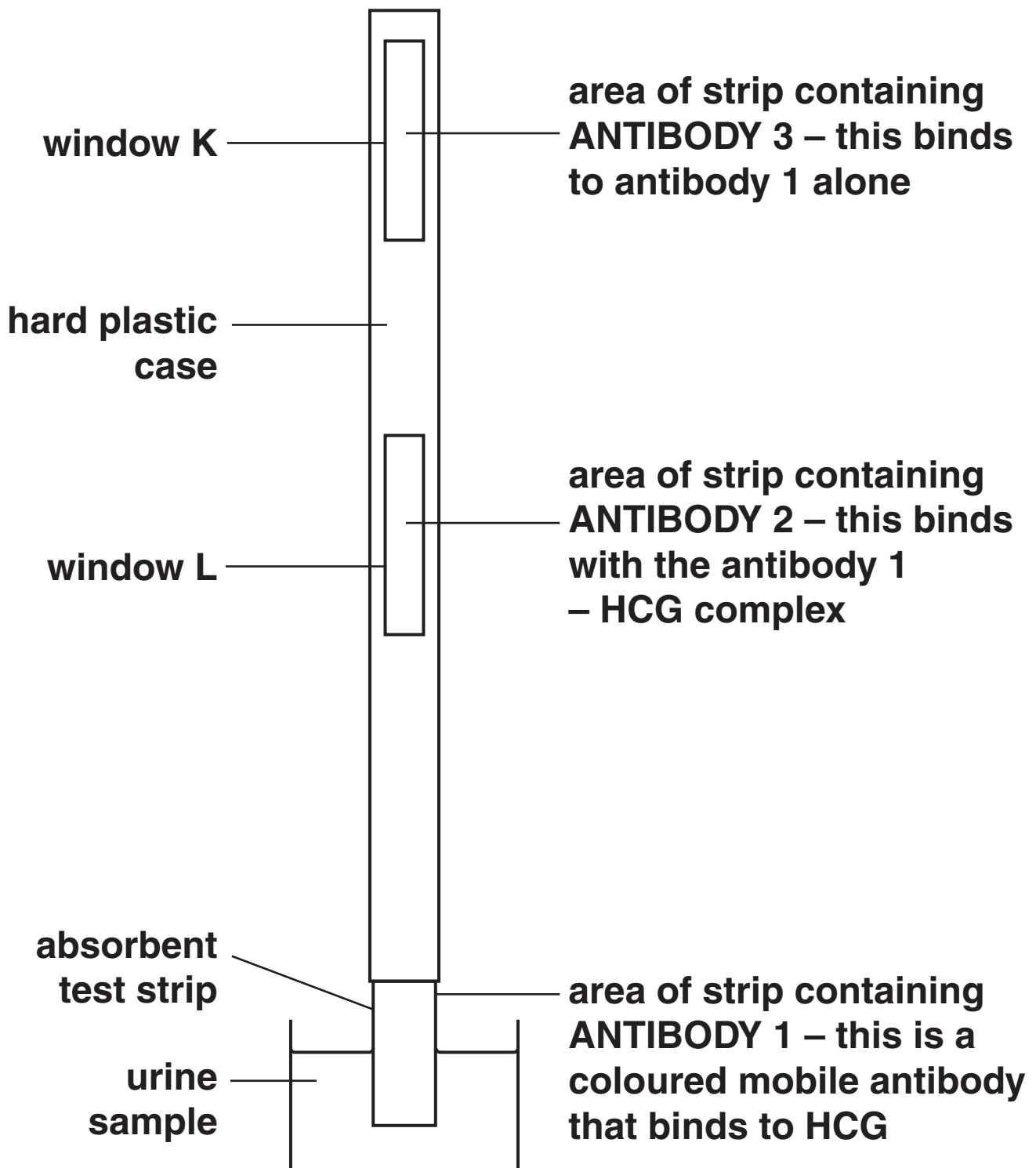
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**[4]**

**(b) Most home pregnancy test kits use monoclonal antibodies to detect the presence or absence of HCG in a woman's urine.**

**An absorbent plastic strip containing three different antibodies is used. The positions of these antibodies are shown in Fig. 3.1.**



**Fig. 3.1**  
**12**

**Using the information in Fig. 3.1, explain how a pregnancy is indicated when a coloured line appears in BOTH windows.**



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

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**[6]**

**[Total: 10]**

- 4 (a) Endurance athletes, such as marathon runners, rely on their stores of glycogen during training and competition.

