

Week 11

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

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9. Transport in animals

Starter Quiz · 课前小测

IGCSE Biology

Name: _____ Score: _____

- In a double circulation, blood passes through the heart:
 - ☐ twice per full circuit of the body
 - ☐ once per circuit
 - ☐ three times
 - ☐ never
- The upper chambers of the heart that receive blood are the:
 - ☐ atria
 - ☐ ventricles
 - ☐ valves
 - ☐ arteries
- Arteries carry blood:
 - ☐ away from the heart
 - ☐ back to the heart
 - ☐ only to the lungs
 - ☐ in both directions
- Red blood cells carry oxygen using:
 - ☐ haemoglobin
 - ☐ plasma
 - ☐ platelets
 - ☐ antibodies
- The pulmonary circulation carries blood between the heart and the:
 - ☐ lungs
 - ☐ liver
 - ☐ legs
 - ☐ brain
- Fish have a single circulation, while mammals have a double circulation.
 - ☐ True ☐ False

7. The left ventricle has a thicker muscular wall than the right.

☐ True ☐ False

8. The pulmonary artery carries deoxygenated blood, showing "artery = away from heart", not "artery = oxygen-rich".

☐ True ☐ False

9. Red blood cells have no nucleus, leaving more room for haemoglobin.

☐ True ☐ False

10. The circulation that carries blood to the body (not the lungs) is the _____ circulation.

9. Transport in animals

Answers · 答案

IGCSE Biology

1. twice per full circuit of the body

Double circulation means two passes through the heart.

2. atria

Atria receive; ventricles pump.

3. away from the heart

Arteries carry blood away from the heart.

4. haemoglobin

Haemoglobin binds oxygen.

5. lungs

Pulmonary = to the lungs for oxygen.

6. True

Mammals pump blood twice per circuit.

7. True

It pumps blood to the whole body at high pressure.

8. True

Arteries are defined by direction, not oxygen content.

9. True

No nucleus and a biconcave shape suit oxygen transport.

10. systemic

Systemic = to the body; pulmonary = to the lungs.

9.1 Circulatory systems

Name: _____ Class: _____ Date: _____ **Total: 8 marks**

KEY WORDS circulatory system 循环系统 • heart 心脏 • mammal 哺乳动物 • oxygen 氧气
• blood vessels 血管

Objective

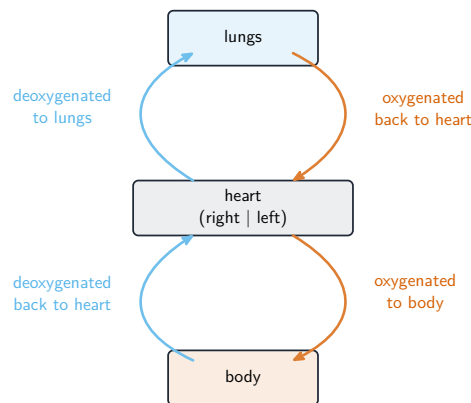
Build the skills to answer exam questions on **circulatory systems** 循环系统 — the parts of the system and **single vs double circulation** 单循环/双循环.

You must be able to:

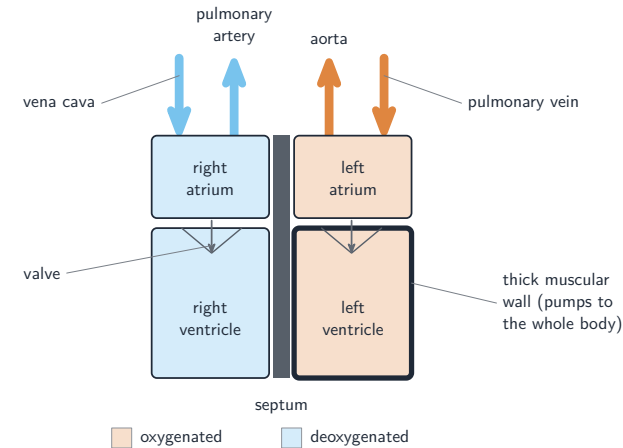
- name the parts of the circulatory system
- compare single and double circulation
- explain the advantage of a double circulation

1 Worked examples

■ Double circulation



Mammals have a double circulation — blood passes through the heart twice each trip



The heart pumps the double circulation

- **system:** a pump (heart), blood vessels, valves (one-way flow).
- **advantage:** blood is re-pumped at high pressure before going to the body → fast oxygen delivery.

2 Practice

2.1 Name the three parts of the circulatory system. [3]

2.2 State how many times blood passes through the heart in a single circulation. [1]

3 Exam-style questions

3.1 In a double circulation, blood passes through the heart: [1]

- **A** once per trip
 - **B** twice per trip
 - **C** never
 - **D** four times per trip
-

3.2 Mammals have a double circulation.

(a) State the advantage of a double circulation. [2]

(b) State the job of the valves in the circulatory system. [1]

Solutions

2.1 a pump (heart); blood vessels; valves.

2.2 once.

3.1 B. In a double circulation blood passes through the heart twice per trip.

3.2 (a) blood can be pumped again at high pressure before going to the body; so it travels faster and delivers oxygen quickly.

(b) they keep the blood flowing one way only.

