

Circulatory & Respiratory Systems

Key ideas

Double circulation: pulmonary circuit (heart ↔ lungs) and systemic circuit (heart ↔ body). **Blue** = deoxygenated, **red** = oxygenated.

Arteries carry blood away from the heart; **veins** carry it back; **capillaries** exchange materials with cells.

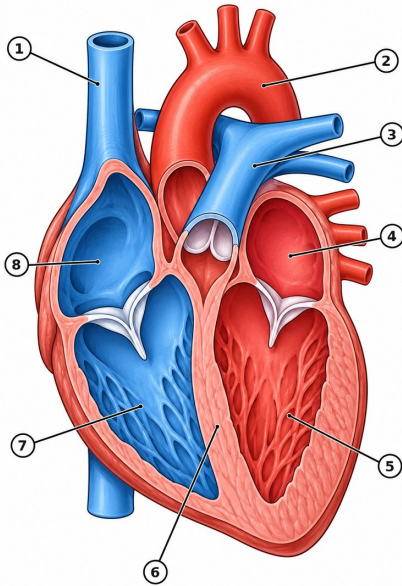
Cardiac output = heart rate × stroke volume · **Minute ventilation** = tidal volume × breathing rate

Gas exchange happens by diffusion across alveolus and capillary walls: O₂ into the blood, CO₂ out.

A Label the heart

4 marks

Word bank: Aorta · Left atrium · Left ventricle · Pulmonary artery · Right atrium · Right ventricle · Septum · Superior vena cava



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

B The path of blood

5 marks

9. Blood returns from the body through the vena cava. Put the structures it passes through in order. (2 marks)

P Right ventricle

S Right atrium

Q Aorta

T Lungs

R Left atrium

U Left ventricle

_____ → _____ → _____ → _____ → _____ → _____

(drawn as if you are facing the person)

10. Look at parts 5 and 7 on the diagram. Why is the wall of the left ventricle much thicker than the wall of the right ventricle?

11. Name the only artery that carries deoxygenated blood, and the only vein that carries oxygenated blood.

12. What is the job of the valves between the atria and the ventricles?

C Parts of the blood

2 marks

Write the letter of the matching function (½ mark each).

13. _____ Plasma

a. Cell fragments that help blood clot at a wound

14. _____ Red blood cells

b. Carry oxygen, bound to haemoglobin

15. _____ White blood cells

c. Liquid part of blood that carries nutrients, hormones and wastes

16. _____ Platelets

d. Fight infection and destroy pathogens

D Blood vessels

3 marks

1 mark per row.

	Vessel	Wall structure	Direction of blood flow	Key feature
17.	Artery			
18.	Vein			
19.	Capillary			

E Heart calculations

4 marks

20. Cardiac output = heart rate $\times$ stroke volume. A student's heart rate is 72 beats/min and stroke volume is 70 mL/beat. Find the cardiac output in L/min.

21. A blood pressure reading is 120/80 mmHg. What do the two numbers mean?

22. A trained athlete has the same cardiac output (5.0 L/min) but a resting heart rate of only 50 beats/min. Find the stroke volume, and explain why it is larger. (2 marks)

F The respiratory system

7 marks

23. Put the structures that air passes through on the way to the blood in order. (2 marks)

P Bronchioles Q Trachea R Nasal cavity S Alveoli T Larynx U Bronchi V Pharynx

____ $\rightarrow$ ____ $\rightarrow$ ____ $\rightarrow$ ____ $\rightarrow$ ____ $\rightarrow$ ____ $\rightarrow$ ____

24. Explain how the diaphragm causes you to inhale. (2 marks)

25. Give two features of alveoli that make them good at gas exchange. (2 marks)

26. Minute ventilation = tidal volume $\times$ breathing rate. Find the minute ventilation for a tidal volume of 500 mL and 12 breaths/min, in L/min.

G Spot the mistake

2 marks

27. A student writes: "All arteries carry oxygenated blood." Explain the error and correct it.

28. A student writes: "When you inhale, air rushes in and pushes the diaphragm down." Explain the error and correct it.

Circulatory & Respiratory Systems

Name: _____

Date: _____ Score: ____ / 27

ANSWER KEY

Key ideas

Double circulation: pulmonary circuit (heart ↔ lungs) and systemic circuit (heart ↔ body). **Blue** = deoxygenated, **red** = oxygenated.

Arteries carry blood away from the heart; **veins** carry it back; **capillaries** exchange materials with cells.

