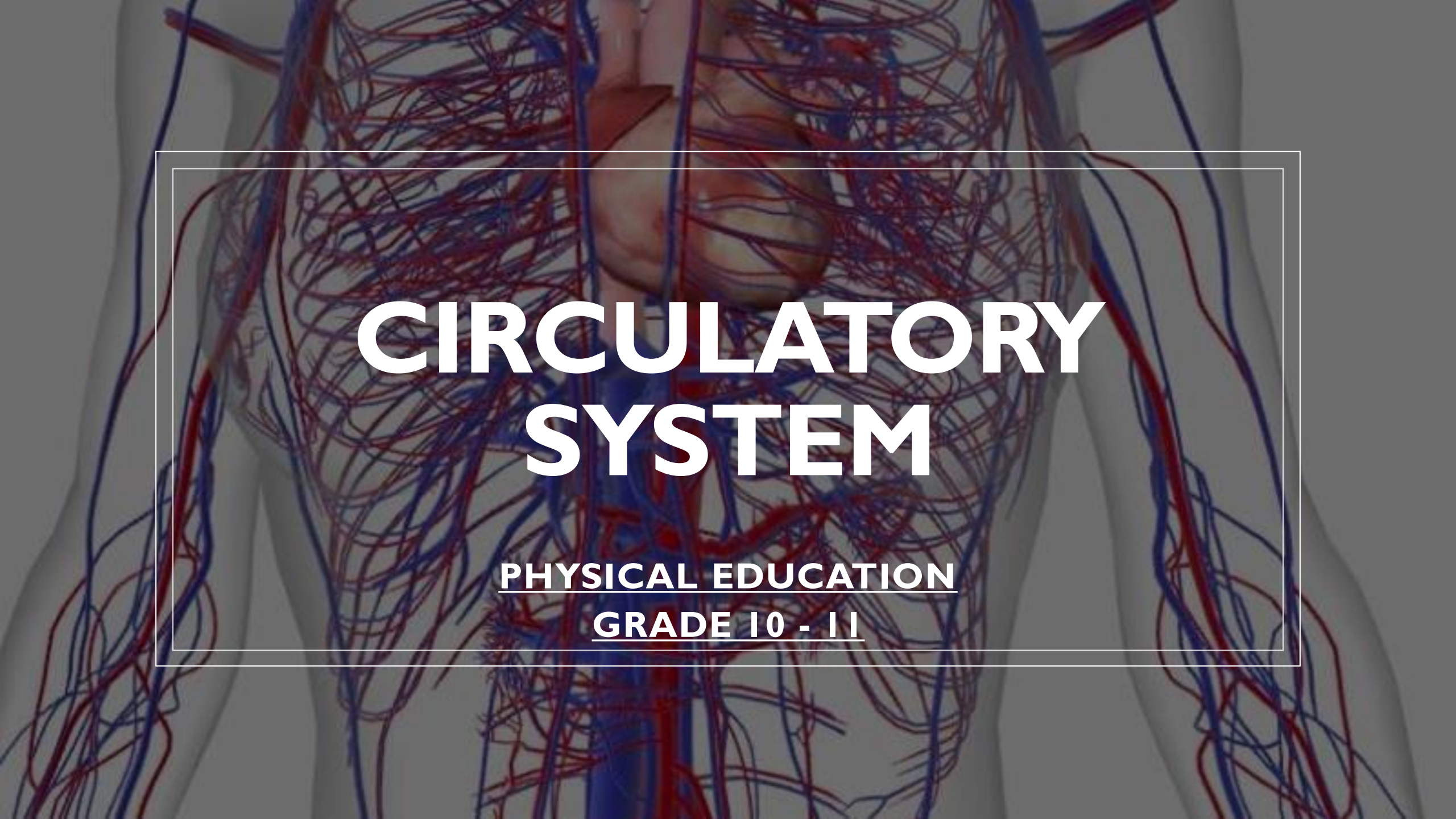
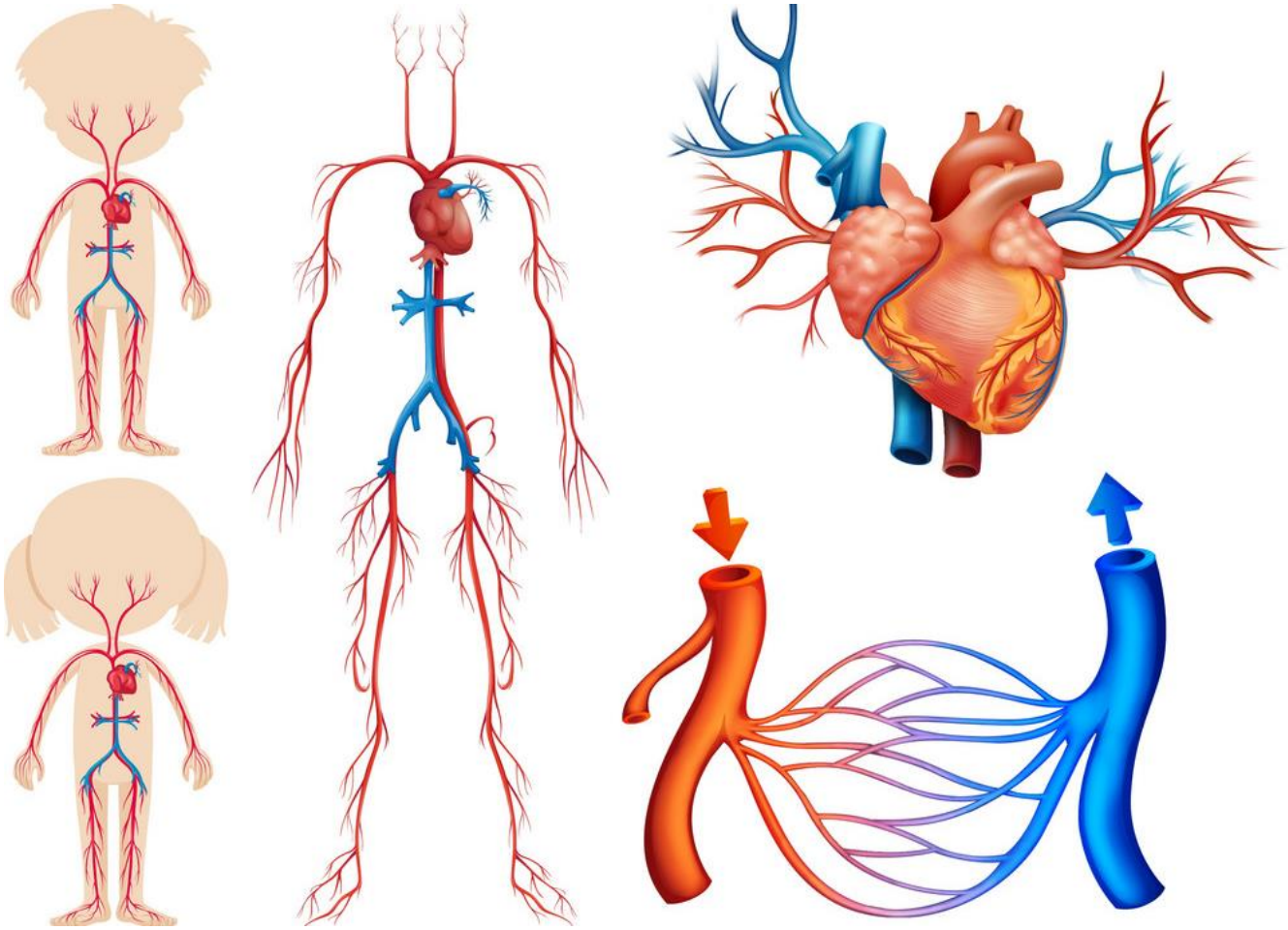


