Q1.

Atherosclerosis is more likely to occur in arteries due to the higher blood pressure in these blood vessels.
Explain how the structure of an artery wall is adapted both to withstand and to maintain high blood pressure.

(3)

_____

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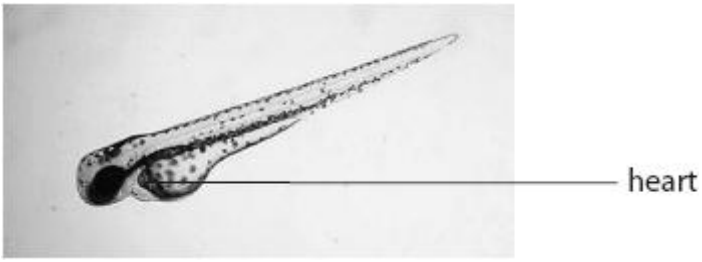
_____

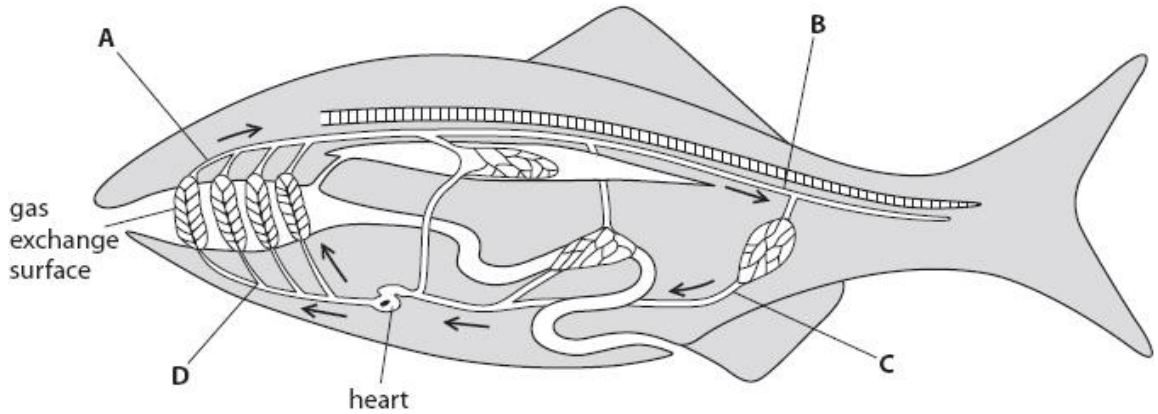
(Total for question = 3 marks)

Q2.

The photograph shows a young zebrafish that can be used to investigate the circulatory system. Zebrafish are vertebrates.



The diagram shows the direction of blood flow in a fish.



(i) Which labelled part of this circulatory system has the lowest concentration of carbon dioxide?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) Which labelled part of this circulatory system has the highest blood pressure?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for question = 2 marks)

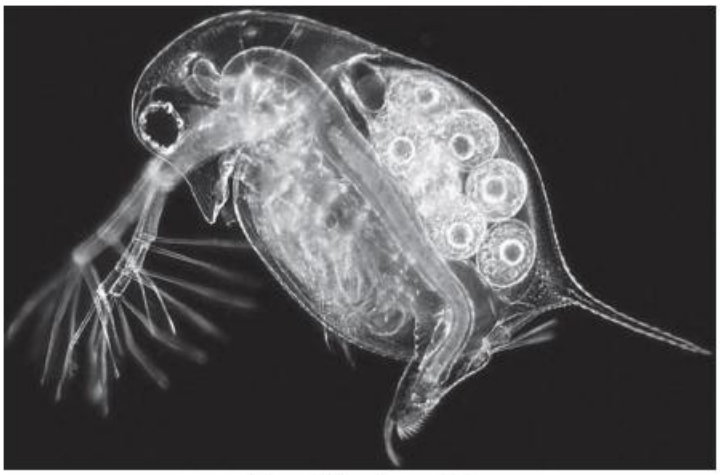
Q3.

Explain how the dipolar nature of water is essential for living organisms.

(2)

Q4.

The photograph below shows *Daphnia* (a water flea). *Daphnia* can be used to investigate the effect of chemicals on heart rate.



