The circulatory system

Question Paper 4

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in mammals
Sub Topic	The circulatory system
Booklet	Theory
Paper Type	Question Paper 4

Time Allowed : **63 minutes**

Score : **/ 52**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Mammals have closed, double circulatory systems.

(a) Explain what are meant by the terms *closed* and *double* as applied to mammalian circulatory systems.

closed .....

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double .....

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..... [2]

Fig. 5.1 shows a longitudinal section through a mammalian heart.

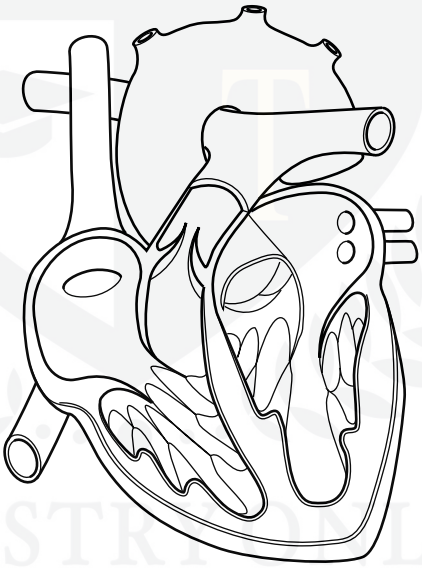

Fig. 5.1

(b) Use label lines and the letters **P**, **Q**, **R** and **S** to label the following on Fig. 5.1:

P the right atrium

Q a semilunar valve

R a blood vessel that carries deoxygenated blood

S the position of Purkyne tissue [4]

Catheters are small tubes that are inserted into blood vessels. A catheter was inserted into an artery in the arm and then moved into the aorta and then into the left ventricle during a diagnostic investigation. The catheter contained a device to measure the blood pressure in the aorta and in the left ventricle. The results are shown in Fig. 5.2.

