

8.1 The circulatory system

Name: _____ Class: _____ Date: _____

Total: 11 marks

Objective

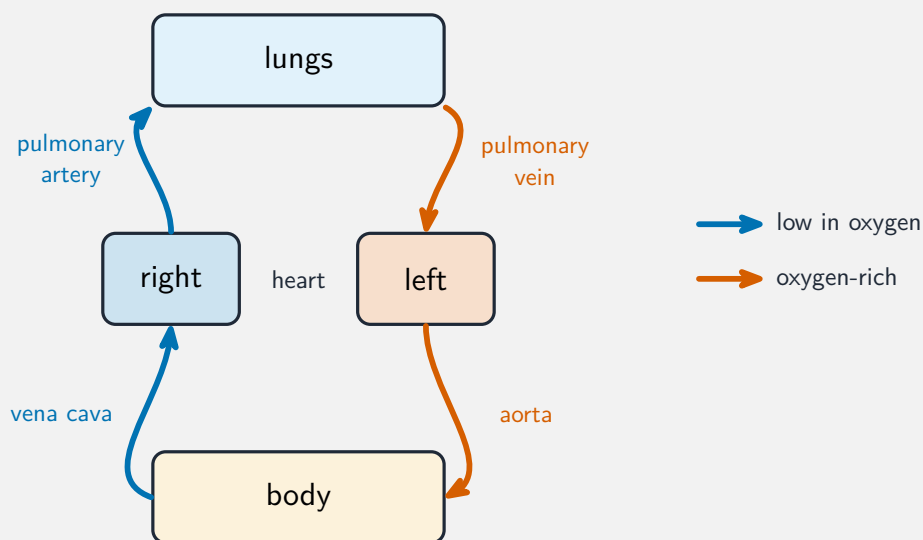
Build the skills to answer exam questions on **the circulatory system** —the **double circulation** 双循环, the structure of blood vessels, and the formation of **tissue fluid** 组织液.

You must be able to:

- describe the closed double circulation and the functions of the main vessels
- relate the structure of arteries, veins and capillaries to their functions
- describe the formation of tissue fluid in a capillary network

1 Worked examples

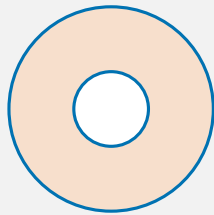
■ Double circulation



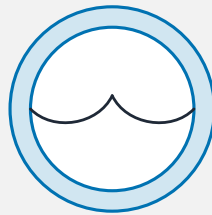
Pulmonary loop to the lungs, systemic loop to the body; blood passes through the heart twice

Main vessels: **pulmonary artery** (heart → lungs, low O₂); **pulmonary vein** (lungs → heart, high O₂); **aorta** 主动脉 (heart → body); **vena cava** 腔静脉 (body → heart).

■ Vessel structure and function



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



vein
thin wall;
wide lumen;
valves
(low pressure)

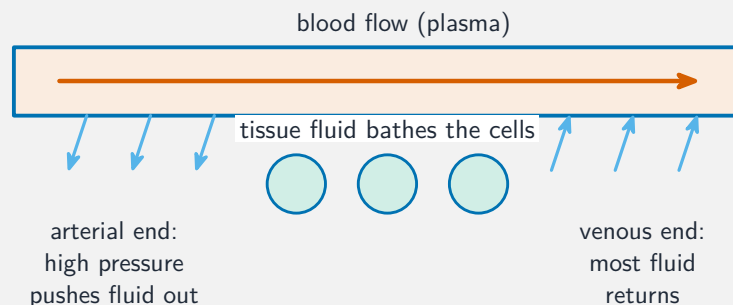


capillary
wall one cell
thick; very
narrow (exchange)

Artery: thick wall, narrow lumen. Vein: thin wall, wide lumen, valves. Capillary: one cell thick.

vessel	structure	function
artery	thick muscle + elastic 弹性 wall, narrow lumen	high-pressure flow; recoil smooths flow
capillary	wall one cell thick	short distance for exchange
vein	thin wall, wide lumen, valves 瓣膜	low-pressure return; valves stop backflow

■ Tissue fluid



High pressure at the arterial end forces fluid out as tissue fluid; most returns at the venous end

At the arterial end the high blood pressure forces plasma (not cells or large proteins) out of the capillary to form **tissue fluid**, which supplies cells with O₂ and glucose. Most returns at the lower-pressure venous end.

2 Practice

2.1 Name the vessel that carries oxygen-rich blood from the lungs to the heart. [1]

2.2 Explain why an artery has a thick wall of elastic fibres. [2]

3 Exam-style questions

3.1 Which feature is found in veins but **not** in arteries? [1]

- **A** a muscular wall
- **B** valves
- **C** a lumen
- **D** an endothelium

3.2 Why is a capillary wall only one cell thick? [1]

- **A** to carry blood at high pressure
- **B** to give a short diffusion distance for exchange
- **C** to prevent backflow
- **D** to store tissue fluid

3.3 (a) Describe how tissue fluid is formed at the arterial end of a capillary. [3]

(b) State **two** substances that pass from the tissue fluid into the body cells. [1]

3.4 Explain why most tissue fluid returns to the capillary at the venous end. [2]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **8.1 The circulatory system** past-paper sheet in the Library, or try these in **Practice mode**:

- 9700/11 N25 —Q30 (blood vessels)
- 9700/13 N25 —Q31 (circulation)
- 9700/24 N25 —Q5 (tissue fluid)
- 9700/23 N25 —Q6 (heart and circulation, structured)

Solutions

2.1 the pulmonary vein.

2.2 the elastic wall stretches when the heart pumps and recoils between beats, smoothing the high-pressure flow / maintaining pressure.

3.1 B. Veins have valves to prevent backflow; arteries do not.

3.2 B. A one-cell-thick wall gives a short diffusion distance for exchange.

3.3 (a) at the arterial end the blood (hydrostatic) pressure is high; this forces plasma/fluid out through the capillary wall; cells and large plasma proteins stay in.

(b) oxygen and glucose.

3.4 at the venous end the blood pressure is lower; and the plasma proteins left behind lower the water potential, so water returns by osmosis.