OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE

F221/01

HUMAN BIOLOGY

Molecules, Blood and Gas Exchange

TUESDAY 21 MAY 2013: Afternoon
DURATION: 1 hour
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	

Centre number						Candidate number				

Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Electronic calculator
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (CW/SW) 2291571630 79551/1

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. 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 pages 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.**
- **Any blank pages are indicated.**

BLANK PAGE

QUESTION 1 BEGINS ON PAGE 4

Answer ALL the questions.

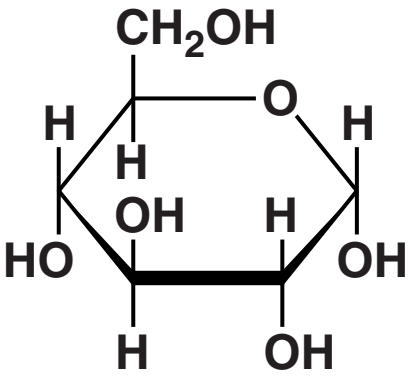
1 Fig. 1.1 (opposite) shows the structure of an alpha glucose molecule and part of a glycogen molecule.

(a) Complete the table below with a tick (✓) to show which of the following statements describe alpha glucose, glycogen or both. The first one is done for you.

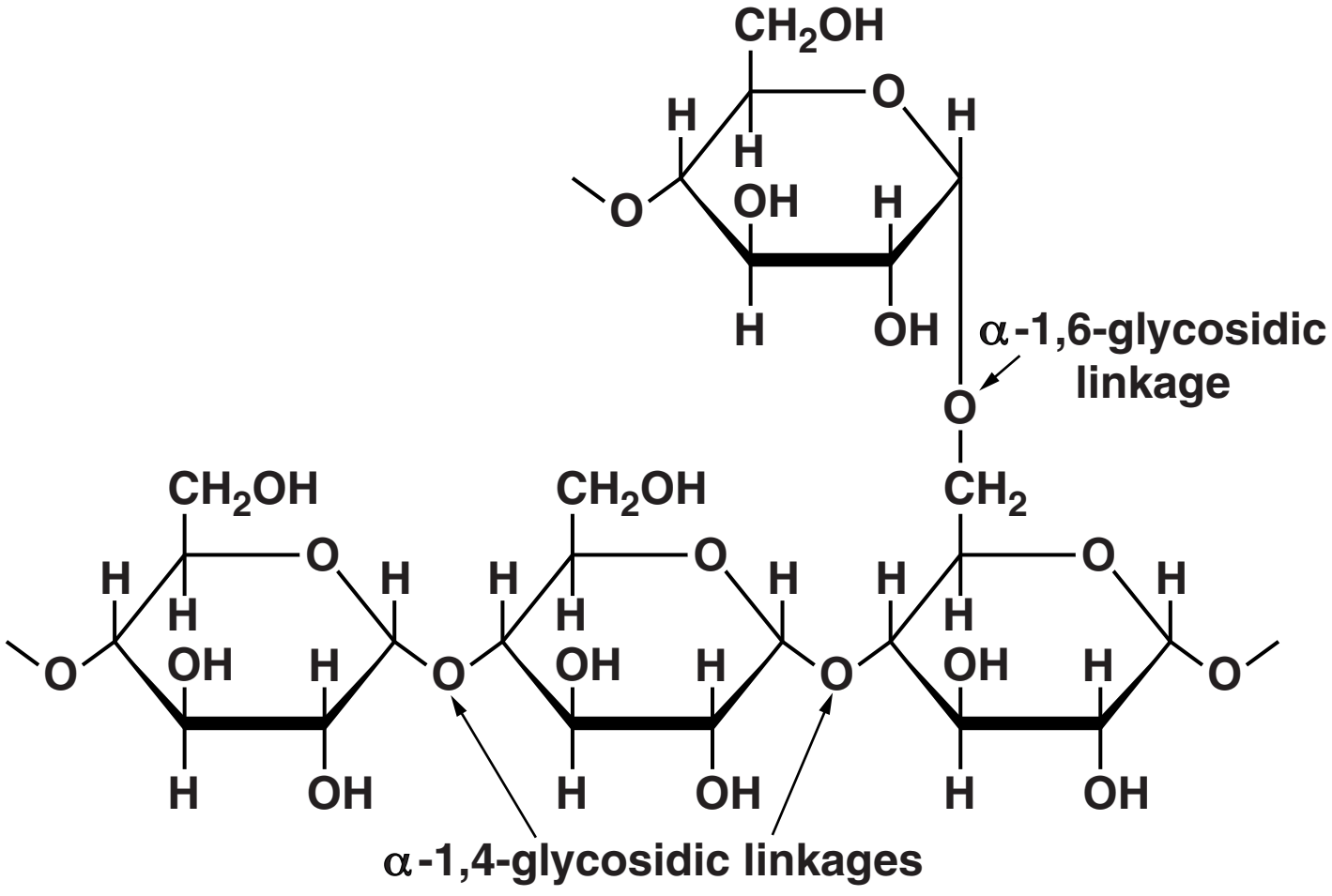
Statement	Alpha glucose	Glycogen	Both
a carbohydrate			✓
insoluble in water			
a polysaccharide			
may affect the water potential of the blood			
formed by condensation reactions			
a hexose sugar			