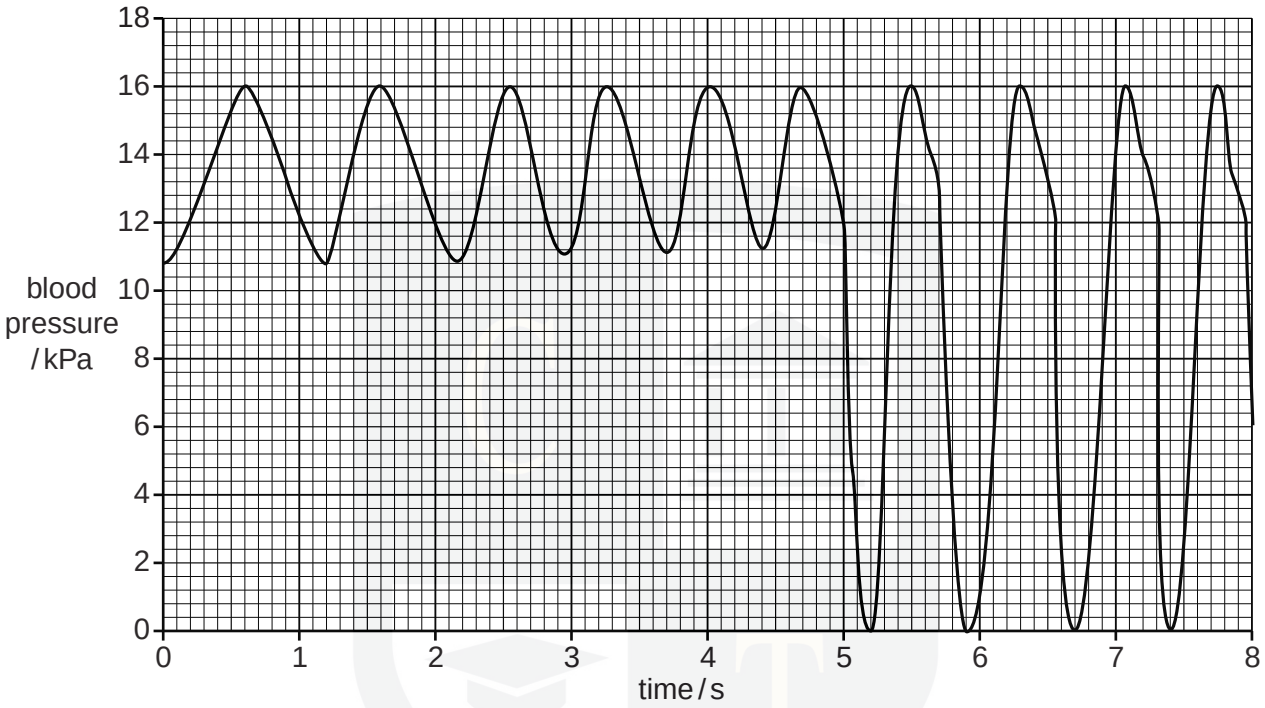

Fig. 5.2

(c) (i) Calculate the heart rate during the period of the investigation.

Show your working.

answer .....[2]

(ii) Describe **and** explain the differences in pressure as the catheter moves from the aorta into the left ventricle.

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.....[4]

Fig. 5.3 is an X-ray showing narrowing in the blood vessels supplying muscles in the heart. A catheter is used to insert a dye into the blood vessels so that they appear clearly in the X-ray. The arrows indicate where there is narrowing of the blood vessels.

Fig. 5.3

(d) **(i)** Name the blood vessels shown in Fig. 5.3.

.....[1]

(ii) State the likely effect of narrowing of these blood vessels.

.....[1]

(e) Suggest ways in which the condition shown in Fig. 5.3 may be treated.

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.....[2]

[Total: 16]

2 Red blood cells are suspended in plasma which has a concentration equivalent to that of 0.9% sodium chloride (NaCl) solution.

A student investigated what happens to red blood cells when placed into sodium chloride solutions of different concentration.

A small drop of blood was added to 10 cm^3 of each sodium chloride solution. Samples were taken from each mixture and observed under the microscope. The number of red blood cells remaining in each sample was calculated as a percentage of the number in the 0.9% solution. The results are shown in Fig. 3.1.

