The Circulatory System

Total marks:19

Q1.

Some blood transfusions contain red blood cells.

Red blood cells are stored in a solution containing 5.0% glucose and 0.9% salt.

Explain why red blood cells cannot be stored in pure water.

(3)

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(Total for question = 3 marks)

Q2.

* Figure 18 shows the structure of the human heart.

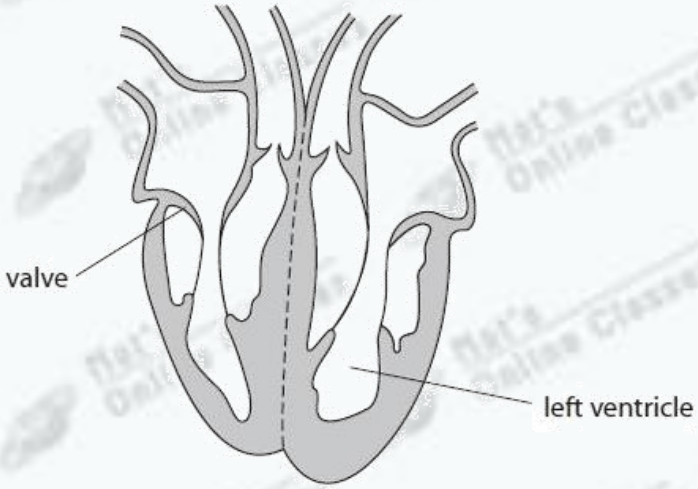

Figure 18

Explain how the structure of the heart is related to its function.

(6)

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(Total for question = 6 marks)

Q3.

Figure 13 shows the heart rate of person A and person B.

Person A does not do any regular exercise.

Person B has been running regularly for one year.

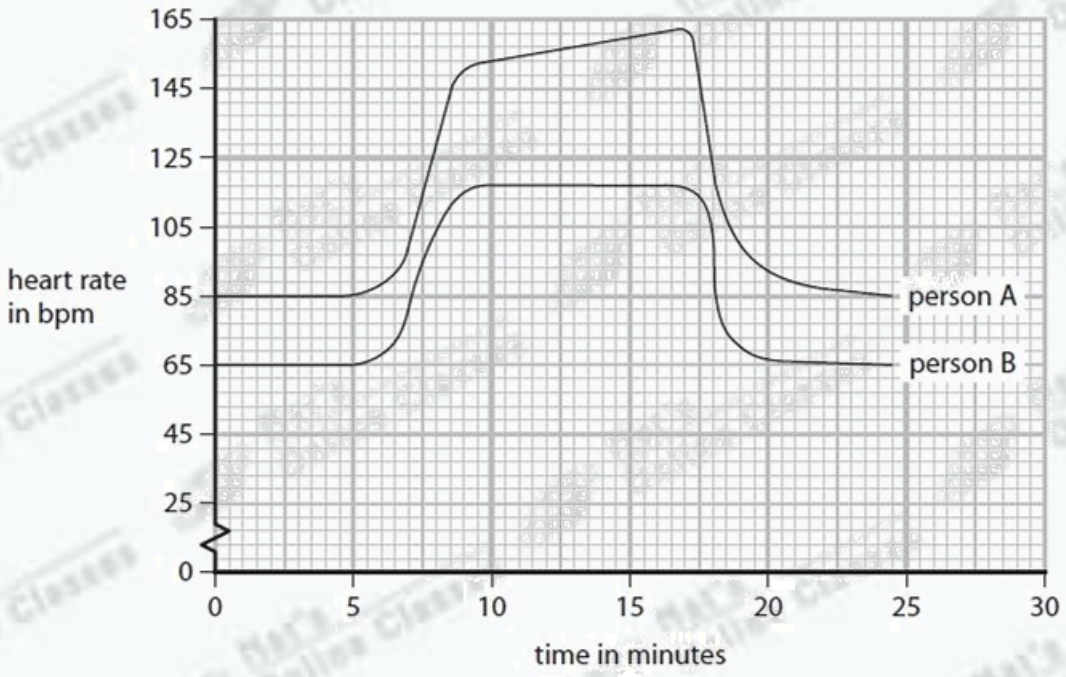

Figure 13

Both people rested for the first 6 minutes, then did the same high intensity exercise for the next 12 minutes, then rested.

