Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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The heart and double circulation

Time allowed: 1 hour 25 minutes

Subject code **0610**

Biology

Questions from Paper 3, Paper 4 and Paper 6

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 85

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 9 questions worth 85 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 Fig. 3.1 shows an external view of the heart.

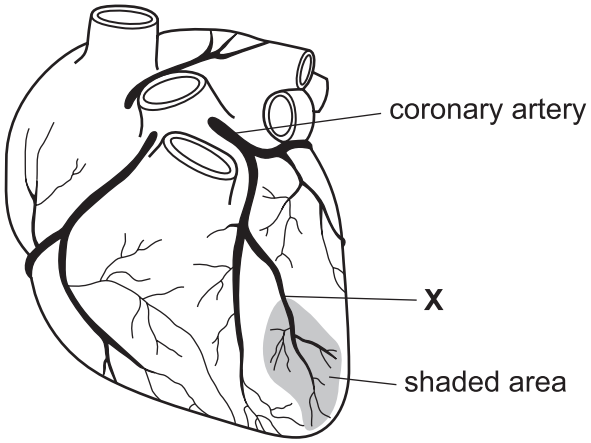


Fig. 3.1

(a) A blood clot is stuck at **X**. Explain what will happen to the heart muscle cells in the shaded area on Fig. 3.1.

.....

.....

.....

.....

.....

..... [3]

(b) List **three** actions people can take to reduce the risk of having a blood clot in the coronary arteries.

1 .....

.....

2 .....

.....

3 .....

..... [3]

[Total: 6]

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1 (a)	1 blood unable to reach muscle (in shaded region); 2 less / no oxygen / glucose reaches muscle; 3 less / no respiration; 4 less / no energy release; 5 (muscle) cells die; 6 causes a heart attack; any three – 1 mark each	[3]	lg – nutrients
(b)	1 exercise (regularly); 2 reduce / stop smoking (tobacco); 3 reduce (animal / saturated) fat / cholesterol in diet; 4 lose weight; 5 reduce salt intake; 6 avoid stressful lifestyles; 7 use of medication qualified; any three – 1 mark each	[3]	A – examples of exercise lg – refs to balanced diet lg – refs to visits to doctor
		[Total: 6]	

2 Plan an investigation to determine the effect of exercise intensity on heart rate in humans.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

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2	**1** *independent variable* different intensities of exercise / different exercises / exercise for different lengths of time ; **2** *dependent variable* after / during, exercise measure, heart rate / pulse rate ; **3 and 4** *detail of method* ;; • description of named exercise of different intensities • ensuring heart rate returns to resting rate • use of a heart rate monitor **5, 6 and 7** *constant variables* ;;; • same speed / distance / time, of exercise • same age of people • same sex of people • same, person / fitness level / mass of person / height of person / BMI • same, place / time of day / temperature / weather **8** at least three trials / two more repeats ; **9** relevant safety precaution ;	**6**	

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3 Fig. 2.1 shows an external view of a human heart seen from the front.

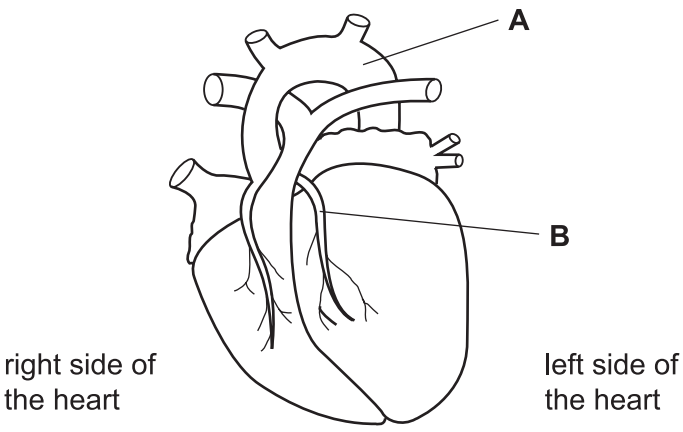


Fig. 2.1

(a) (i) Name blood vessel **A**.

.....

[1]

(ii) Blood vessel **B** supplies blood to the muscle of the heart wall.

Name blood vessel **B**.

.....

[1]

(iii) State what happens if blood vessel **B** becomes blocked.

.....

.....

[1]

(iv) Describe **and** explain how the structure of the left ventricle differs from the structure of the right ventricle.

.....

.....

.....