- 15 Which statement describes a double circulatory system?
- A Blood goes through the lungs twice every time it goes round the body.
 - B Blood goes through the kidneys twice every time it goes round the body.
 - C Blood goes through the heart twice every time it goes round the body.
 - D Blood goes through the brain twice every time it goes round the body.

- 2 (a) Fig. 2.1 is a diagram of part of the human circulatory system.
- The arrows show the direction of blood flow.

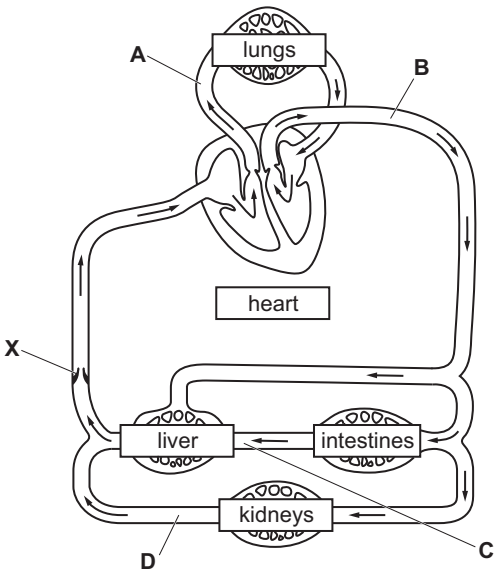


Fig. 2.1

- (i) Complete Table 2.1 by naming the blood vessels in Fig. 2.1 and stating whether the blood in each vessel is oxygenated.

Table 2.1

letter in Fig. 2.1	name of the blood vessel	carries oxygenated blood (yes/no)
A		
B		
C		
D		

[4]

- (ii) State the name of structure X in Fig. 2.1 and outline its function.

name

function

[2]

(b) Fig. 2.2 is a diagram of part of a fish circulatory system.

The arrows show the direction of blood flow.

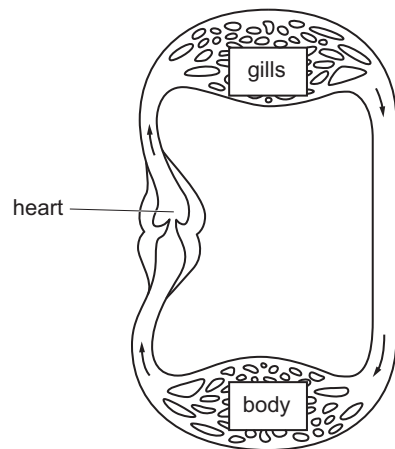


Fig. 2.2

(i) Describe how the structure of the fish heart in Fig. 2.2 differs from a human heart.

.....

.....

.....

.....

..... [2]

(ii) Explain the advantages of the type of circulatory system found in humans, compared with the circulatory system shown in Fig. 2.2.

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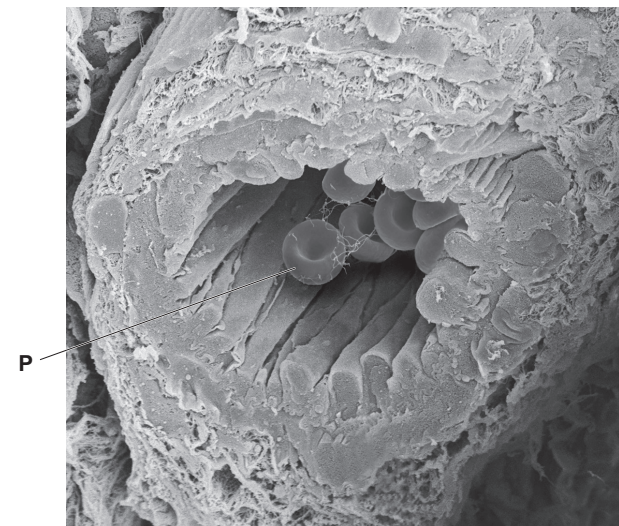
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.....

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..... [4]

(c) Fig. 2.3 is a photomicrograph of an arteriole.



magnification $\times 1430$

Fig. 2.3

(i) Identify the structure labelled **P** in Fig. 2.3.

..... [1]

(ii) The magnification of the image is provided. Write the formula that would be used to calculate the actual diameter of the lumen of the arteriole in Fig. 2.3.

..... [1]

(iii) The actual diameter of the lumen of the arteriole shown in Fig. 2.3 is 0.0315 mm.

Convert 0.0315 mm to micrometres (μm).

..... μm [1]

[Total:15]

15 In a fish, what is the sequence of structures that blood passes through after it leaves the heart?

- A gills → muscles → heart
- B gills → heart → muscles → heart
- C muscles → gills → heart
- D muscles → heart

16 What is an advantage of a double circulatory system?

- A It allows the mixing of oxygenated and deoxygenated blood.
- B It can keep blood pressure high in the lungs.
- C Less carbon dioxide is removed from the body cells.
- D Oxygen is supplied to body cells by blood at high pressure.