Fig. 4.1 summarises the reactions that take place in a cell after it has absorbed glucose from blood plasma.

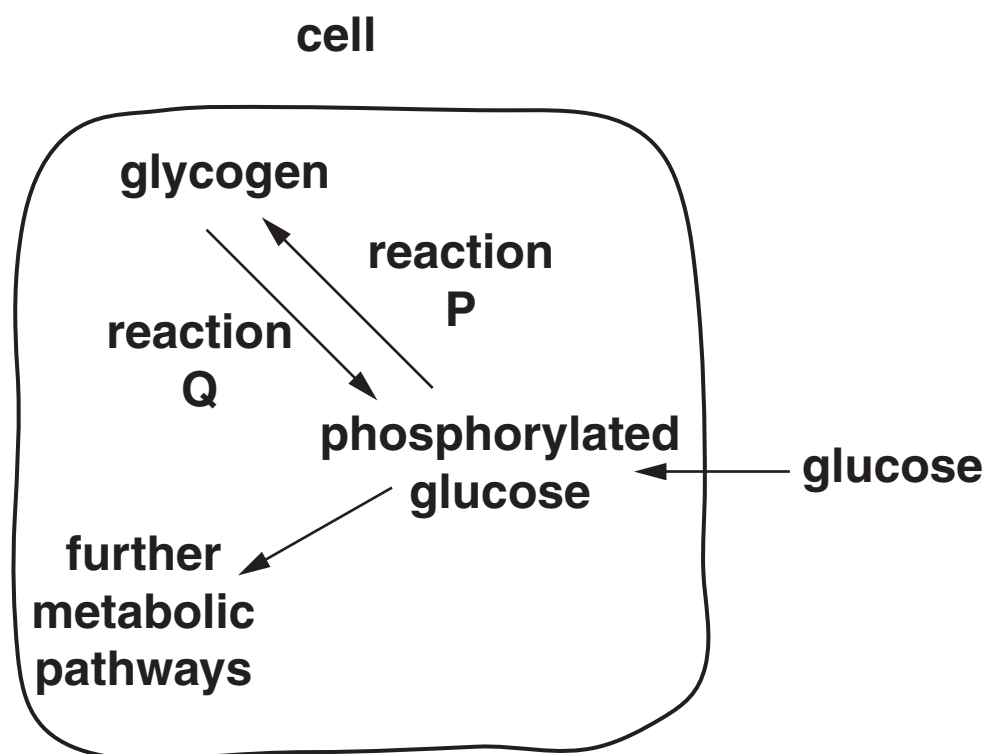


Fig. 4.1

- (i) Name a tissue that contains cells where reactions such as those shown in Fig. 4.1 take place.

\_\_\_\_\_ [1]

- (ii) State the process by which glucose enters the cell.

\_\_\_\_\_ [1]