CIRCULATORY SYSTEM

PHYSICAL EDUCATION

GRADE 10 - 11



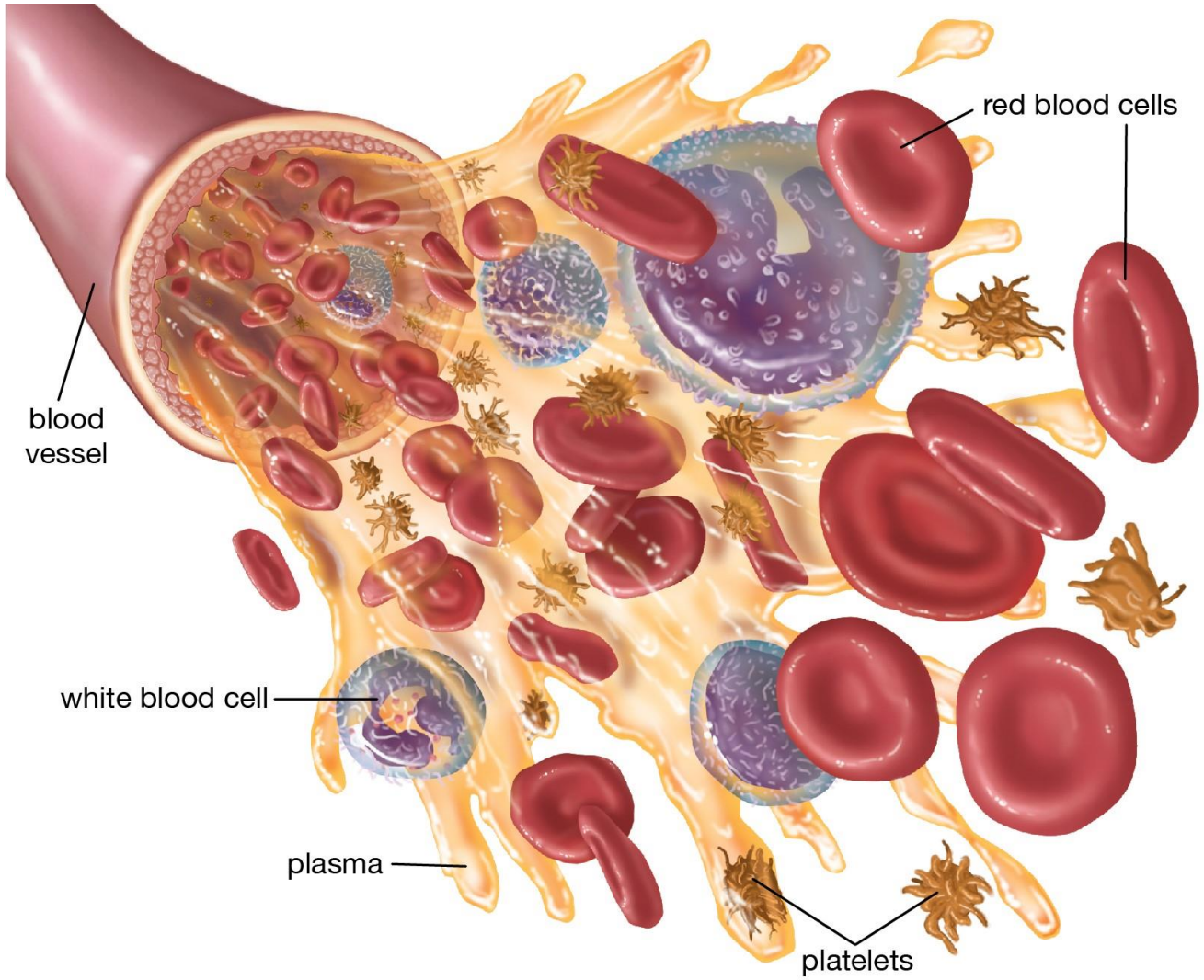
Circulatory System

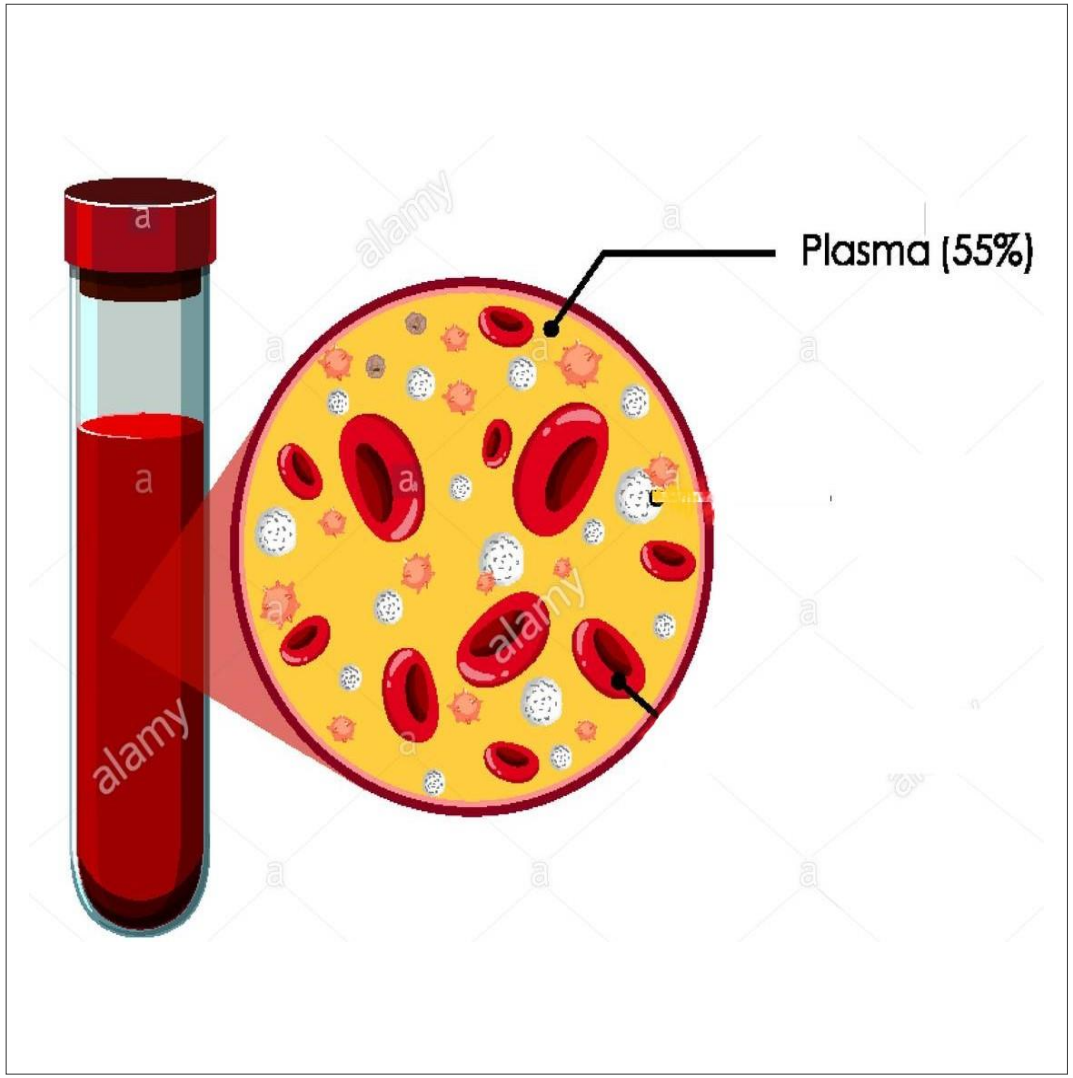
- Our muscles require energy to contract and to enable us to play sport.
- There are energy supplies in the working muscles but these are used up very quickly.
- Therefore, we require a method of transporting the oxygen into these muscles.
- The method of transporting oxygen around the body is called the circulatory system.
- Circulatory system can be defined as the body's transport system that consists of the lungs, heart, blood vessels and blood.
- The lungs, heart, blood vessels and bloods are the main elements for the transport to be efficient in our body.

Blood

- Blood is classified as a connective tissue.
- The average total blood volume is about 5 litres (about 9 pints), making up approximately 8% of our body weight.
- Blood consists if the following elements:

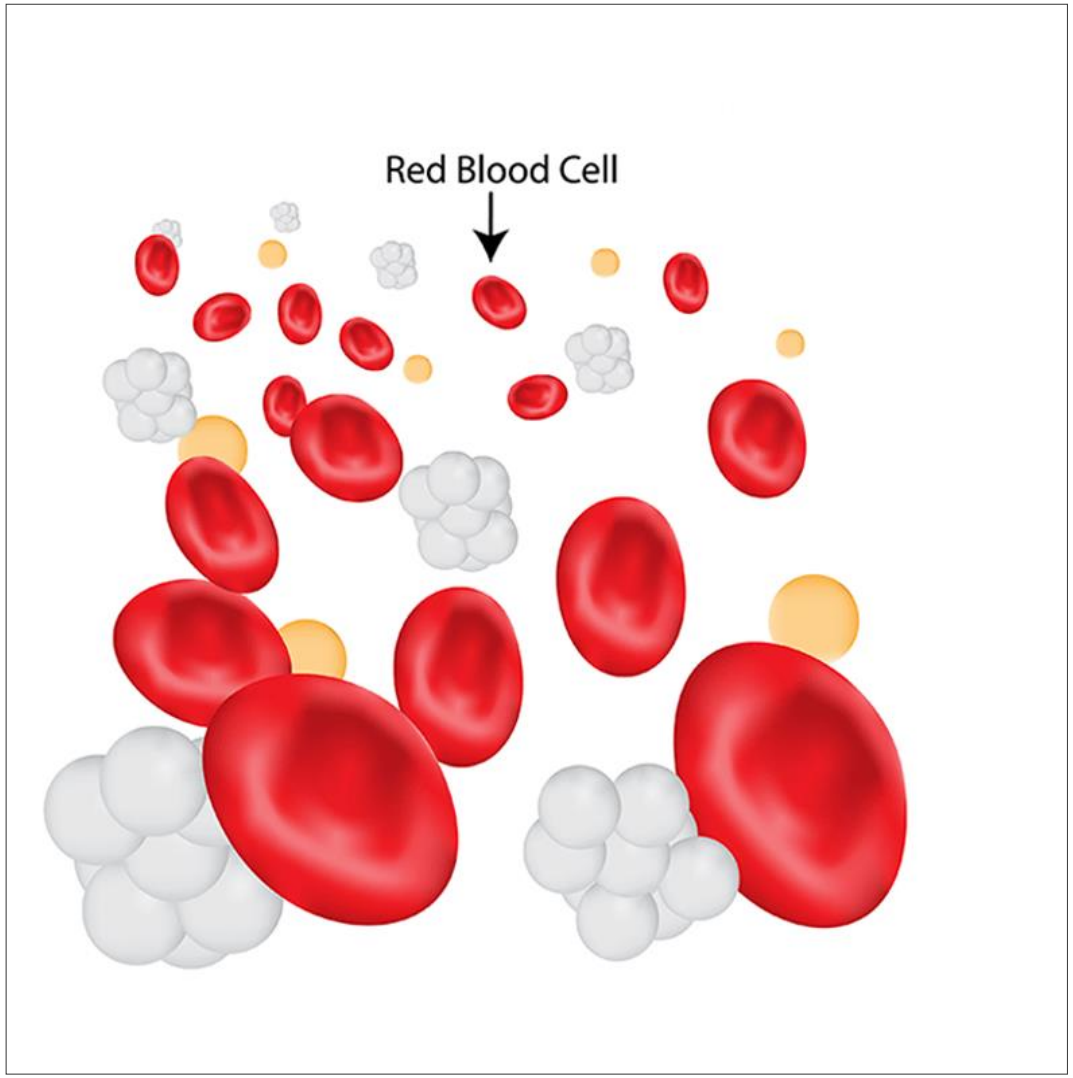
1. Blood Plasma
2. Red Blood Cells
3. White Blood Cells
4. Blood Platelets





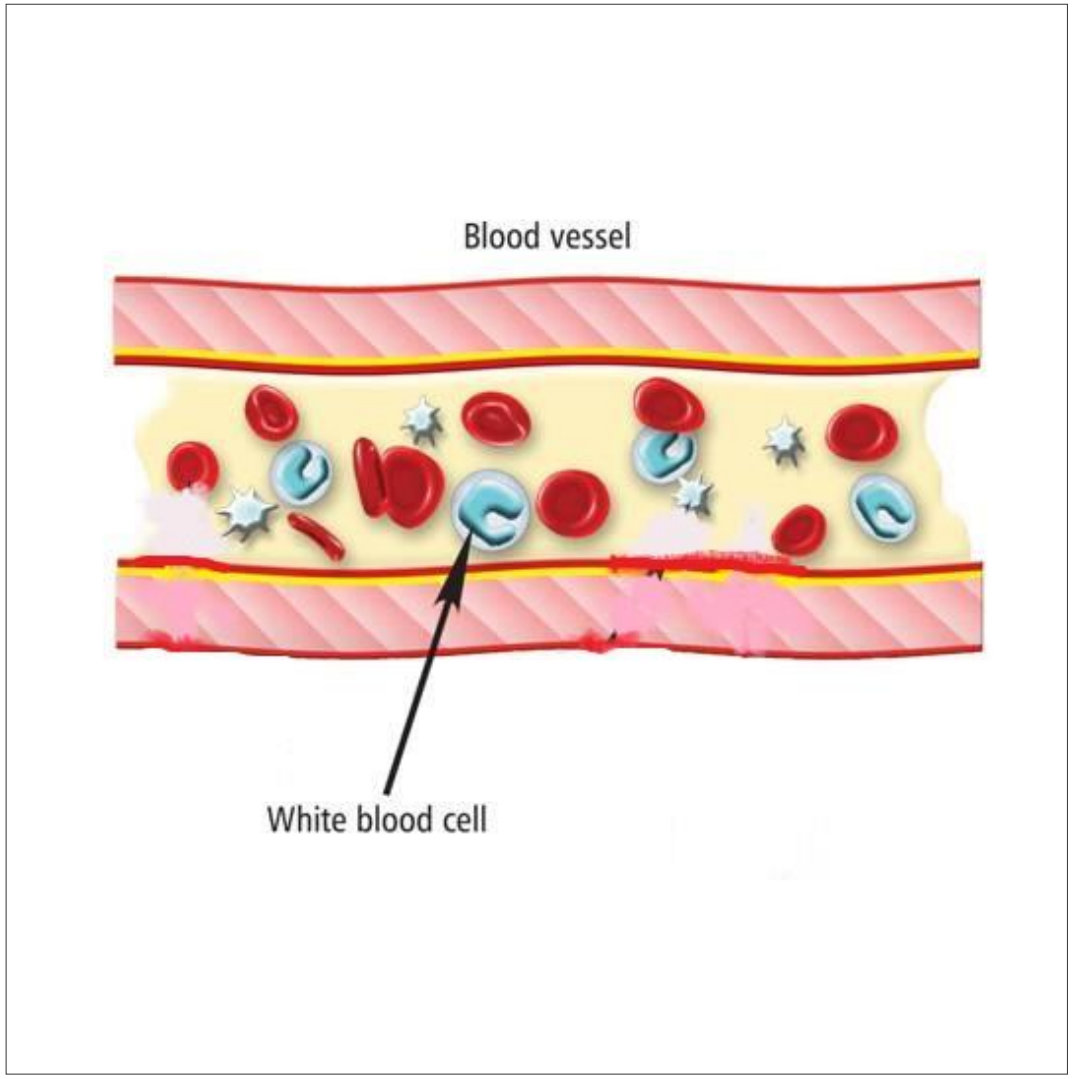
Blood - Plasma

- Make up 55% of the total blood volume.
- Pale yellow fluid which consists mainly of water.
- It carries carbon dioxide, hormones and waste products through the body.



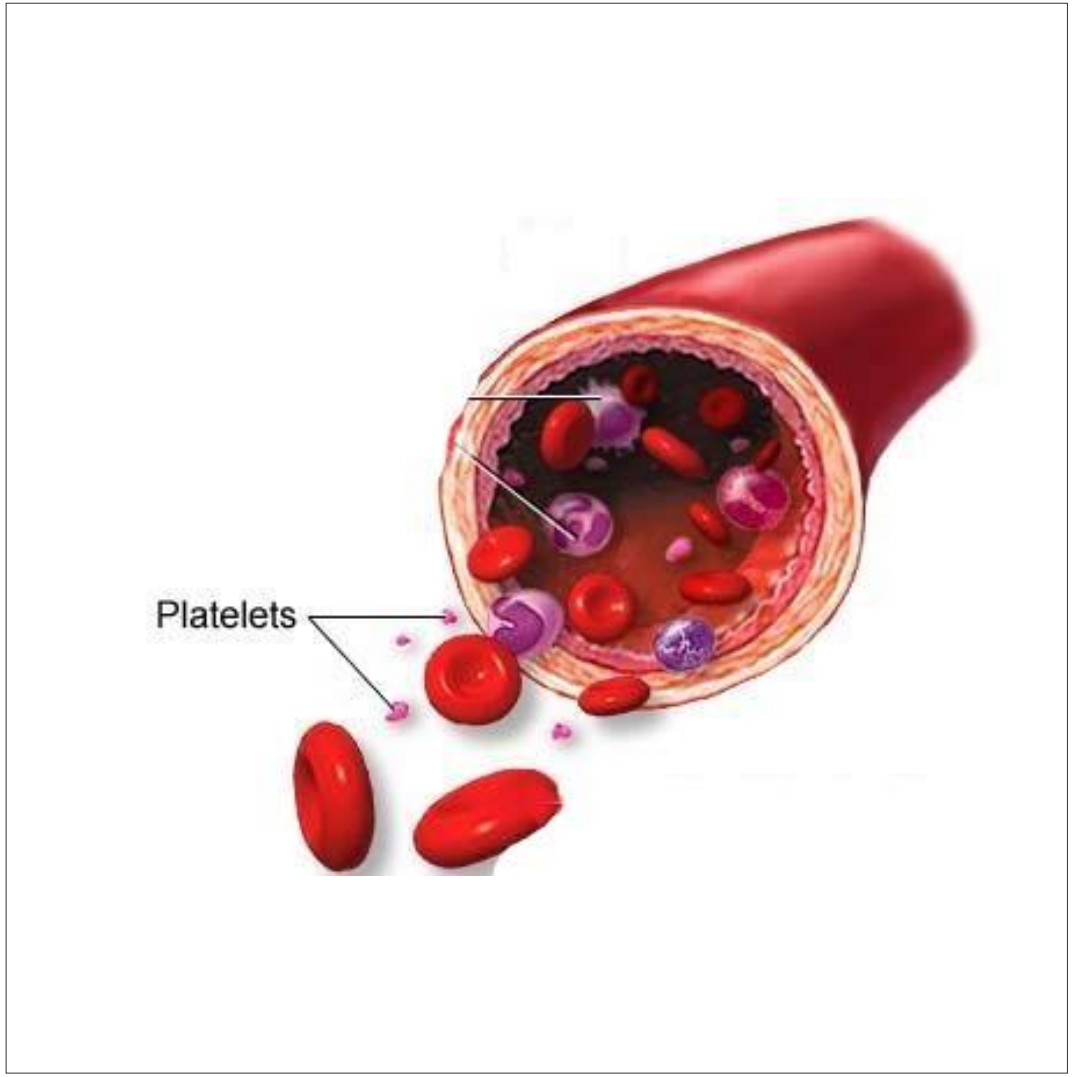
Blood - Red Blood Cells

- Also referred to as RBC.
- Make up the majority of the remaining 45% of the total volume.
- The small red disks contain substance called haemoglobin, which carries oxygen.
- When the blood contain oxygen, it is called oxygenated.
- When the blood has no oxygen, it is called deoxygenated.
- Red blood cells are made in the bone marrow.
- The more you train the more red blood cells are made.