9.2 Heart

KEY WORDS heart 心脏 • coronary heart disease 冠心病 • heart rate 心率 • ventricle 心室
• septum 隔膜

Objective

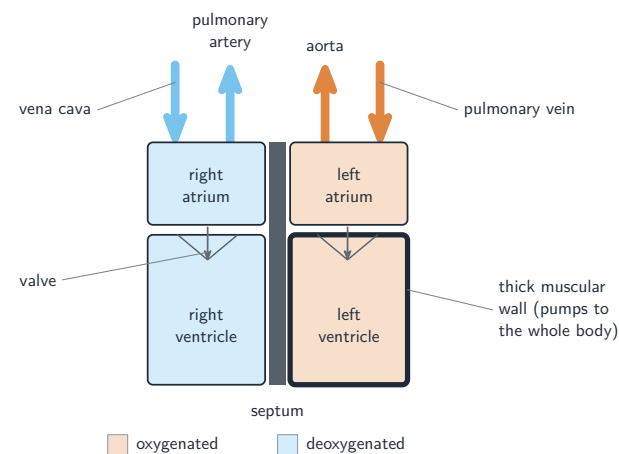
Build the skills to answer exam questions on the **heart** 心脏 — its chambers, why the left ventricle wall is thicker, heart rate, and **coronary heart disease** 冠心病.

You must be able to:

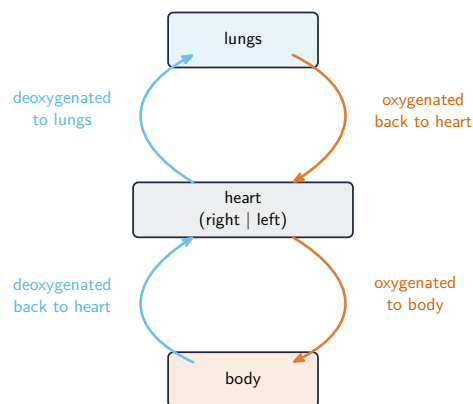
- name the chambers and the role of the septum and valves
- explain why the left ventricle wall is thickest
- give the risk factors for coronary heart disease

1 Worked examples

■ Heart structure



Left ventricle wall is thickest — it pumps blood to the whole body



The heart drives two circuits of blood

- **atria** (upper, thin) push blood to the **ventricles** (lower); the **septum** keeps the two sides apart.
- valves stop blood flowing backwards; coronary arteries feed the heart muscle.

■ The heart, the vessels, and the double circulation

The **double circulation** 双循环: blood passes through the heart **twice** for each complete circuit. The **pulmonary circuit** carries blood to the lungs and back; the **systemic circuit** carries it to the rest of the body and back. The advantage is that blood leaves the heart for the body at **high pressure**, so it travels quickly and reaches every organ.

The **path through the heart**, which the exam asks for in order: vena cava → right atrium → tricuspid valve → right ventricle → pulmonary artery → lungs → pulmonary vein → left atrium → bicuspid valve → left ventricle → aorta → body.

△ The **pulmonary artery** is the **one artery** carrying **deoxygenated blood**, and the **pulmonary vein** the **one vein** carrying **oxygenated blood**. Naming vessels by their oxygen instead of their direction is the standard error: an **artery** carries blood **AWAY** from the heart, a **vein** carries it **TOWARDS** the heart, whatever it contains.

The **left ventricle** has a **much thicker muscular wall** than the right, because it pumps blood all round the body against greater resistance, while the right pumps only to the lungs, which are close by and whose delicate capillaries would burst at high pressure.

Vessel	Wall	Lumen	Valves	Job
artery 动脉	thick, muscular and elastic	narrow	none	carries blood away from the heart at high pressure
vein 静脉	thin	wide	yes	returns blood at low pressure; valves stop backflow
capillary 毛细血管	one cell thick	very narrow	none	exchange with the tissues

Worked example. Explain two ways the structure of a capillary suits exchange. Its wall is one cell thick, so the diffusion distance is short and substances pass quickly. Its very narrow lumen slows the blood and forces red cells to pass in single file, giving more time and a larger surface for exchange.

2 Practice

2.1 Name the upper and lower chambers of the heart. [2]

2.2 State the role of the septum. [1]

2.3 Name the vessel that carries oxygenated blood to the heart. [1]

2.4 Explain why the left ventricle wall is thicker than the right. [2]

2.5 State the function of the valves in a vein. [1]

3 Exam-style questions

3.1 The wall of the left ventricle is thicker than the right because it: [1]

- A pumps blood only to the lungs
- B pumps blood to the whole body
- C holds more blood
- D has no valves

3.2 During exercise the heart rate increases.

(a) Explain why this is needed. [2]

(b) State two risk factors for coronary heart disease. [2]

3.3 The diagram of a mammalian heart shows the four chambers and the main vessels.

(a) Name the blood vessel that carries blood from the heart to the lungs, and state whether the blood in it is oxygenated or deoxygenated. [2]

(b) Give the path of a red blood cell from the vena cava to the aorta, naming every chamber and vessel it passes through. [4]

(c) Explain why mammals are described as having a double circulation, and give one advantage of it. [3]

(d) Complete the table comparing an artery with a vein. [3]

Feature	Artery	Vein
thickness of wall		
width of lumen		
valves present?		

(e) Explain two ways in which a capillary is adapted for exchange with the tissues. [2]

Solutions

2.1 upper: atria; lower: ventricles.

