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BIOLOGY

ORGANISMS EXCHANGE SUBSTANCES

Level & Board	AQA (A-LEVEL)
TOPIC:	MASS TRANSPORT IN ANIMALS
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	6
TOTAL MARKS	47

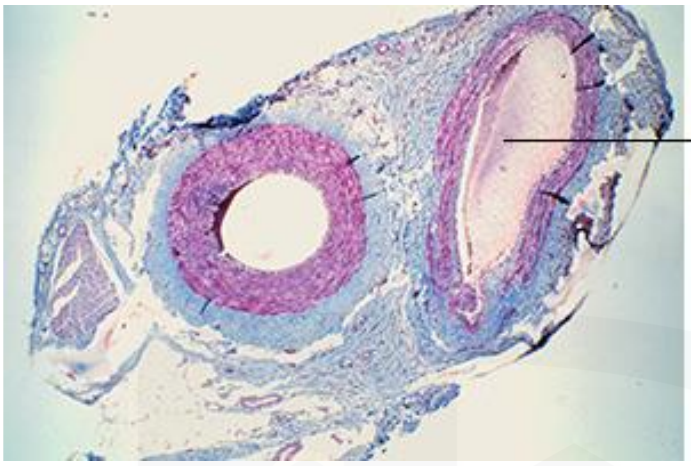
Mass Transport in Animals - 1

1.

(a) Describe the route that a red blood cell takes from a kidney to the lungs in the human circulatory system.

Please refrain from describing the function of heart valves or the variations in heart pressure in your response. **(3)**

A slice through two different types of blood vessels seen under an optical microscope is depicted in the figure below.



(b) Which kind of blood vessel is indicated by the letter M in the above figure?

(2)

(c) Blood at the arteriole end of a capillary bed forms tissue fluid.

Describe the process by which water from tissue fluid is reintroduced into the bloodstream. **(4)**

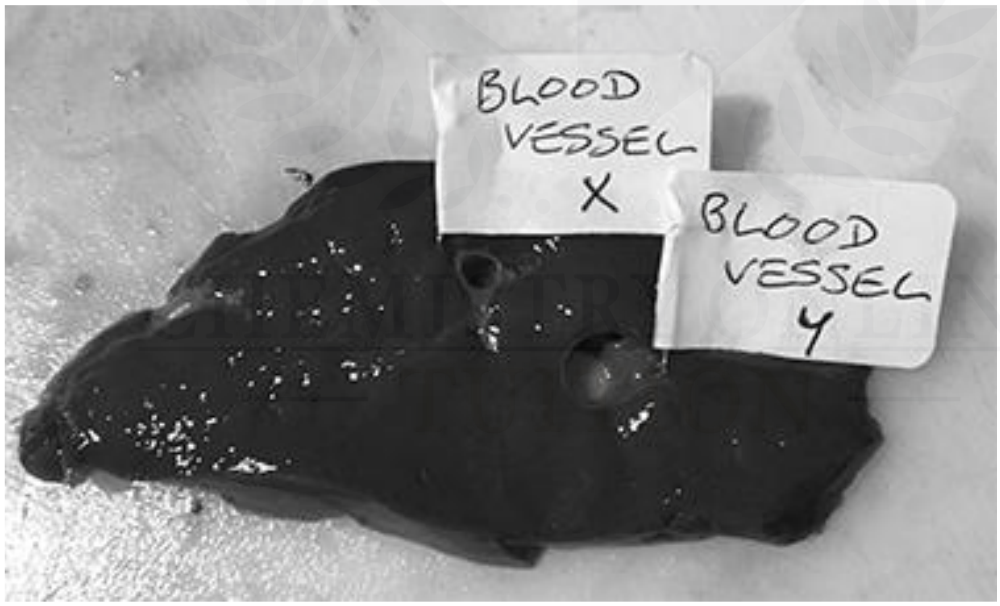
2.

To see blood vessels, a student dissected an organ from a mammal.

After slicing the organ apart, he found two blood veins.