Blood – White Blood Cells

- Also referred to as WBC.
- An important part of the immune system.
- Protect the body from diseases and infection by attacking any foreign substances.
- They produce antibodies and destroy the harmful microorganism in the body.
- They are made in the bone marrow.



Blood - Platelets

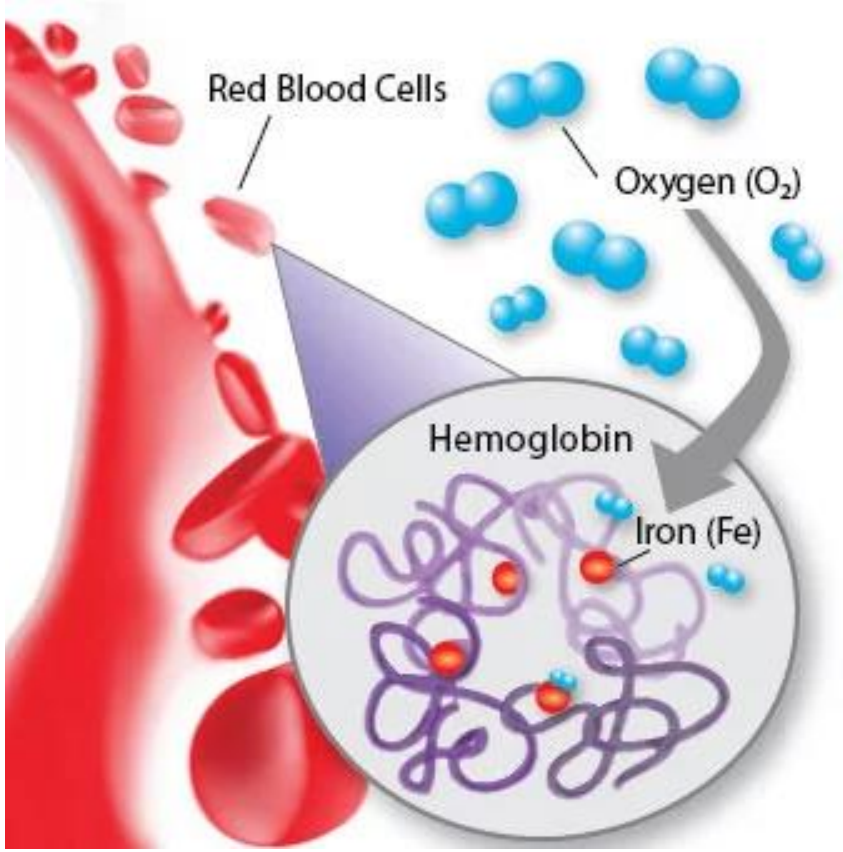
- Are microscopic cells that normally appear at the site of a cut.
- It forms a platelet plug in small blood vessels.
- It forms a clot in larger wounds in order to stop bleeding.

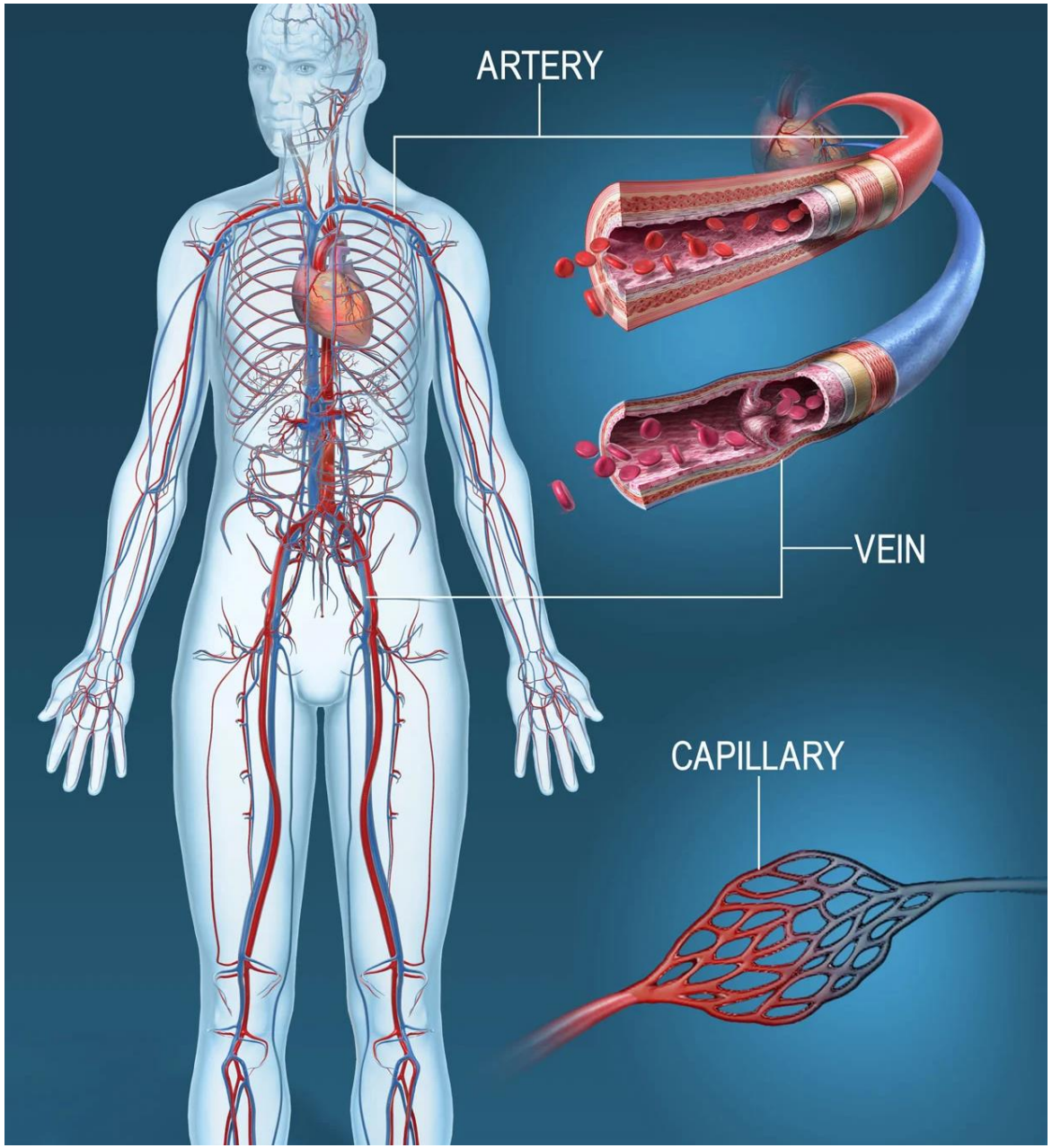
TEST YOURSELF – ACTIVITY ONE

- Name one component of blood and explain how it helps to maintain good health.
- Explain how white blood cells aid a performer.
- Describe the importance of plasma in the blood.

The Role of Haemoglobin in Red Blood Cells

- Haemoglobin (Hb) is a red coloured protein pigment found within RBC's.
- It is formed during haemopoesis with mature red cells when the iron containing the pigment haem and the protein globin to produce further the supplies of haemoglobin.
- When it is mixed with oxygen, it is called oxyhaemoglobin which is bright red in colour.
- When the state of oxygen is reduced, it is called deoxyhaemoglobin which is purplish blue in colour.
- The main function of haemoglobin are to uptake oxygen in the lungs and carry them in the red blood cells to release it in other tissues in the human body.