2.2 it keeps oxygenated and deoxygenated blood apart (so they do not mix).

2.3 The pulmonary vein.

2.4 The left ventricle pumps blood all round the body, against greater resistance, so it needs a thicker muscular wall to produce the higher pressure.

2.5 They prevent the backflow of blood, keeping it moving towards the heart.

3.1 B. The left ventricle pumps blood to the whole body, so its wall is thickest.

3.2 (a) the muscles need more oxygen and glucose during exercise; a faster heart rate delivers blood (and these) to them faster.

(b) any two of: high-fat diet; lack of exercise; smoking; stress; genetics/age.

3.3 (a) The pulmonary artery; the blood in it is deoxygenated.

(b) Vena cava → right atrium → right ventricle → pulmonary artery → lungs → pulmonary vein → left atrium → left ventricle → aorta.

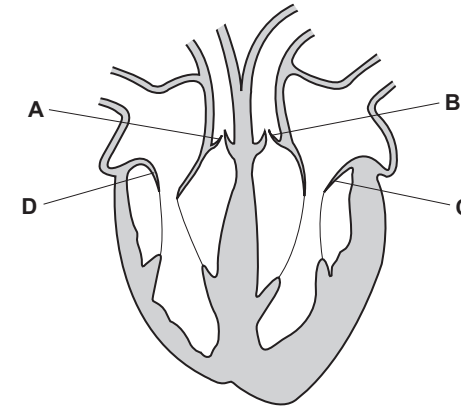
(c) The blood passes through the heart twice for each complete circuit of the body: once to the lungs and once to the rest of the body. The advantage is that blood is returned to the heart and re-pressurised before going to the body, so it travels quickly and reaches every organ.

(d) Wall: artery thick, muscular and elastic; vein thin. Lumen: artery narrow; vein wide. Valves: artery none; vein yes.

(e) The wall is one cell thick, so the diffusion distance is short; the lumen is very narrow, which slows the blood and gives more time for exchange.

16 The diagram shows a section through a human heart.

Which structure is an atrioventricular valve in the right side of the heart?



4 Fig. 4.1 shows a section through a human heart and the main blood vessels.

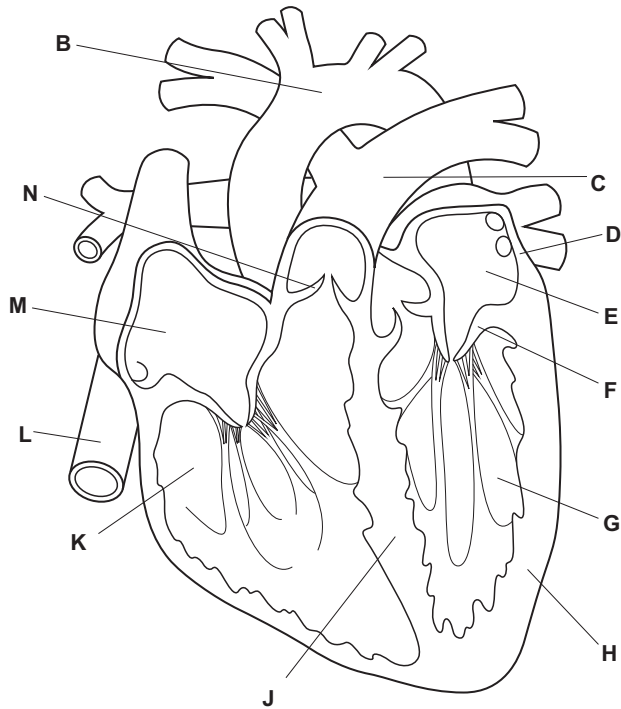


Fig. 4.1

- (a) (i)

State the letter in Fig. 4.1 that identifies:
the structure that separates oxygenated and deoxygenated blood
an atrioventricular valve.

[2]
- (ii)

Explain why the heart wall at H is thicker than the heart wall at D in Fig. 4.1.
.....
.....
.....
.....
.....

[2]

- (iii)
- Table 4.1 contains eight descriptions of parts of the pathway a red blood cell takes as it moves from the vena cava to the aorta.

Using Fig. 4.1, complete Table 4.1 by numbering the descriptions to show the correct sequence.

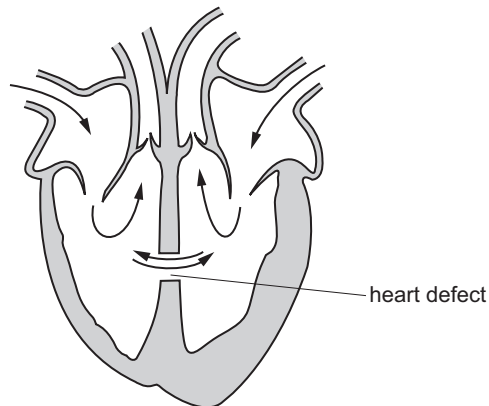
Two have been done for you.

Table 4.1

description	sequence
blood enters C	
blood enters E and then E contracts	
blood enters M and then M contracts	1
blood travels to lungs	
blood moves into G	
blood moves into B	8
N opens	
blood moves into K	

16 The diagram shows a heart defect that some babies are born with.

The arrows indicate direction of blood flow.



