

The circulatory system

Question Paper 5

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in mammals
Sub Topic	The circulatory system
Booklet	Theory
Paper Type	Question Paper 5

Time Allowed : 60 minutes

Score : / 50

Percentage : /100

Grade Boundaries:

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

- 1 (a) Fig. 4.1 shows two ways in which enzymes interact with their substrates.

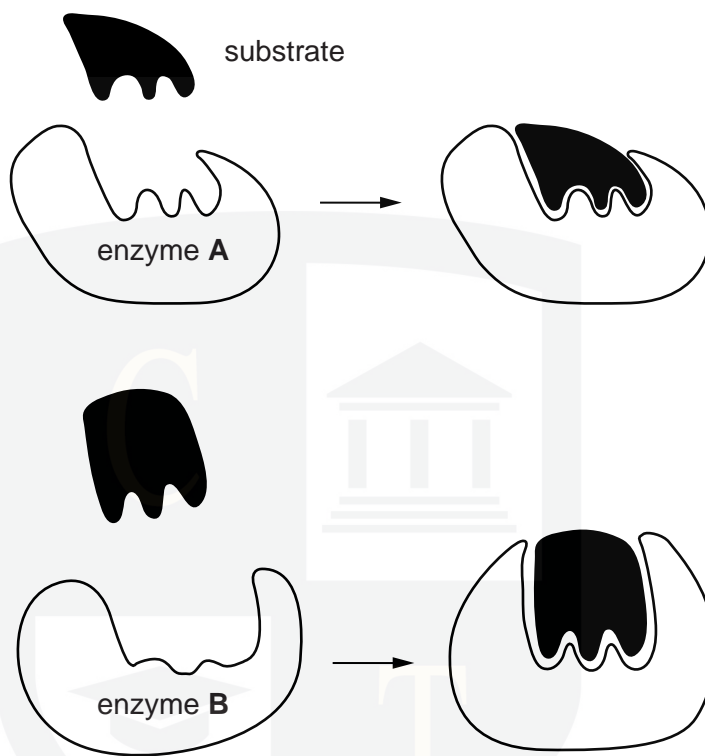


Fig. 4.1

Explain the difference between the two ways in which enzymes interact with their substrates as shown in Fig. 4.1.

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. [3]

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(i) With reference to Fig. 4.2 and the parts labelled **P** and **Q**, explain the term *secondary structure*.



CHEMISTRY ONLINE [3]

- [4]

- 2 Capillaries are known as exchange vessels. Substances are exchanged between blood and tissue fluid as the blood flows through the capillaries.

Fig. 1.1 is an electron micrograph of a section through a capillary with two red blood cells.



Fig. 1.1

- (a) (i) Name the cells labelled **A** and the structure labelled **B**.

A

B [2]

- (ii) Calculate the actual distance **X – Y** on Fig. 1.1.

Show your working and give your answer to the nearest micrometre (μm).

answer μm [2]

(iii) Explain how capillaries are adapted for their function as exchange vessels.

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..... [2]

(b) Table 1.1 shows the composition of blood, tissue fluid and lymph.

Table 1.1

component	blood	tissue fluid	lymph
red blood cells /cells mm ⁻³ × 10 ⁶	5.1	0.0	0.0
white blood cells /cells mm ⁻³	9000	75	1 000 000
glucose/g dm ⁻³	800	800	775
protein/g dm ⁻³	71	1	26

Explain the differences between the composition of blood, tissue fluid and lymph as shown in Table 1.1, for white blood cells, glucose and protein.

white blood cells

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glucose

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protein

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..... [5]

(c) Outline how **red blood cells** are involved in the transport of carbon dioxide.

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..... [3]

[Total: 14]



- 3 Haemoglobin is a globular protein with quaternary structure.

Fig. 5.1 is a diagram of the haemoglobin molecule.