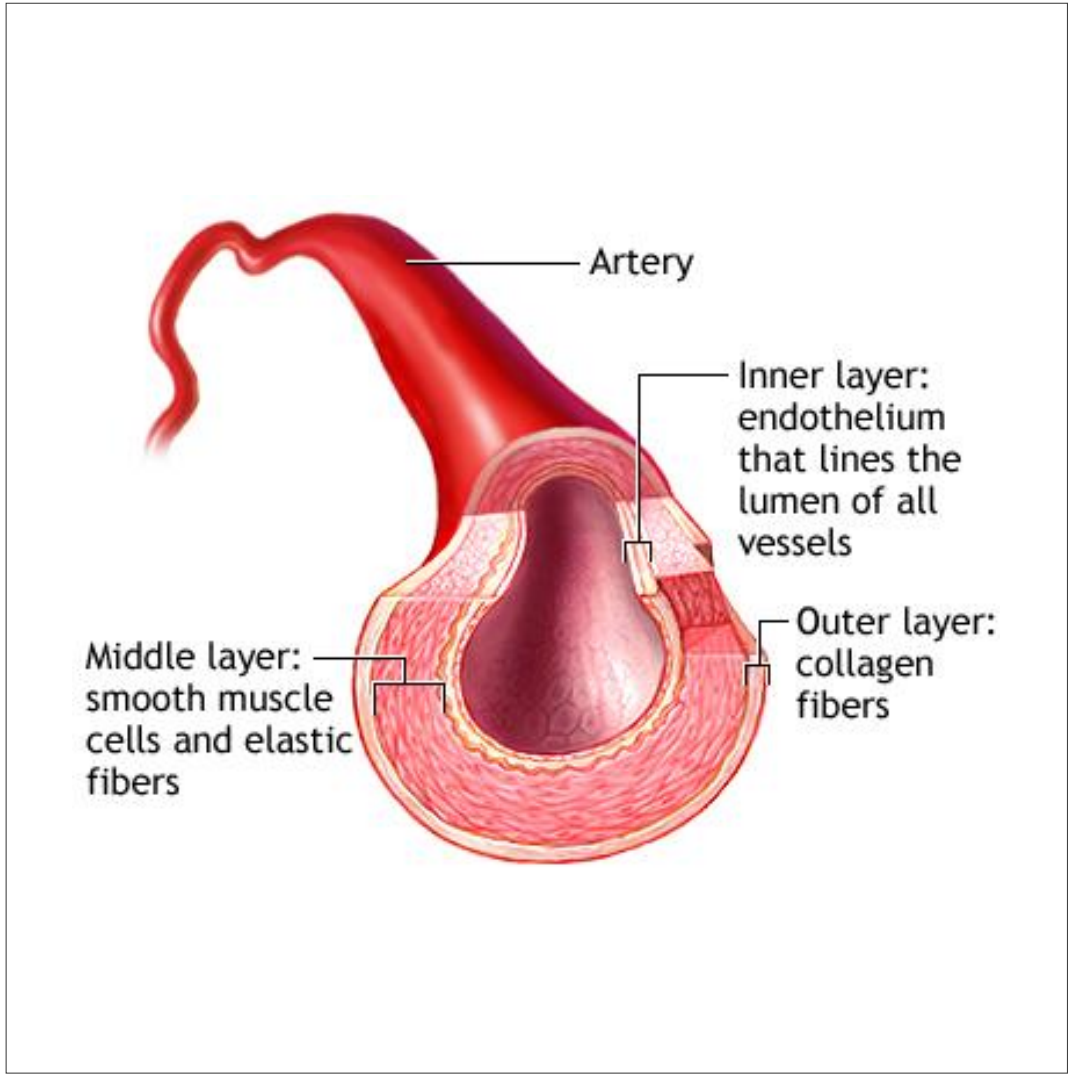


Blood Vessels

- Blood flows through vessels which are namely;

1. The Arteries
2. The Capillaries
3. The Veins

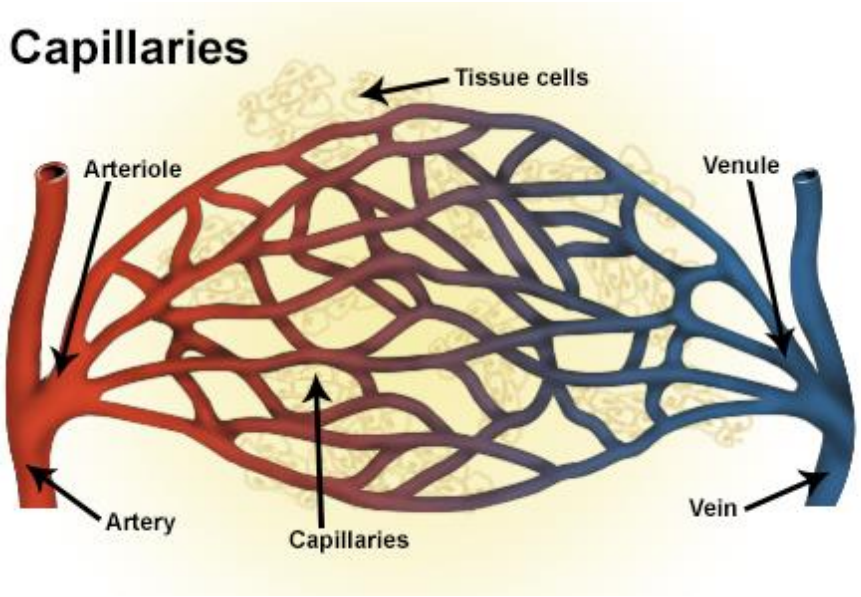
- The arteries carries nutrients to the muscles.
- The veins carries waste products away from the muscles.
- One of the most important nutrients are the oxygen, without which most tissue cells cannot function.



Arteries

- It carry blood away from the heart.
- They consist of three layer; an inner lining, a layer of smooth muscle and a fibrous outer covering.
- Artery walls are thick as the blood is travelling under high pressure.
- Function:

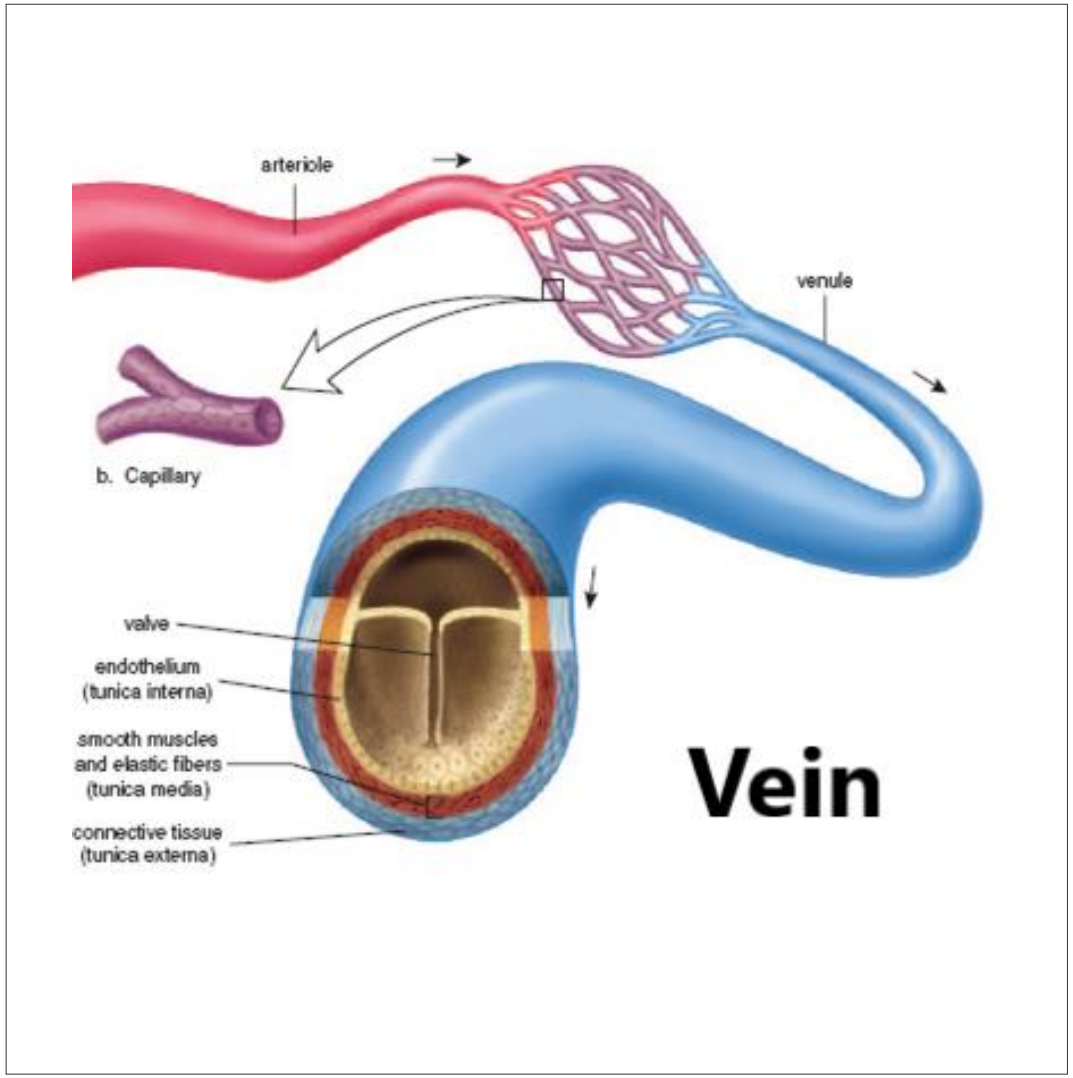
1. Transport blood away from the heart.
2. Carry oxygenated blood (except in the case of the pulmonary artery).
3. Have relatively narrow lumens.
4. Have relatively more muscle/elastic tissue than veins
5. Transport blood under high pressure than veins
6. Do not have valves – except for the semi-lunar valves of the pulmonary artery and the aorta.