[5]

FIG. 1.1



ALPHA GLUCOSE



GLYCOGEN

(b) Glycogen is an ideal storage molecule and is found in large amounts in liver cells. Fig. 1.1 shows that glycogen is a branched molecule.

(i) Explain why the branches are important to the function of glycogen as a storage molecule.

_____

_____

_____

_____

_____

_____ **[2]**

(ii) Apart from liver cells, name ONE other type of cell in the human body that may contain large amounts of glycogen.

_____ **[1]**

(c) The glycogen in liver cells is found in granules within the cytoplasm. Periodic Acid Schiff is a stain that can be used to make the granules appear red under a microscope.

What is the term used for the type of stain, such as Periodic Acid Schiff, which makes some cellular structures appear different in colour?

_____ **[1]**

(d) Leishman's stain is another type of stain that is used in pathology laboratories to stain blood smears.

Explain how Leishman's stain helps to distinguish between different types of leucocyte.

_____

_____

_____

_____

_____

_____ **[2]**

(e) Describe the procedure for staining a blood sample containing leucocytes for viewing under a light microscope.

_____

_____

_____

_____

_____

_____

_____

_____ **[3]**

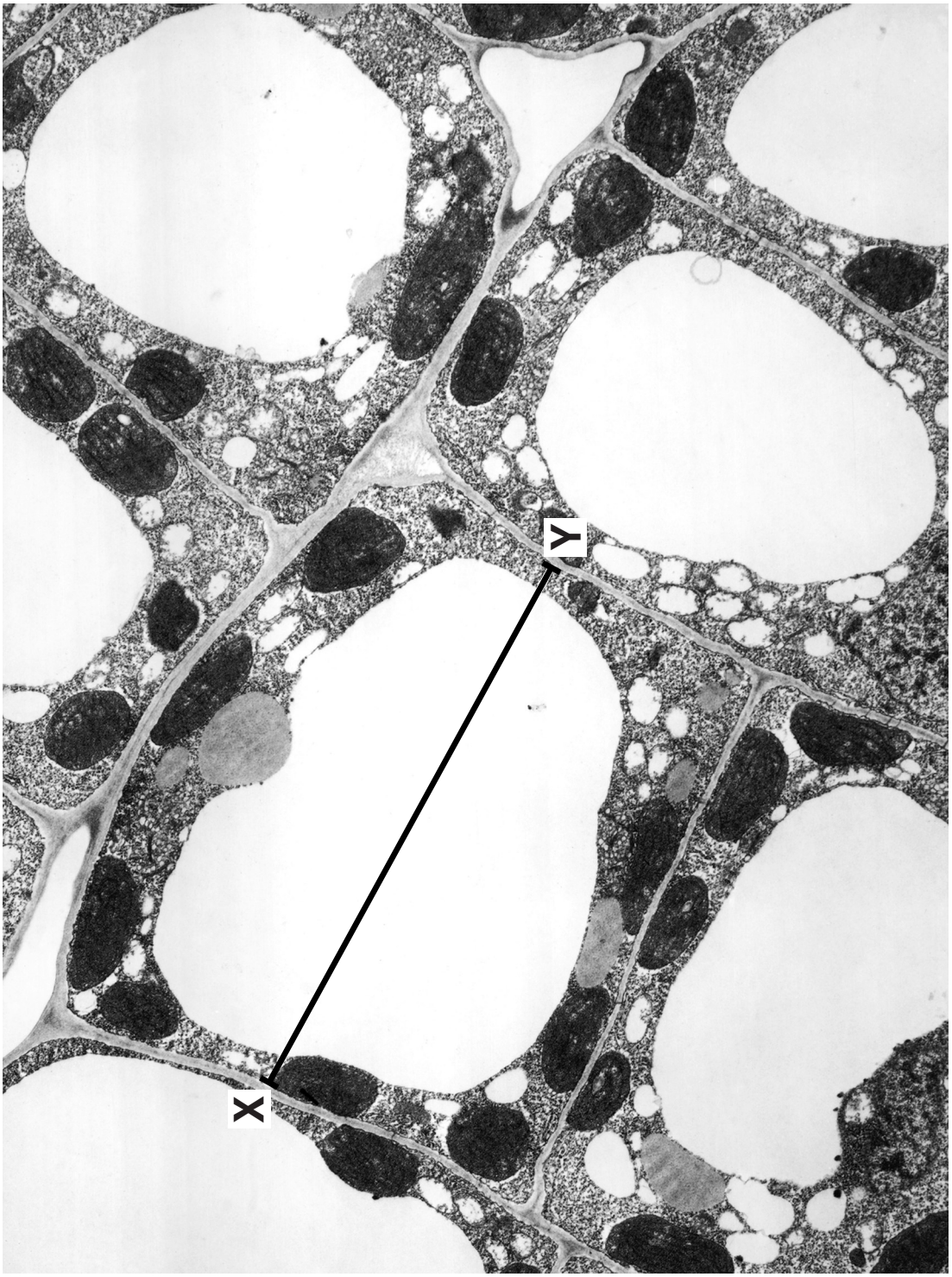
[TOTAL: 14]

