

OCR AS GCE Biology (21 pages)

F211 Cells, Transport and Exchange

Exam questions from January 2009-June 2012

Topics:

1.2.2 Transport in Animals

Explain the need for transport systems in multicellular animals in terms of size, level of activity and surface area:volume ratio;

Explain the meaning of the terms *single circulatory system* and *double circulatory system*, with reference to the circulatory systems of fish and mammals;

Explain the meaning of the terms *open circulatory system* and *closed circulatory system*, with reference to the circulatory systems of insects and fish;

Describe, with the aid of diagrams and photographs, the external and internal structure of the mammalian heart;

Explain, with the aid of diagrams, the differences in the thickness of the walls of the different chambers of the heart in terms of their functions;

Describe the cardiac cycle, with reference to the action of the valves in the heart;

Describe how heart action is coordinated with reference to the sinoatrial node (SAN), the atrioventricular node (AVN) and the Purkyne tissue;

Interpret and explain electrocardiogram (ECG) traces, with reference to normal and abnormal heart activity;

Describe, with the aid of diagrams and photographs, the structures and functions of arteries, veins and capillaries;

Explain the differences between blood, tissue fluid and lymph;

Describe how tissue fluid is formed from plasma;

Describe the role of haemoglobin in carrying oxygen and carbon dioxide;

Describe and explain the significance of the dissociation curves of adult oxyhaemoglobin at different carbon dioxide levels (the Bohr effect);

Explain the significance of the different affinities of fetal haemoglobin and adult haemoglobin for oxygen

5 Fish have a single, closed circulatory system.

(a) State the meaning of the terms *single circulatory system* and *closed circulatory system*.

single circulatory system

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closed circulatory system

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..... [2]

(b) The heart of a mammal contains four main chambers. The action of these chambers is coordinated by electrical activity in specialised tissues.

Fig. 5.1 shows where these tissues are found in the heart.

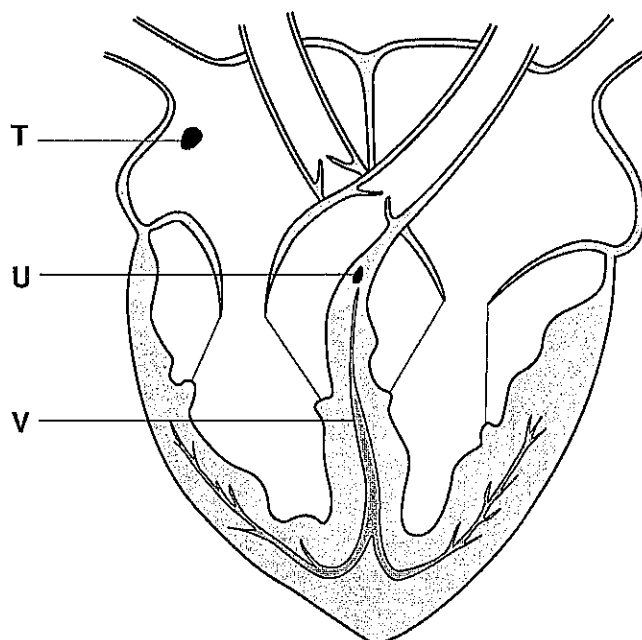


Fig. 5.1

(i) Name the tissues labelled T, U and V.

T

U

V

[3]

(ii) Describe how the action of the heart is initiated **and** coordinated.

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

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[Total: 10]

6 (a) (i) Name the type of muscle found in the walls of the heart chambers.
 [1]

(ii) Name the process that creates pressure inside the heart chambers.
 [1]

(b) Fig. 6.1 shows the changes in pressure inside the heart chambers during one heart beat.