.....

.....

[2]

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(b) Exercise affects pulse rate.

Describe how you would measure a person's pulse rate.

.....

.....

.....

.....

..... [2]

[Total: 7]

Heart and circulation Click for more variations

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3 **(a) (i)**	aorta;	[1]	
(ii)	coronary artery;	[1]	A – coronary vessel R – coronary vein
(iii)	no oxygen getting to heart muscle; severe pain / heart attack occurs / heart muscle dies;	Max [1]	A – description of heart attack
(iv)	wall / muscle of left ventricle much thicker / stronger than wall / muscle of right ventricle; L.V. has to force blood all round body / must create more force / pressure;	[2]	A – ref LV valve 2 flaps, RV valve 3 flaps – 1 mark A – ORA
(b)	select suitable / named position (of artery); press on artery with fingers; count number of beats per minute / unit time;	Max [2]	R – thumb A – ref to pulse / heart rate meter
		[Total: 7]	

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4 The heart pumps blood around the body.

(a) Explain why the heart is an organ.

.....

.....

..... [1]

(b) Complete the sentences:

The ..... system includes the heart and blood vessels. Deoxygenated blood from the body is transported to the heart in the ..... .

During a heart beat the ventricles contract. The right ventricle pumps deoxygenated blood to the lungs. The right ventricle has a ..... muscular wall than the left ventricle.

Gas exchange in the lungs occurs by ..... . Oxygenated blood travels back to the heart where it enters the ..... of the heart.

The two sides of the heart are separated by the ..... . This structure prevents the mixing of oxygenated and deoxygenated blood. Oxygenated blood is then delivered to the rest of the body. Blood is supplied to the muscle of the heart in the ..... .

[7]

(c) Many people monitor their heart rate by counting their pulse.

State **one** other method of monitoring heart rate.

..... [1]

[Total: 9]

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4(a)	(group of) tissue<u>s</u> working together, to pump blood around the body / AW / performing the (same) function ;	**1**	
4(b)	**1** circulatory ; **2** vena cava ; **3** thinner ; **4** diffusion ; **5** <u>left atrium</u> ; **6** septum ; **7** <u>coronary</u>, artery / arteries ;	**7**	MP1 **A** cardiovascular / circulation MP2 **A** veins MP3 **A** less
4(c)	ECG / electrocardiogram / listening to valves close / AVP ;	**1**	

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5 Fig. 2.1 shows some of the external features of the human heart.

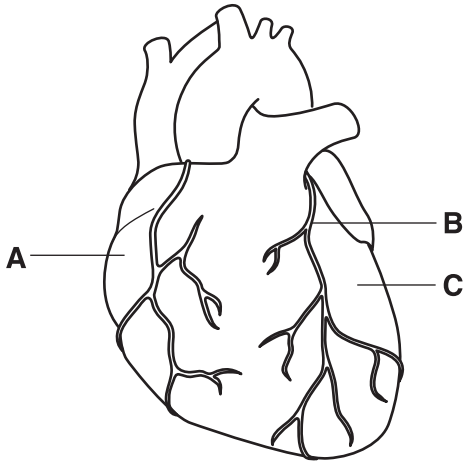


Fig. 2.1

(a) (i) State the function of the heart.

.....[1]

(ii) Name the tissue that makes up most of the heart wall labelled **C** on Fig. 2.1.

.....[1]

(iii) State **two** ways that the activity of the heart can be monitored.

1 .....

2 .....

[2]

(b) (i) Identify blood vessel **B** on Fig. 2.1.

Draw a circle around your answer.

aorta **coronary artery** **pulmonary artery**

pulmonary vein **vena cava**

[1]

(ii) Blockage of this blood vessel can cause serious damage to the heart.

Describe **one** factor that can increase the risk of developing a blockage in this blood vessel.

.....[1]

(iii) Name the type of blood vessel that carries blood

away from the heart .....

towards the heart .....

[1]

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(c) (i) Deoxygenated blood from the body enters the part of the heart labelled **A** on Fig. 2.1.

State the name of part **A** .....[1]

(ii) The inside of the heart contains a number of valves.

State the function of these valves.

.....

.....[1]

(iii) State the name of the structure which separates the two sides of the heart.

.....[1]

[Total: 10]

Heart and circulation Click for more variations

Reduced to 75% to fit the page (wider than A4).

