OCR
RECOGNISING ACHIEVEMENT

Wednesday 11 January 2012 – Morning

AS GCE HUMAN BIOLOGY

F221 Molecules, Blood and Gas Exchange

Candidates answer on the Question Paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

F2102012111

F 2 2 1

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- 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 page at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

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 Fig. 1.1 shows a type of tissue found in the respiratory system.

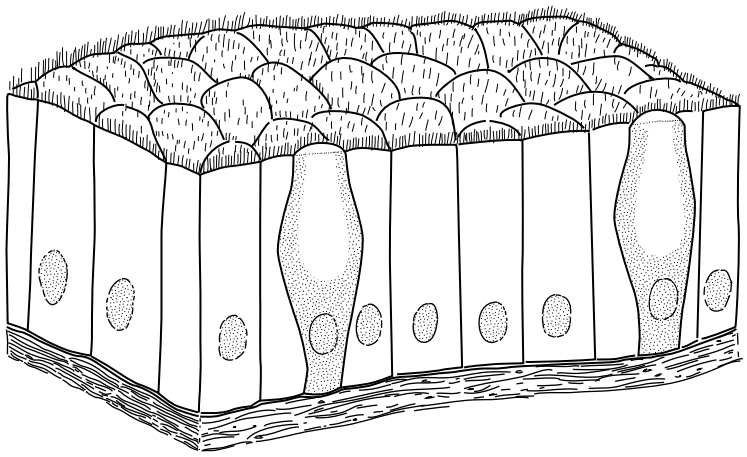

Fig. 1.1

(a) (i) State the name of this type of tissue.

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

(ii) State where in the respiratory system you would find this type of tissue.

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

(iii) Suggest why cells in this type of tissue have large numbers of mitochondria.

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

(iv) Explain how this **tissue** helps to protect against lung infections.

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

(b) Fig. 1.2 shows tissue **X**, which is found in capillary walls.

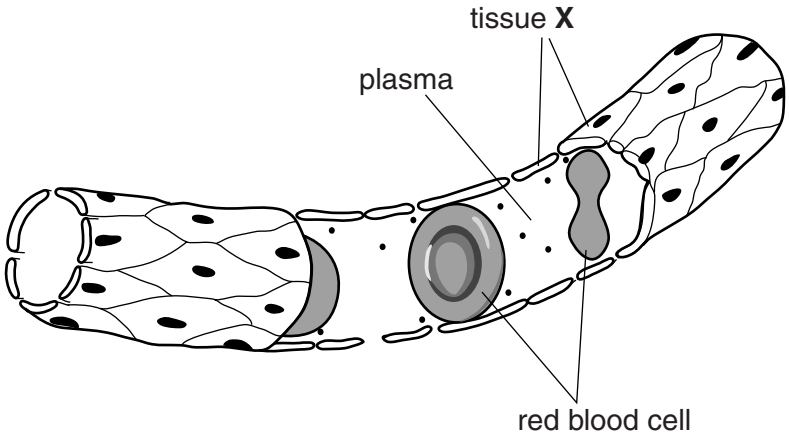

Fig. 1.2

(i) Name tissue **X**.

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

(ii) Using Fig. 1.2, explain **two** ways in which the structure of the capillary **wall** is adapted to its function.

structure .....

function .....

.....

.....

structure .....

function .....

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

[Total: 12]

2 The concentration of glucose in the blood can be measured to monitor the health of an individual.

(a) Outline the **procedure** by which the concentration of glucose in the blood is measured.

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

(b) In an investigation, the blood glucose concentration of a healthy patient was measured for several hours after drinking a glucose solution.

Fig. 2.1 shows the results for this patient.