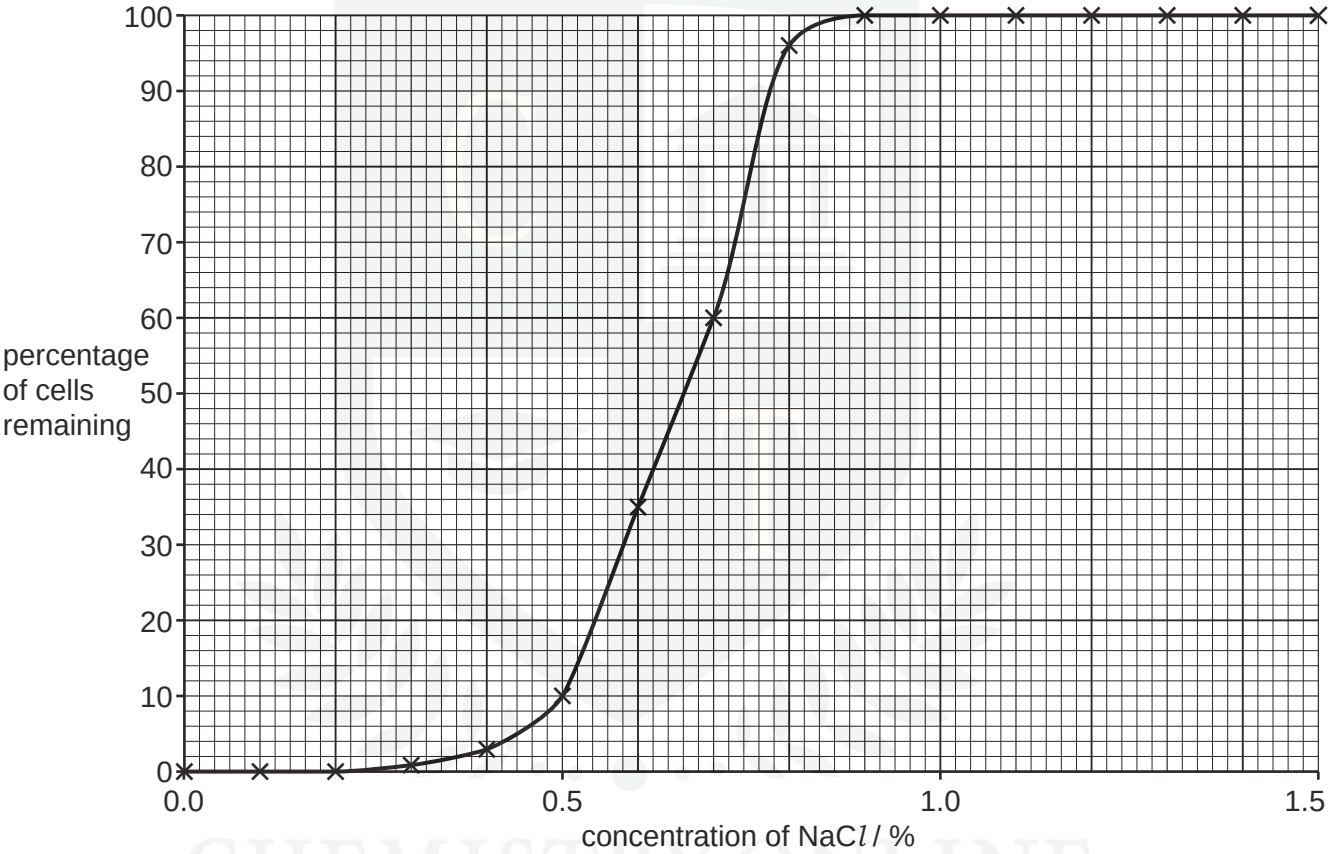

Fig. 3.1

(a) With reference to Fig. 3.1, describe the student's results.

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..... [3]

The student also measured the cell volumes of the red blood cells in three of the sodium chloride solutions. The results are shown in Table 3.1.

Table 3.1

concentration of sodium chloride /%	mean red cell volume /μm^3
0.7	120
0.9	90
1.5	65

Fig. 3.2 shows the appearance of some red blood cells removed from the 1.5% sodium chloride solution.

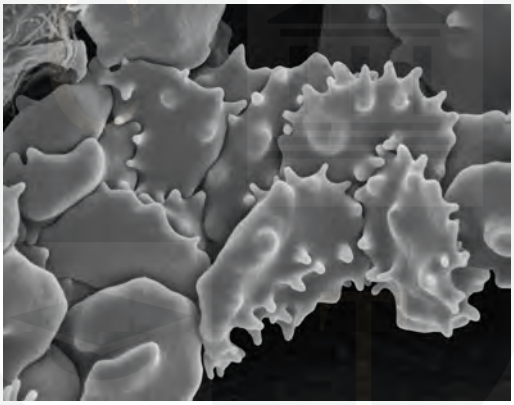

Fig. 3.2

(b) Explain the results shown in Fig. 3.1, Table 3.1 and Fig. 3.2, in terms of **water potential**.

0% NaCl solution .....

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0.7% NaCl solution .....

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1.5% NaCl solution .....

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.....[6]

Red blood cells each contain about 240 million molecules of haemoglobin that transport oxygen and carbon dioxide.

(c) Describe the role of haemoglobin in the **transport** of oxygen and carbon dioxide.

oxygen .....

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carbon dioxide .....

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.....[4]

(d) The haematocrit is the proportion of the blood that is composed of red blood cells. Samples of blood were taken from an athlete who lived at sea level since birth and moved to live and train at an altitude of 5000 m for three weeks. The haematocrit and the number of red blood cells per mm^3 were determined before moving to high altitude and after three weeks at that altitude. The results are shown in Table 3.2.

Table 3.2

altitude	haematocrit	number of red blood cells × 10^6 per mm^3
sea level	0.45	6.1
5000 m (after three weeks)	0.53	7.3

(i) Calculate the percentage increase in the number of red blood cells per mm^3 after three weeks at 5000 m. Show your working.

Answer = ... % [2]

(ii) Explain why the haematocrit increases at altitude.