5(a)(i)	to pump blood / AW ;	**1**	
5(a)(ii)	(cardiac) muscle ;	**1**	
5(a)(iii)	ECG ; (counting the) pulse / heart beat ; using a, heart monitor / pulse monitor / blood pressure meter ; listening (to heart valves closing) ;	**2**	
5(b)(i)	a circle drawn around the coronary artery ;	**1**	
5(b)(ii)	*any one from* diet ; stress ; smoking ; genetic factors ; age / gender ; lack of exercise ; high blood cholesterol ; obese ; diabetes ;	**1**	**A** family history
5(b)(iii)	arteries veins ;	**1**	must have both in correct order
5(c)(i)	right atrium ;	**1**	**A** right auricle
5(c)(ii)	ensure one way flow of blood / prevent backflow ;	**1**	
5(c)(iii)	septum ;	**1**	

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6 Fig. 1.1 is a diagram of the human heart. The diagram shows the phase during the heart beat when the atria contract. The blood vessels that carry blood to and from the heart are labelled **A** to **F**.

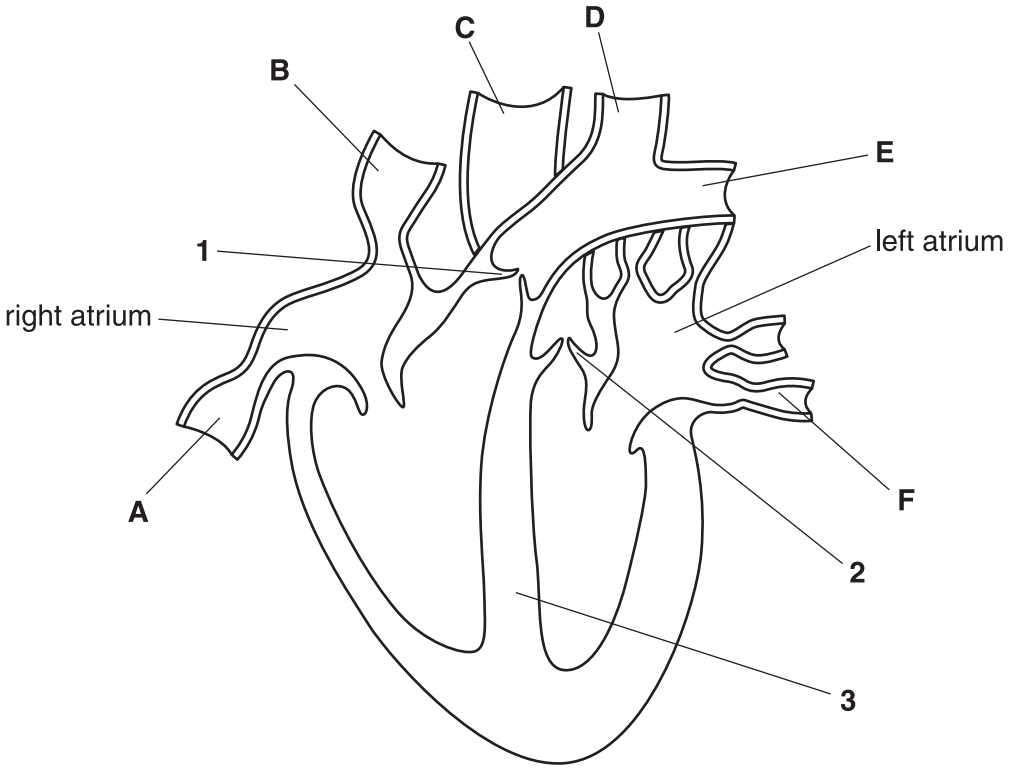


Fig. 1.1

(a) (i) Draw **one** arrow on Fig. 1.1 to show the pathway taken by blood from a vein into the **right ventricle**. [1]

(ii) Identify the letter of the blood vessel that carries blood at the highest pressure and state its name.

letter .....

name of the blood vessel .....
[1]

(b) (i) Suggest what causes the valves at **1** and **2** to close during a heart beat.

.....

.....[1]

(ii) State the function of valves **1** and **2** in the heart.

.....[1]

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(c) Fig. 1.1 shows the phase of the heartbeat when the ventricles are filling with blood.

Using Fig. 1.1, describe **and** explain how the blood travels from the right ventricle to the lungs.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

(d) State the name of the part of the heart labelled **3** and state its role in the mammalian circulation.

name .....

role .....

.....

