

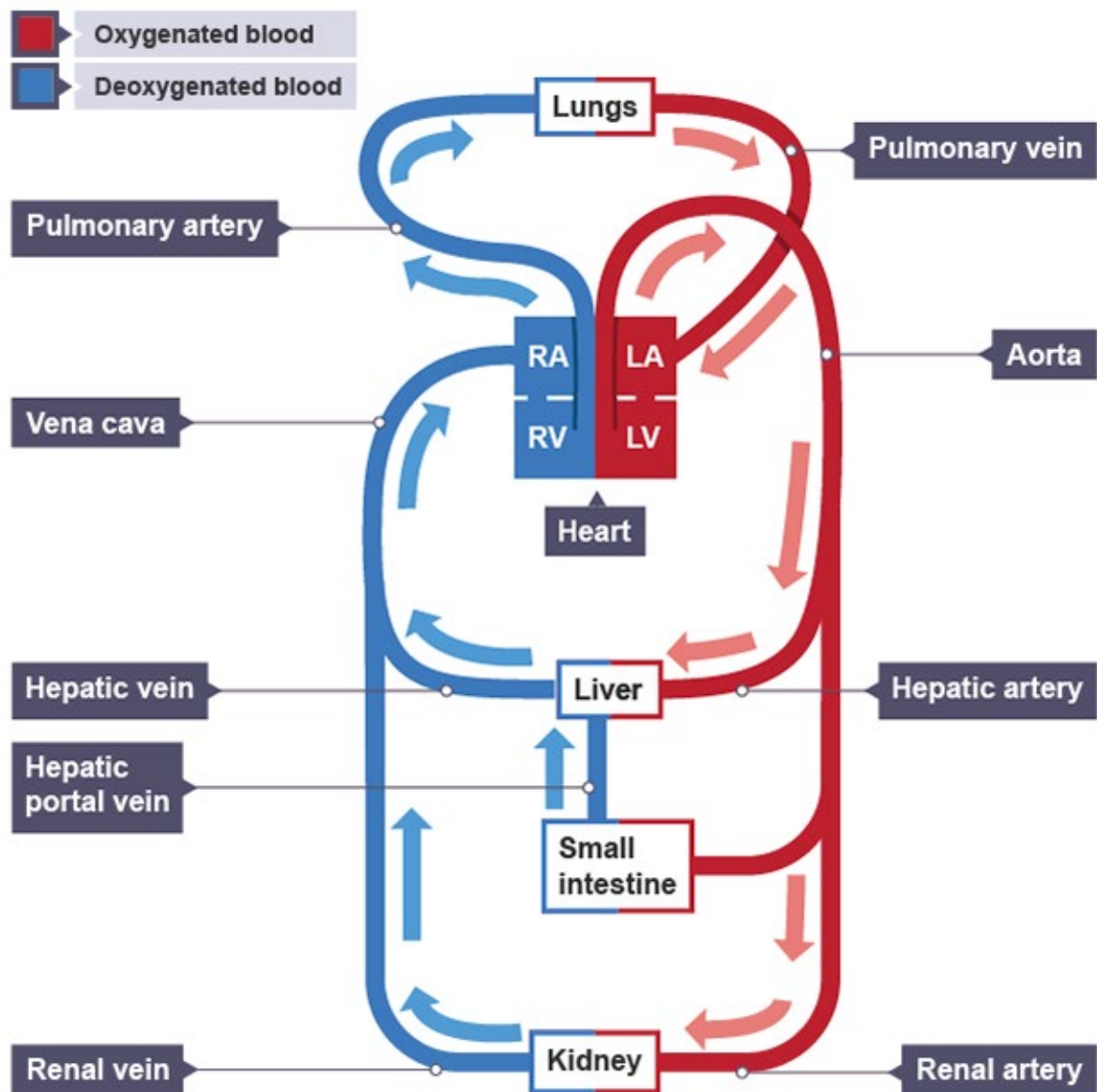
# Knowledge Organiser: Circulation

## The Circulatory System

Your circulatory system is made up of three parts: the heart, blood vessels and the blood itself.