BLANK PAGE

QUESTION 2 BEGINS ON PAGE 10

2 **Fig. 2.1 is an electron micrograph showing palisade mesophyll cells.**

FIG. 2.1



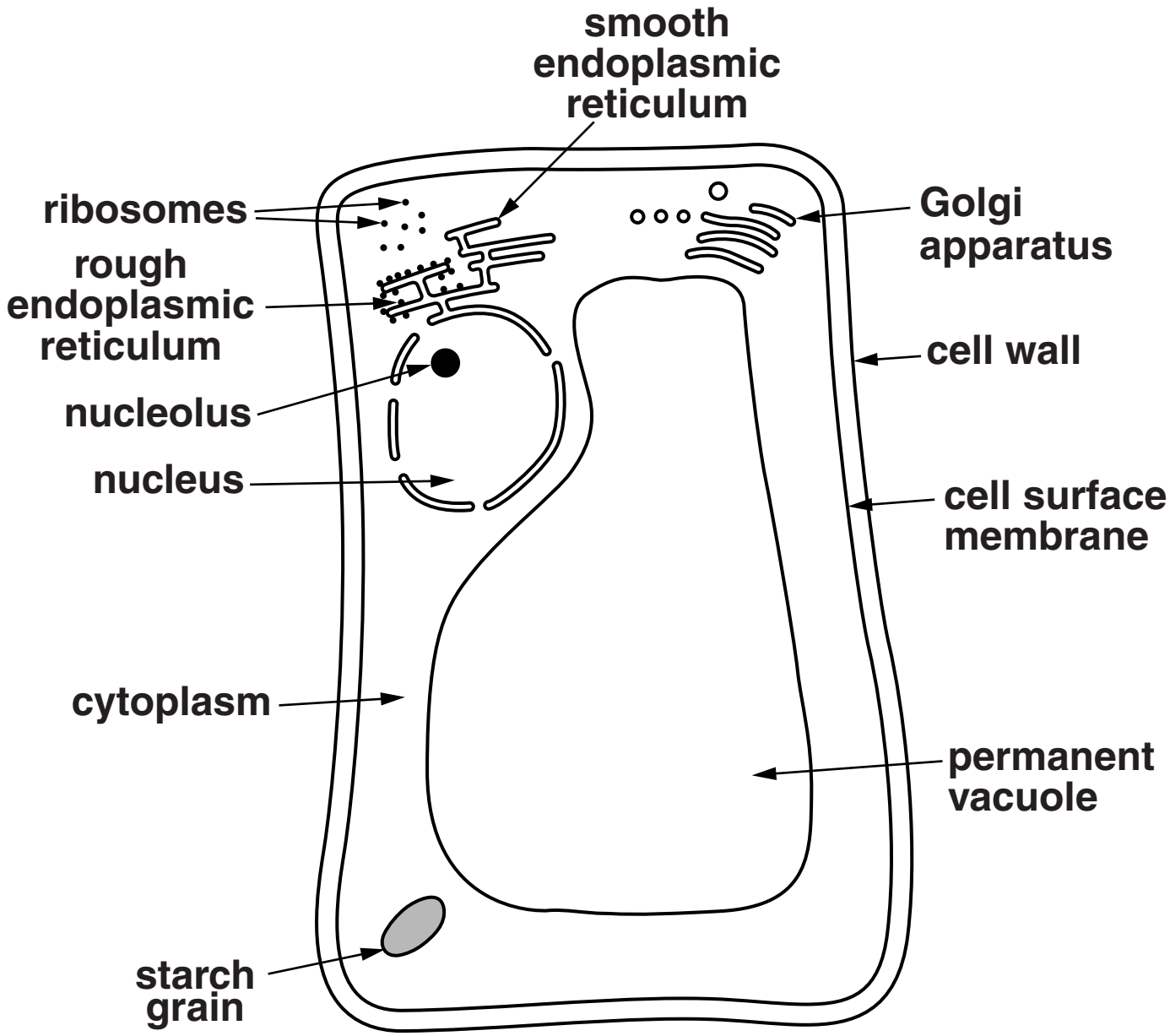
(a) Calculate the actual length of the palisade mesophyll cell shown between X and Y.