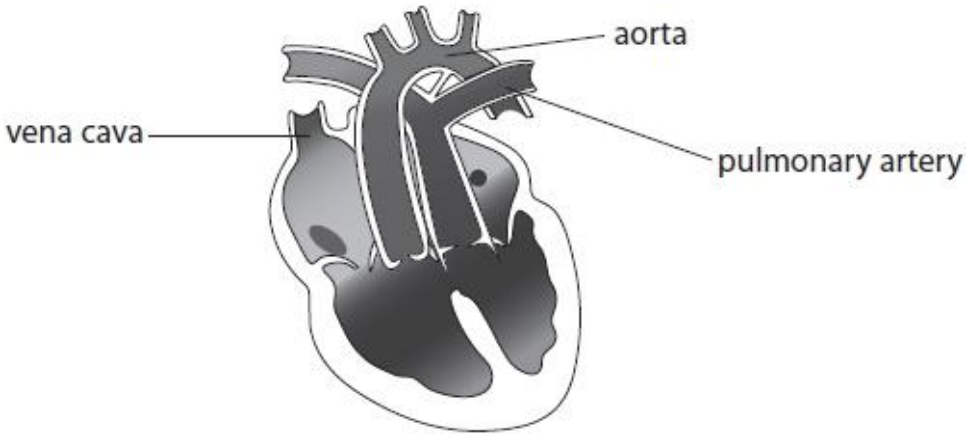
Magnification ×30

Explain why many small animals, such as *Daphnia*, have a heart.

(3)

Q5.

A baby was born with an abnormal heart. The diagram shows the heart of this baby. There is a hole in the septum between the two ventricles.



(i) Identify the problem with the blood vessels of this heart.

(1)

_____

_____

_____

(ii) The baby survived because of the hole in the septum of the heart.
Explain how the hole in the septum allowed this baby to survive.

(3)

_____

_____

_____

_____

_____

_____

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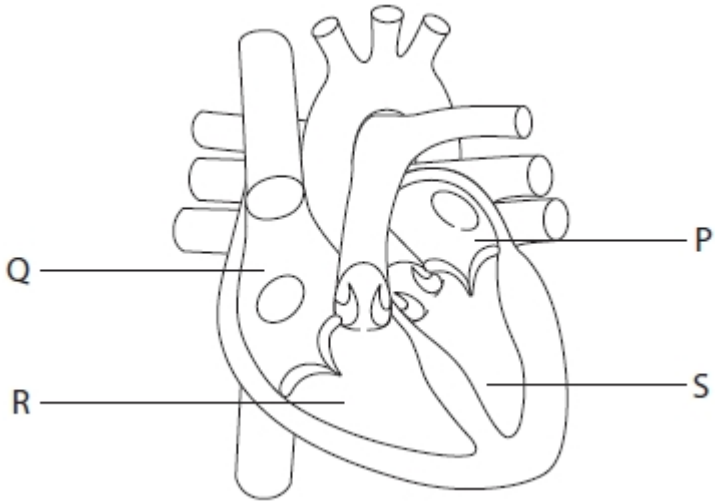
(Total for question = 4 marks)

Q6.

This diagram shows the structure of a normal human heart.



(i) Which chamber of the heart generates the highest blood pressure?

(1)

A P
B Q
C R
D S

(ii) Which stage of the cardiac cycle is shown in the diagram of the heart?

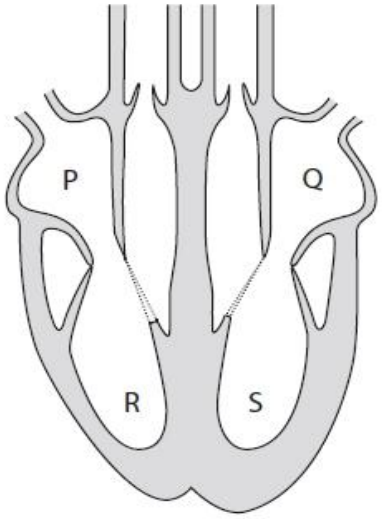
(1)

A atrial diastole
B atrial systole
C ventricular diastole
D ventricular systole

(Total for question = 2 marks)

Q7.