Which statement explains why this heart defect might cause the baby to have poor growth?

- A Blood flows to the lungs at high pressure increasing rate of gas exchange.
- B Blood flows to the lungs at low pressure decreasing rate of gas exchange.
- C Mixing of blood results in less oxygen available for respiration.
- D Mixing of blood results in more glucose available for respiration.

9.3 Blood vessels

Name: _____ Class: _____ Date: _____ Total: 6 marks

KEY WORDS blood vessels 血管 • lumen 管腔 • ions 离子 • veins 静脉 • arteries 动脉

Objective

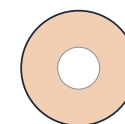
Build the skills to answer exam questions on **blood vessels** 血管 — **arteries** 动脉, **veins** 静脉 and **capillaries** 毛细血管, and how each is adapted.

You must be able to:

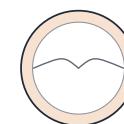
- compare arteries, veins and capillaries (wall, lumen, valves, job)
- explain how each is adapted to its function
- name the main blood vessels

1 Worked examples

■ The three vessels



artery
thick muscular,
elastic wall;
narrow lumen;
high pressure

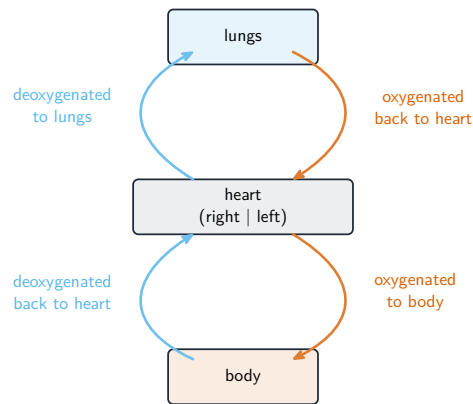


vein
thin wall;
wide lumen;
has **valves**;
low pressure



capillary
wall one cell
thick; lets
substances be
exchanged

Artery: thick wall, away from heart, high pressure. Vein: thin wall, valves, back to heart. Capillary: one cell thick, exchange



Arteries, veins and capillaries in the circulation

2 Practice

2.1 State which vessel carries blood away from the heart. [1]

2.2 State why veins have valves. [1]

3 Exam-style questions

3.1 A capillary is well adapted for exchange because its wall is: [1]

- A thick and muscular
- B one cell thick
- C full of valves
- D very elastic

3.2 Arteries carry blood at high pressure.

(a) Explain how the artery wall is adapted to high pressure. [2]

(b) Name the artery that carries blood from the heart to the body. [1]

Solutions

2.1 an artery.

2.2 to stop the low-pressure blood flowing backwards.

3.1 B. A capillary wall is one cell thick, giving a short distance for exchange.

3.2 (a) it has a thick, muscular and elastic wall; to withstand and cope with the high pressure.

(b) the aorta.

Name:

IGCSE Biology: w25 23

15 What is a feature of veins?

A one-cell-thick wall

B narrow lumen

C thick muscular walls

D valves are present

2 (a) Fig. 2.1 is a diagram of part of the human circulatory system.

The arrows show the direction of blood flow.

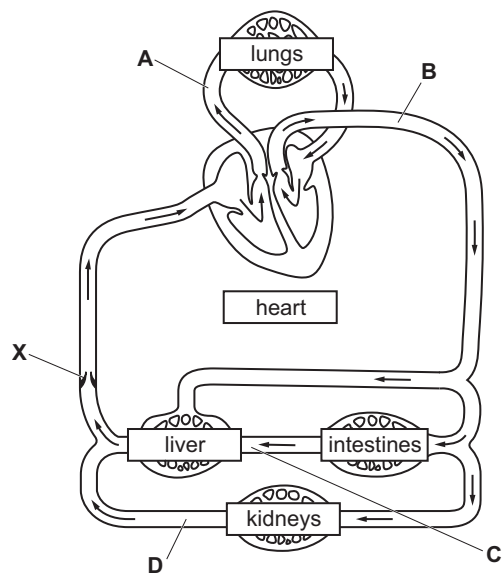


Fig. 2.1

- (i) Complete Table 2.1 by naming the blood vessels in Fig. 2.1 and stating whether the blood in each vessel is oxygenated.

Table 2.1

letter in Fig. 2.1	name of the blood vessel	carries oxygenated blood (yes/no)
A		
B		
C		
D		

[4]

- (ii) State the name of structure X in Fig. 2.1 and outline its function.

name

function

(2)

[2]

(b) Fig. 2.2 is a diagram of part of a fish circulatory system.

The arrows show the direction of blood flow.

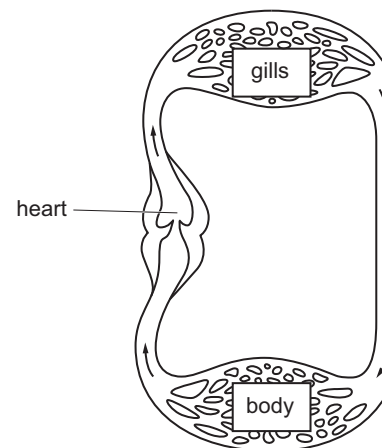


Fig. 2.2

- (i) Describe how the structure of the fish heart in Fig. 2.2 differs from a human heart.