Compare the heart rates of person A with the heart rates of person B.

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(Total for question = 4 marks)

Q4.

Figure 10 shows the estimated blood flow through some parts of the body when a person is at rest and during exercise.

part of the body	estimated rate of blood flow in cm^3 per minute	
	at rest	during exercise
brain	750	748
heart muscle	350	1 150
digestive system	2 500	1 200
other muscles	1 200	14 500
all other organs (except lungs)	1 423	1 420

Figure 10

A person has a cardiac output of 4.9 litres per minute. The stroke volume of each heart beat is 70 ml.

Calculate the heart rate.

(2)

..... beats per minute

(Total for question = 2 marks)

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 1 shows a diagram of the heart.

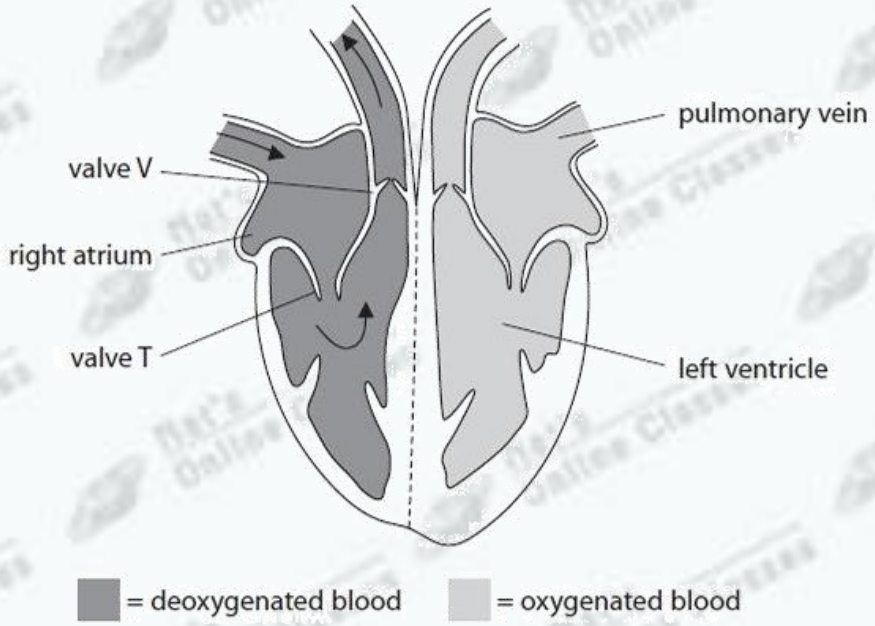


Figure 1

(i) Draw arrows on Figure 1 to show how oxygenated blood moves through the heart.

(1)

(ii) What happens when the right ventricle contracts?

(1)

☒ **A** valve T opens

☒ **B** valve T closes

☒ **C** blood is forced into the left atrium

☒ **D** blood is forced into the pulmonary vein

(iii) Draw **one** straight line from each structure to its function.

(2)

structure	function
pulmonary vein	carries deoxygenated blood
	forces blood towards body organs
	carries blood from the lungs to the heart
left ventricle	takes blood to the right side of the heart
	forces blood towards the lungs

(Total for question = 4 marks)

Mark scheme:

Q1.

Question Number	Answer	Additional guidance	Mark
	An explanation linking **three** from: • water will move into the erythrocyte (1) • by osmosis (1) • down a concentration gradient (1) • causing the erythrocyte to {burst/lyse} (1)	 accept red blood cell for erythrocyte accept from high water concentration to low water concentration	**(3)** **AO2 1**

Q2.