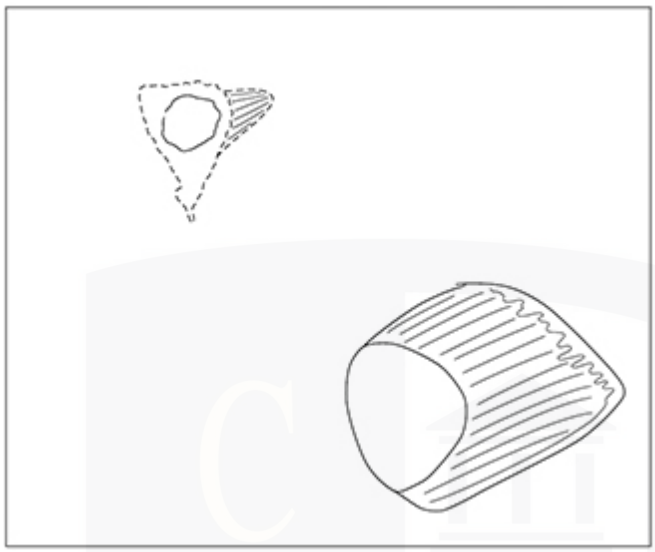
A picture of his dissection can be found in Figure 1.

Figure 1



A sketch of the blood vessels from his dissection is presented in **Figure 2.**

Figure 2



(a) Provide the student with two suggestions on how to make his scientific drawing of the blood arteries in this dissection better. **(2)**

(b) Determine which kind of blood vessel is labeled X and which type is labeled Y in Figure 1.

Explain a characteristic that helped you recognize the blood vessels**. (2)**

(c) Give the student two safety measures to follow when packing up after the dissection. **(2)**

3.

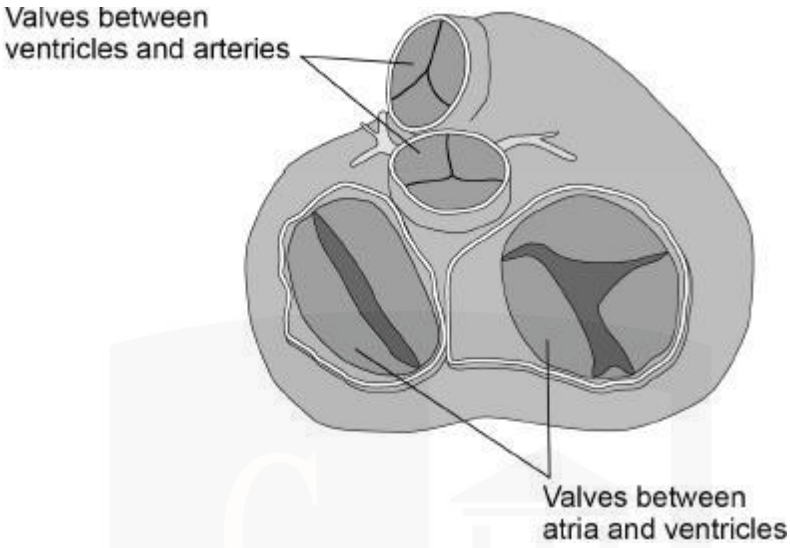
(a) Describe how a capillary blood flow can be decreased by an arteriole.

(2)

I am Sorry !!!!!

Heart valves throughout one phase of a cardiac cycle are depicted in the graphic below.

The open valves allow visibility of the ventricles.



(b) Based on the valves appearance in the figure above, what conclusions can you draw regarding the passage of blood and the activity of the heart muscles between:

1. ventricles and arteries? (2)

2. atria and ventricles? (2)

(c) Next to the blood vessel that is delivering blood at the lowest blood pressure, check (✓) one box. **(1)**

Capillary ☐

Pulmonary vein ☐

Renal vein ☐

Vena cava ☐

(d) Before an athlete engaged in activity, a scientist measured the athlete's heart rate and the volume of blood pumped in a single heartbeat (stroke volume), and then computed the cardiac output.