Capillaries

- Once the arteries begin to spread out, the blood passes through a network of smaller vessels called the capillaries.
- They have thin vessels through which a red blood cell can barely squeeze.
- The wall of capillaries are only one cell thick, which enables gases and nutrients to be exchanged between the blood and the cells.
- The process is known as diffusion, whereby gases pass through a membrane from an area of high concentration to an area of lower concentration.
- Function:

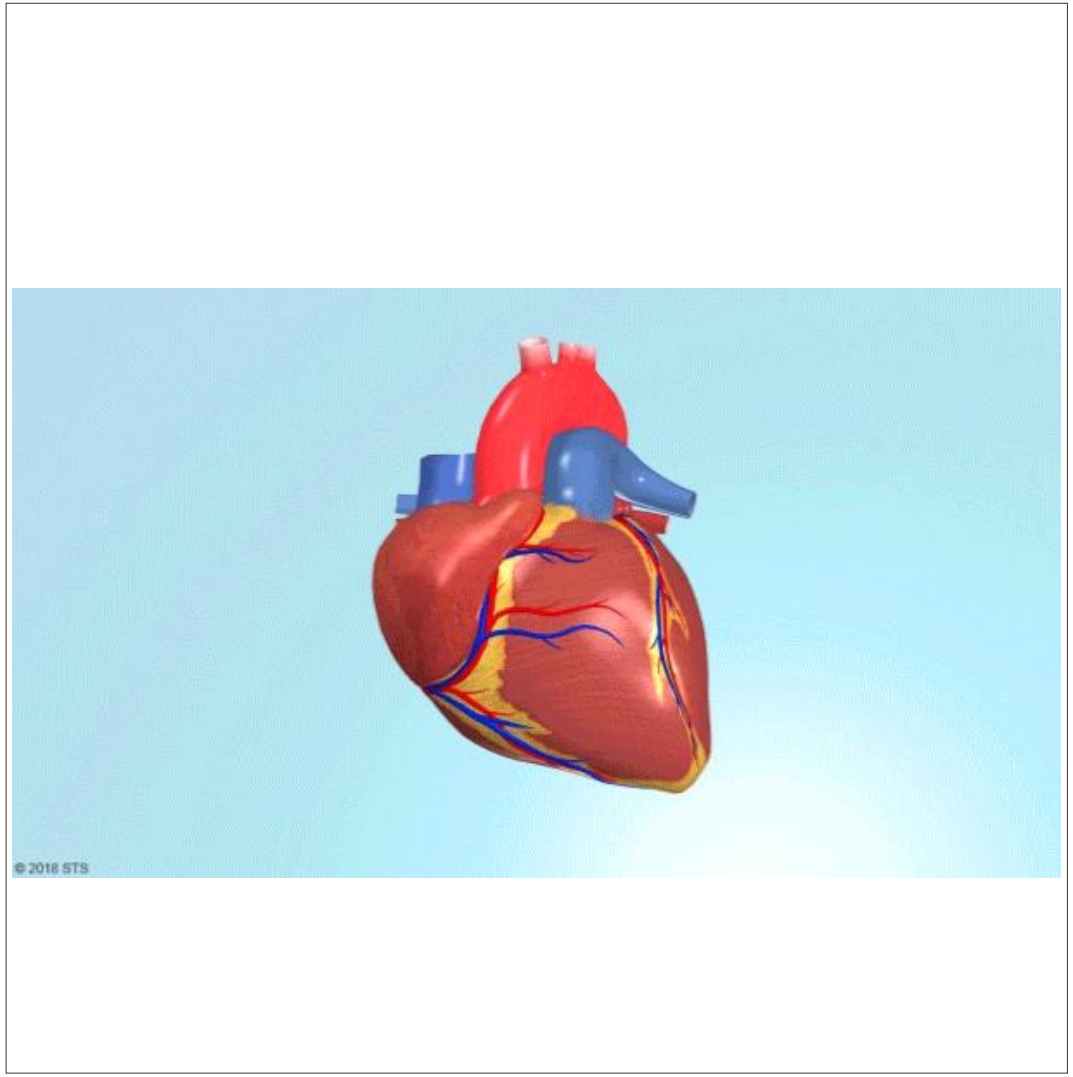
1. To supply tissues with components of and carried by, the blood and also to remove waste from the surrounding cells.
2. The exchange of oxygen, carbon dioxide, water, salts. Etc between the blood and the surrounding body tissues.



Veins

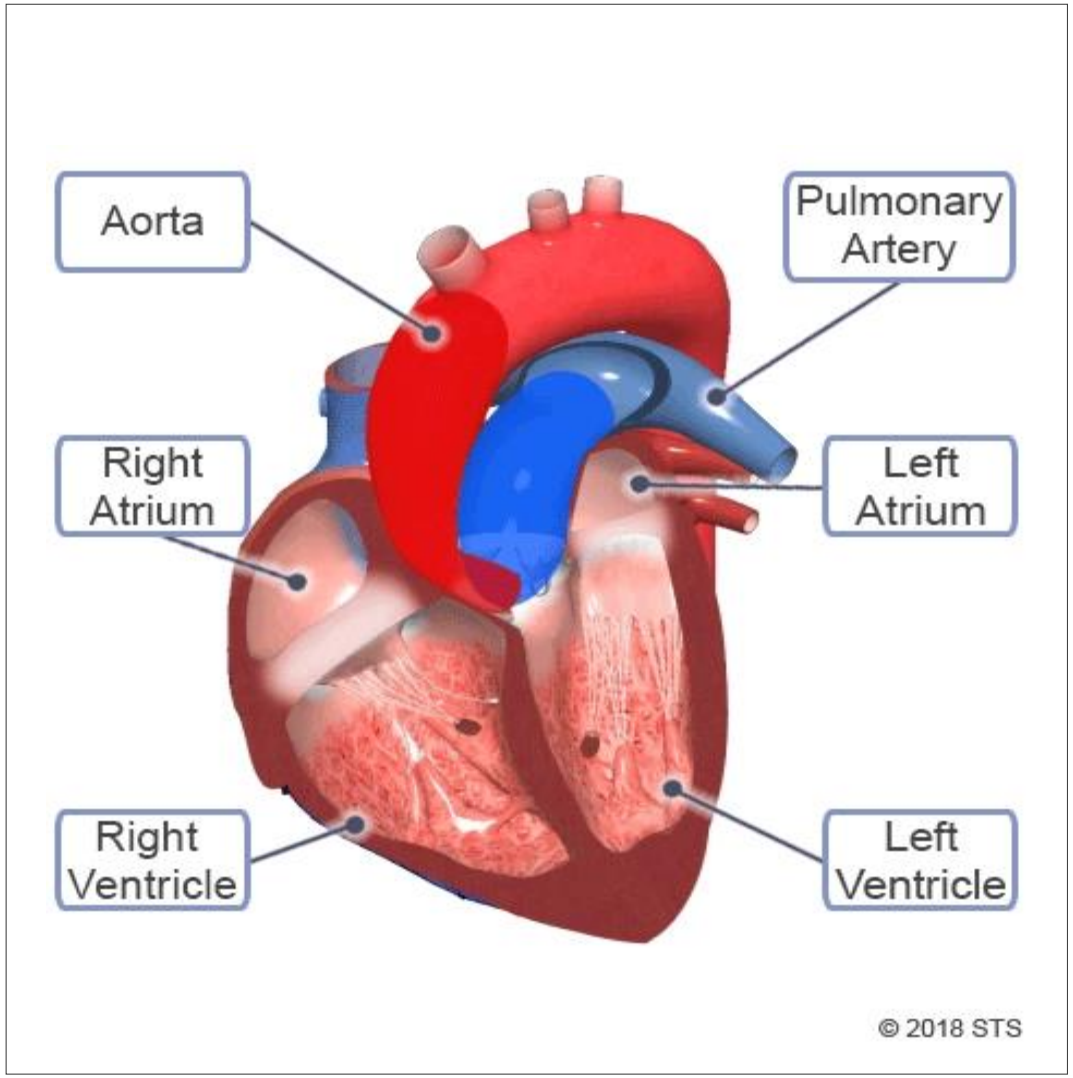
- They are blood vessels which carry blood back to the heart.
- They have a wall of three layers but a thinner one.
- Veins prevent the backflow of blood through a system of valves.
- Function:

1. Transport blood towards the heart.
2. Carry deoxygenated blood (except in the case of the pulmonary vein).
3. Have relatively wide lumens.
4. Have relatively less muscle/elastic tissue than arteries.
5. Transport blood under lower pressure than artery.
6. Have valves throughout the main veins of the body to prevent blood flowing in the wrong direction.