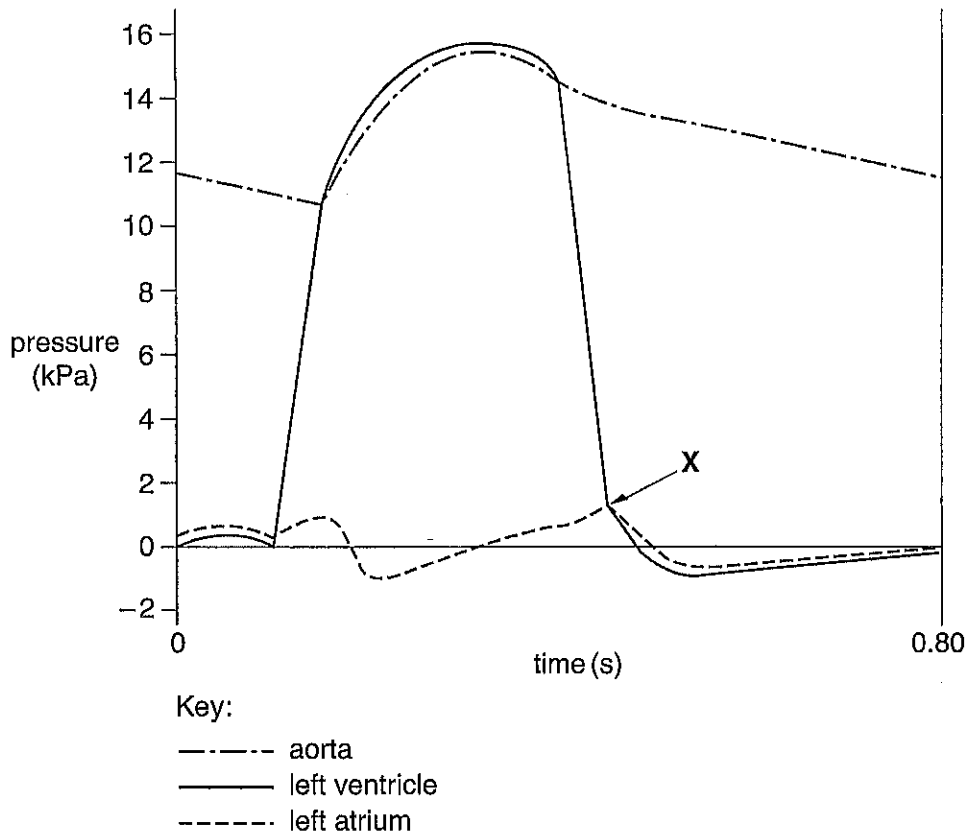


Fig. 6.1

(i) Calculate the heart rate from the information in Fig. 6.1.
 Show your working and give your answer **to the nearest whole number**.

Answer = beats min⁻¹ [2]

(ii) Describe and explain what happens **immediately after X** on Fig. 6.1.



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

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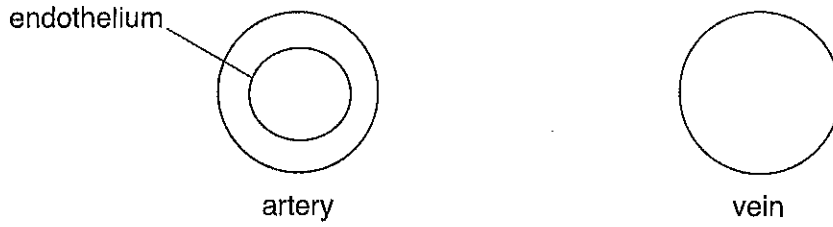
..... [4]

[Total: 8]

END OF QUESTION PAPER

5 (a) (i) Fig. 5.1 represents a transverse section of an artery and a vein.

Draw a line to show the relative position of the endothelium of the **vein**.



[1]

Fig. 5.1

(ii) State **two other** ways in which the wall of an artery is different from the wall of a vein.

- 1
-
- 2
- [2]

(b) (i) Blood in the arteries has a high hydrostatic pressure.

State how this hydrostatic pressure is generated in the heart.