The diagram shows a section of a human heart and blood vessels.



(i) The blood vessel transporting blood with the highest pressure is

(1)

- ☒ **A** aorta
- ☒ **B** pulmonary artery
- ☒ **C** pulmonary vein
- ☒ **D** vena cava

(ii) The order in which blood flows through the chambers of the heart is

(1)

- ☒ **A** P → R → S → Q
- ☒ **B** P → R → Q → S
- ☒ **C** P → S → R → Q
- ☒ **D** P → S → Q → R

(iii) Which structures will fill with blood as a result of atrial systole?

(1)

- ☒ **A** P and R
- ☒ **B** P and Q
- ☒ **C** Q and R
- ☒ **D** R and S

Q8.

As levels of activity increase, the heart can respond to the changing demand for oxygen.

During the cardiac cycle there are pressure changes in the chambers of the heart.

Explain how pressure differences in the heart ensure efficient pumping of the blood into the arteries.

(3)

_____

_____

_____

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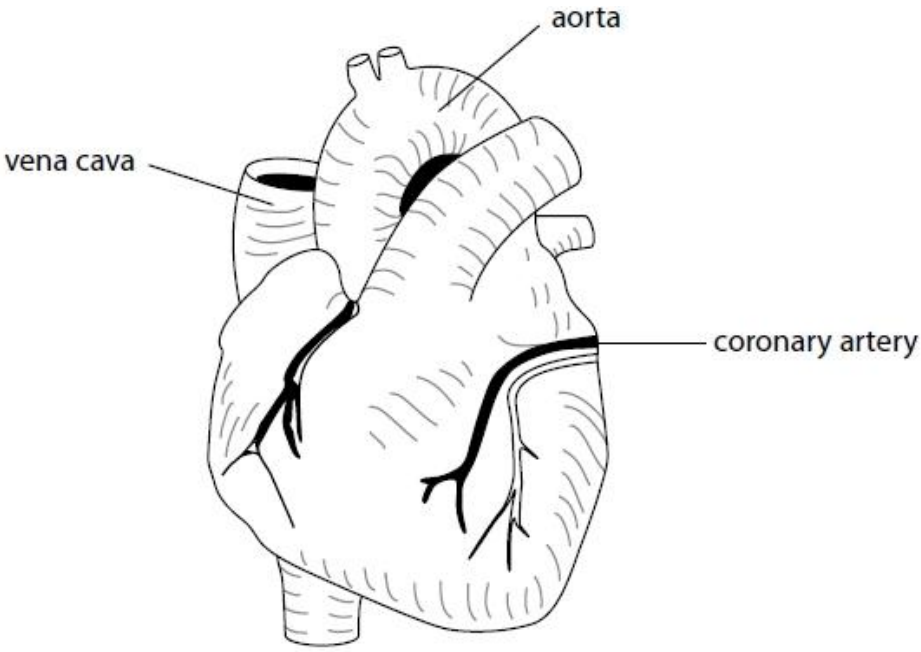
(Total for question = 3 marks)

Q9.

A student studied the external view of a mammalian heart, as shown in the diagram.



The student wanted to compare the size of the aorta and the vena cava of this heart.

She determined the cross-sectional area of the aorta, which was 72.22 mm^2.
She also measured the diameter of the vena cava which was 17.0 mm.

(i) Calculate the difference in the cross-sectional area of the vena cava and the aorta.

(2)

Answer ..... mm^2

(ii) The student also compared the thickness of the aorta wall of this heart with the thickness of the aorta wall in a giraffe. The thickness of the aorta wall in this heart is 3 mm and in a giraffe it is 15 mm.

Give one reason why the aorta wall in a giraffe is much thicker.

(1)

_____

_____

_____

(Total for question = 3 marks)

Q10.

Blood plasma contains glucose dissolved in water. Glucose is a polar molecule that is taken up by muscle cells and used in the synthesis of glycogen.

Explain why water is a good solvent.

(2)

_____

_____

_____

_____

_____

(Total for question = 2 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • (more) collagen provides strength (to withstand pressure) (1) • (contraction of) muscle allows constriction (of lumen / artery) (1) • elastic fibres allow (stretch and) {recoil / lumen to return to original size} (1)	ALLOW narrowing of {lumen / artery}	(3)

Q2.