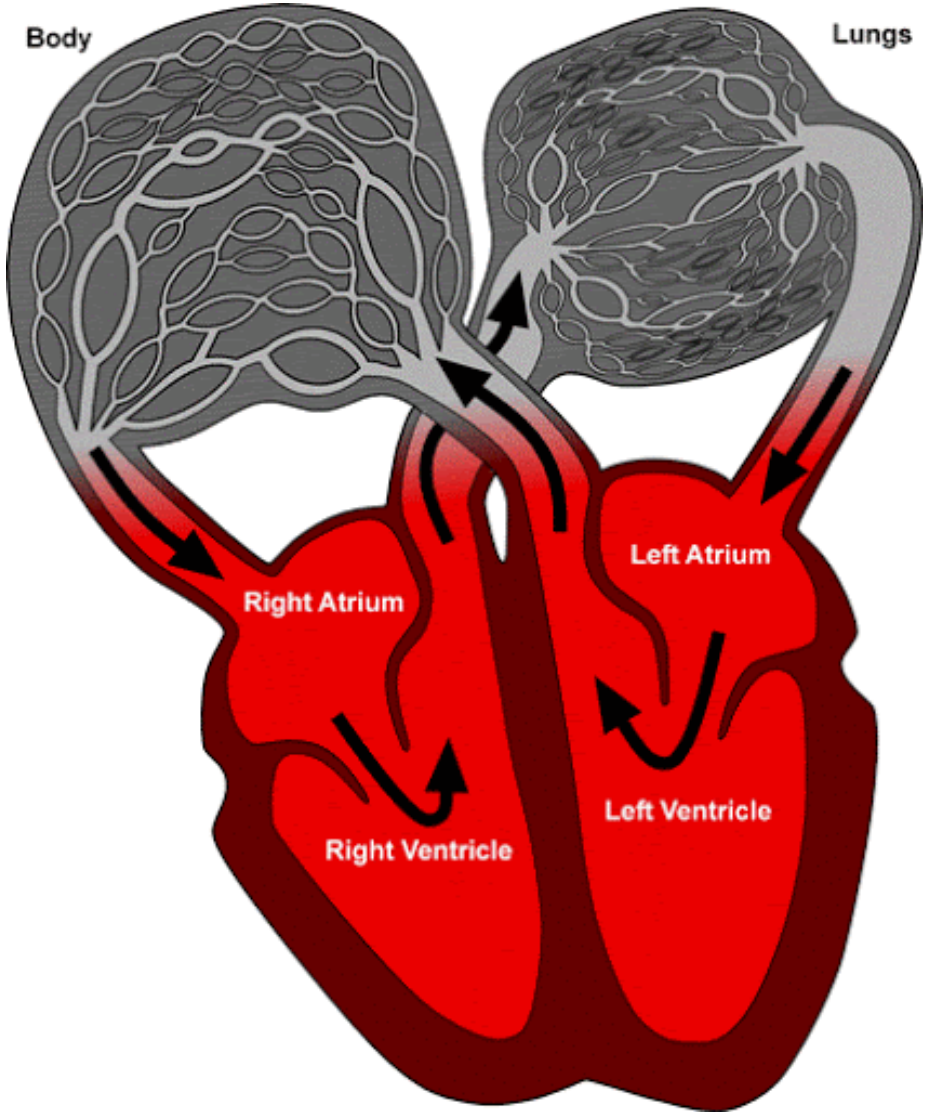
The Heart

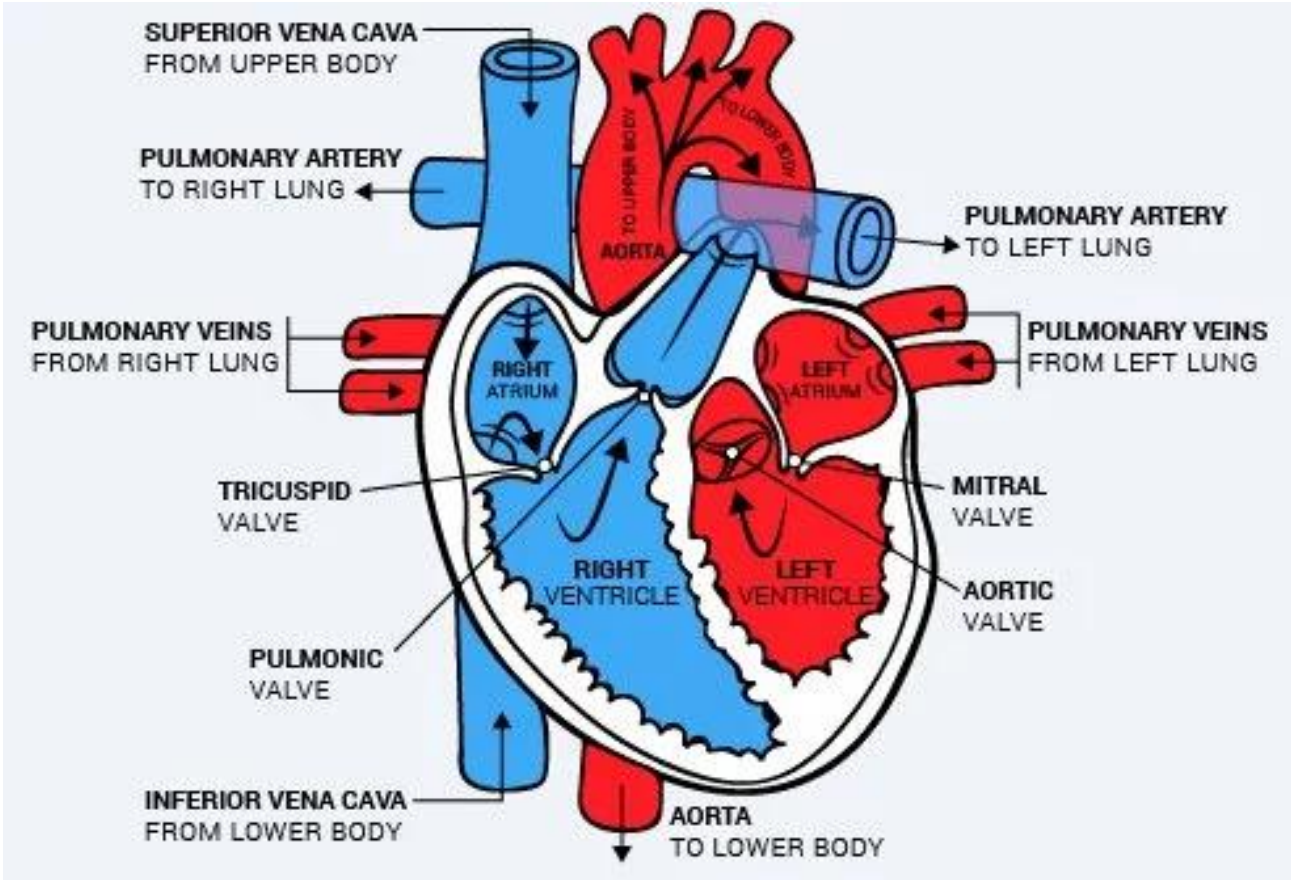
- The heart is a muscular cone-shaped organ about the size of a clenched fist of the same person.
- It is located in the upper body (chest area) between the lungs and with its pointed end called the apex downward, forward and pointing towards the left.
- The main purpose of the heart is to pump blood around the body.