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- [1]

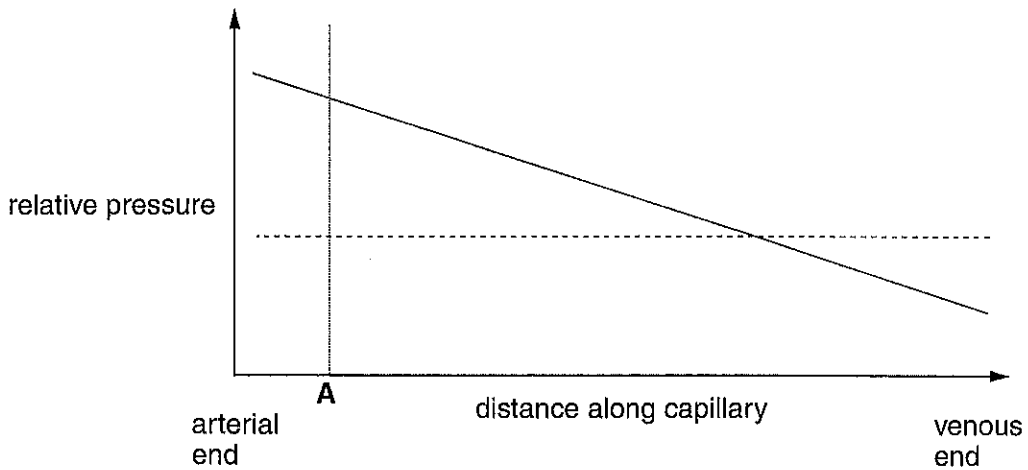
(ii) Explain why the hydrostatic pressure of the blood drops as blood moves away from the heart.

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- [2]

(iii) Capillaries have walls that are one cell thick.

Fig. 5.2 shows how the hydrostatic pressure of the blood changes as it moves through a capillary.

Fig. 5.2 also shows the water potential of the blood, due largely to the plasma proteins, which tends to move water into the blood.



Key:

———— hydrostatic pressure

----- water potential of blood

Fig. 5.2

Describe **and** explain what happens to the blood plasma at point A along the capillary in Fig. 5.2.

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[3]

(c) Carbon dioxide is produced in tissues as a waste product of respiration.

The majority of carbon dioxide is carried as hydrogencarbonate ions (HCO_3^-) in the plasma.

Fig. 5.3 shows the chemical pathway in which carbon dioxide is converted into HCO_3^- in a red blood cell.

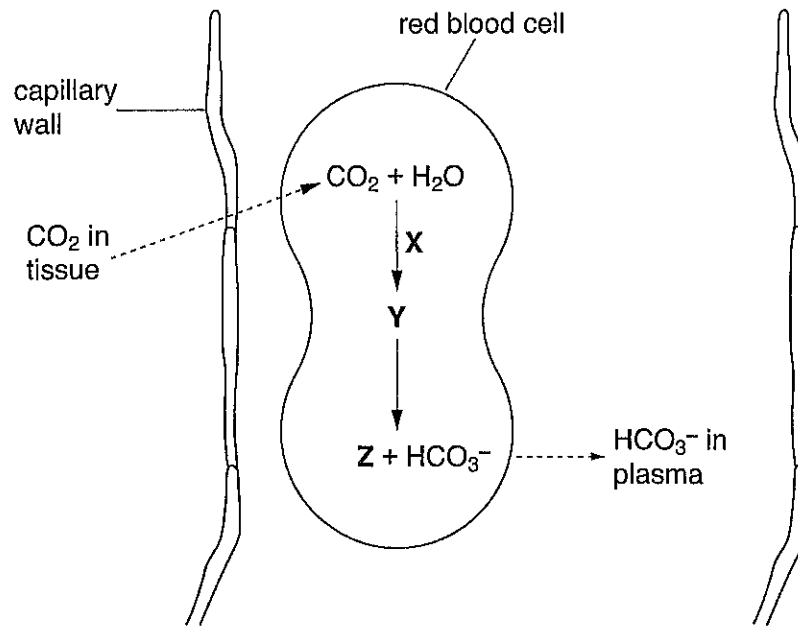


Fig. 5.3

Identify the following:

enzyme X

substance Y

ion Z [3]

[Total: 12]

2 Fig. 2.1, on the insert, is a photomicrograph of a blood smear. The smear has been stained.

(a) State **two** reasons why the blood smear has been stained.