Question Number	Answer	Mark
(i)	**The only correct answer is A** ***B*** *is not correct because the blood has passed through tissues where gaseous exchange has taken place* ***C*** *is not correct because the blood has passed through tissues where gaseous exchange has taken place* ***D*** *is not correct because this would have the highest concentration*	(1)

Question Number	Answer	Mark
(ii)	**The only correct answer is D** ***A*** *is not correct because the pressure would have decreased as the blood passed through the gas exchange surface* ***B*** *is not correct because the blood pressure decreases with increasing distance from the heart.* ***C*** *is not correct because the blood pressure decreases with increasing distance from the heart.*	(1)

Q3.

Question Number	Answer	Additional Guidance	Mark
	1. idea that water can form {hydrogen bonds / eq} ; and any one from 2. water is a solvent / {ions / polar molecules / eq } can {dissolve / be transported / eq } in water 3. reference to cohesion/adhesion 4. idea of hydrogen bonds holding water together as a liquid, so that it can move in mass flow systems 5. suitable ref. to specific heat capacity 6. idea of distribution of thermal energy around body 7. reference to high latent heat of vaporisation ;	1. **ACCEPT** water is slightly charged, description of charges on O and /or H IGNORE polar/ dipole as stated in Q stem 2. **ACCEPT** named polar molecule IGNORE non polar molecules dissolving 3. **ACCEPT** specific example e.g. surface tension on a pond 5. **ACCEPT** thermal buffer / needs a lot of energy to change the temperature / eq **IGNORE** pH buffer	**(2)**

Q4.

Question Number	Answer	Additional Guidance	Mark
	1. reference to mass flow ; 2. name a suitable substance transported e.g. oxygen ; 3. comment on {blood pressure / fast movement of blood to cells /eq} ; 4. idea of increased concentration gradient of solutes e.g. oxygen ; 5. idea that diffusion alone would be too slow ; 6. has high metabolic rate / eq ;	1. **ACCEPT** mass transport 2. **IGNORE** oxygenated blood 3. **IGNORE** pump alone 4. **ACCEPT** improved gaseous exchange 5. **ACCEPT** surface area to volume ratio too small 6. **IGNORE** activity level	**(3)**

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	The aorta and pulmonary artery are { attached to the wrong ventricles / the wrong way around }	Allow aorta leaves the right ventricle and the pulmonary artery leaves the left ventricle	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • the hole allows oxygenated and deoxygenated blood to mix (between the two ventricles) (1) • oxygenated blood { travels to the body / enters aorta } / deoxygenated blood { travels to the lungs / enters pulmonary artery } (1) • providing some oxygen for respiration (1)	Allow converse	(3)

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	D - S		(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	D - ventricular systole		(1)

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	A (aorta)		**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	B (P → R → Q → S)		**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	D (R and S)		**(1)**

Q8.

Question number	Answer	Additional guidance	Mark
	An explanation that makes reference to three of the following points: • pressure increases in the ventricles (1) • greater pressure (in the ventricles) than in the { atria / arteries } (1) • causing atrioventricular valves to close (1) • causing the semilunar valves to open / forcing blood into the arteries (1)	IGNORE reference to events during atrial systole	(3)

Q9.

Question Number	Acceptable Answer	Additional guidance	Mark
(i)	8.5 x 8.5 = 72.25 72.25 x π= 226.98 (mm^2) (1) 226.98 – 72.22 = 154.76 (mm^2) (1)	Allow rounded values of π (e.g. 3.142) Correct answer gains full marks, no working	**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(ii)	Answer that makes reference to the following: • Need to withstand higher pressure from the left ventricle / need to have more elastic tissue to create pressure to move blood against gravity		**(1)**

Q10.

Question Number	Answer	Additional Guidance	Mark
	An explanation which includes reference to two of the following: • description of water as a {polar / dipole / dipolar} molecule (1) • water surrounds (polar) molecules allowing them to dissolve (1) • hydrogen bonds form (1)	ALLOW correct description of uneven charges	**(2)**