This equation is used to determine cardiac output.

cardiac output = heart rate × stroke volume

Her results are shown in the table below.

Heart rate / beats minute^{-1}	**Stroke volume / cm^3**	**Cardiac output / cm^3 minute$^-$**
62	80	4960

Following exercise, the athlete's cardiac output was 13 832 cm3 minute $^{-1}$, and their stroke volume increased by 30%.

Determine the athlete post-exercise heart rate.

Provide the response for two important numbers. Display your work. **(2)**

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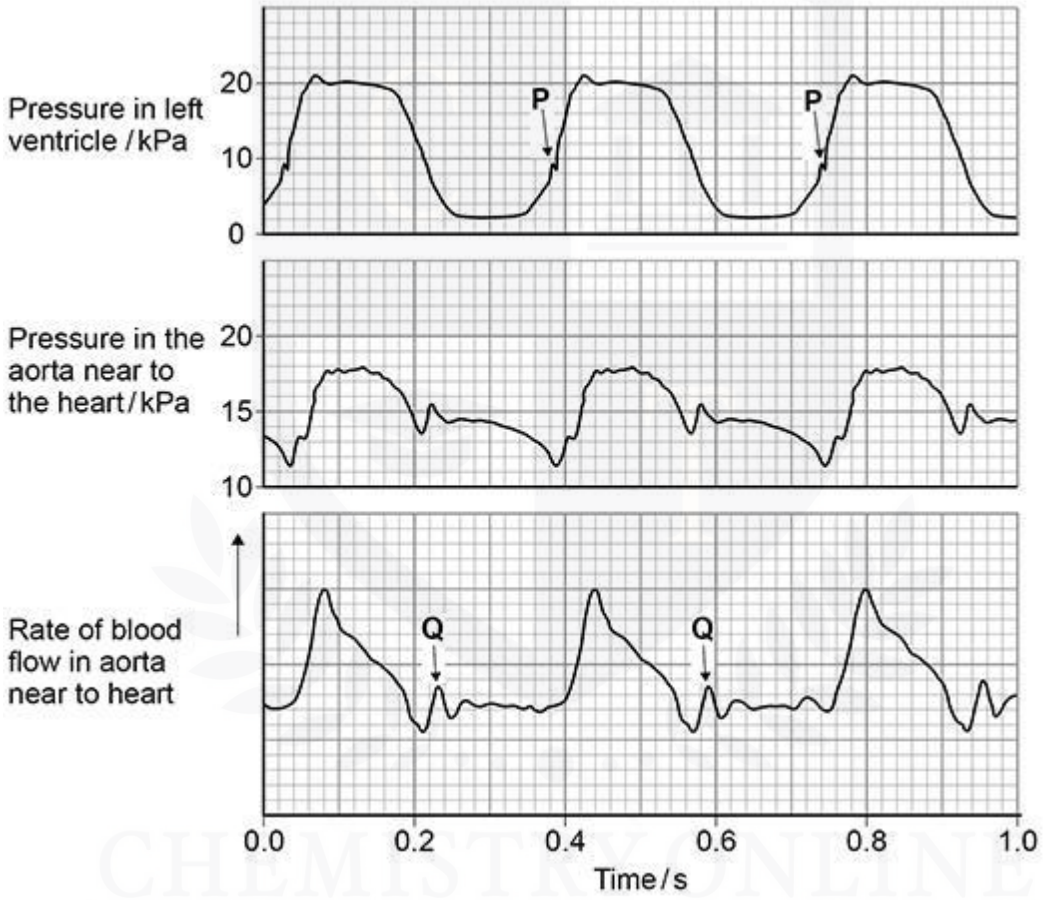
Heart rate _____ beats minute $^{-1}$

4.

The pressure and blood flow during a dog's cardiac cycle are depicted in the diagram below.



(a) The left ventricle pressure is rising at P in the above diagram.

The aorta's blood flow rate has not yet begun to grow at this point.