[2]

[Total: 10]

Heart and circulation Click for more variations

Reduced to 77% to fit the page (wider than A4).

6(a)(i)	arrow / (s) from a vena cava through atria and into right ventricle ;	**1**	
6(a)(ii)	**C**, aorta ;	**1**	
6(b)(i)	ventricles relax ; increased volume of ventricles ; higher blood pressure in, the arteries / **C**, **D** and **E** / aorta and pulmonary artery (than in the ventricles) ; **ora**	**1**	
6(b)(ii)	stop back-flow (of blood) / ensure (blood) flows one way ;	**1**	**I** pressure changes
6(c)	1 (right) ventricle contracts ; 2 blood pressure increases (in heart) ; 3 higher blood pressure in ventricles than in arteries ; 4 semilunar valve / valve **1**, opens ; 5 blood flows into, **D** / **E** / pulmonary artery ; 6 semilunar valve closes (when blood in pulmonary artery) ; 7 **D** / **E**, is a pulmonary artery ; 8 valve **1** is a semilunar valve ;	**4**	sequence of events must be in the correct order
6(d)	1 septum ; *either* 2 separates oxygenated and deoxygenated blood ; *or* 3 to allow a double circulation ;	**2**	

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7 Fig. 2.1 shows a section through the human heart.

Chamber **A** collects deoxygenated blood from the body.

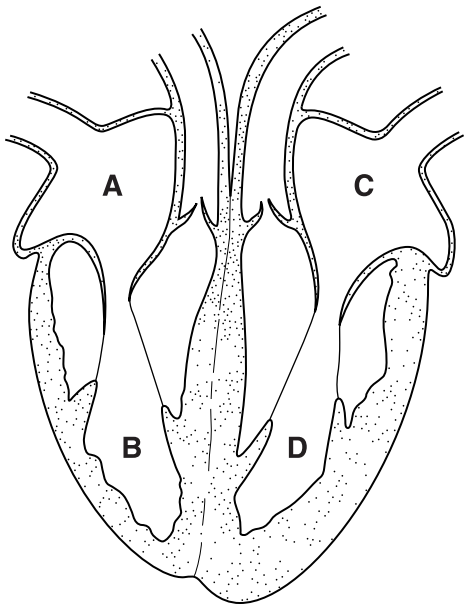


Fig. 2.1

(a) (i) State the name of chamber **B**.

.....[1]

(ii) State which organ the blood goes to after it leaves chamber **B**.

.....[1]

(iii) Blood can contain different concentrations of carbon dioxide and oxygen.

Tick (✓) the boxes that describe the blood found in chamber **C**.

high concentration of carbon dioxide	☐
low concentration of carbon dioxide	☐
high concentration of oxygen	☐
low concentration of oxygen	☐

[1]

(iv) Name the tissue that makes up the wall of chamber **D**.

.....[1]

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(b) The heart contains a number of valves.

(i) Draw a line on Fig. 2.1 to identify **one** of the valves.
Label this line with a **V**. [1]

(ii) State the function of the valves in the heart.

.....

.....

.....[1]

(c) **(i)** Suggest **two** ways in which the heartbeat changes when a person exercises.

1 .....

.....

2 .....

.....
[2]

(ii) The coronary artery supplies blood to the heart tissue. People with coronary heart disease (CHD) are unable to do much exercise.

State a cause of CHD and explain why people with this disorder are unable to do much exercise.

cause .....

.....

explanation .....

.....

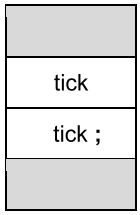
.....

.....
[3]

[Total: 11]

Heart and circulation Click for more variations

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7 **(a) (i)**	right ventricle ;	[1]	**ignore** ventricle alone
(ii)	lung(s) ;	[1]	**ignore** left or right
(iii)		[1]	both ticks correct for 1 mark 0 marks for more than two ticks
(iv)	(cardiac) muscle ;	[1]	
(b) (i)	any valve correctly labelled with a V ;	[1]	
(ii)	ensure one-way flow of blood / prevent blood flowing in the wrong direction / prevent backflow / AW ;	[1]	
(c) (i)	(heartbeat) faster / accelerates / speeds up / AW ; contracts more, forcefully / strongly, / AW ; increased output per beat / increased stroke volume / AW ;	[max 2]	**ignore** contracts better / more efficient **ignore** pumps more blood **A** 'heartbeat increases' for 1 mark if no other marks awarded
(ii)	*cause:* blocked coronary artery / AW ; high fat diet / high cholesterol / high stress levels / smoking / sedentary life style ; *explanation:* heart muscle / tissue, receives insufficient blood / AW ; heart muscle / tissue, receives insufficient oxygen / glucose ; respiration limited ; insufficient / poor, energy released ; heart (muscle) can't contract sufficiently (to support exercise) ;	[max 3] **[Total: 11]**	award max 2 marks for each of cause and explanation

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8 **(a)** Fig. 5.1 is a diagram of a human heart.

