1 **(a)** Table 5.1 and Table 5.2 list events that occur during the cardiac cycle.

Each event in Table 5.1 is immediately followed by one of the events listed in Table 5.2.

Complete Table 5.1 by inserting the appropriate letters of the events from Table 5.2.

The first row has been completed for you.

Event in the order in which they occur	**Letter describing the event that follows**
atrial walls start to relax	D
sinoatrial (SA) node generates electrical signals	
atrioventricular (AV) node receives electrical signals from SA node	
ventricle walls start to contract	
ventricle walls relax	

Table 5.1

Event	**Letter**
atrioventricular valves close	A
semilunar valves close	B
walls of atria contract	C
ventricle walls start to contract	D
electrical signals transmitted down septum	E

Table 5.2

[4]

(b) Fig. 5.1 shows a normal ECG trace. The electrical activity of the heart is measured in millivolts (mV).

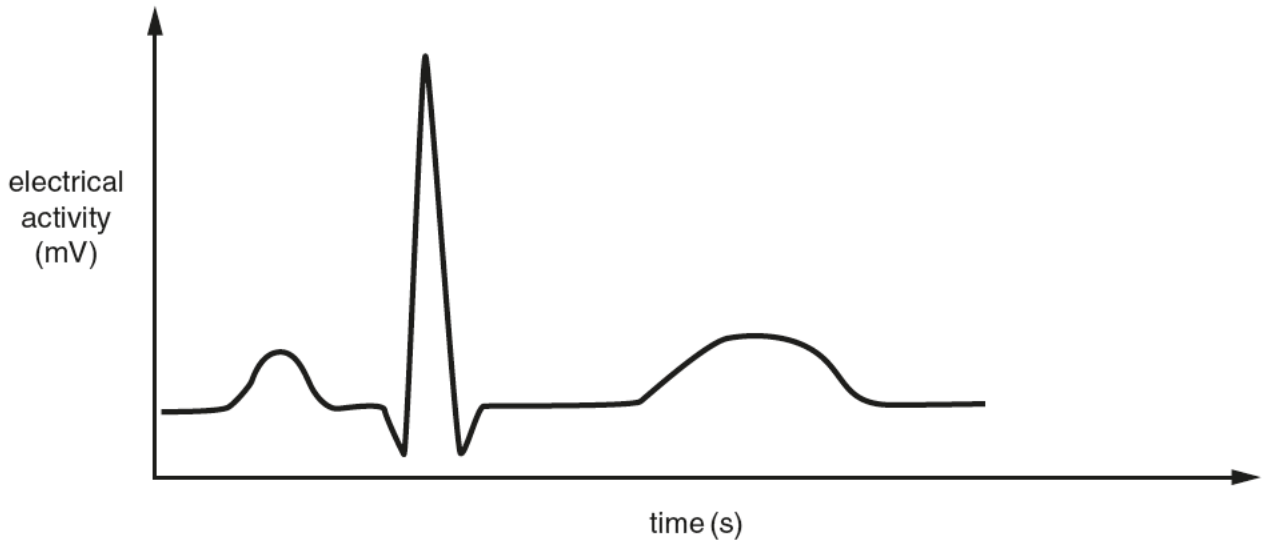
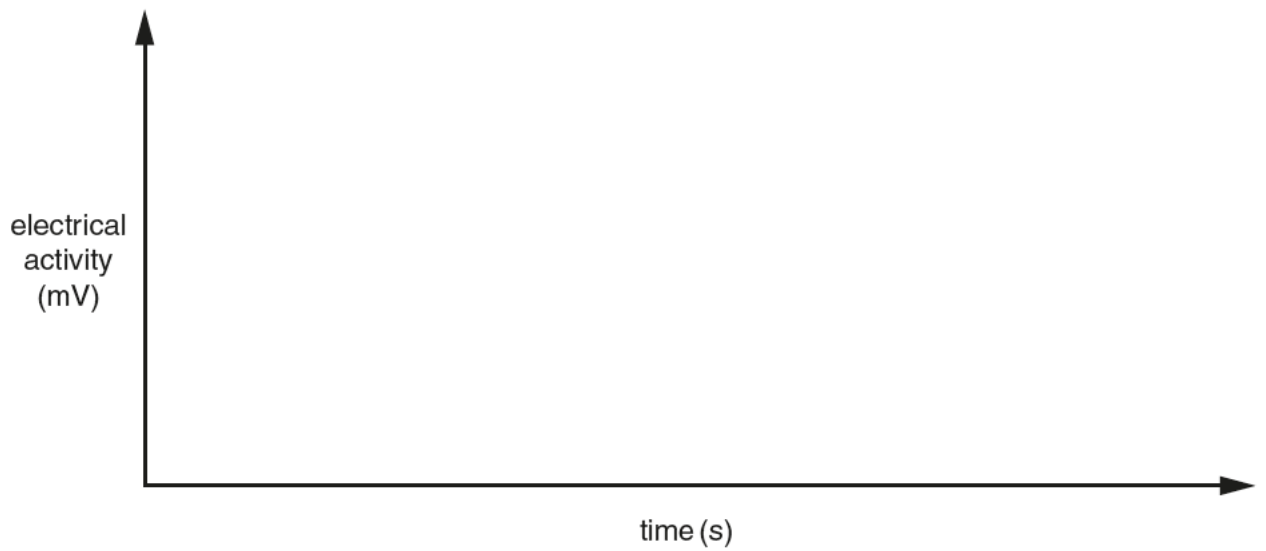