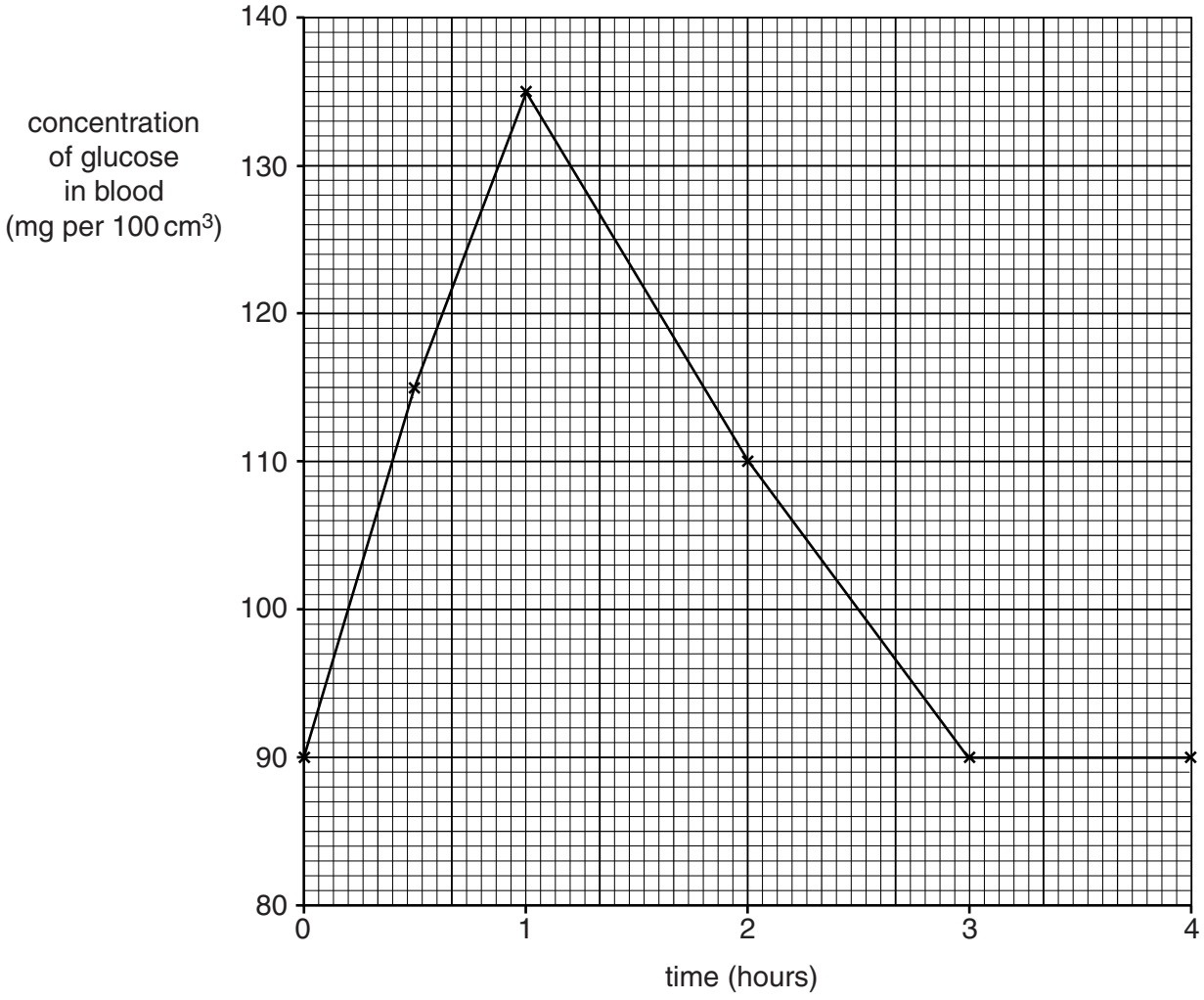

Fig. 2.1

(i) Using the information in Fig. 2.1, describe how the blood glucose concentration changes from 0 to 4 hours after drinking the glucose solution.

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

(ii) Glucose is removed from the blood plasma by cells, including those of the liver and muscles.

State the process by which glucose enters cells across cell surface membranes **and** suggest two uses for the glucose taken up by **liver** cells.

process .....

use 1 .....

use 2 ..... **[2]**

[Total: 7]

3 An electrocardiogram (ECG) can be used to measure the electrical activity in the heart.

ECG traces may be used by cardiology technicians to detect problems with the heart of a patient. Technicians must compare abnormal ECG traces with those of a normal, healthy heart.

Fig. 3.1, **on the insert**, shows four different ECG traces, **A** to **D**.

(a) A technician identifies trace **A** as the ECG of a normal, healthy heart.

(i) Describe what is happening in the heart at each of the following stages of the ECG in trace **A**:

P wave

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QRS complex.

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

(ii) Using the scale on Fig. 3.1, calculate the heart rate in beats per minute (bpm) in trace **A**.

Show your working. Give your answer **to the nearest whole number**.

Answer = ... bpm **[2]**

(b) Suggest which of the traces, **B**, **C**, or **D**, is most likely to indicate the following heart activity.

You may use each letter once, more than once or not at all.

(i) A heart which is not functioning correctly because the contractions of the cardiac muscle in the ventricles are not coordinated.

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

(ii) A heart in which the sinoatrial node (SAN) has been stimulated by the drug, caffeine.