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..... [2]

(b) Suggest **one** detail that would be made visible if the micrograph were taken using:

(i) a scanning electron microscope

.....

(ii) a transmission electron microscope.

..... [2]

(c) The red colouration of the red blood cells is caused by the pigment haemoglobin. The main function of haemoglobin is to transport oxygen in the form of oxyhaemoglobin.

Fig. 2.2 shows the dissociation curves of adult oxyhaemoglobin (curve A) and fetal oxyhaemoglobin (curve F).

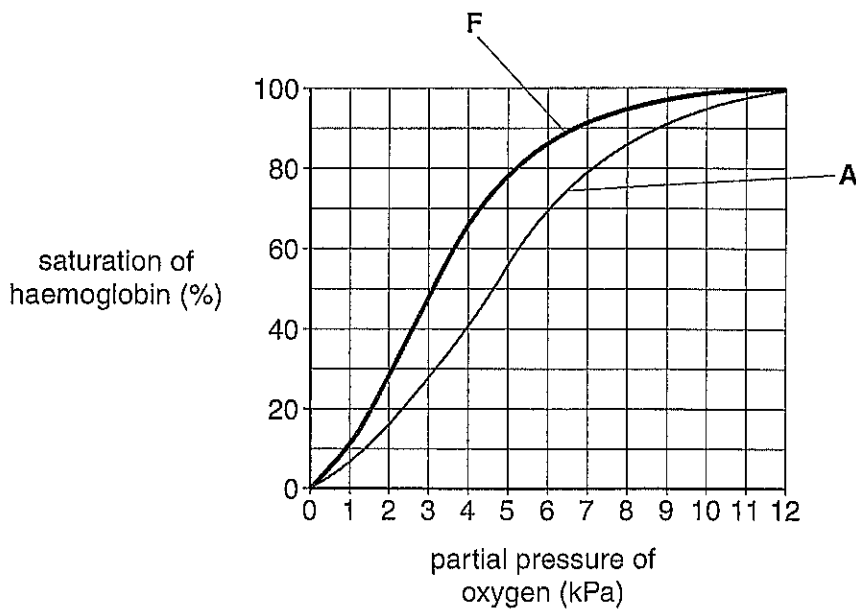
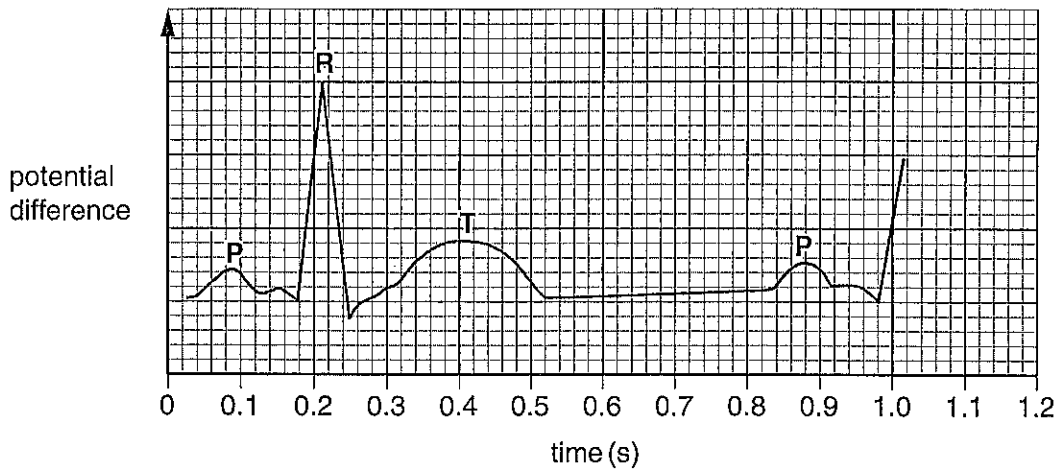


Fig. 2.2

6 Fig. 6.1 shows two electrocardiogram (ECG) traces.

- Trace A is a normal trace.
- Trace B is a trace from a heart after treatment with the drug digitalis.