Question Number	Indicative content	Mark
*	**Functions linked to structures** • walls contract / the heart pumps blood • atria push blood down into the ventricles • ventricles pumps blood out of heart • left ventricle / side pumps {blood to the body / oxygenated blood} • right ventricle/ side pumps {blood to the lungs / deoxygenated blood} • left ventricle wall thicker (than right ventricle wall) / produces more pressure to pump blood • right ventricle is thinner / produces less pressure to pump blood • valves prevent backflow /named valves prevent backflow between specific parts of the heart • the muscles can contract faster / harder so that blood is pushed around the body faster • the septum stops (oxygenated blood mixing with deoxygenated blood) • named arteries / veins related to where blood is going to / coming from	**(6)** **AO1 1**

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. • Presents an explanation with some structure and coherence.
Level 2	3-4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and /or developed. • Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	5-6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • Presents an explanation that has a well-developed structure which is clear, coherent and logical.

Level	Mark	Additional Guidance	General additional guidance The level is determined by the functions covered in the response The mark within the level is determined by linking the functions to their related structures
	0	No rewardable material	Possible candidate responses
Level 1	1–2	• An isolated function is identified • the function is linked to a relevant structure	• the heart pumps blood around the body • the heart pumps blood around the body when the muscles contract.
Level 2	3–4	• more than one function is identified • the functions are linked to their relevant structures	• when the heart contracts, blood is forced into the arteries. The blood on the left side does not mix with the blood on the right side. • the left ventricle has thicker walls that push blood out through the aorta to the body under high pressure.
Level 3	5-6	• at least three functions are identified • the functions are linked to their relevant structures	• the atria push the blood into the ventricles. This can only go this way blood can't go back up into the atria. When the ventricles contract the left walls are thicker than the right so put the blood under more pressure. • The two sides are separated by a wall of muscle which stops the oxygenated and the deoxygenated blood mixing. Blood flows back to the heart in veins. This flows into the atria which contract pushing blood into the ventricles.

Q3.

Question number	Answer	Additional guidance	Mark
	An answer comparing the following: • the heart rate of person A is higher than the heart rate of person B (1) • the heart rate of person A increases **more** during exercise than person B (1) • the heart rate of person B is level during exercise whereas the heart rate of person A keeps increasing (1) • person B returns to their resting heart rate faster than person A (1) • comparative data analysis (1)	accept the rate of increase for person A is higher than person B	**(4)** **AO3 1ab**

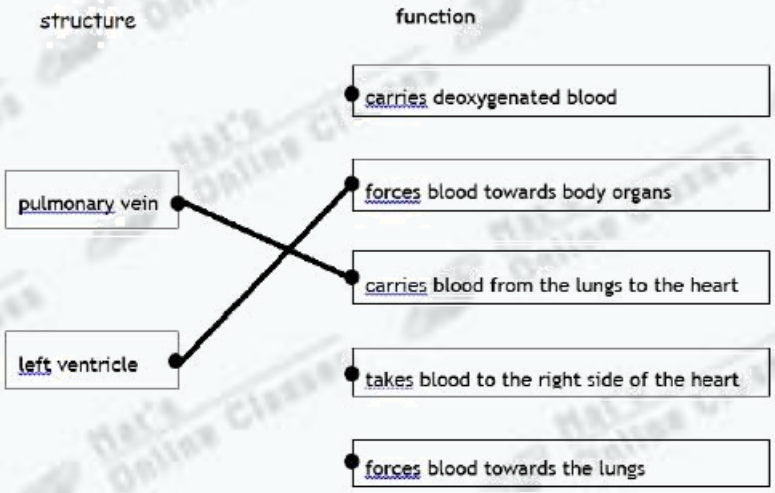
Q4.

Question number	Answer	Additional guidance	Mark
	Substitution 4.9 ÷ 0.07 / 4 900 ÷ 70 (1) Evaluation 70 (beats per minute)	full marks for correct answer no working accept 4.9 ÷ 70 = 0.07 for 1 mark	**(2)** AO 1 2

Q5.

Question number	Answer	Additional guidance	Mark
(i)	All three arrows in correct direction (1) 	accept any number of arrows showing the correct route	**(1)** AO1.1

Question number	Answer	Mark
(ii)	B valve T closes The only correct answer is **B** valve T closes A is incorrect because valve T does not open. C is incorrect because blood is not forced into the left atrium. D is incorrect because blood is not forced into the pulmonary vein.	**(1)** AO2.1

Question number	Answer	Mark
(iii)		**(2)** AO1.1
	Reject if more than one line is drawn from each structure.	