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

(iii) A heart of a person who is exercising.

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

(c) Athletes monitor their heart function during training programmes. The table below provides definitions of some of the terms used to describe heart function.

term	definition
heart rate	number of beats per minute
Y	volume of blood pumped out of left ventricle in one cardiac cycle
Z	volume of blood pumped out of left ventricle in one minute

(i) State the correct term for:

Y .....

Z ..... **[2]**

(ii) A trained athlete will have a high value of **Y**, even when the athlete is at rest.

Suggest why.

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

[Total: 12]

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QUESTION 4 STARTS ON PAGE 10

4 Polypeptides and proteins are formed from amino acids.

Fig. 4.1 shows **two** different amino acids.

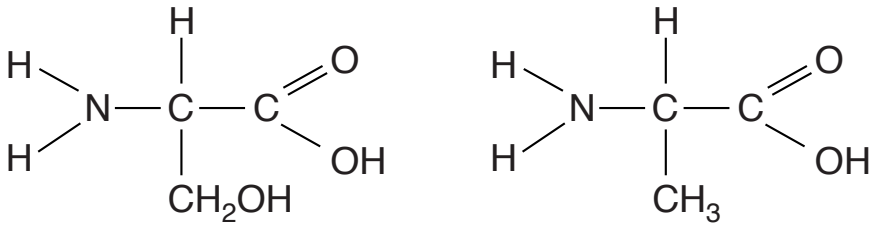

Fig. 4.1

(a) Name two chemical groups present in **all** amino acids.

1 .....

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

(b) Polypeptides are formed by a series of condensation reactions between amino acids.

(i) Using the information from Fig. 4.1, draw a diagram **in the space below** to show how these two amino acids are joined by a condensation reaction.

[3]

(ii) **Name** the bond formed between amino acids.

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

(c) Fig. 4.2 shows the structure of the enzyme, thrombin. Thrombin is a protein molecule which has a specific 3-D shape.

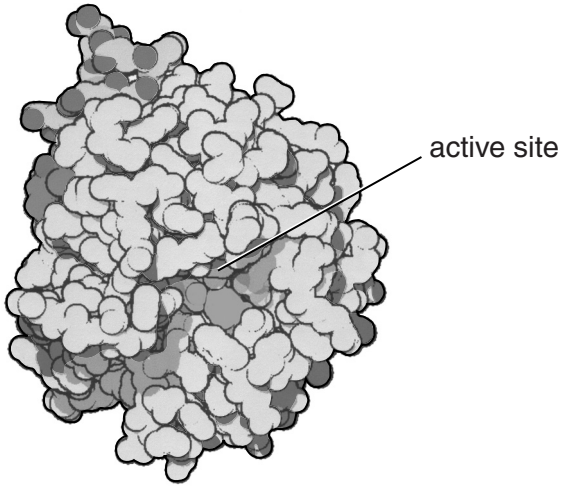

Fig. 4.2

State the bonds and interactions that occur between the R groups of amino acids **and** explain how they maintain the specific shape of thrombin.

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

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

[Total: 11]

5 Enzymes control metabolic reactions in the body. They catalyse reactions by lowering the activation energy.

(a) Describe what is meant by the term *activation energy*.

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

(b) Fig. 5.1 shows how the activity of an enzyme is affected by the concentration of substrate.