Show your working.
Give your answer to ONE DECIMAL PLACE.

Answer = _____ μm [2]

A student was asked to draw a diagram to show the ultrastructure of a palisade mesophyll cell. The completed diagram is shown in Fig. 2.2.

FIG. 2.2



(b) (i) Using Fig. 2.2, name TWO organelles in a palisade mesophyll cell that the student did not include in their diagram.

_____

_____ **[2]**

(ii) Which of the organelles shown in the palisade mesophyll cell in Fig. 2.2 has the function of producing ribosomes?

_____ **[1]**

(iii) What is the role of ribosomes in the palisade mesophyll cell?

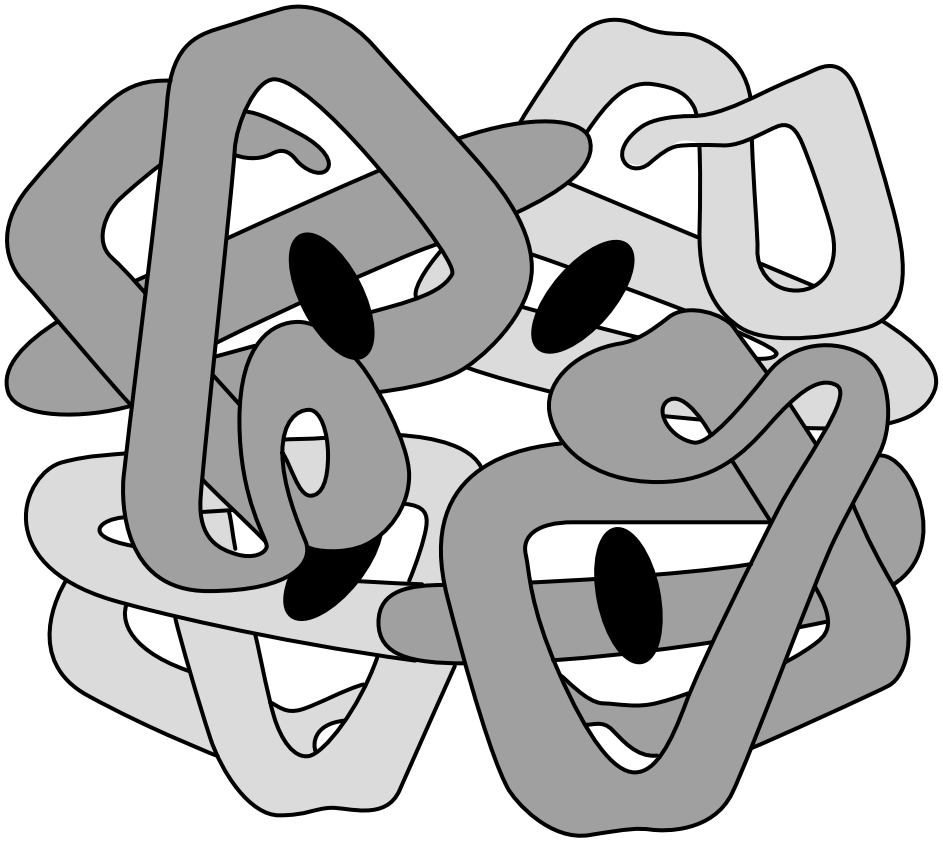
_____

_____ **[1]**

[TOTAL: 6]

3 Fig. 3.1 shows a simplified diagram of the structure of a haemoglobin molecule.

FIG. 3.1



(a) Describe how the molecular structure of haemoglobin enables it to transport oxygen molecules.

Details of oxygen dissociation curves are NOT required.

In your answer, you should use appropriate technical terms, spelled correctly. [5]