Trace A – an electrocardiogram from a normal heart



Trace B – an electrocardiogram from a heart after treatment with digitalis

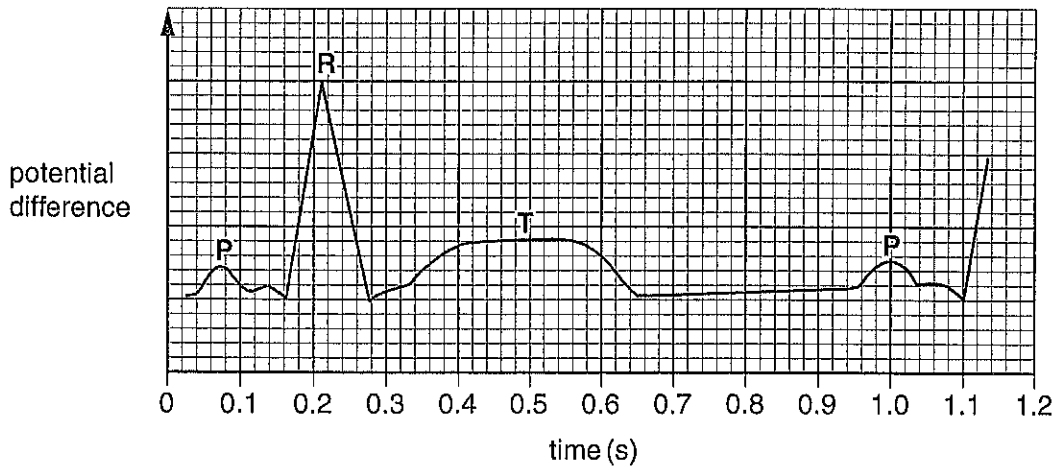


Fig. 6.1

(a) Calculate the heart rate using the information in Trace A.

Show your working.

Answer = beats per minute [2]

(b) Using the information in Fig. 6.1, state **two** effects of digitalis on the activity of the heart.

1

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2

..... [2]

(c) Describe the roles of the sinoatrial node (SAN) **and** the atrioventricular node (AVN) in coordinating the cardiac cycle.

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..... [3]

[Total: 7]

END OF QUESTION PAPER

(c) As part of an allergic response, certain cells in the lungs release histamine.

Histamine is a cell signalling molecule that stimulates smooth muscle in the wall of structure **A** to contract.

Suggest how histamine stimulates smooth muscle contraction.

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..... [2]

(d) Another action of histamine is to make capillary walls more permeable.

Suggest **two** effects this increased permeability may have on the surrounding tissues.

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..... [2]

[Total: 8]

- 3 Read the following passage and complete each sentence by writing the most appropriate **term or phrase** in the spaces provided.

Large, active organisms need a circulatory system because they have a small

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Haemoglobin is a pigment found in red blood cells. These cells are also known as

..... Haemoglobin has a high for oxygen. In the

lungs, the haemoglobin associates with oxygen to form

In respiring tissues, the oxygen is released by dissociation. In very active tissues, the amount of

oxygen released can be increased by the presence of more

This is called the effect.

[6]

[Total: 6]

3 Large animals, such as mammals, need efficient transport systems.

(a) Fig. 3.1 shows a section through the mammalian heart.