To explain why, use the diagram above as proof. **(2)**

(b) There is a slight increase in the aorta's blood flow rate and pressure at Q on the above diagram.

Describe the process and significance of this**. (2)**

(c) Plotting the right ventricular pressure on the same grid as the left ventricle pressure in the accompanying diagram was done successfully by a student.

Explain one way the student curve resembles and one way it differs from the curve depicted in the previous diagram. **(2)**

Similarity

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Difference

(d) Use information from the diagram above to calculate the heart rate of this dog. **(1)**

Heart rate _____ beats minute^{-1}

5.

(a) What are the benefits of the Bohr effect when engaging in vigorous exercise? **(2)**

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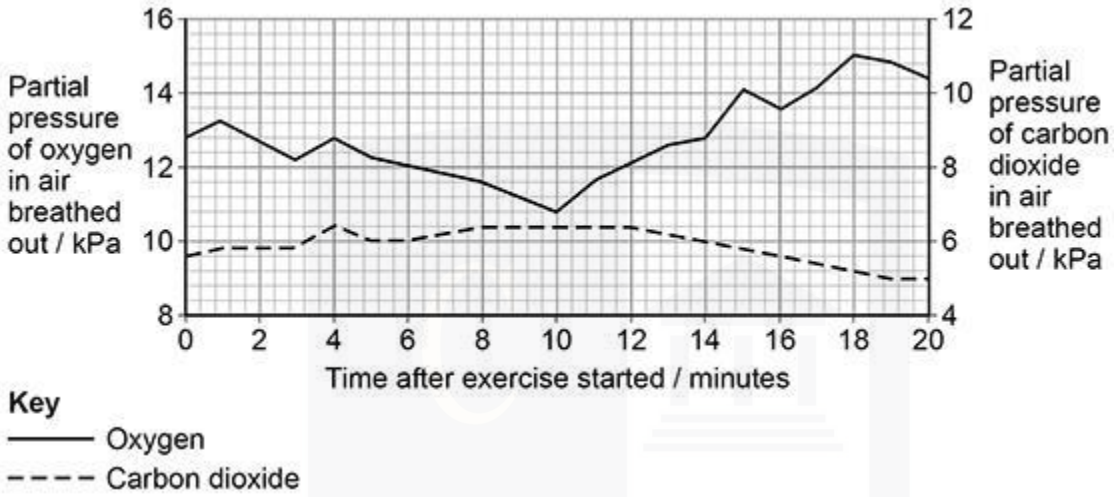
A cyclist used an exercise bike to accomplish a fitness test. Every ten seconds, the exercise's intensity was raised. When he was unable to

complete another cycle, the test was over. Measurements were made of the partial pressures of carbon dioxide (pCO_2) and oxygen (pO_2) in exhaled air.

The cyclist's fitness test results are displayed in the graph below.



The moment at which anaerobic respiration becomes more necessary to sustain muscular contraction because aerobic respiration is no longer sufficient is known as the ventilatory threshold, or VT.

(b) When there is an increase in pO_2 exhaled without a corresponding increase in pCO_2, (b) VT can be recognized as the initial point.

Calculate the amount of time the cyclist reached VT after the exercise began using the graph above.

Determine the current breath-out air pO_2 to pCO_2 ratio. **(2)**

Time when the cyclist reached VT = _____ min

Ratio of pO_2 to pCO_2 at VT = _____ :1

(c) The amount of carbon dioxide produced during exercise increases as exercise intensity does.

The graph above, however, demonstrates that there was not a significant rise in the pCO_2 in the air exhaled throughout the activity.

Name one physiological alteration that might lead to this outcome. Describe how the physiological shift would enable the increased amount of carbon dioxide produced to be eliminated. **(2)**

Another medication that improves performance is EPO. The hematocrit the proportion of red blood cells in blood may rise as a result.

(d) The coronary arteries' failure to supply enough glucose and oxygen to the heart muscle results in a heart attack. The risk of a heart attack can rise with excessive EPO use.