**(iii) Name the type of reaction occurring at P and the type of reaction occurring at Q.**

**P** \_\_\_\_\_

**Q** \_\_\_\_\_ **[2]**

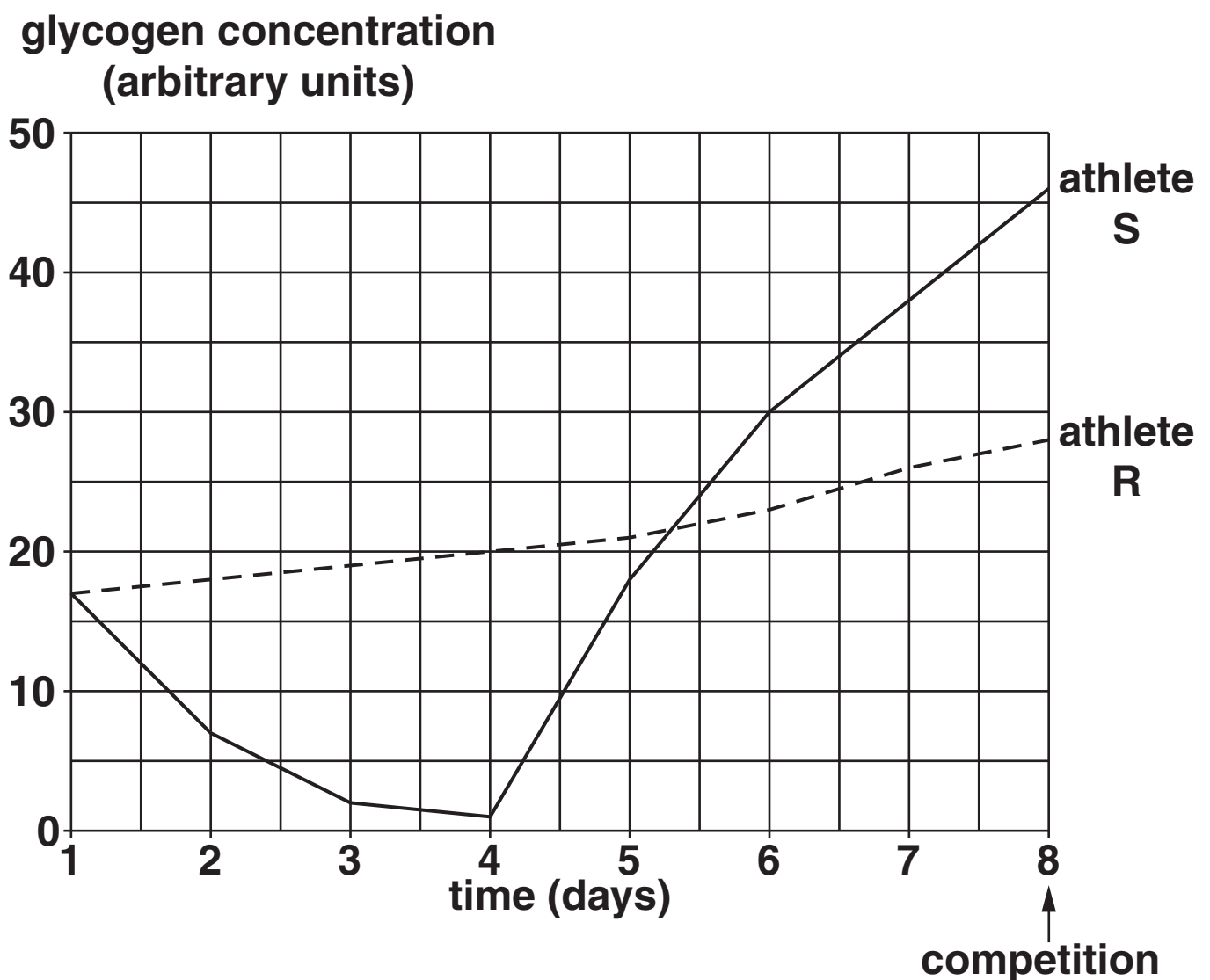
**(iv) With reference to Fig. 4.1, suggest ONE example of a 'further metabolic pathway' for glucose.**

\_\_\_\_\_ **[1]**

**(b) Carbohydrate loading is a legal method of boosting the amount of glycogen in the body prior to a competition.**

**Fig. 4.2 shows the cellular glycogen concentration of two athletes, R and S, during the days leading up to a competition.**

- **Athlete R has followed a normal diet and increased their carbohydrate intake gradually.**
- **Athlete S has followed a carbohydrate loading programme.**



**Fig. 4.2**



- (i) Using Fig. 4.2, COMPARE the glycogen concentrations of athletes R and S for the days leading up to the competition.