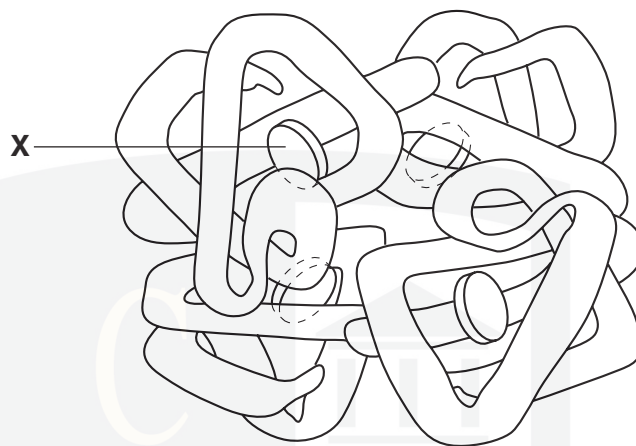


Fig. 5.1

- (a) With reference to Fig. 5.1,

- (i) name **X** and state its function;

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.....[2]

- (ii) explain why haemoglobin is described as a *globular protein* with *quaternary structure*.

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.....
.....[2]

- (b) Explain why people who have a deficiency of iron in their diet are often lacking in energy and feel tired.

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.....[3]

Fig. 5.2 shows the oxygen dissociation curves for myoglobin, **M**, and haemoglobin, **H**.

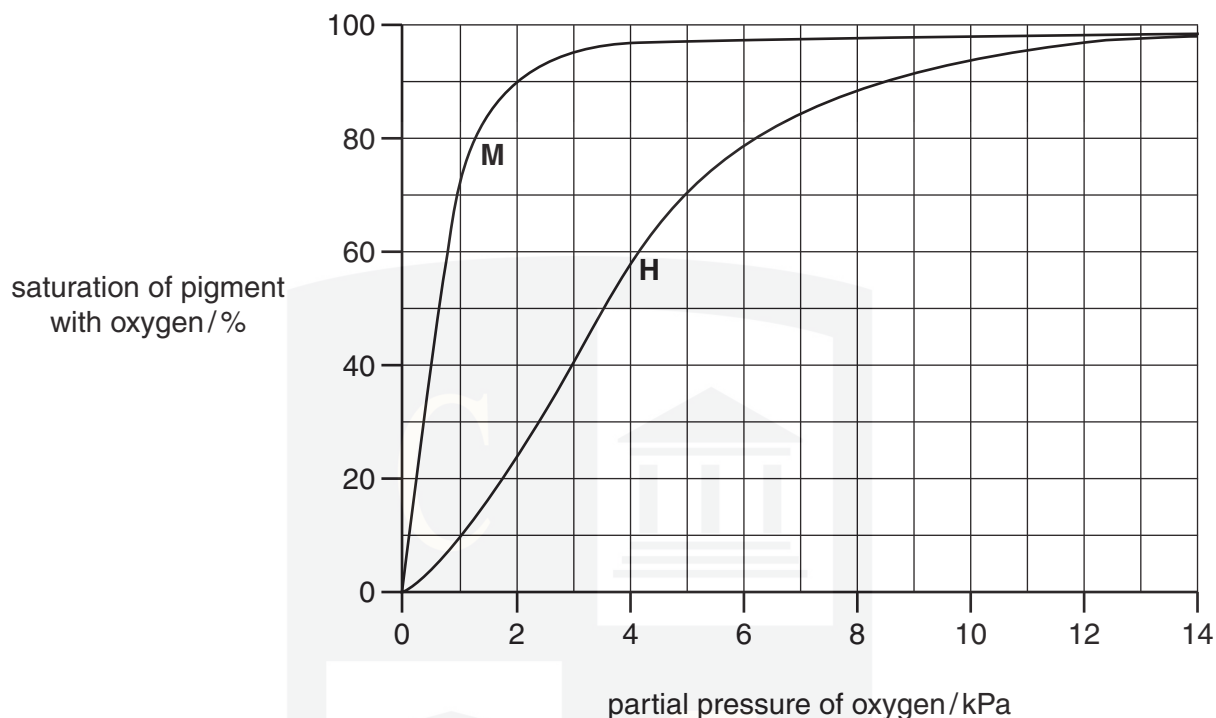


Fig. 5.2

(c) State the tissue where myoglobin is found.