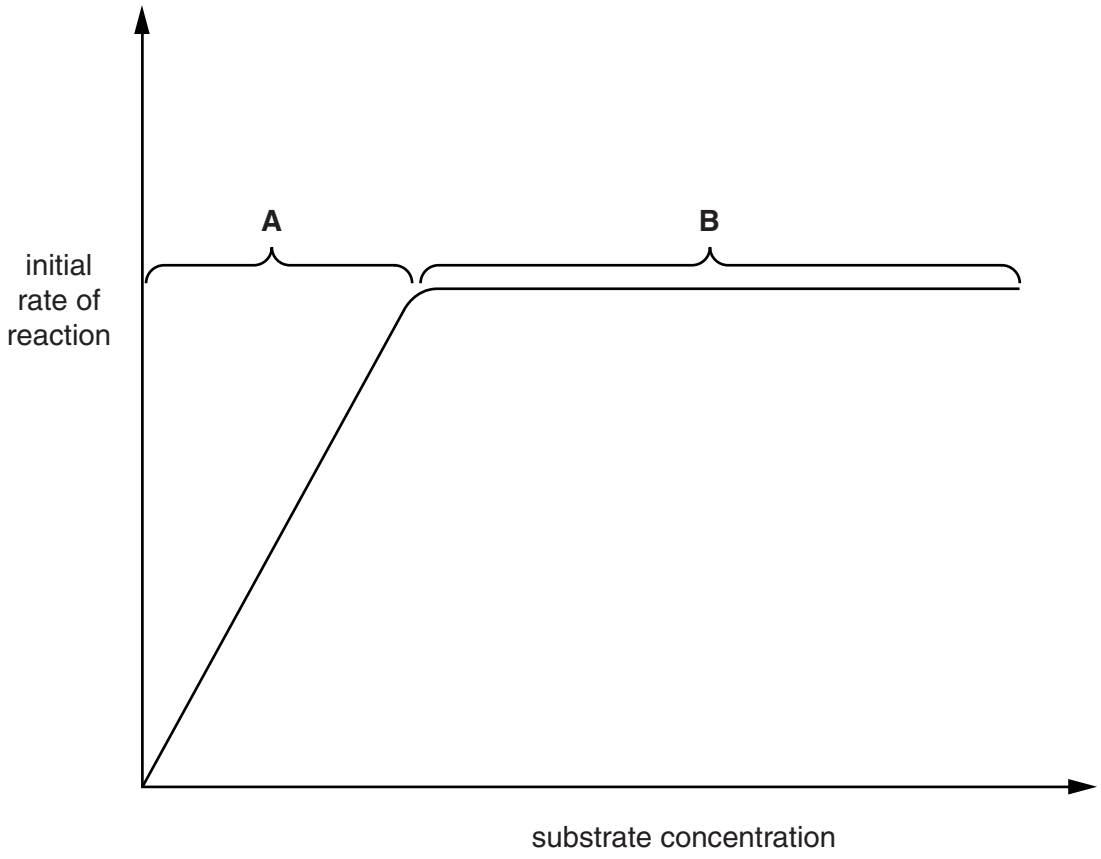

Fig. 5.1

(i) Fig. 5.1 shows that as substrate concentration increases, the initial rate of reaction increases (**A**) and then becomes constant (**B**).

Explain why.

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

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

(ii) A rare condition called afibrinogenaemia is caused by a low concentration of fibrinogen in the blood.

Suggest why a person with afibrinogenaemia bleeds for longer than expected following an injury.

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

[Total: 7]

QUESTION 6 STARTS ON PAGE 14

6 Erythrocytes (red blood cells) are a major component of blood. They play an important role in transporting respiratory gases.

(a) Complete the passage below about the structure and function of erythrocytes using the most appropriate word(s).

Erythrocytes are small and ..... in shape. They are flexible, which allows them to travel through tiny capillaries. Mature erythrocytes have few ..... such as mitochondria and Golgi apparatus. They also have no ..... and so they cannot divide.

The erythrocytes contain a lot of ..... which can combine temporarily with oxygen or carbon dioxide. These gases can pass through the cell surface membrane of the erythrocyte by the process of ..... .

[5]

(b) Two students were investigating the effect of cell diameter on the surface area to volume ratio. They calculated the surface area to volume ratio for an erythrocyte and a leucocyte.

The students were told to assume that the cells were spherical for the purpose of their calculations.

Their results are shown in Table 6.1.

Table 6.1

	erythrocyte	leucocyte
maximum diameter of cell (μm)	8	14
surface area (μm^2)	200	615
volume (μm^3)	268	1 437
surface area : volume ratio	0.8 : 1	0.4 : 1

(i) Using the data in Table 6.1, describe how increasing the diameter of a cell affects the surface area : volume ratio.

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

(ii) The students then found data from other studies about erythrocytes. These studies gave different values for the calculations to those that they had obtained. These data are shown in Table 6.2.

Table 6.2

	erythrocyte
maximum diameter of cell (μm)	8
surface area (μm^2)	390
volume (μm^3)	260
surface area : volume ratio	1.5 : 1

One of the students suggested that these values were not caused by errors in calculation but were due to the shape of the erythrocyte.

Explain why the shape of the erythrocyte may alter the value of the surface area : volume ratio.

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

(iii) People with one form of anaemia have erythrocytes which are small and spherical in shape. These erythrocytes are called spherocytes.

People who have spherocytes can maintain healthy levels of oxygen in their blood, but may still develop symptoms of anaemia.

Suggest why spherocytes can lead to symptoms of anaemia.

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

[Total: 11]

END OF QUESTION PAPER

ADDITIONAL PAGE

If additional space is required, you should use the lined page below. The question number(s) must be clearly shown.