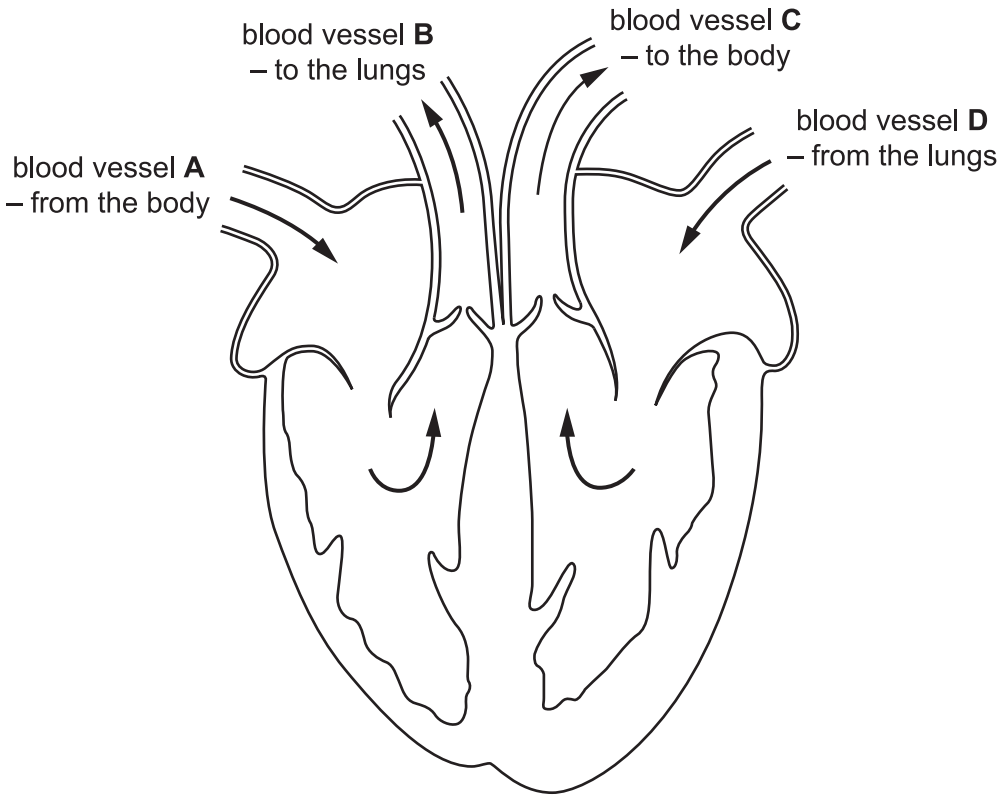


Fig. 5.1

(i) Use label lines and labels to identify these structures on Fig. 5.1:

- **atrium**
- **septum**
- **ventricle**
- **valve**

[4]

(ii) Identify the letter or letters of all the blood vessels from Fig. 5.1, that:

are arteries .....

is the pulmonary vein ..... .

[2]

(b) The activity of the heart can be monitored by measuring the pulse rate.

State **two other** ways of monitoring the activity of the heart.

1 .....

2 .....

[2]

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(c) Coronary heart disease (CHD) is caused by a blockage of blood vessels in the heart.

(i) State the name of the blood vessels that become blocked.

..... [1]

(ii) State **three** risk factors for developing CHD.

1 .....

2 .....

3 .....

[3]

[Total: 12]

Heart and circulation Click for more variations

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8(a)(i)	*correct labelling of :* atrium ; septum ; ventricle ; valve ;	**4**	
8(a)(ii)	**B** and **C** ; **D** ;	**2**	
8(b)	*any two from:* ECG ; listening to the closing of the valves ; AVP ;	**2**	
8(c)(i)	coronary arteries ;	**1**	
8(c)(ii)	*any three from*: diet (or described); obesity ; stress ; smoking ; genetic predisposition ; age ; sex ; AVP ;;	**3**	

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9 Fig. 4.1 shows a section through a human heart and the main blood vessels.