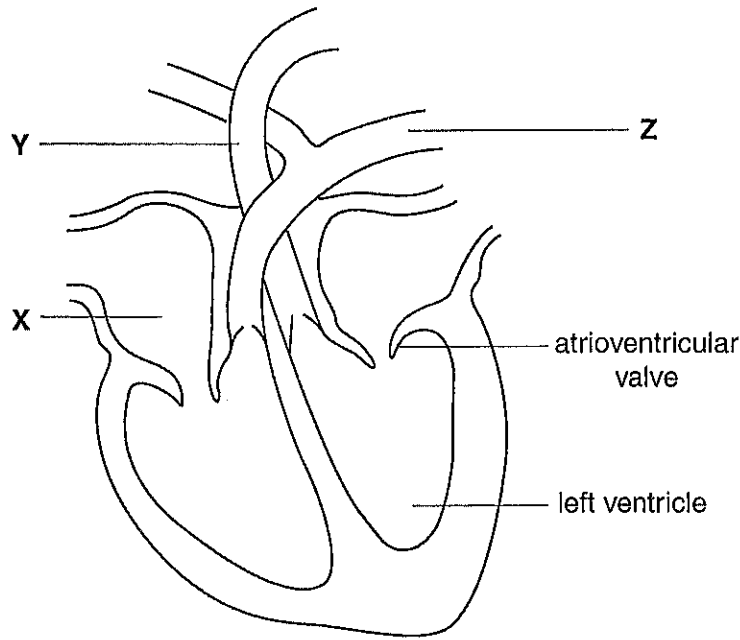


Fig. 3.1

(i) Name the parts labelled X, Y and Z.

X

Y

Z

[3]

(ii) Explain why the wall of the left ventricle is thicker than the wall of the left atrium.

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..... [3]

(iii) Explain how pressure changes in the heart bring about the closure of the atrioventricular (bicuspid) valve.

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..... [2]

(b) The mammalian transport system is a double circulatory system.

An efficient circulatory system consists of a pump, a means of maintaining pressure, a transport medium and exchange surfaces.

State the component of the **mammalian circulatory system** that fulfils each of these roles.

The first one has been done for you.

pump heart
means of maintaining pressure
transport medium
exchange surface

[3]

[Total: 11]

3 Three examples of fluids in the mammalian body are blood, tissue fluid and lymph.

(a) Complete Table 3.1 below comparing different features of arterial blood, tissue fluid and lymph.

Table 3.1

feature	arterial blood	tissue fluid	lymph
hydrostatic pressure		low	
presence of large proteins	yes		
presence of neutrophils	yes		
presence of erythrocytes			no

[4]

(b) In a closed circulatory system, blood is kept inside blood vessels.

(i) Suggest **two** advantages of keeping the blood inside vessels.

- 1
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- 2
- [2]

- (ii) Describe **and** explain how the wall of an artery is adapted both to withstand and maintain high hydrostatic pressure.



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

to withstand pressure

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to maintain pressure

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[5]

[Total: 11]

3 Fig. 3.1 provides information about the blood pressure in different parts of the mammalian blood circulatory system.

Fig. 3.1 also shows the **total** cross-sectional area of the vessels, relative to one another, in parts of the blood circulatory system.

