

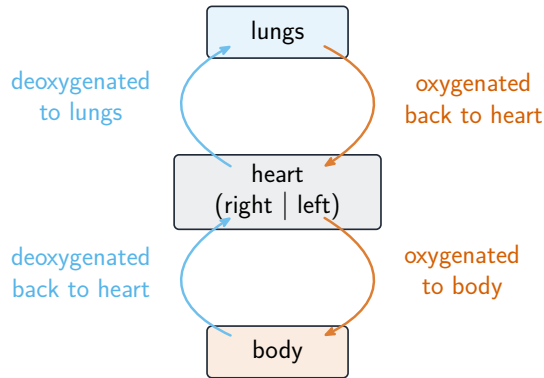
Exercise walk-through

9.2.1

Valves, the heartbeat, monitoring the heart and coronary heart disease

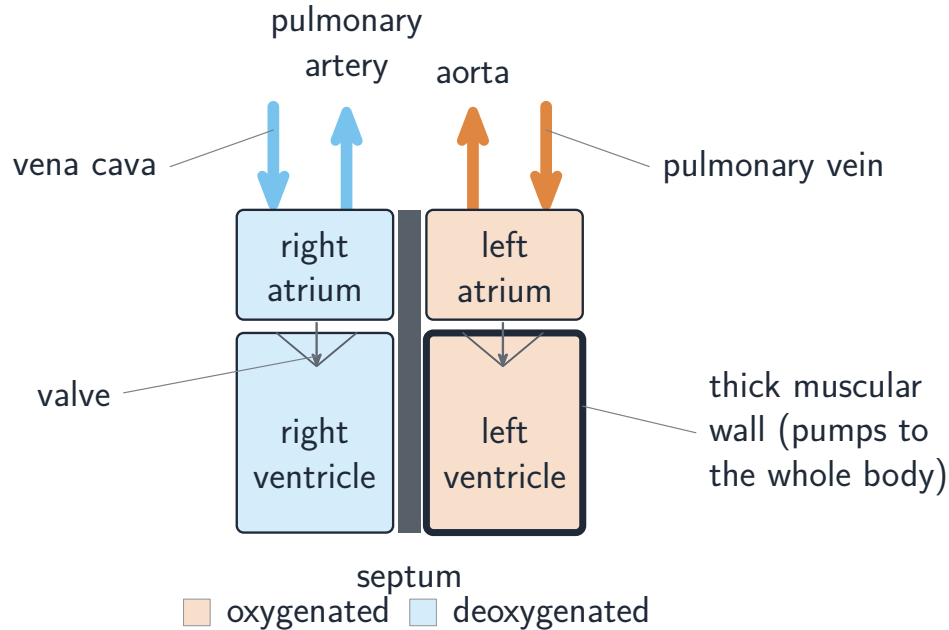
IGCSE Biology

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 2.1·2.2

2.1 Name the two kinds of valve in the heart, and state where each one is found. [2]

2.2 Explain why the walls of the atria are thinner than the walls of the ventricles. [2]

Exercises 2.1·2.2

2.1 Name the two kinds of valve in the heart, and state where each one is found. [2]

2.1

- **atrioventricular valves**, between each atrium and the ventricle below it
 - **semilunar valves**, where the arteries leave the ventricles
-

2.2 Explain why the walls of the atria are thinner than the walls of the ventricles. [2]

2.2

- the atria only push blood a **short distance**, down into the ventricles
- so much **less force** is needed, and a thinner layer of muscle is enough

Exercises 2.3-2.4

2.3 A baby is born with a hole in the septum. Explain why this baby becomes breathless easily. [3]

2.4 State **three** ways in which the activity of the heart can be monitored. [3]

Exercises 2.3-2.4

2.3 A baby is born with a hole in the septum. Explain why this baby becomes breathless easily. [3]

2.3

- the septum normally keeps **oxygenated** blood on the left completely separate from **deoxygenated** blood on the right
- a hole lets the two mix, so the blood pumped to the body carries **less oxygen**
- the body cells cannot respire fast enough, so the baby breathes faster to try to take in more oxygen and becomes breathless

2.4 State **three** ways in which the activity of the heart can be monitored. [3]

2.4

- measuring the **pulse rate**
- **listening** to the sounds of the valves closing, with a stethoscope
- recording an **ECG**

Exercise 2.5

2.5 Describe how you would investigate the effect of exercise on a person's pulse rate. [3]

Exercise 2.5

2.5 Describe how you would investigate the effect of exercise on a person's pulse rate. [3]

2.5

- measure the resting pulse rate, repeating it and taking a **mean**
- exercise for a set **time** at a set **intensity**, then measure the pulse rate immediately afterwards
- keep measuring once a minute until it returns to the resting value; keep the type, intensity and duration of the exercise the **same** for everyone compared

Exercise 3.1

3.1 Which row describes the heart while the **ventricles** are contracting? [1]

	atrioventricular valves	semilunar valves	blood moves
A	open	shut	from the atria into the ventricles
B	shut	open	from the ventricles into the arteries
C	open	open	from the atria into the arteries
D	shut	shut	nowhere

