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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE**

F221

HUMAN BIOLOGY

Molecules, Blood and Gas Exchange

WEDNESDAY 11 JANUARY 2012: Morning

DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

Insert (inserted)

OTHER MATERIALS REQUIRED:

Electronic calculator


Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

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 on the first page. 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.

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.

Answer ALL the questions.

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

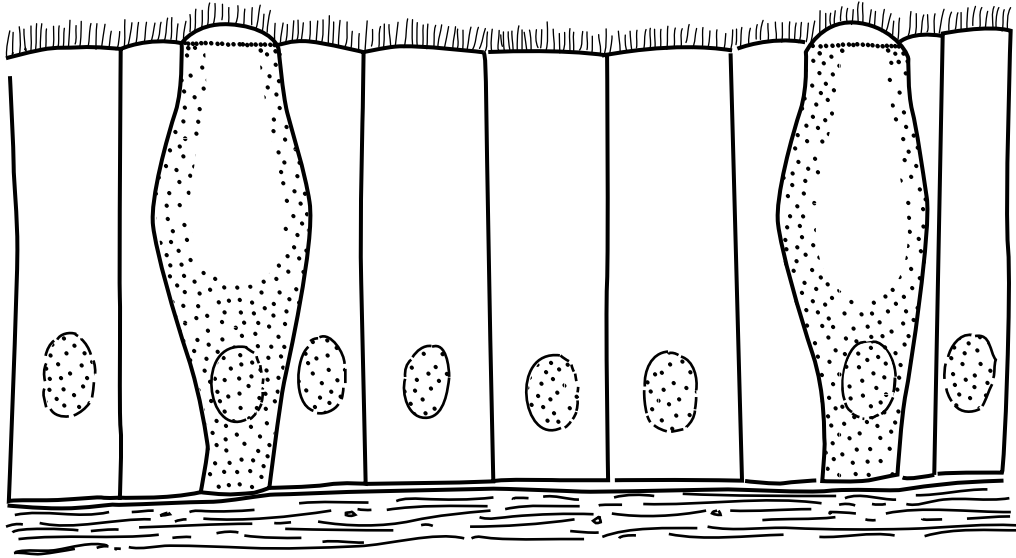


Fig. 1.1

- (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.**

_____ [2]

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

[3]

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

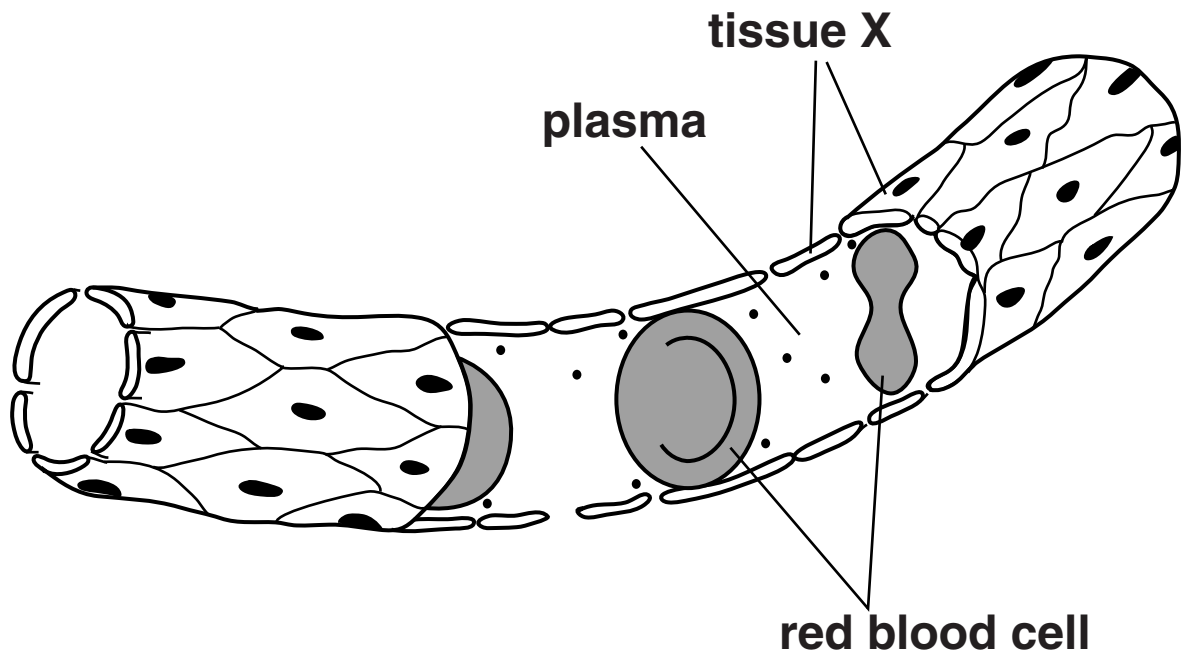


Fig. 1.2

(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 _____

_____ **[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.

[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, ON THE INSERT, shows the results for this patient.

(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.

[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

QRS complex.

[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.

_____ [1]

[Total: 12]

4 Polypeptides and proteins are formed from amino acids.

Fig. 4.1 shows TWO different amino acids.