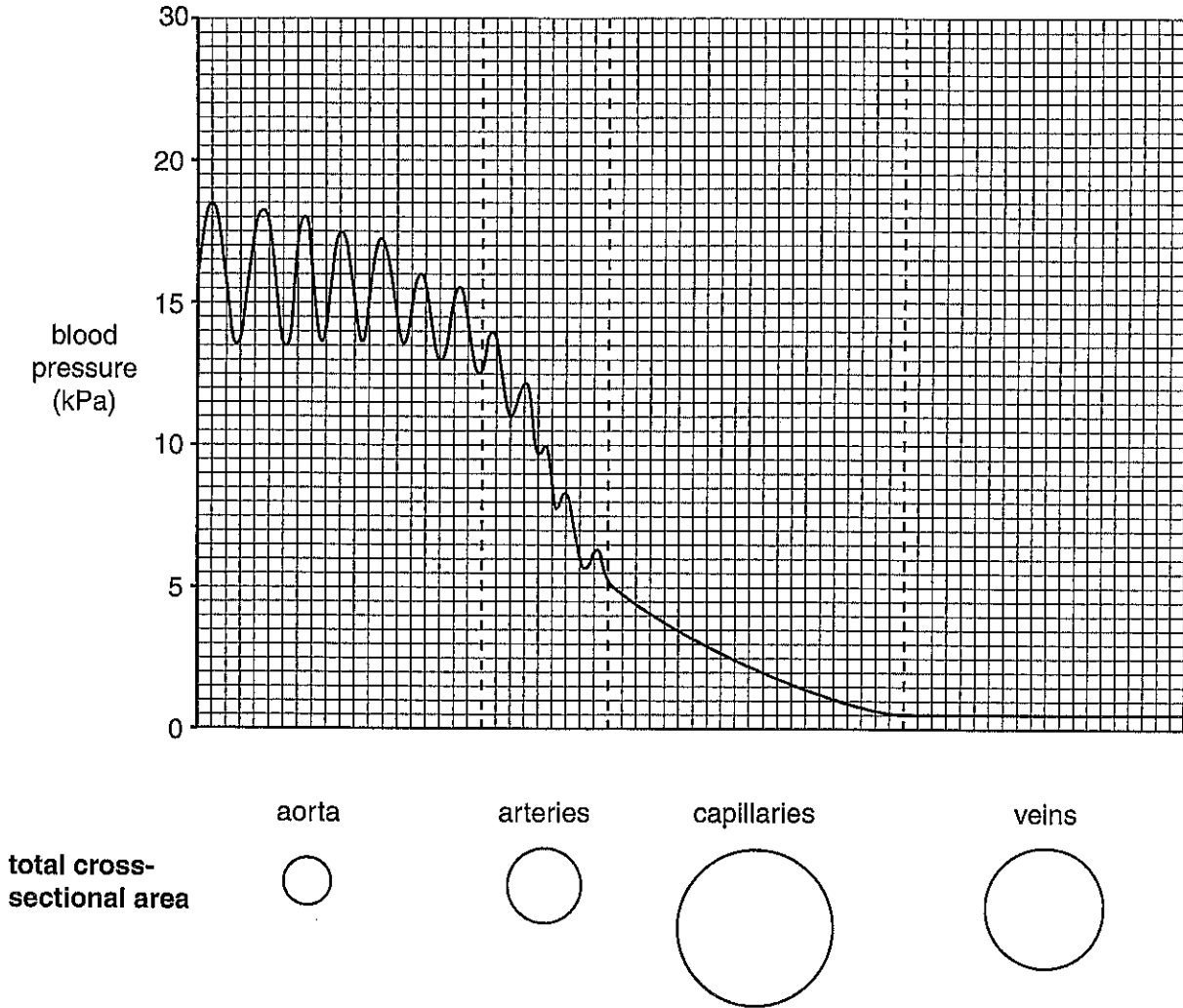


Fig. 3.1

(a) Place a tick (✓) in the box below that most closely describes the mammalian blood circulatory system.

	open circulatory system	closed circulatory system
single circulatory system		
double circulatory system		

[1]

(b) The pressure fluctuates as the blood flows along the aorta, as shown in Fig. 3.1.

(i) Explain what causes this fluctuation.

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..... [2]

(ii) State the term used to describe the number of fluctuations per minute.

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..... [1]

(c) Using the information in Fig. 3.1, describe the pressure changes in the blood as it flows through the circulatory system from the aorta to the veins.

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..... [3]

(d) (i) Using the information in Fig. 3.1, explain what causes the overall change in pressure as blood flows from the aorta to the arteries and from the arteries to the capillaries.

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..... [2]

(ii) Explain why it is important that the pressure changes as blood flows from the aorta to the capillaries.

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[Total: 11]