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[3]

- (ii) Explain the pattern shown by the graph for athlete S.

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[2]

**(c) Another way to enhance athletic performance is to use synthetic steroids to mimic the action of natural steroids such as the hormone testosterone.**

**(i) Suggest why steroid molecules are easily taken up by the body's cells.**

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**[1]**

**(ii) Explain how the use of synthetic steroids can lead to an improvement in an athlete's performance.**

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**[2]**

**(iii) Suggest TWO long-term disadvantages of MALE athletes taking synthetic steroids.**

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**[2]**

**[Total: 15]**

- 5 (a) In 1978, Peter Mitchell, a British biochemist, won the Nobel Prize for his contribution to the understanding of biological energy transfer through the formulation of the chemiosmotic theory.

Chemiosmosis occurs on the inner mitochondrial membrane (crista) and involves the production of ATP.

Fig. 5.1 shows the structure of part of a crista.

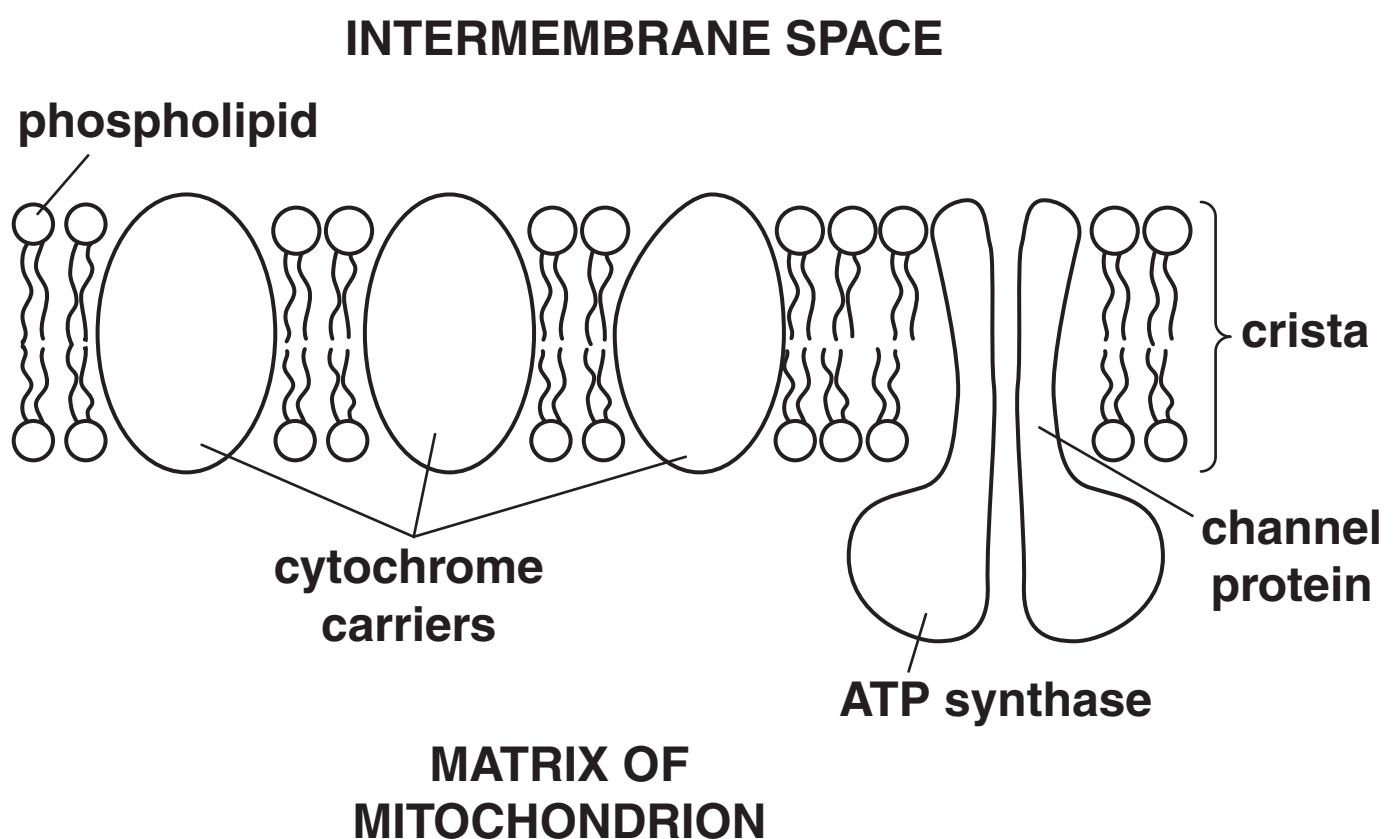


Fig. 5.1

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**QUESTION 5(a) CONTINUES ON PAGE 22**

The different stages of chemiosmosis are listed below. They are not listed in the correct order.

<b>stage</b>	<b>description of stage</b>
<b>P</b>	<b>protons diffuse through the channel protein into the matrix</b>
<b>Q</b>	<b>a proton gradient is set up across the crista</b>
<b>R</b>	<b>NAD is reduced during glycolysis</b>
<b>S</b>	<b>hydrogen atoms split into protons and electrons</b>
<b>T</b>	<b>protons combine with electrons and oxygen atoms to form water</b>
<b>U</b>	<b>electrons are passed from carrier to carrier</b>
<b>V</b>	<b>reduced NAD releases hydrogen atoms to cytochrome carriers</b>
<b>W</b>	<b>energy from electron transfer is used to pump protons into the intermembrane space</b>
<b>X</b>	<b>ATP synthase produces ATP</b>

**Complete Table 5.1 to show the correct order of the stages of chemiosmosis.**

**Two of the stages have been done for you.**

**Table 5.1**

<b>correct order</b>	<b>letter of stage</b>
<b>1</b>	<b>R</b>
<b>2</b>	_____
<b>3</b>	_____
<b>4</b>	_____