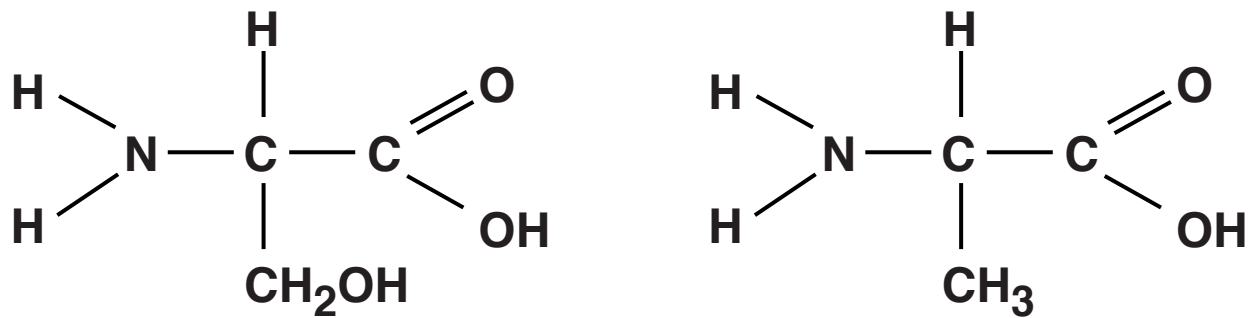


Fig. 4.1

(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]**

[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.

[1]

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

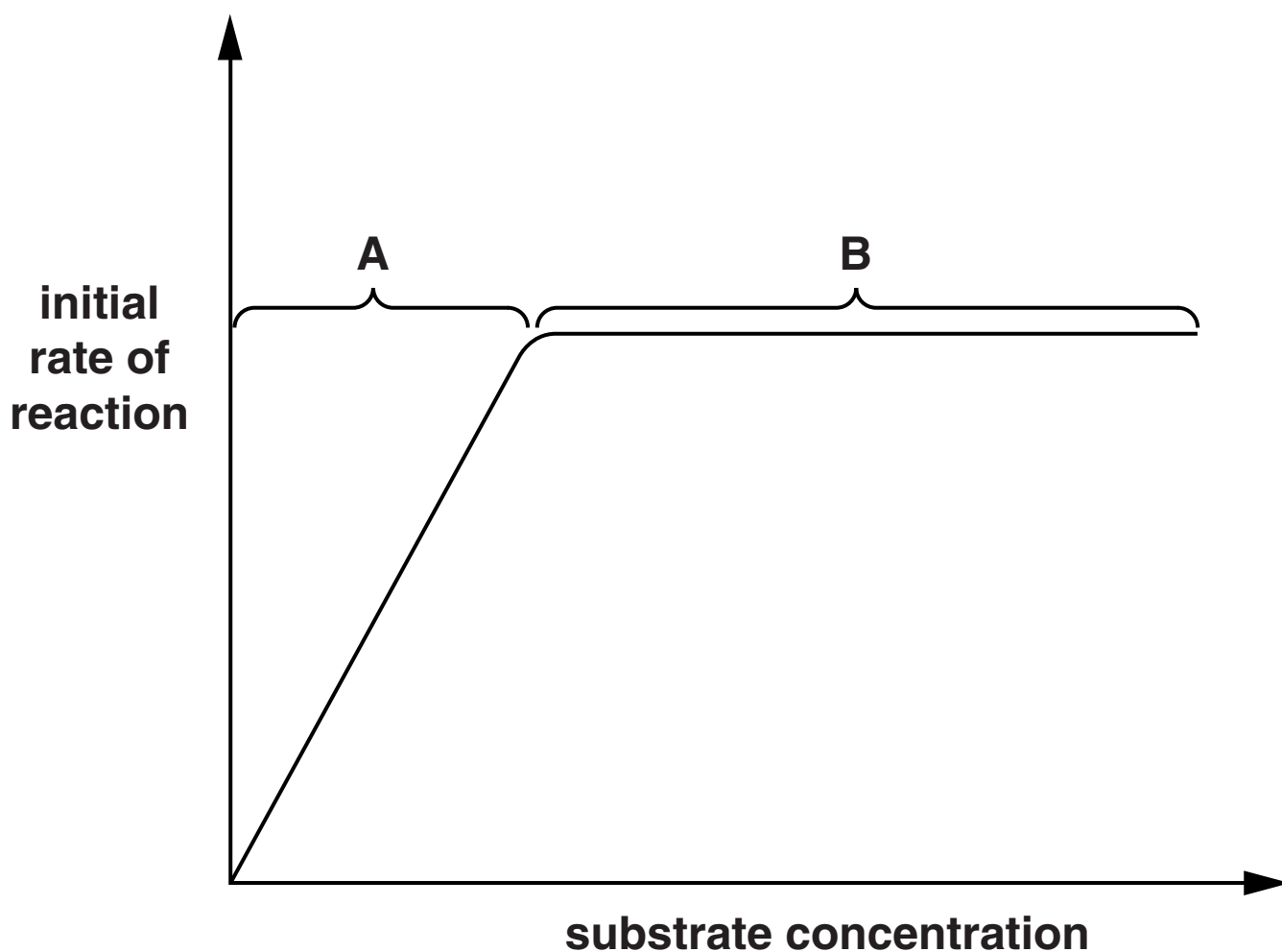


Fig. 5.1

- (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.

[2]

[Total: 7]

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.**

[2]

QUESTION 6(b)(ii) STARTS ON PAGE 24

- (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.

[2]

QUESTION 6(b)(iii) STARTS ON PAGE 26

- (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.

[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.

ADDITIONAL PAGE



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