.....

.....

.....

.....

..... [2]

- (ii) Explain the advantages of the type of circulatory system found in humans, compared with the circulatory system shown in Fig. 2.2.

.....

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..... [4]

(3)

(c) Fig. 2.3 is a photomicrograph of an arteriole.

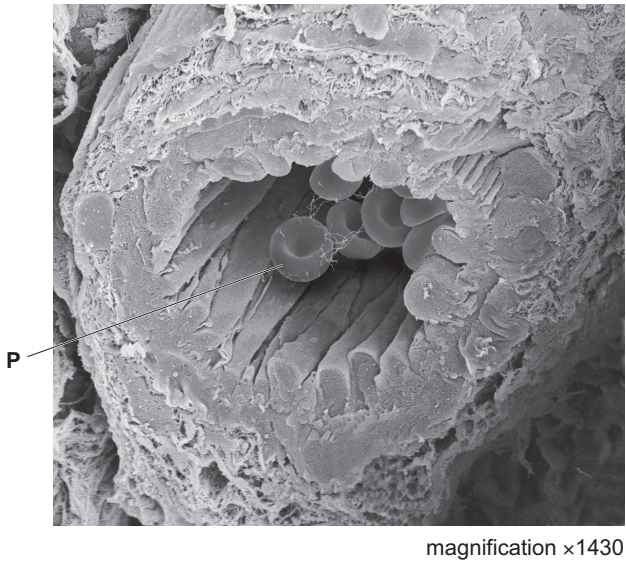


Fig. 2.3

- (i) Identify the structure labelled **P** in Fig. 2.3.
- [1]
- (ii) The magnification of the image is provided. Write the formula that would be used to calculate the actual diameter of the lumen of the arteriole in Fig. 2.3.
- [1]
- (iii) The actual diameter of the lumen of the arteriole shown in Fig. 2.3 is 0.0315 mm.
- Convert 0.0315 mm to micrometres (μm).
- μm [1]
- [Total:15]

18 Which row shows the features of a vein?

	relative thickness of the wall to total vessel diameter	diameter of the lumen	presence or absence of valves
A	thick	large	absent
B	thick	small	present
C	thin	small	absent
D	thin	large	present

9.4 Blood

Name: _____ Class: _____ Date: _____ Total: 29 marks

KEY WORDS blood 血液 • clot 凝血 • red blood cells 红细胞 • antibodies 抗体
• haemoglobin 血红蛋白

Objective

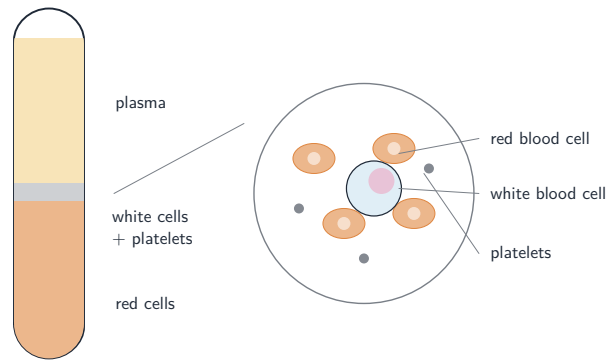
Build the skills to answer exam questions on **blood** 血液 — the four components, the role of white blood cells, and **clotting** 凝血.

You must be able to:

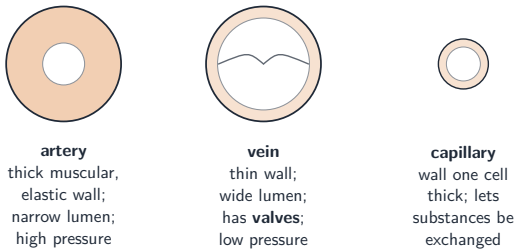
- name the four components of blood and their functions
- describe how phagocytes and lymphocytes defend the body
- describe how blood clots

1 Worked examples

■ Components of blood



Red cells (oxygen, haemoglobin), white cells (defence), platelets (clotting), plasma (transport)



Blood components travel in the vessels

- **phagocytes** engulf pathogens; **lymphocytes** make antibodies.
- clotting: fibrinogen → fibrin threads → a net that traps cells.

■ Four components, and how each is built for its job

Component	What it does	Adaptation
red blood cells 红细胞	carry oxygen as oxy-haemoglobin	biconcave disc for a large surface area; no nucleus , so more room for haemoglobin; flexible, to squeeze through capillaries
white blood cells 白细胞	defence	phagocytes 吞噬细胞 engulf and digest pathogens; lymphocytes 淋巴细胞 make antibodies
platelets 血小板	clotting	fragments of cells; trigger the clotting cascade
plasma 血浆	transport medium	a straw-coloured liquid carrying carbon dioxide, urea, hormones, nutrients, ions and heat

Oxygen transport, in the words the mark scheme uses. In the lungs, where the oxygen concentration is high, haemoglobin **combines** with oxygen to form **oxy-haemoglobin**; in respiring tissues, where the concentration is low, oxyhaemoglobin **dissociates**, releasing oxygen to the cells. “Picks up” and “drops off” do not score; *combines* and *dissociates* do.