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.....[3]

[Total: 18]

3 Fig. 3.1 shows the changes in blood lactate concentration with increasing workload in a distance runner and untrained person.

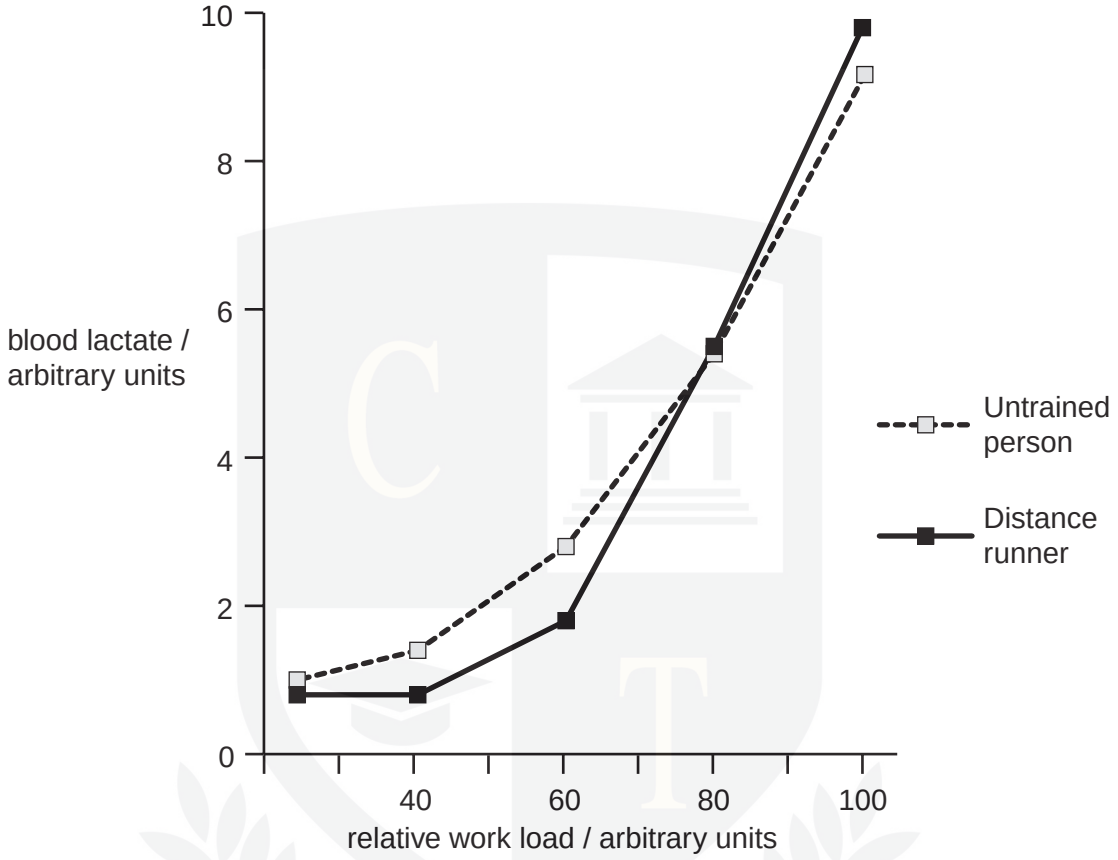

Fig. 3.1

(a) Describe the relationship between blood lactate concentration and relative workload for the distance runner.

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.....[2]

(b) Describe how the lactate that appears in the blood is formed.

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.....[3]

(c) Outline how blood lactate is linked to oxygen debt.

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.....[3]

(d) Suggest why the build up of lactate occurs at a higher workload in the distance runner.

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.....[1]

[Total: 9]

4 Fig. 1.1 is a photomicrograph of a transverse section of an artery and a vein from a mammal.

Fig. 1.1

(a) State three ways, **visible in Fig. 1.1**, in which the artery differs from the vein.

1 .....

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2 .....

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3 .....

.....[3]

(b) The lungs contain arteries, veins and capillaries.

Explain the role of capillaries in the lungs.

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(c) Describe the effect of tar from cigarettes on the lining of the gaseous exchange system.

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.....[3]

[Total: 9]