

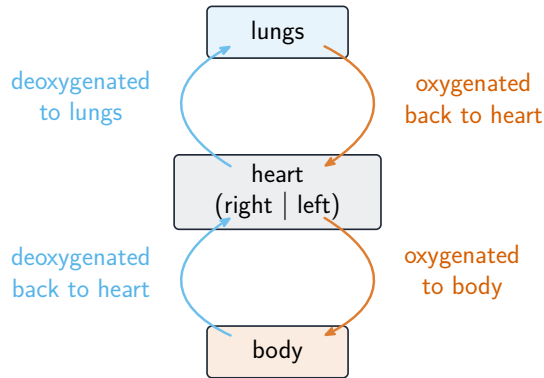
Exercise walk-through

9.2

Heart

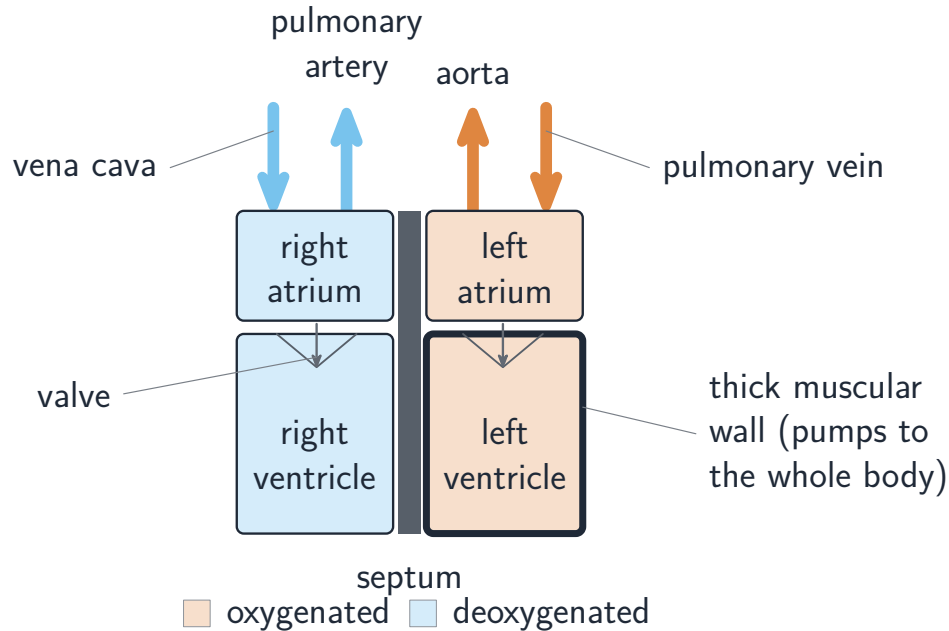
IGCSE Biology

Single and double circulation



- A fish has a **single circulation** : the blood passes through the heart **once** on each trip around the body.
- A **mammal** has a **double circulation** : the blood passes through the heart **twice** on each full trip – once on the way to the lungs, and once on the way to the rest of the body.
- The advantage of a double circulation: the blood can be pumped again at **high pressure** before going to the body, so it travels faster and delivers **oxygen** quickly.

The heart



Four chambers: two **atria** (top) & two **ventricles** (bottom), split by the **septum**.

- left ventricle wall is **thickest** (pumps to the whole body)
- valves stop backflow

The four great vessels, and where each goes

Vena cava

Brings deoxygenated blood from the body into the right atrium.

Pulmonary artery

The **pulmonary artery** carries deoxygenated blood from the right ventricle to the lungs – the one artery that carries deoxygenated blood.

Pulmonary vein

The **pulmonary vein** returns oxygenated blood from the lungs to the left atrium – the one vein that carries oxygenated blood.

Aorta

Leaves the left ventricle for the whole body, which is why that wall is the thickest.
To the kidney: **renal artery** in, **renal vein** out.

An artery carries blood away from the heart and a vein back to it. Oxygen is not part of the definition – the two pulmonary vessels prove it.

Heart rate and disease

exercise

heart rate rises, so
blood reaches muscles
faster with O₂ & glucose

coronary heart disease

coronary arteries narrow; risks:
fatty diet, smoking, no exercise

Exercises 2.1-2.3

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]

Exercises 2.1-2.3

2.1 Name the upper and lower chambers of the heart.

[2]

2.1

- upper chambers: **atria**
- lower chambers: **ventricles**

2.2 State the role of the septum.

[1]

2.2

- the septum keeps oxygenated and deoxygenated blood **apart**

2.3 Name the vessel that carries oxygenated blood to the heart.

[1]

2.3

- oxygenated blood to the heart: the **pulmonary vein**

Exercises 2.4·2.5

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]

Exercises 2.4-2.5

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

2.4

- the left ventricle pumps blood **all round the body**, against greater resistance
 - it needs a **thicker wall** to produce the higher pressure
-

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

2.5

- vein valves **prevent backflow**, keeping blood towards the heart

Exercise 3.1

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

Exercise 3.1

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

3.1 B

- the left ventricle pumps blood to the **whole body**, so its wall is thickest
- A is the right ventricle; C and D are false

Exercise 3.2 (a)

3.2 During exercise the heart rate increases.

(a) Explain why this is needed.

[2]

Exercise 3.2 (a)

3.2 During exercise the heart rate increases.

(a) Explain why this is needed.

[2]

(a)

- muscles need more **oxygen and glucose** during exercise
- a faster heart rate **delivers blood faster**

Exercise 3.2 (b)

3.2 During exercise the heart rate increases.

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

[2]

Exercise 3.2 (b)

3.2 During exercise the heart rate increases.

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

[2]

(b)

- any **two** of: high-fat diet / lack of exercise / smoking / stress / genetics or age

Exercise 3.3 (a)

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]

Exercise 3.3 (a)

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]

(a)

- **pulmonary artery**; the blood in it is **deoxygenated**

Exercise 3.3 (b)

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

(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]

Exercise 3.3 (b)

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

(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]

(b)

- vena cava → right atrium → right ventricle → pulmonary artery
- lungs → pulmonary vein → left atrium → left ventricle → aorta

Exercise 3.3 (c)

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

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

Exercise 3.3 (c)

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

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

(c)

- blood passes through the heart **twice** per circuit
- once to the lungs and once to the body
- advantage: blood is **re-pressurised** so it reaches every organ quickly

Exercise 3.3 (d)

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

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

[3]

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

Exercise 3.3 (d)

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

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

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

(d)

- wall: artery **thick, muscular, elastic**; vein **thin**
- lumen: artery **narrow**; vein **wide**
- valves: artery **none**; vein **yes**

Exercise 3.3 (e)

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

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

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

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

(e)

- wall **one cell thick** → short diffusion distance
- **narrow lumen** slows the blood, giving more time for exchange