Exercise 3.1

3.1 Which row describes the heart while the **ventricles** are contracting? [1]

	atrioventricular valves	semilunar valves	blood moves
A	open	shut	from the atria into the ventricles
B	shut	open	from the ventricles into the arteries
C	open	open	from the atria into the arteries
D	shut	shut	nowhere

3.1 B

- while the ventricles contract, the atrioventricular valves are pushed **shut** and the semilunar valves are pushed **open**, so blood leaves in the arteries
- **A** describes the atria contracting; **C** would let blood run straight through; **D** would move no blood at all

Exercise 3.2 (a)

3.2 A doctor listens to a patient's heart with a stethoscope and hears two sounds in each heartbeat.

(a) Describe what happens in the heart when the atria contract. [3]

Exercise 3.2 (a)

3.2 A doctor listens to a patient's heart with a stethoscope and hears two sounds in each heartbeat.

(a) Describe what happens in the heart when the atria contract. [3]

(a)

- the atria **contract**, raising the pressure inside them
- the **atrioventricular valves open**
- blood is pushed **down into the ventricles**, while the semilunar valves stay shut

Exercise 3.2 (b)

3.2 A doctor listens to a patient's heart with a stethoscope and hears two sounds in each heartbeat.

(b) Explain what causes the two sounds the doctor hears.

[2]

Exercise 3.2 (b)

3.2 A doctor listens to a patient's heart with a stethoscope and hears two sounds in each heartbeat.

(b) Explain what causes the two sounds the doctor hears. [2]

(b)

- the first sound is the **atrioventricular valves shutting**, as the ventricles begin to contract
- the second is the **semilunar valves shutting**, as the ventricles relax

Exercise 3.2 (c)

3.2 A doctor listens to a patient's heart with a stethoscope and hears two sounds in each heartbeat.

(c) Name the valves that stop blood flowing back from the arteries into the ventricles.[1]

Exercise 3.2 (c)

3.2 A doctor listens to a patient's heart with a stethoscope and hears two sounds in each heartbeat.

(c) Name the valves that stop blood flowing back from the arteries into the ventricles.[1]

(c)

- the **semilunar valves**

Setup for exercise 3.3

3.3 A student measured her pulse rate before exercise, immediately after five minutes of running, and then once a minute until it returned to normal.

time after the exercise stopped / minutes	pulse rate / beats per minute
before the exercise	72
0 (immediately after)	148
1	120
2	96
3	80
4	74

Exercise 3.3 (a)

(a) State what is meant by the pulse rate, and name one other way of monitoring the activity of the heart. [2]

Exercise 3.3 (a)

(a) State what is meant by the pulse rate, and name one other way of monitoring the activity of the heart. [2]

(a)

- the pulse rate is the number of **heart beats per minute**, felt where an artery passes close to the skin
- also acceptable: an **ECG**, or listening to the valve sounds with a stethoscope

Exercise 3.3 (b)

(b) Describe how her pulse rate changed after the exercise stopped.

[2]

Exercise 3.3 (b)

(b) Describe how her pulse rate changed after the exercise stopped. [2]

(b)

- it **fell**, from 148 beats per minute immediately after the exercise to 74 after 4 minutes
- the fall was **fastest at the start** and slowed as the rate approached the resting value of 72

Exercise 3.3 (c)

(c) Explain why her heart rate increased during the exercise.

[4]

Exercise 3.3 (c)

(c) Explain why her heart rate increased during the exercise.

[4]

(c)

- her muscles **respired faster** during the exercise, to release more energy
- so they needed more **oxygen** and **glucose**, and produced more **carbon dioxide**
- the heart beat **faster and more strongly**, so blood flowed through the muscles more quickly
- delivering oxygen and glucose faster and carrying carbon dioxide away faster

Exercise 3.3 (d)

(d) A second student of the same age did the same exercise, and her pulse rate was back to its resting value after 2 minutes. Suggest what this shows about the second student.[2]

Exercise 3.3 (d)

(d) A second student of the same age did the same exercise, and her pulse rate was back to its resting value after 2 minutes. Suggest what this shows about the second student.[2]

(d)

- her pulse rate **recovered more quickly**, in 2 minutes rather than 4
- which suggests she is **fitter**

Exercise 3.3 (e)

(e) State **two** risk factors for coronary heart disease other than a lack of exercise. [2]

Exercise 3.3 (e)

(e) State **two** risk factors for coronary heart disease other than a lack of exercise. [2]

(e)

- any **two** of: a diet high in **saturated fat** or salt; **smoking**; **stress**; **age**; **sex**; a **genetic** predisposition

Exercise 3.3 (f)

(f) Explain how taking regular exercise reduces the risk of coronary heart disease. [2]

Exercise 3.3 (f)

(f) Explain how taking regular exercise reduces the risk of coronary heart disease. [2]

(f)

- exercise **strengthens the heart muscle** and helps keep blood pressure and body mass down
- so less fatty material builds up in the **coronary arteries**, and they are less likely to become blocked