Fig. 5.1

In a condition known as supraventricular tachycardia, electrical signals leak from the atrial walls directly to the top of the ventricles. This causes the ventricle walls to contract twice for every atrial contraction.

(i) Using the axes below, sketch an ECG trace that might be expected in a patient with this condition.



[1]

(ii) Suggest and explain what effect supraventricular tachycardia might have on blood flow from the heart.

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

(c) The blood circulatory system of a mammal undergoes changes at, or soon after, birth.

(i) One of these changes is that the foramen ovale, a hole in the septum between the right and left atria, closes. In the fetus, the foramen ovale allows blood to flow directly from the right atrium to the left atrium.

Suggest why the foramen ovale is open in the fetus before birth.

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

(ii) Another change occurring after birth is that fetal haemoglobin is replaced with adult haemoglobin.

State one difference between fetal haemoglobin and adult haemoglobin **and** give one reason why this difference is essential to the fetus.

difference .....

.....

reason .....

.....

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

[Total: 11]

2 **(a)** Blood contains erythrocytes and neutrophils.

Tissue fluid may contain neutrophils but does not contain erythrocytes.

Tissue fluid is formed from plasma by pressure filtration through the capillary walls.

All materials exchanged between the blood and cells pass through the capillary wall.

Explain why tissue fluid does not contain erythrocytes.

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

(b) Erythrocytes are full of haemoglobin.

Describe the role of haemoglobin in transporting oxygen around the body.

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

(c) Most carbon dioxide is transported as hydrogencarbonate ions in the plasma.

Hydrogencarbonate ions are produced in the erythrocytes and diffuse into the plasma.

(i) Describe how the hydrogencarbonate ions are **produced** in the erythrocytes.



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

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

(ii) High concentrations of carbon dioxide in the blood reduce the amount of oxygen transported by haemoglobin.

Name this effect and explain why it occurs.

name .....

explanation .....

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[3]

[Total: 12]

3 Smoking has a number of negative effects on a person's health.

(a) State what is meant by the term *health.*

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

(b) An investigation was carried out on the causes of death in a large number of heavy smokers.

- The investigators recorded the number of deaths from a range of diseases within the group of smokers.
- This was compared with the expected number of deaths from the same number of people across the population as a whole.

The results are shown in Table 6.1.

Cause of death	Recorded deaths	Expected deaths	Percentage by which deaths are increased in smokers
Coronary heart disease (CHD)	3361	1973	70.3
Lung cancer	397	37	973.0
Other lung diseases e.g. COPD	231	81	

Table 6.1

(i) Calculate the percentage by which deaths from **other lung diseases** was increased in the smoking group. Show your working and **write your answer in the table**.

[2]

(ii) Outline **two** conclusions that could be drawn from the data in Table 6.1 about the effects of smoking on lung cancer or CHD.

1 .....

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2 .....

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[2]

(c) Describe how the components of tobacco smoke can affect the **cardiovascular system** of smokers.



In your answer you should link the chemicals in tobacco smoke to their effects on the cardiovascular system.

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4 Fig. 4.1 shows the oxygen dissociation curves for fetal haemoglobin (**A**) and adult haemoglobin (**B**).