Suggest how? **(2)**

(e) For male humans, the typical hematocrit is 47(±5)%. The maximum permissible hemoglobin percentage for male professional riders is 50%.

Professional male cyclists should be permitted to use EPO until their hemoglobin level is 50%, according to a student's suggestion.

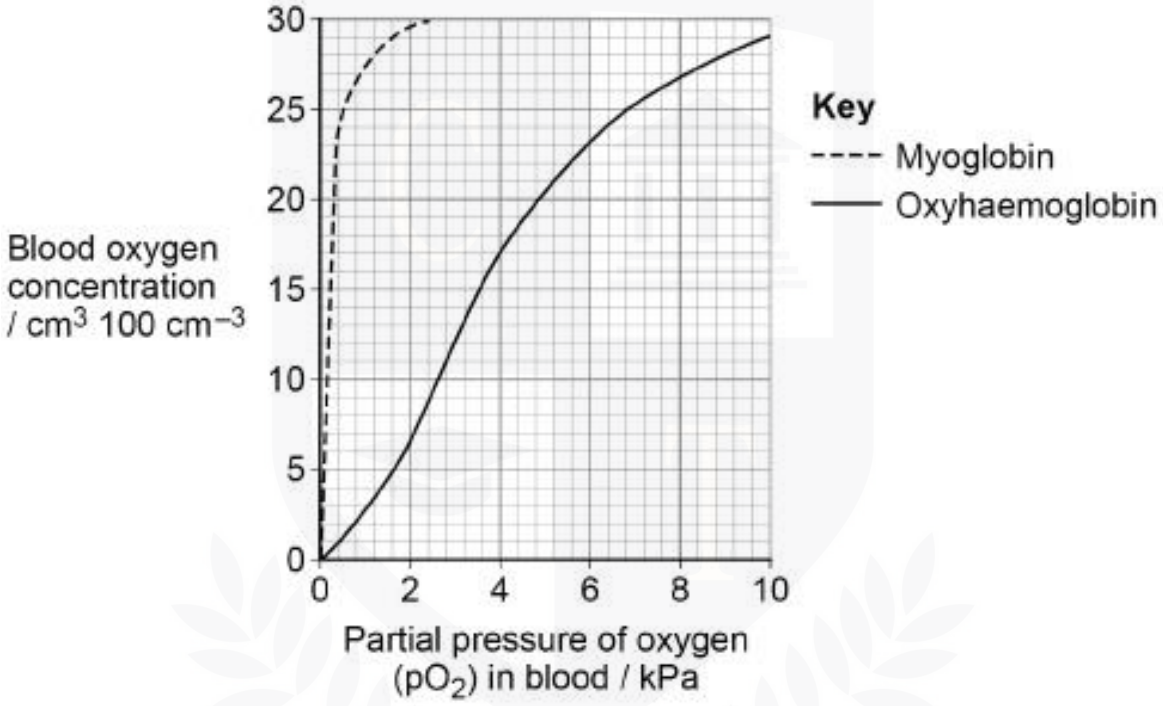
Give two arguments against the validity of this proposition. **(2)**

6.

(a) Describe and elucidate how the dissociation of oxyhemoglobin is impacted by rising carbon dioxide concentrations. **(2)**

Mammals that dive are seals. They inflate their lungs prior to the dive and retain their breath throughout.

The dissociation curves for seal myoglobin and seal oxyhemoglobin are displayed on the graph. Myoglobin is a protein in muscles that carries oxygen.



(b) Explain how the seal's myoglobin dissociation curve indicates that it is suited for diving using the data in the graph. **(2)**

(c) Researchers evaluated how much oxygen seal blood could hold**.**

They discovered that 1.07 × 104 cm^3 of oxygen were present in the hemoglobin of a 190 kg seal.

The seal consumed 5.2 cm^3 of oxygen per minute per kilogram of body weight when it dove.

Determine the most minutes the seal can stay underwater using this information. Assume that throughout the dive, all of the oxygen bonded to the hemoglobin is released. **(2)**

Answer = _____ minutes

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