

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

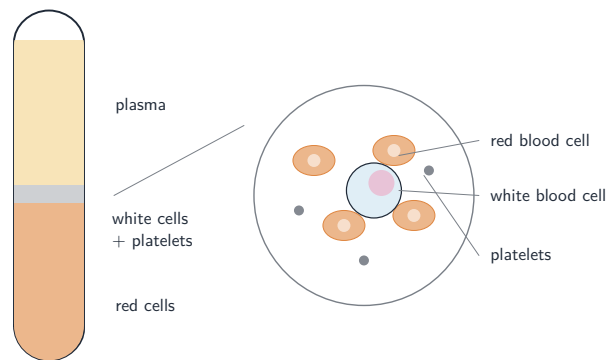
Build the skills to answer exam questions on **blood** 血液 — the four components, the role of white blood cells, and **clotting** 凝血.

You must be able to:

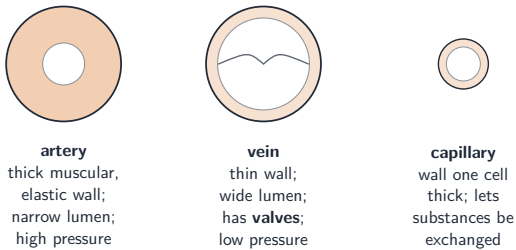
- name the four components of blood and their functions
- describe how phagocytes and lymphocytes defend the body
- describe how blood clots

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.