<b>5</b>	_____
<b>6</b>	<b>Q</b>
<b>7</b>	_____
<b>8</b>	_____
<b>9</b>	_____

**[4]**

**(b) Explain the precise role of ATP in muscle contraction.**

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

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**[4]**

**[Total: 8]**



**6 (a) The conditions under which animals are reared can impact on human populations. For example, it has been suggested that the intensive farming of animals may have contributed to the swine flu epidemic of 2009.**

**(i) Outline the main features of intensive farming.**

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**[3]**

**(ii) Suggest TWO disadvantages of intensive farming.**

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**[2]**

- (b) Most scientists believe that the climate changes that have occurred over the past 50 years have been greatly influenced by human activity. Some scientists disagree.**

**The following three observations are accepted by most scientists.**

### **OBSERVATION 1**

**2 500 million years ago, 80% of the earth's atmosphere was carbon dioxide. In 1958, the percentage of carbon dioxide in the atmosphere was 0.03% and in 2007 the value was 0.04%.**

### **OBSERVATION 2**

**The decade of 1998 to 2007 was the warmest on record, according to the World Meteorological Organisation.**

### **OBSERVATION 3**

**The mean sea level in 2003 was 75.6 mm higher than in 1961.**

- (i) Suggest reasons for the decrease in the percentage of carbon dioxide in the atmosphere from 2 500 million years ago until 1958.**

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[2]

- (ii) Suggest an explanation for OBSERVATION 2.**

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[3]

- (iii) Suggest why an increase in environmental temperature could lead to an increase in crop production.

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[2]

- (iv) Calculate the **AVERAGE YEARLY INCREASE** in sea levels between 1961 and 2003.

Give your answer to one decimal place.

Show your working.

Answer = \_\_\_\_\_ mm [2]

[Total: 14]

**END OF QUESTION PAPER**

## ADDITIONAL PAGES

**IF ADDITIONAL SPACE IS REQUIRED, YOU SHOULD USE THE LINED PAGES BELOW. THE QUESTION NUMBER(S) MUST BE CLEARLY SHOWN.**

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