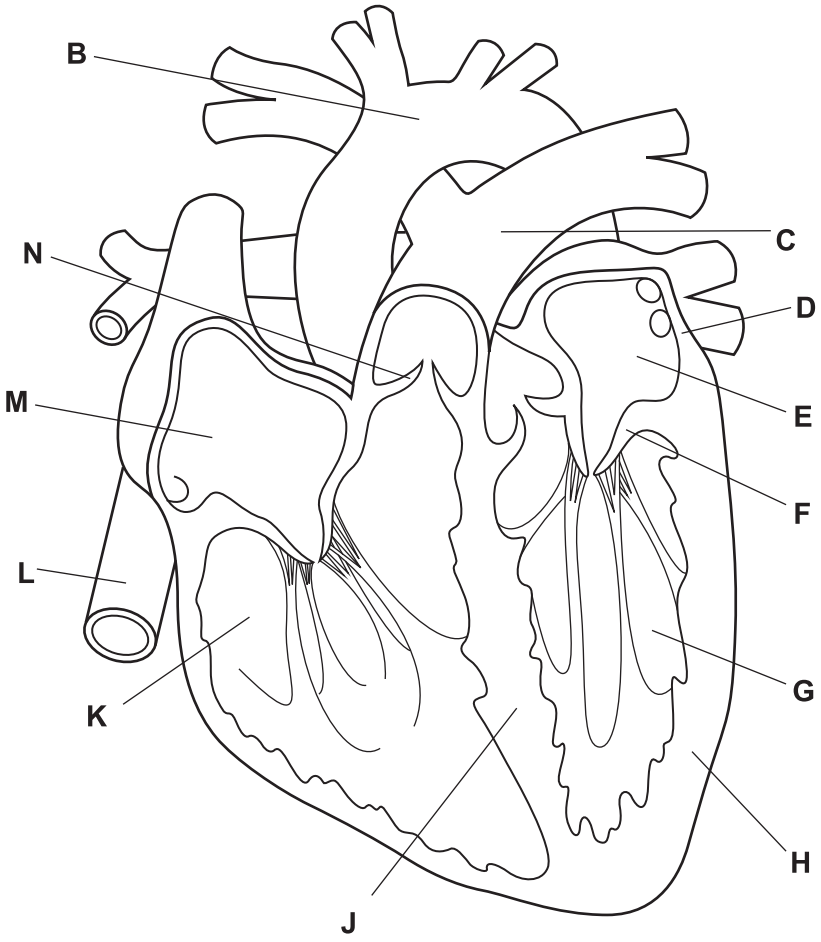


Fig. 4.1

(a) (i) State the letter in Fig. 4.1 that identifies:

the structure that separates oxygenated and deoxygenated blood .....

an atrioventricular valve. .....

[2]

(ii) Explain why the heart wall at **H** is thicker than the heart wall at **D** in Fig. 4.1.

.....

.....

.....

.....

..... [2]

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(iii) Table 4.1 contains eight descriptions of parts of the pathway a red blood cell takes as it moves from the vena cava to the aorta.

Using Fig. 4.1, complete Table 4.1 by numbering the descriptions to show the correct sequence.

Two have been done for you.

Table 4.1

description	sequence
blood enters **C**	
blood enters **E** and then **E** contracts	
blood enters **M** and then **M** contracts	1
blood travels to lungs	
blood moves into **G**	
blood moves into **B**	8
N opens	
blood moves into **K**	

[2]

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(b) Fig. 4.2 shows the effect of exercise on heart rate.