Your heart keeps all the blood in your circulatory system flowing. The blood travels through a network of blood vessels to everywhere in your body. It carries useful materials like oxygen, water and nutrients and removes waste products like carbon dioxide.

Mammals have a **double circulatory system**. This means blood travels through the heart twice in one circulation of the body.



Ventricular walls are **thicker** than atrial walls because the ventricles have to pump blood further. The left ventricle wall is thicker than the right because it pumps blood around the body while the right pumps blood to the lungs, located close to the heart.

The oxygen and glucose carried in oxygenated blood is used for respiration in the body's cells.

The coronary arteries provide the heart muscle with the glucose and oxygen it needs for respiration. These are small blood vessels that branch off the aorta and can be seen on the external surface of the heart.

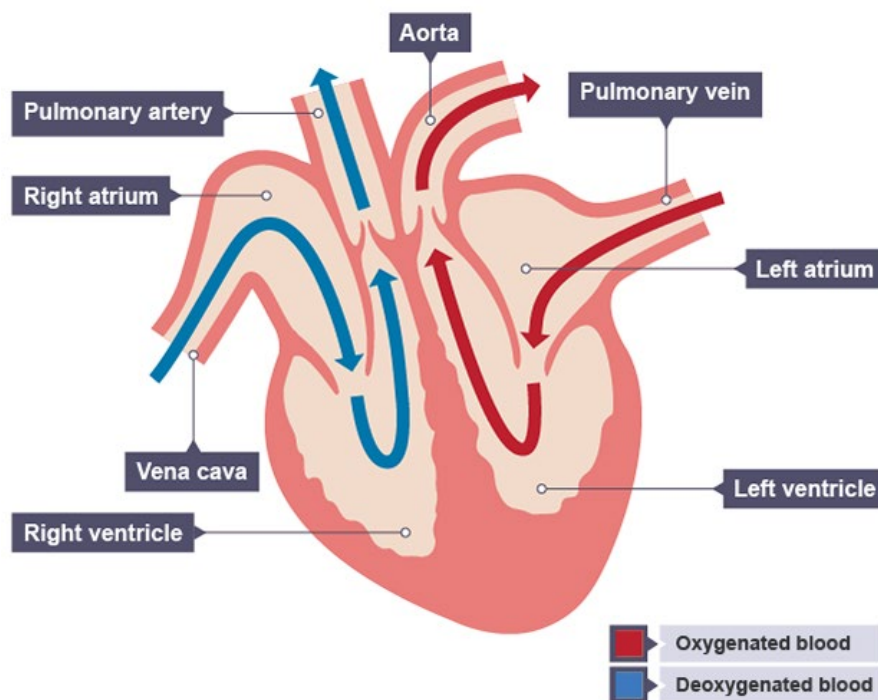
The following arteries and veins transport blood to and from some of the body's organs:

Blood vessel	Function
Vena cava	Carries deoxygenated blood from the body back to the heart.
Pulmonary artery	Carries deoxygenated blood from the heart to the lungs.
Pulmonary vein	Carries oxygenated blood from the lungs to the heart.
Aorta	Carries oxygenated blood from the heart around the body.
Hepatic artery	Carries oxygenated blood to the liver.
Hepatic vein	Carries deoxygenated blood back to the heart. Carries digested food (glucose and amino acids) from the liver around the body.
Hepatic portal vein	Carries digested food from the small intestine to the liver.
Renal artery	Carries oxygenated blood (also rich in urea) to the kidneys for excretion.
Renal vein	Carries deoxygenated blood (also low in urea as it has been purified in the kidney) back to the heart.

## The Heart

The heart is a **muscular organ**. Its function is to pump blood. The right side pumps blood through the lungs, while the left side pumps blood through the body.