Clotting, in order: platelets and damaged tissue release chemicals; these convert the soluble protein **fibrinogen** into insoluble **fibrin**; fibrin forms a mesh of fibres across the wound that traps red blood cells, forming a clot; the clot dries to a scab. Two jobs: it **stops blood loss** and it **prevents pathogens entering**.

Worked example. A person living at high altitude develops a higher red blood cell count. Explain why, and predict what happens to it on returning to sea level.

1. The air at high altitude has a lower partial pressure of oxygen, so less oxygen diffuses into the blood.

2. Making more red blood cells increases the total haemoglobin, so more oxygen can be carried and enough still reaches the tissues.
3. Back at sea level the oxygen supply is adequate again, so the count gradually falls to normal — which is why athletes train at altitude shortly before competing rather than months ahead.

2 Practice

2.1 State the function of red blood cells. [1]

2.2 Name the part of the blood that helps it clot. [1]

2.3 Name the four components of blood. [2]

2.4 State the two roles of a blood clot. [2]

2.5 Explain why red blood cells have no nucleus. [2]

3 Exam-style questions

3.1 The liquid part of blood that carries dissolved substances is the: [1]

- A plasma
- B platelets
- C red blood cells
- D haemoglobin

3.2 White blood cells defend the body.

(a) Describe how a phagocyte deals with a pathogen. [1]

(b) Describe how a lymphocyte deals with a pathogen. [1]

3.3 Explain why clotting of blood at a cut is important. [2]

3.4 A blood sample is examined under a microscope.

(a) Complete the table by naming the component that carries out each function. [4]

Function	Component
transports oxygen	
engulfs and digests pathogens	
produces antibodies	
transports carbon dioxide, urea and hormones	

(b) Describe how oxygen is carried from the lungs to a respiring muscle, using the correct terms for the two changes. [3]

(c) Describe two ways in which a red blood cell is adapted to its function, explaining each. [4]

(d) Describe how a clot forms at a cut, naming the two proteins involved. [3]

(e) A person moves to live at high altitude and their red blood cell count rises. Explain why. [2]

Solutions

2.1 they carry oxygen (using haemoglobin).

2.2 platelets.

2.3 Red blood cells, white blood cells, platelets and plasma.

2.4 It stops further loss of blood; it prevents pathogens entering the wound.

2.5 Without a nucleus there is more space inside the cell for haemoglobin, so each cell can carry more oxygen.

3.1 A. Plasma is the liquid that carries dissolved substances.

3.2 (a) it surrounds and digests (engulfs) the pathogen.

(b) it makes antibodies that stick to and destroy the pathogen.

3.3 the clot seals the wound to stop blood loss; and stops pathogens getting in.

3.4 (a) Red blood cells; phagocytes, a type of white blood cell; lymphocytes; plasma.

(b) In the lungs the oxygen concentration is high, so haemoglobin combines with oxygen to form oxyhaemoglobin; the blood carries it to the muscle; in the muscle the oxygen concentration is low, so the oxyhaemoglobin dissociates and releases oxygen to the cells.

(c) Any two, each for two marks: the biconcave shape gives a large surface area to volume ratio for faster diffusion of oxygen; having no nucleus leaves more room for haemoglobin; being small and flexible lets it pass through narrow capillaries.

(d) Platelets and the damaged tissue release chemicals that start the process; these convert the soluble protein fibrinogen into insoluble fibrin; the fibrin forms a mesh of fibres that traps red blood cells and seals the wound.

(e) The air at high altitude contains oxygen at a lower pressure, so less oxygen diffuses into the blood; more red blood cells means more haemoglobin, so enough oxygen can still be carried to the tissues.

2 (a) Fig. 2.1 is a diagram of part of the human circulatory system.

The arrows show the direction of blood flow.

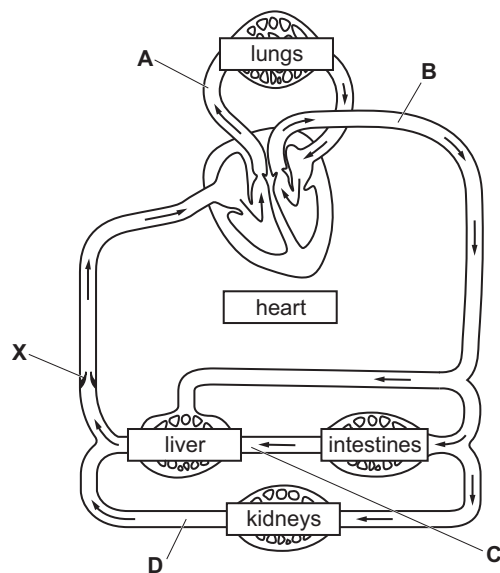


Fig. 2.1

(i) Complete Table 2.1 by naming the blood vessels in Fig. 2.1 and stating whether the blood in each vessel is oxygenated.

Table 2.1

letter in Fig. 2.1	name of the blood vessel	carries oxygenated blood (yes/no)
A		
B		
C		
D		

[4]

(ii) State the name of structure X in Fig. 2.1 and outline its function.

name

function

[2]

(b) Fig. 2.2 is a diagram of part of a fish circulatory system.