_____

_____

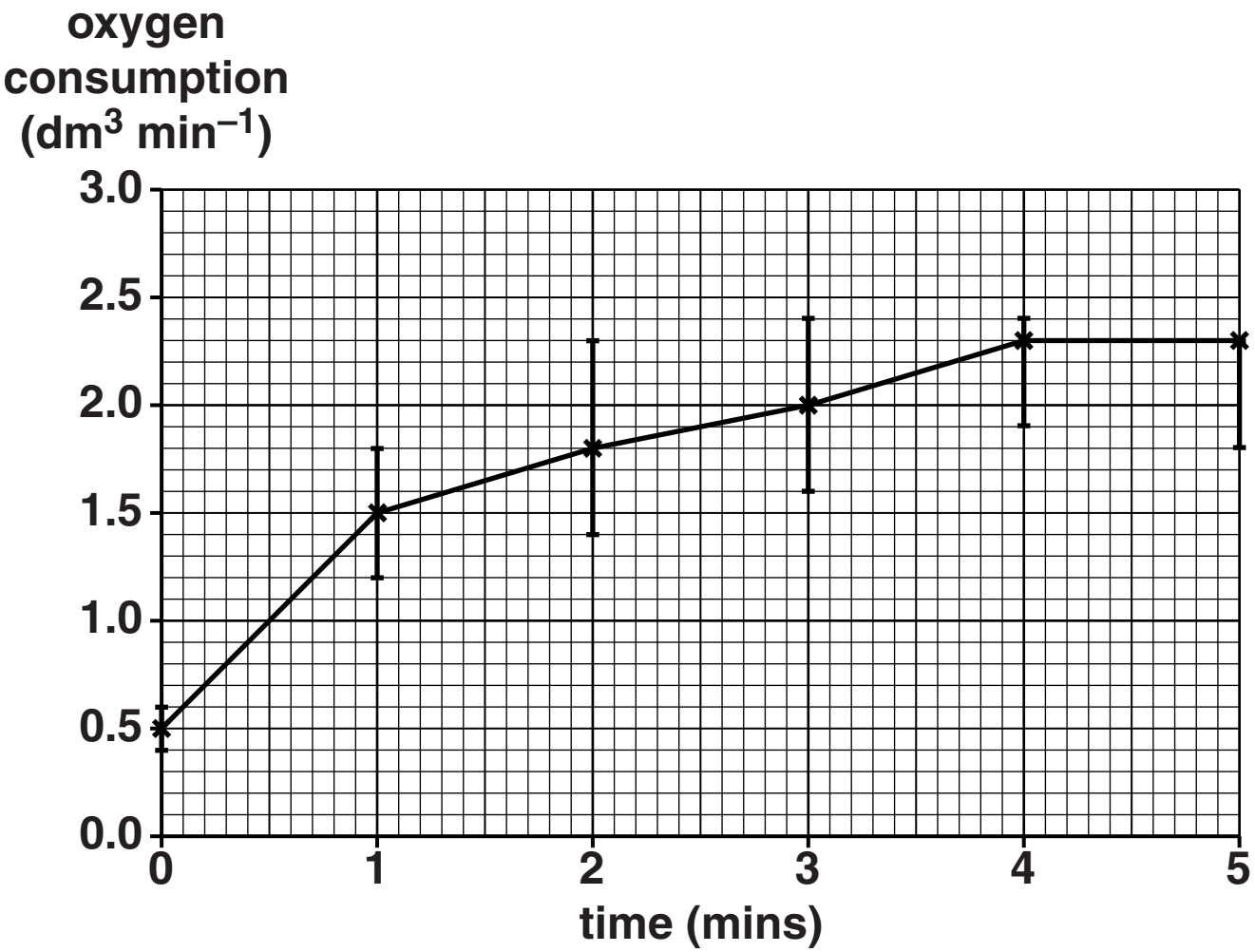
_____

(b) State ONE way, other than being attached to haemoglobin, in which oxygen molecules can be transported in the blood.

_____ **[1]**

(c) The points plotted on Fig. 3.2 show the mean oxygen consumption of a group of students, measured during a period of exercise.

FIG. 3.2



(i) Describe the pattern shown by the data in Fig. 3.2.

_____

_____

_____

_____

_____

_____

_____

_____ **[3]**

(ii) The range bar plotted at one minute is much smaller than the range bar plotted at two minutes.

What does this tell you about these data?

_____

_____ **[1]**

(iii) Each point plotted on Fig. 3.2 represents the mean of a set of data.

On Fig. 3.2, circle the point that represents the data set that is most likely to contain an anomalous result.

The answer to this question should be drawn on Fig. 3.2. [1]

(iv) Give a reason for your choice in (iii).

_____

_____

_____

_____ **[1]**

[TOTAL: 12]

4 Body fluids contain water. The properties of water make it an ideal transport medium.

(a) Complete the sentences below about the properties of water.

A water molecule consists of two hydrogen atoms joined to an oxygen atom by covalent bonds. A water molecule has an uneven distribution of charge so it is said to be _____ .

This property means that water is a liquid at room temperature because of the _____ bonds that form between water molecules. It also means that many different substances such as glucose will dissolve in water and it is often known as the universal _____ .

Lipid molecules are insoluble in water as they are _____ . **[4]**

(b) Blood plasma is a body fluid which contains electrolytes.

(i) State TWO electrolytes found in blood plasma.

_____

_____ **[2]**

(ii) Explain the importance of electrolytes in blood plasma.

