

# 8.1 The circulatory system

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 11 marks

**KEY WORDS** blood vessel • capillary • vein • artery  
• tissue fluid

## Objective

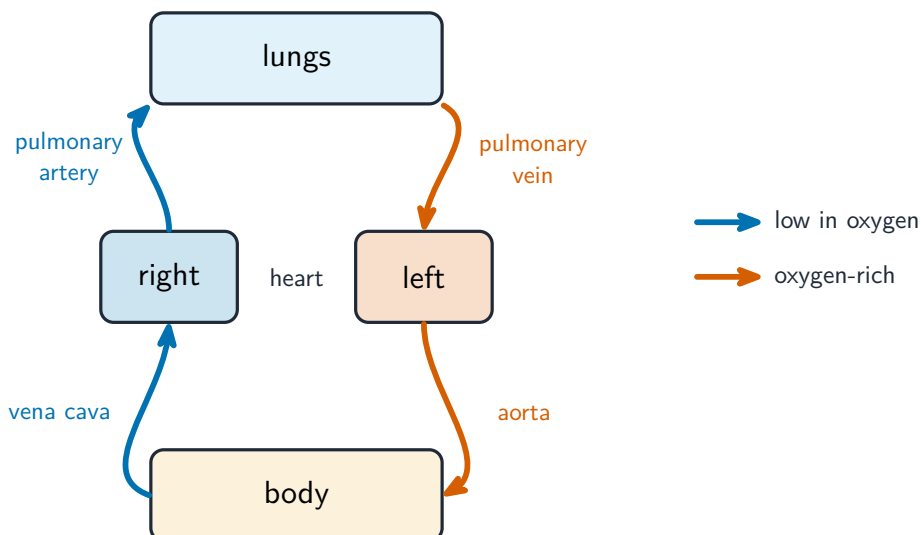
Build the skills to answer exam questions on **the circulatory system** – the **double circulation**, the structure of blood vessels, and the formation of **tissue fluid**.

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 Key knowledge and worked examples

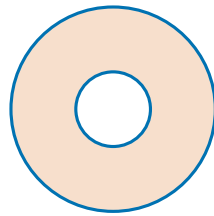
### ■ Double circulation



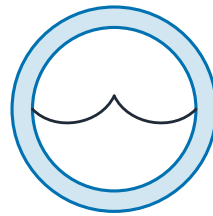
*Pulmonary loop to the lungs, systemic loop to the body; blood passes through the heart twice*

Main vessels: **pulmonary artery** (heart → lungs, low O<sub>2</sub>); **pulmonary vein** (lungs → heart, high O<sub>2</sub>); **aorta** (heart → body); **vena cava** (body → heart).

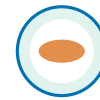
### ■ Vessel structure and function



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



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

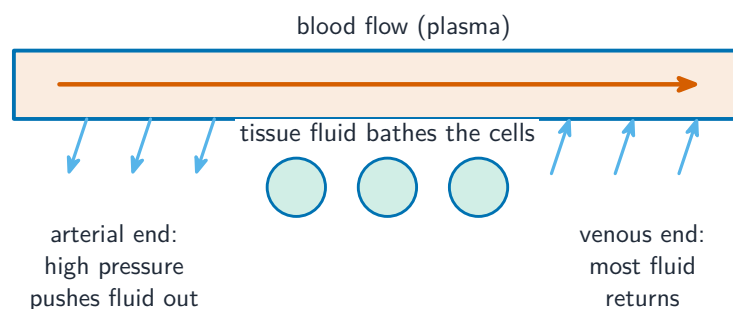


**capillary**  
wall one cell  
thick; very  
narrow (exchange)

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

| vessel    | structure                                           | function                                     |
|-----------|-----------------------------------------------------|----------------------------------------------|
| artery    | thick muscle + <b>elastic</b> wall,<br>narrow lumen | high-pressure flow; recoil<br>smooths flow   |
| capillary | wall one cell thick                                 | short distance for exchange                  |
| vein      | thin wall, wide lumen, <b>valves</b>                | low-pressure return; valves<br>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 O<sub>2</sub> and glucose. Most returns at the lower-pressure venous end.

## 2 Practice

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

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

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## 3 Exam-style questions

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**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]

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

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

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## Solutions

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Each answer shows the steps, then the **result**.

### 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