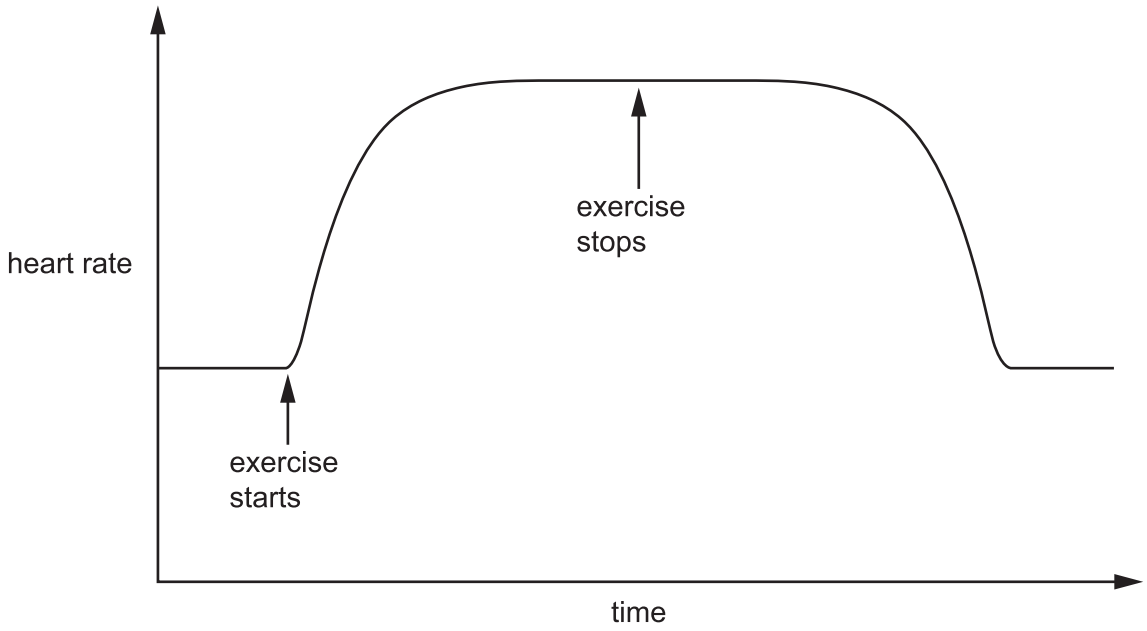


Fig. 4.2

(i) Explain the effect of exercise on heart rate shown in Fig. 4.2.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

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(ii) A lack of exercise can increase the risk of coronary heart disease.

State **three** other factors that can increase the risk of coronary heart disease.

1 .....

2 .....

3 .....

[3]

[Total: 14]

Heart and circulation Click for more variations

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9(a)(i)	**J ;** **F ;**	**2**	**R** each additional letter
9(a)(ii)	*any two from:* **1** (left ventricle / **H**) contains more muscle **; ora** **2** (muscle) contracts / pumps, with more force **; ora** **3** (contraction) creates a high(er) pressure **; ora** **4** blood (leaving the ventricle) is required to move further / out of the heart / to aorta / to the (whole) body / left atrium is only pushing blood to the ventricle **;**	**2**	
9(a)(iii)	<table><tr><th>description</th><th>sequence</th></tr><tr><td>blood enters **C**</td><td>4</td></tr><tr><td>blood enters **E** and then **E** contracts</td><td>6</td></tr><tr><td>blood enters **M** and then **M** contracts</td><td>1</td></tr><tr><td>blood travels to lungs</td><td>5</td></tr><tr><td>blood moves into **G**</td><td>7</td></tr><tr><td>blood moves into **B**</td><td>8</td></tr><tr><td>**N** opens</td><td>3</td></tr><tr><td>blood moves into **K**</td><td>2</td></tr></table> **;;**	**2**	all correct = 2 marks four correct / only 2 wrong = 1 mark

9(b)(i)	*any five from:* **1** (exercise can lead to release of) adrenaline that increases heart rate **;** **2** (exercise results in) increased (rate of) blood (flow) to muscle (cells) **;** **3** needed for (delivery of), oxygen / glucose **OR** removal of carbon dioxide **;** **4** respiration releases energy **;** **5** energy required for (muscle) contraction **;** **6** (exercise can lead to) anaerobic respiration / production of, lactic acid / lactate **;** **7** correct ref. to oxygen debt **;** **8** (heart rate remains high after exercise) to remove, lactic acid / lactate (quickly) from muscles / to liver **OR** to continue supplying oxygen (to repay the oxygen debt) **;** **9** lactic acid / lactate, broken down / (aerobically) respired / converted to glucose / carbon dioxide and water / oxidised, in liver**;** **10 AVP ;**	**5**	e.g. increased, carbon dioxide / acidity, in the blood increases heart rate
9(b)(ii)	*any three from:* **1** diet **OR** a diet high in, salt / saturated fats / cholesterol **;** **2** (uncontrolled) stress **;** **3** smoking (tobacco) **;** **4** genetic (predisposition) **;** **5** (old) age **;** **6** sex **;** **7** and **8 AVP ;;**	**3**	e.g. high blood pressure / excessive alcohol consumption / obesity

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