_____

_____

_____

_____

_____

_____ **[2]**

(c) A decrease in the concentration of one of the electrolytes in blood plasma can cause a heart condition called tachycardia. Tachycardia can be diagnosed by using an electrocardiogram (ECG).

(i) Outline the procedure a nurse would follow when taking a patient's ECG.

_____

_____

_____

_____

_____

_____

_____ **[2]**

(ii) Suggest TWO conditions, other than tachycardia, that could be diagnosed using an ECG.

_____

_____ **[2]**

[TOTAL: 12]

5 Fig. 5.1 (opposite) shows how the blood pressure changes as blood passes through different areas of the human circulatory system.

The repeated rise and fall of the trace corresponds to the contraction and relaxation of the heart muscle.

(a) (i) Explain why the rise and fall of the trace becomes smaller as blood passes through the arteries into the arterioles.

_____

_____

_____

_____

_____

_____ **[2]**

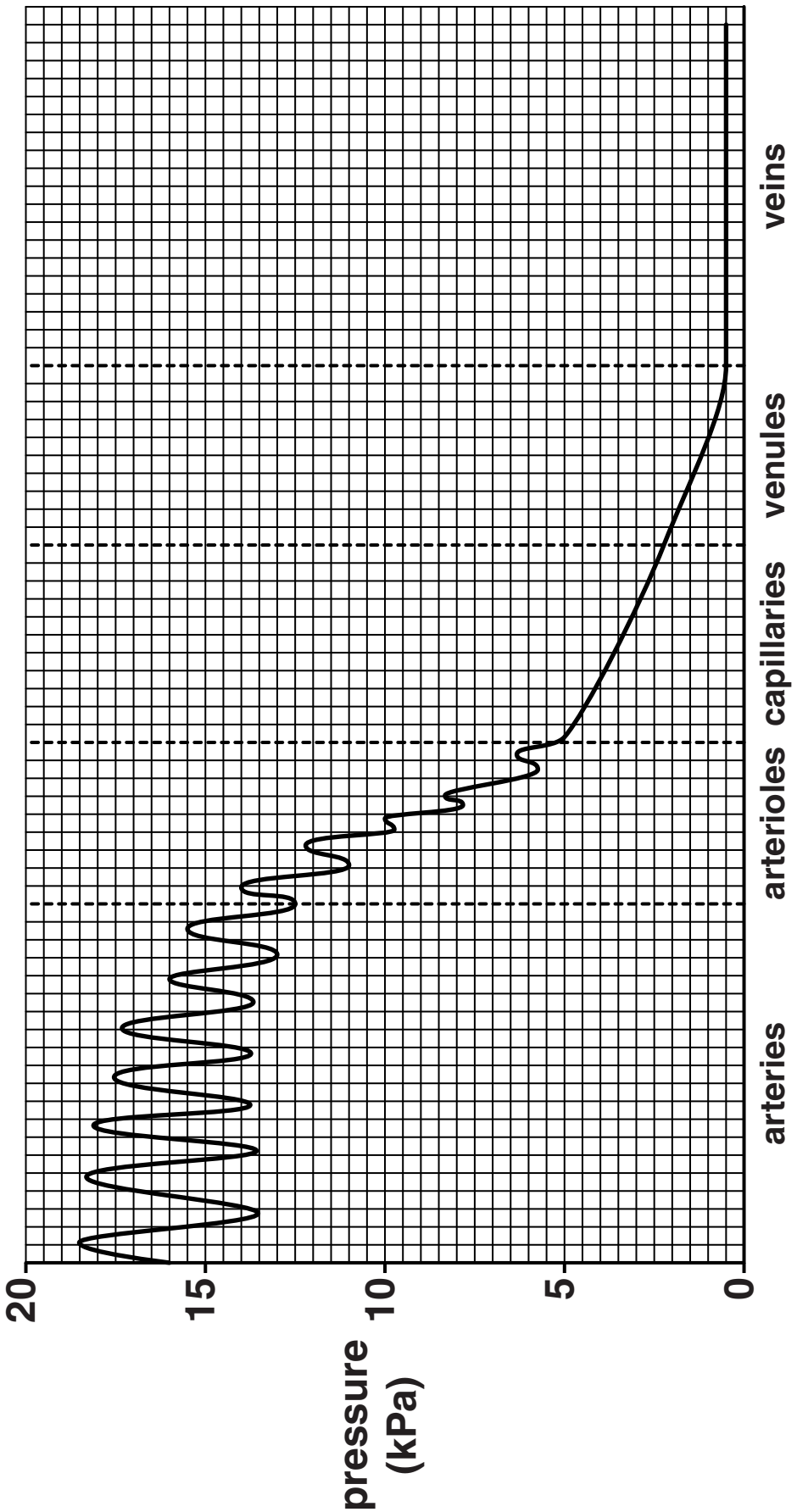
(ii) Using the information in Fig. 5.1, suggest why an injury which damages an artery results in greater immediate blood loss than one which damages a vein.