A **septum** separates the right and left sides. The left side has thicker walls because it needs to put the blood under higher pressure than the right side.



In general, blood flows into the heart from a vein, goes into an atrium, then a ventricle, and out through an artery. The heart contains valves to prevent the blood flowing backwards.

Blood follows the following path as it flows through the heart:

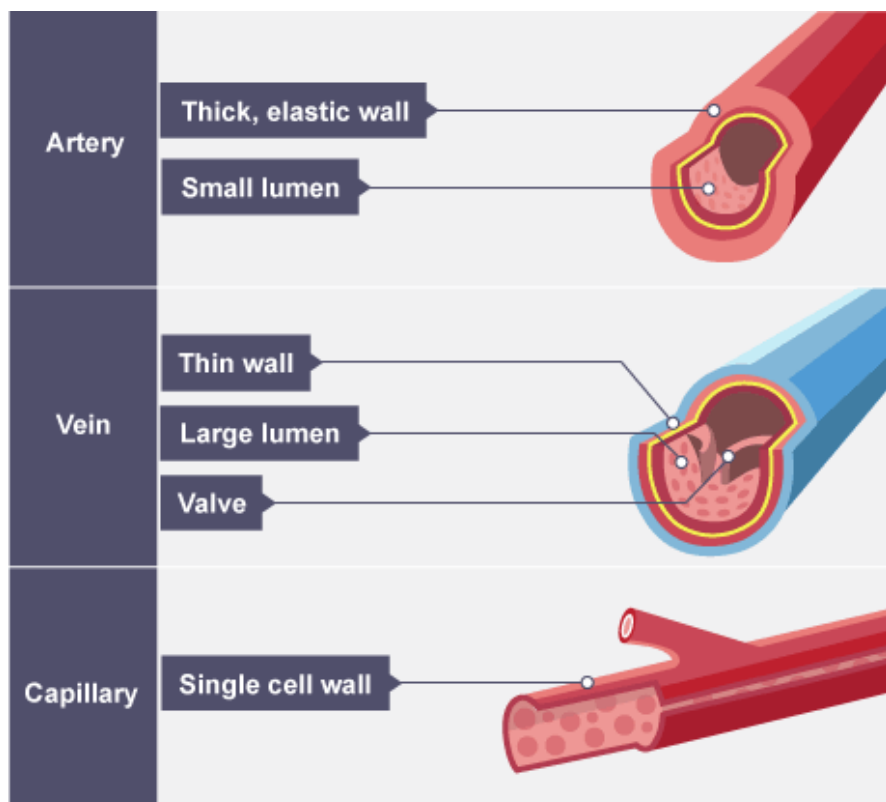
1. Deoxygenated blood enters the right atrium from the vena cava.
2. Blood moves into right ventricle.
3. Blood is pumped into the pulmonary artery.
4. The pulmonary artery carries deoxygenated blood to the lungs.
5. The blood becomes oxygenated in the lungs.
6. Oxygenated blood leaves the lung via the pulmonary vein.
7. Blood enters the left atrium.
8. Blood moves into the left ventricle.
9. Blood is pumped into the aorta, which carries oxygenated blood around the body.

## **Blood Vessels**

Blood is carried through three different types of blood vessels in the body:

1. arteries
2. capillaries
3. veins

All blood vessels are specifically structured to perform their function:

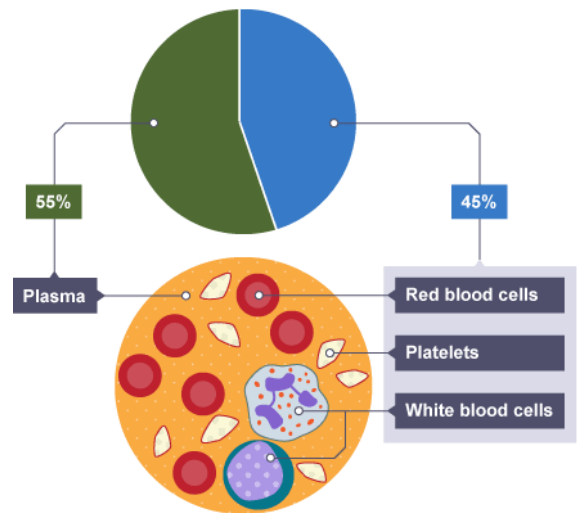


	Artery	Vein	Capillary
Function	Carry blood away from the heart (usually oxygenated blood, except for the pulmonary artery)	Carry blood towards the heart (usually deoxygenated blood, except for the pulmonary vein)	Allows diffusion of gases and nutrients from blood into the body cells
Wall	Thick, muscular	Thinner	Very thin, one cell thick
Lumen	Small	Large	Very small, only allows blood to pass through one cell at a time
Other features	Thick muscular walls to withstand blood flowing at high pressure as it leaves the heart; the largest artery is the aorta	Contain valves to prevent back flow of blood	Walls are made of semi-permeable membrane to allow transport of gases and nutrients into and out of the blood

## Components of Blood

**Blood** transports materials and heat around the body, and helps to protect against disease. It contains:

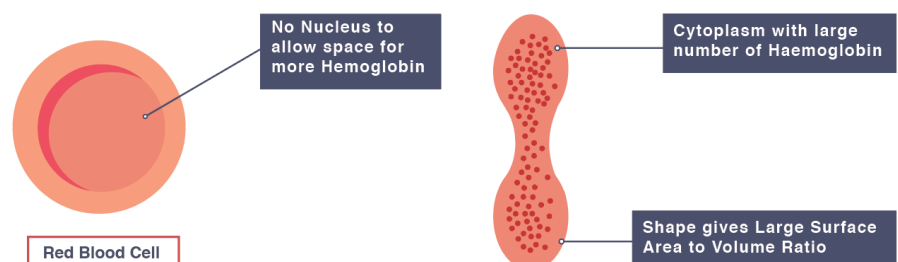
- plasma (straw-coloured liquid that makes up just over half the volume of blood).
- red blood cells
- white blood cells
- platelets



Component	Function(s)
Plasma	Transporting carbon dioxide, digested food, urea, hormones and heat
Red blood cells	Transporting oxygen
White blood cells	Ingesting pathogens and producing antibodies
Platelets	Involved in blood clotting

**Red blood cells** have adaptations that make them suitable for carrying oxygen:

- they contain haemoglobin - a red protein that combines with oxygen
- they have no nucleus so they can contain more haemoglobin
- they are small and flexible so that they can fit through narrow blood vessels
- they have a **biconcave** shape (flattened disc shape) to maximise their surface area for oxygen absorption



## **Heart Disease**

### **Coronary heart disease**

The heart is a muscular pump. Like all muscles, the heart needs oxygen to carry out aerobic respiration which provides the energy it needs to contract. The coronary arteries supply blood, and therefore oxygen, to the heart muscle.

### **Risk factors for cardiovascular disease**

The risk of developing cardiovascular disease is increased by several factors, including:

- smoking
- high blood pressure
- high levels of salt in the diet
- high levels of saturated fat in the diet

High levels of salt in the diet can lead to increased blood pressure. This may damage the blood vessels, making it easier for fatty deposits to build up.

### **Heart attacks**

A heart attack can happen after a sequence of events:

1. high levels of saturated fats in the diet are linked to an increase in levels of cholesterol in the blood
2. high levels of cholesterol cause fatty deposits to build up in the coronary arteries
3. a blood clot can form on a fatty deposit
4. the blood clot can block a coronary artery
5. some heart muscle cells do not get the oxygen and nutrients they need
6. the person develops chest pain
7. if left untreated then the cells start to die
8. this leads to a heart attack