The arrows show the direction of blood flow.

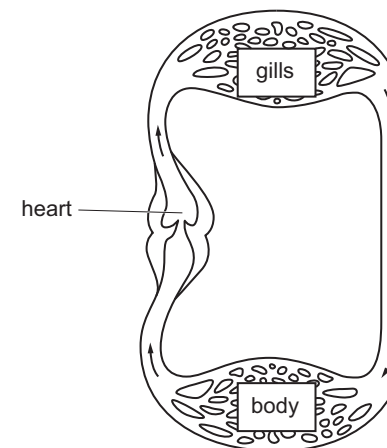


Fig. 2.2

(i) Describe how the structure of the fish heart in Fig. 2.2 differs from a human heart.

.....

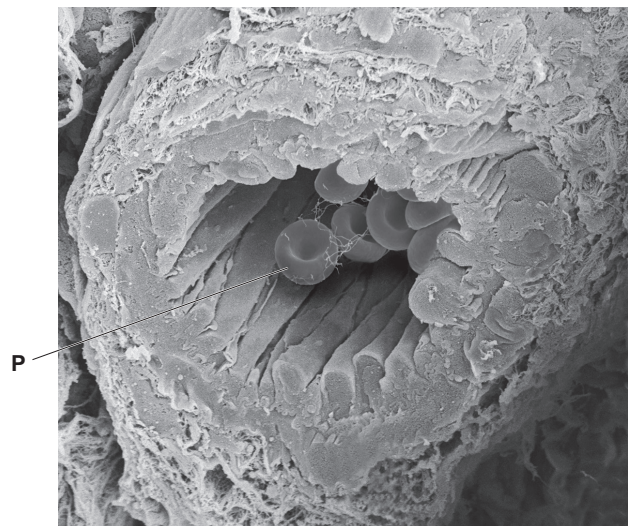
 [2]

(ii) Explain the advantages of the type of circulatory system found in humans, compared with the circulatory system shown in Fig. 2.2.

.....

 [4]

(c) Fig. 2.3 is a photomicrograph of an arteriole.



magnification $\times 1430$

Fig. 2.3

(i) Identify the structure labelled **P** in Fig. 2.3.

..... [1]

(ii) The magnification of the image is provided. Write the formula that would be used to calculate the actual diameter of the lumen of the arteriole in Fig. 2.3.

..... [1]

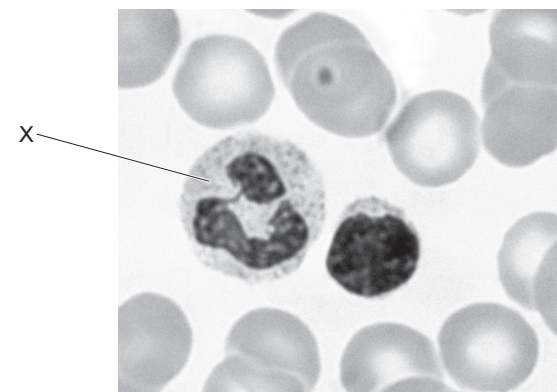
(iii) The actual diameter of the lumen of the arteriole shown in Fig. 2.3 is 0.0315 mm.

Convert 0.0315 mm to micrometres (μm).

..... μm [1]

[Total:15]

16 The photomicrograph shows some blood cells.



Which row shows the name and function of the cell labelled X?

	name	function
A	lymphocyte	engulfs pathogens
B	lymphocyte	produces antibodies
C	phagocyte	engulfs pathogens
D	phagocyte	produces antibodies

2 Fig. 2.1 is a photomicrograph of human blood.

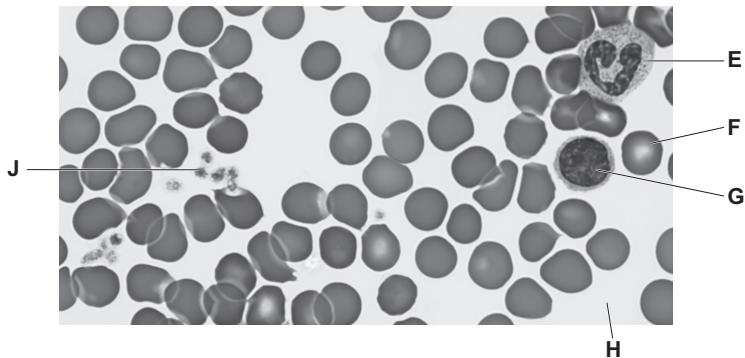


Fig. 2.1

(a) Use the information in Fig. 2.1 to complete Table 2.1.

Table. 2.1

component of blood	letter from Fig. 2.1	function
red blood cell		
		production of antibodies
	H	
		phagocytosis
platelet	J	

[5]

(b) Some diseases are transmissible.

- (i) State the name of a pathogen that is transmitted by direct contact with blood.
..... [1]
- (ii) State **two** ways that a pathogen can be transmitted **indirectly**.
1
2 [2]

(c) Describe the role of antibodies in the defence against pathogens.

.....
.....
.....
.....
.....
.....
..... [3]

(d) Explain how active immunity differs from passive immunity.

.....
.....
.....
.....
.....
.....
..... [3]

[Total: 14]