_____

_____

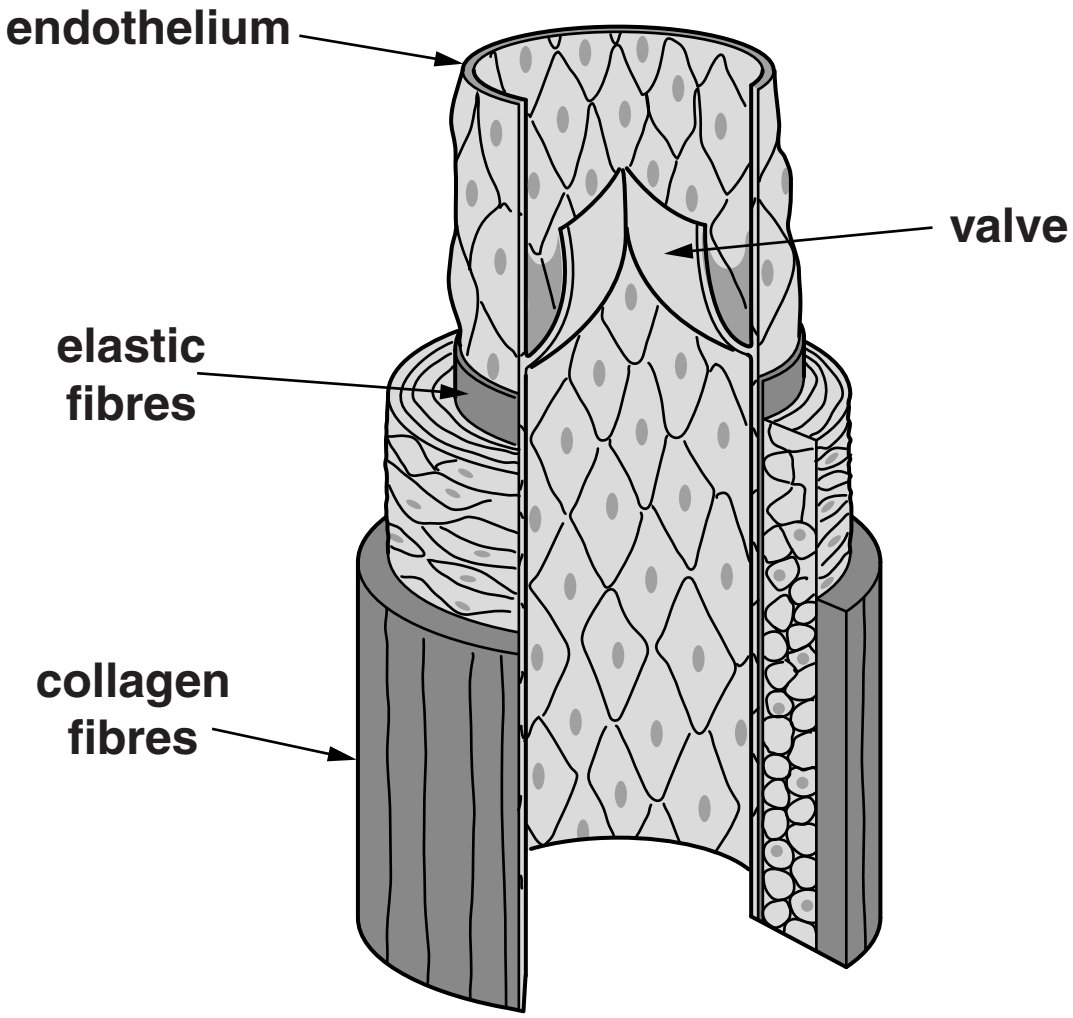
_____ **[1]**

FIG. 5.1


20
15
10
5
0
pressure (kPa)
arteries
arterioles
capillaries
venules
veins

(b) A vein consists of different tissues which work together to ensure that blood is directed back towards the heart. Fig. 5.2 shows the structure of a vein.

FIG. 5.2



Describe the role of the following parts of the vein shown in Fig. 5.2.

endothelium _____

_____

elastic fibres _____

_____

collagen fibres _____

_____

[3]

(c) Deep Vein Thrombosis (DVT) is a condition caused by a blood clot forming in a vein. This may lead to damage to the valves in the vein.

Suggest why hydrostatic pressure in the vein rises when the valves in the vein are damaged.

_____

_____

_____ **[1]**

[TOTAL: 7]

6 Blood banks in the UK store blood until it is required for transfusion. Whole blood must be stored in the correct conditions to ensure that it remains suitable for use.