.....[1]

(d) With reference to Fig. 5.2,

(i) state the percentage saturation of myoglobin and haemoglobin when the partial pressure of oxygen is 2 kPa;

myoglobin

haemoglobin[1]

(ii) explain the significance of the difference in percentage saturation that you have shown in (i).

.....

[3]

(e) When a person exercises vigorously, the partial pressure of carbon dioxide in the blood increases.

Draw on Fig. 5.2 a dissociation curve for haemoglobin when the partial pressure of carbon dioxide has increased. [1]

- 4 Fig. 1.1 is a diagram of a transverse section through a vein.

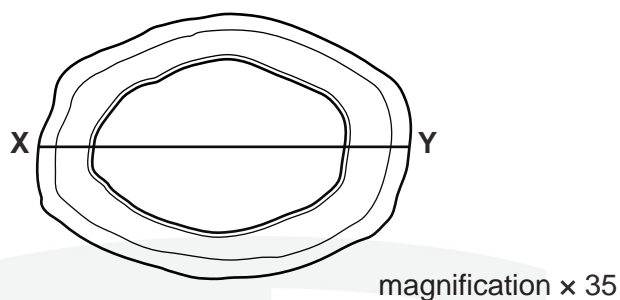


Fig. 1.1

- (a) Calculate the actual diameter of the vein marked by the line X–Y.

Show your working and give your answer in millimetres (mm).

answer mm [2]

- (b) The presence of a valve would help to confirm that the blood vessel in Fig. 1.1 is a vein and not an artery.

Describe three structural features of the blood vessel shown in Fig. 1.1 that would help to identify it as a vein and **not** as an artery.

1.
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2.
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3.
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-[3]

(c) Explain how the following structural features of a capillary are related to its function.

(i) The capillary wall is composed of a single layer of squamous epithelial cells.

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.....[1]

(ii) The diameter of the capillary lumen is approximately $8\mu\text{m}$.

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.....[1]

(d) The inner lining of arteries and veins is composed of a layer of epithelial cells supported by a layer of elastic and connective tissue. The epithelial cells are capable of cell division by mitosis.

(i) State the role of mitosis in cell division of epithelial cells.

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.....[2]

(ii) Explain why the epithelial cells undergo mitosis and **not** meiosis.

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.....[2]

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(e) Fig. 1.2 is a diagram of a cell in late prophase of mitosis.

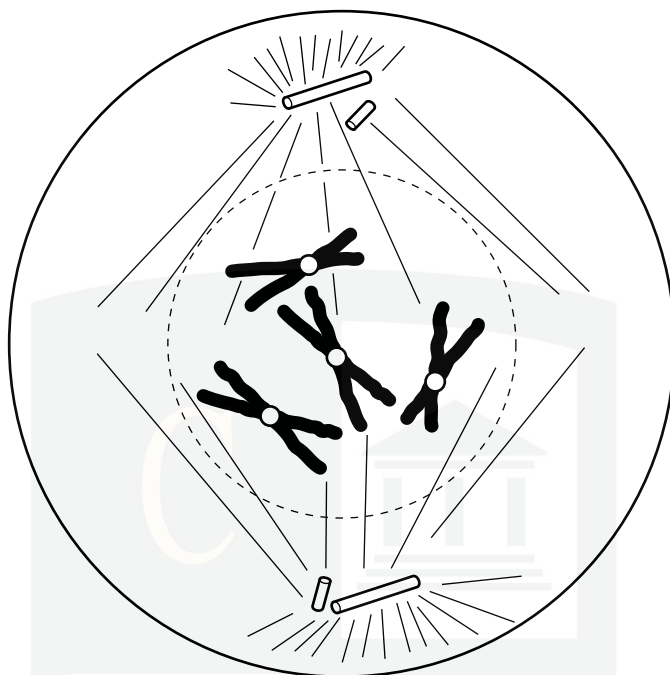


Fig. 1.2

Complete Fig. 1.3 to show the **same cell** in the **anaphase** stage of mitosis.



Fig. 1.3

[2]

[Total: 13]