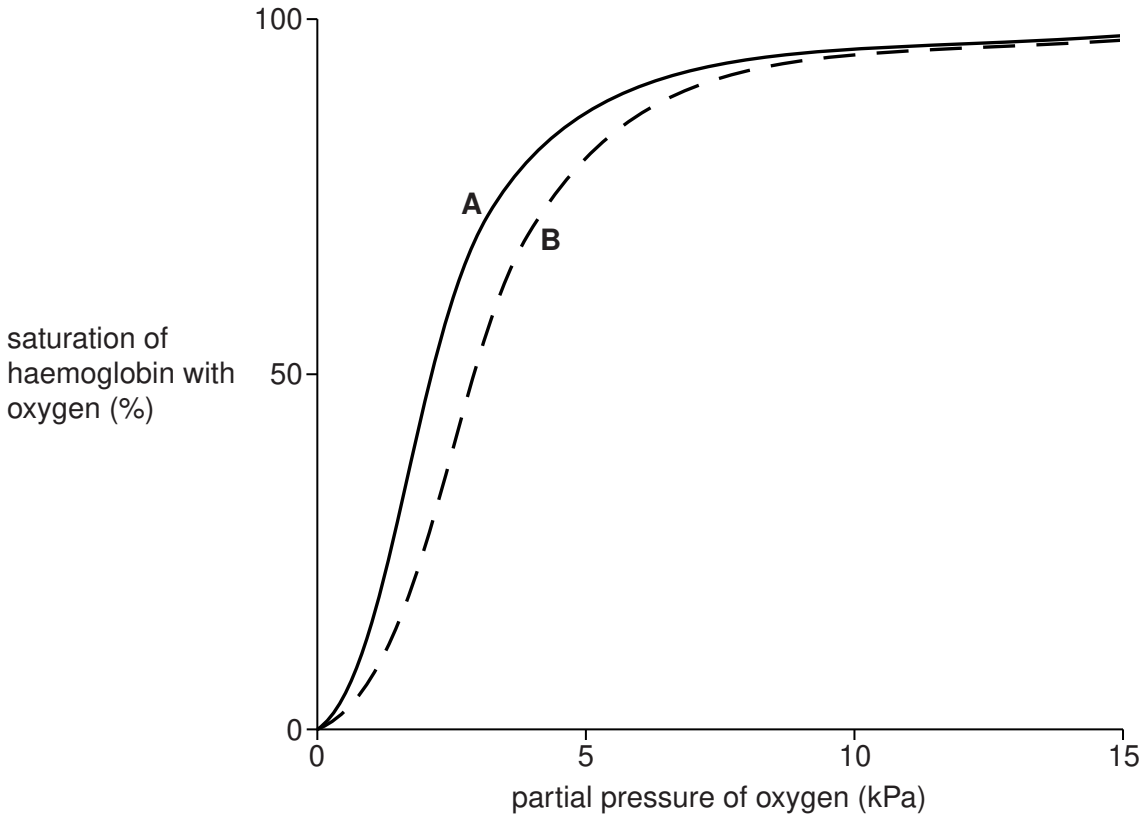


Fig. 4.1

(a) (i) Curve **A** represents fetal haemoglobin.

Explain why the fetal haemoglobin curve is to the left of the adult haemoglobin curve.

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

(ii) Sickle cell anaemia is an inherited disorder in which haemoglobin crystallises when the partial pressure of oxygen (pO_2) is low. The red blood cells change shape and oxygen transport is disrupted.

Treatment with drugs, such as hydroxyurea, can stimulate adults to produce fetal haemoglobin rather than adult haemoglobin.

Suggest why this treatment might be of benefit to adults with sickle cell anaemia.

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

(b) Describe **and** explain how substances that are dissolved in the blood plasma, such as oxygen or glucose, **enter the tissue fluid** from the capillaries.



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

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

[Total: 9]

5 **(a)** The lignin in the xylem vessel walls of plants and the C-rings of cartilage in the mammalian trachea perform an important role.

(i) Explain why lignin is essential in the wall of a xylem vessel.

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

(ii) Explain why cartilage is essential in the trachea.

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

(b) All living organisms exchange substances with their external environment.

The following data apply to an average person:

- the surface area of the body is approximately 1.8 m^2
- the volume of the body is approximately 0.07 m^3
- the surface area of the lungs is approximately 70 m^2.

Comment on the significance of this information for gas exchange.

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

[Total: 9]