(a) Explain why stored whole blood must be maintained at a pH of approximately 7 to remain suitable for use.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[4]**

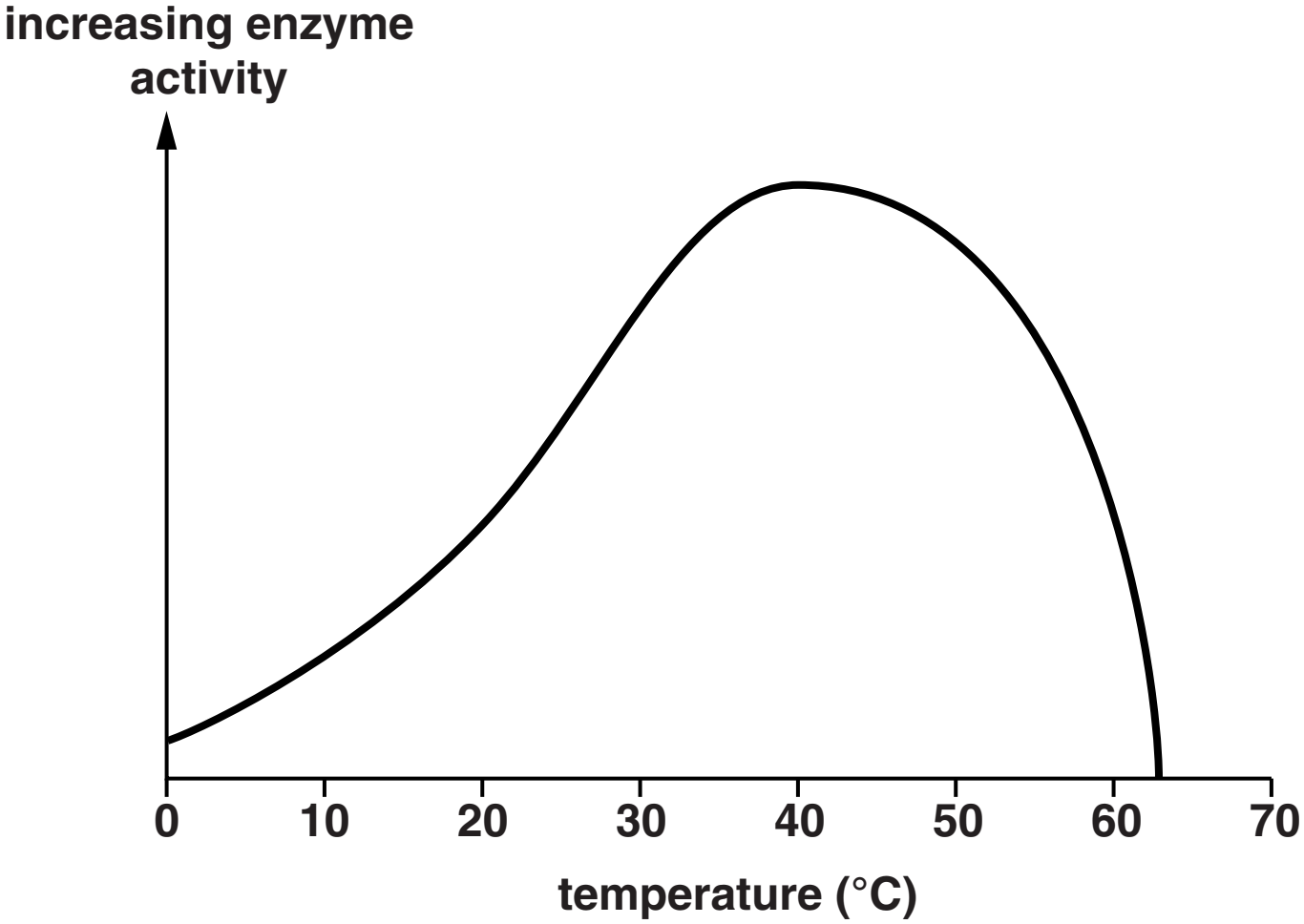
BLANK PAGE

QUESTION 6(b) BEGINS ON PAGE 28

(b) The activities of specific enzymes in stored whole blood may cause it to clot. Enzyme activity is affected by temperature.

Fig. 6.1 shows how temperature affects enzyme activity.

FIG. 6.1



(i) Explain the effect on blood clotting of increasing the temperature of stored whole blood to 30° C.

_____

_____

_____

_____

_____

_____

_____

_____ **[3]**

(ii) What is the ideal temperature for storing blood?

_____ **[1]**

QUESTION 6(c) BEGINS ON PAGE 30

(c) Chemicals such as sodium citrate must be added to blood to prevent it from clotting when stored.

Suggest why chemicals such as sodium citrate prevent blood clotting.

_____

_____

_____ **[1]**

[TOTAL: 9]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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

ADDITIONAL ANSWER SPACE