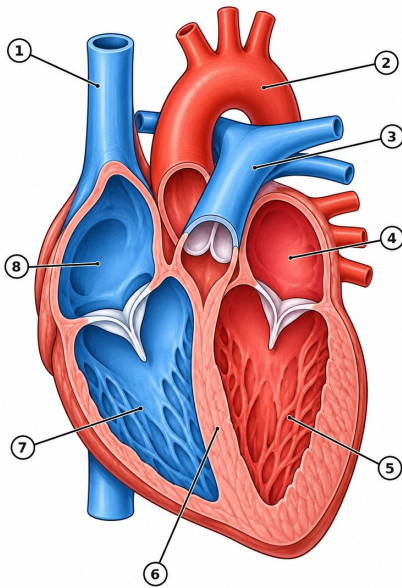
Cardiac output = heart rate × stroke volume · **Minute ventilation** = tidal volume × breathing rate

Gas exchange happens by diffusion across alveolus and capillary walls: O₂ into the blood, CO₂ out.

A Label the heart

4 marks

Word bank: Aorta · Left atrium · Left ventricle · Pulmonary artery · Right atrium · Right ventricle · Septum · Superior vena cava



(drawn as if you are facing the person)

1. **Superior vena cava**2. **Aorta**3. **Pulmonary artery**4. **Left atrium**5. **Left ventricle**6. **Septum**7. **Right ventricle**8. **Right atrium**

B The path of blood

5 marks

9. Blood returns from the body through the vena cava. Put the structures it passes through in order. (2 marks)

P Right ventricle

S Right atrium

Q Aorta

T Lungs

R Left atrium

U Left ventricle

S → **P** → **T** → **R** → **U** → **Q**

10. Look at parts 5 and 7 on the diagram. Why is the wall of the left ventricle much thicker than the wall of the right ventricle?

The left ventricle pumps blood to the whole body at high pressure; the right ventricle only pumps to the nearby lungs.

11. Name the only artery that carries deoxygenated blood, and the only vein that carries oxygenated blood.

Pulmonary artery (heart → lungs) and pulmonary vein (lungs → heart)

12. What is the job of the valves between the atria and the ventricles?

They stop blood flowing backwards into the atria when the ventricles contract.

C Parts of the blood

2 marks

Write the letter of the matching function (½ mark each).

13. **c** Plasma

a. Cell fragments that help blood clot at a wound

14. **b** Red blood cells

b. Carry oxygen, bound to haemoglobin

15. **d** White blood cells

c. Liquid part of blood that carries nutrients, hormones and wastes

16. **a** Platelets

d. Fight infection and destroy pathogens

D Blood vessels

3 marks

1 mark per row.

	Vessel	Wall structure	Direction of blood flow	Key feature
17.	Artery	Thick, muscular, elastic wall	Away from the heart	High pressure; pulses with each heartbeat
18.	Vein	Thin wall, wide lumen	Toward the heart	Valves stop backflow; low pressure
19.	Capillary	Wall one cell thick	From arterioles to venules	Where gases, nutrients and wastes are exchanged

E Heart calculations

4 marks

20. Cardiac output = heart rate $\times$ stroke volume. A student's heart rate is 72 beats/min and stroke volume is 70 mL/beat. Find the cardiac output in L/min.

$$72 \times 70 = 5,040 \text{ mL/min} = 5.04 \text{ L/min}$$

21. A blood pressure reading is 120/80 mmHg. What do the two numbers mean?

**120 = systolic pressure (ventricles contracting);
80 = diastolic pressure (heart relaxing between beats).**

22. A trained athlete has the same cardiac output (5.0 L/min) but a resting heart rate of only 50 beats/min. Find the stroke volume, and explain why it is larger. (2 marks)

$$5000 \div 50 = 100 \text{ mL/beat. Training makes the heart muscle stronger, so it pumps more blood per beat.}$$

F The respiratory system

7 marks

23. Put the structures that air passes through on the way to the blood in order. (2 marks)

P Bronchioles Q Trachea R Nasal cavity S Alveoli T Larynx U Bronchi V Pharynx

R $\rightarrow$ V $\rightarrow$ T $\rightarrow$ Q $\rightarrow$ U $\rightarrow$ P $\rightarrow$ S

24. Explain how the diaphragm causes you to inhale. (2 marks)

The diaphragm contracts and moves down (and the rib muscles lift the ribs), so chest volume increases and air pressure in the lungs drops below outside pressure. Air flows in.

25. Give two features of alveoli that make them good at gas exchange. (2 marks)

Any two: huge total surface area; walls one cell thick; moist lining; surrounded by many capillaries.

26. Minute ventilation = tidal volume $\times$ breathing rate. Find the minute ventilation for a tidal volume of 500 mL and 12 breaths/min, in L/min.

$$500 \times 12 = 6,000 \text{ mL/min} = 6.0 \text{ L/min}$$

G Spot the mistake

2 marks

27. A student writes: "All arteries carry oxygenated blood." Explain the error and correct it.

Arteries carry blood away from the heart. The pulmonary artery carries deoxygenated blood to the lungs.

28. A student writes: "When you inhale, air rushes in and pushes the diaphragm down." Explain the error and correct it.

It is the other way around: the diaphragm contracts first, lowering lung pressure, and then air flows in.