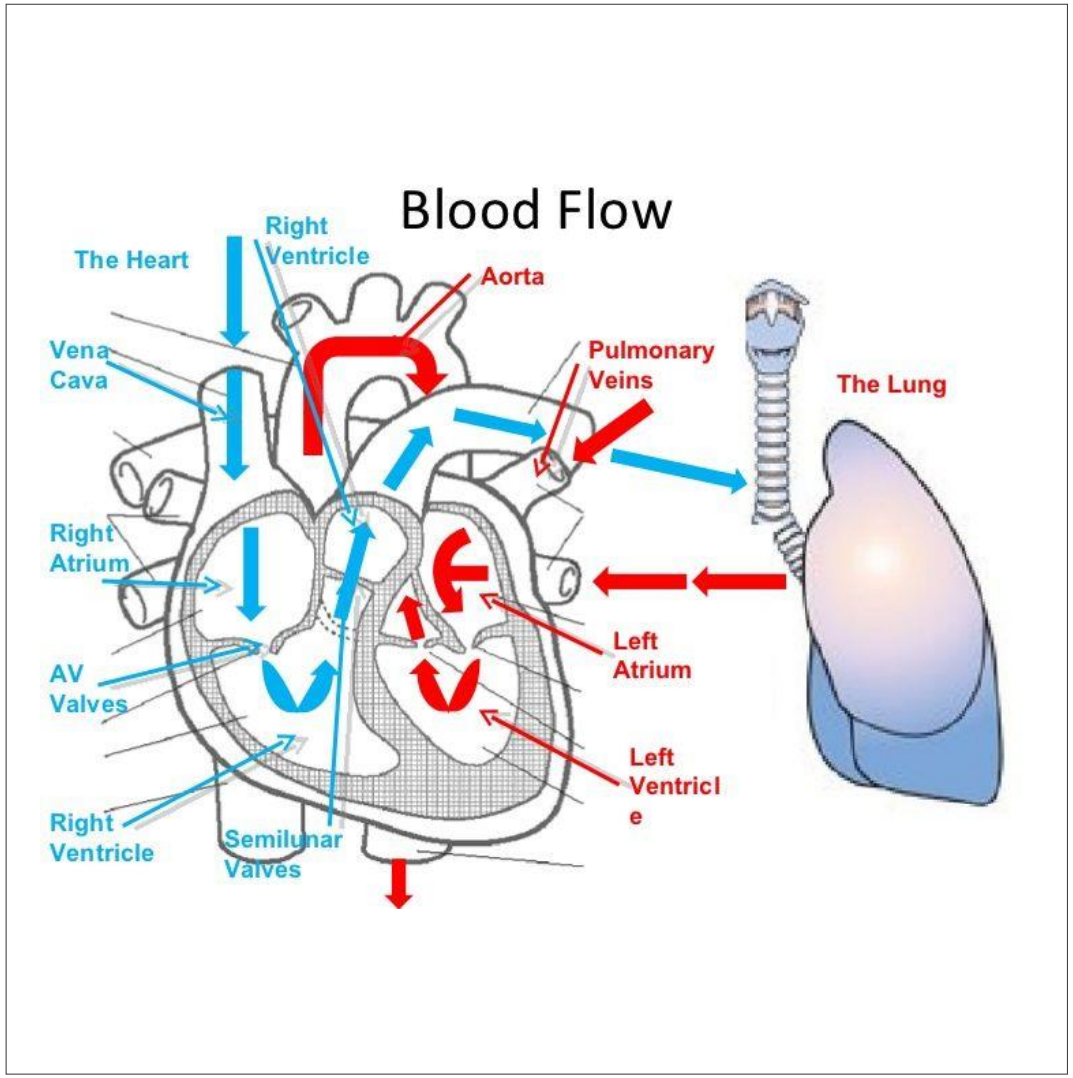


Structure of the Heart

- It consists of four chambers namely; the right atrium, right ventricle, left atrium and left ventricle.
- It is almost entirely made out of cardiac muscle.
- It consists of two muscular pumps separated unto a left-hand side and a right-hand side by a solid muscular wall called the septum.
- The heart is about the size of a closed fist of an adult.
- There are also different valves found inside the heart for appropriate functioning of the blood flow called the bicuspid valve, tricuspid valves, mitral valve, pulmonary valve and aortic valve.


Body
Lungs
Right Atrium
Left Atrium
Right Ventricle
Left Ventricle


SUPERIOR VENA CAVA
FROM UPPER BODY
PULMONARY ARTERY
TO RIGHT LUNG
PULMONARY ARTERY
TO LEFT LUNG
PULMONARY VEINS
FROM RIGHT LUNG
PULMONARY VEINS
FROM LEFT LUNG
TRICUSPID
VALVE
MITRAL
VALVE
AORTIC
VALVE
PULMONIC
VALVE
INFERIOR VENA CAVA
FROM LOWER BODY
AORTA
TO LOWER BODY
AORTA
RIGHT ATRIUM
LEFT ATRIUM
RIGHT VENTRICLE
LEFT VENTRICLE



The Pathway Of Blood Through The Heart

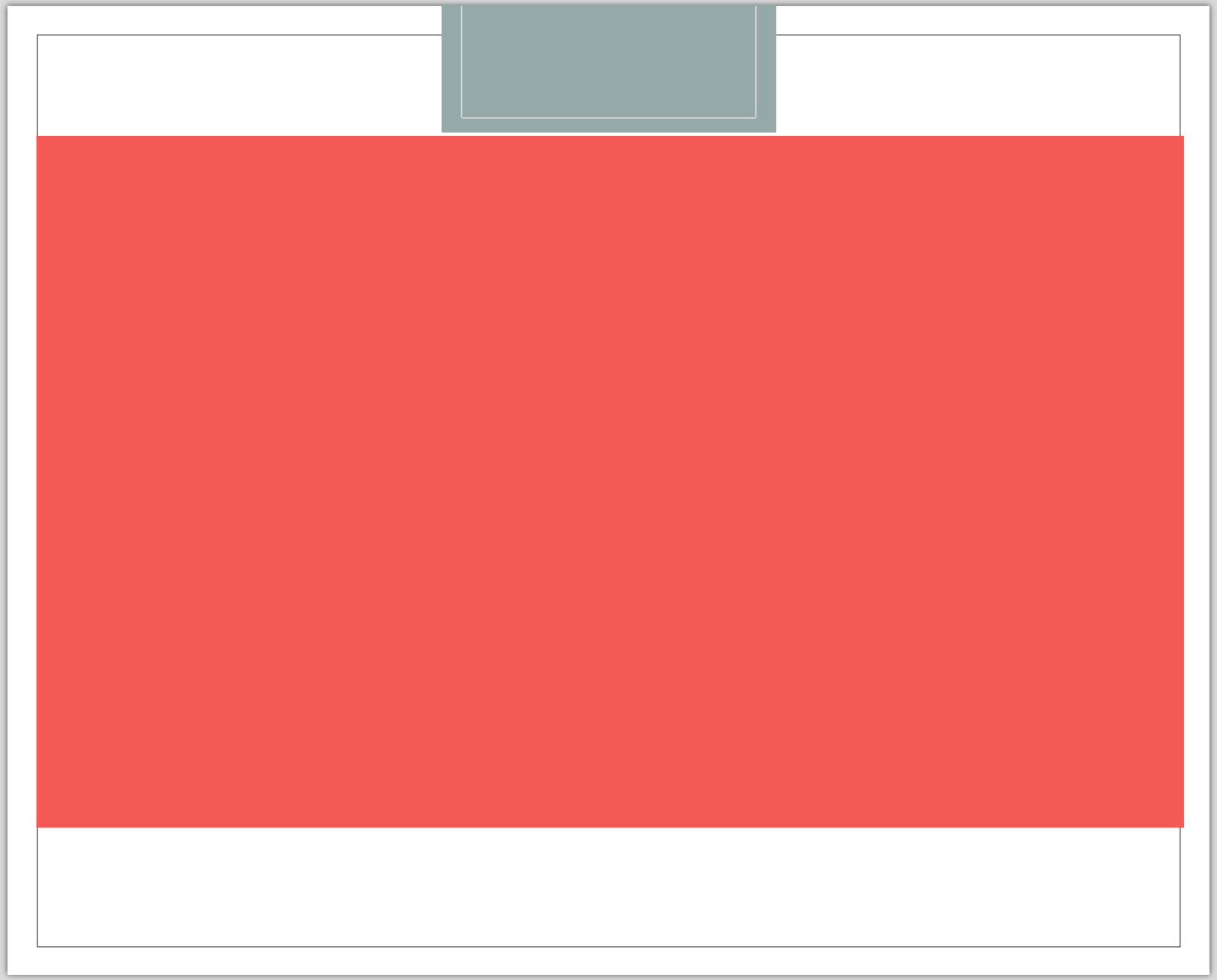
- Deoxygenated blood enters the right atrium from the superior vena cava and the Inferior vena cava.
- Deoxygenated blood leaves the right ventricle by Pulmonary artery, which takes blood to the lungs via the right and left braces if the pulmonary artery.
- Oxygenated blood enters the left atrium from the Pulmonary veins. These may be labelled as 'right pulmonary vein' and 'left pulmonary veins'.
- Oxygenated blood leaves the left ventricle by aorta, which takes blood to the body via its system of arteries and capillaries.
- It is essential that blood flows in the correct direction through the heart so the structure of the heart includes a series of valves.

I. The tricuspid valve separates the right atrium from the right ventricle.

II. The Pulmonary valve separates the right ventricle from the pulmonary artery

III. The bicuspid valve separates the left atrium from the left ventricle.

IV. The Aortic valve separates the left ventricle from the aorta

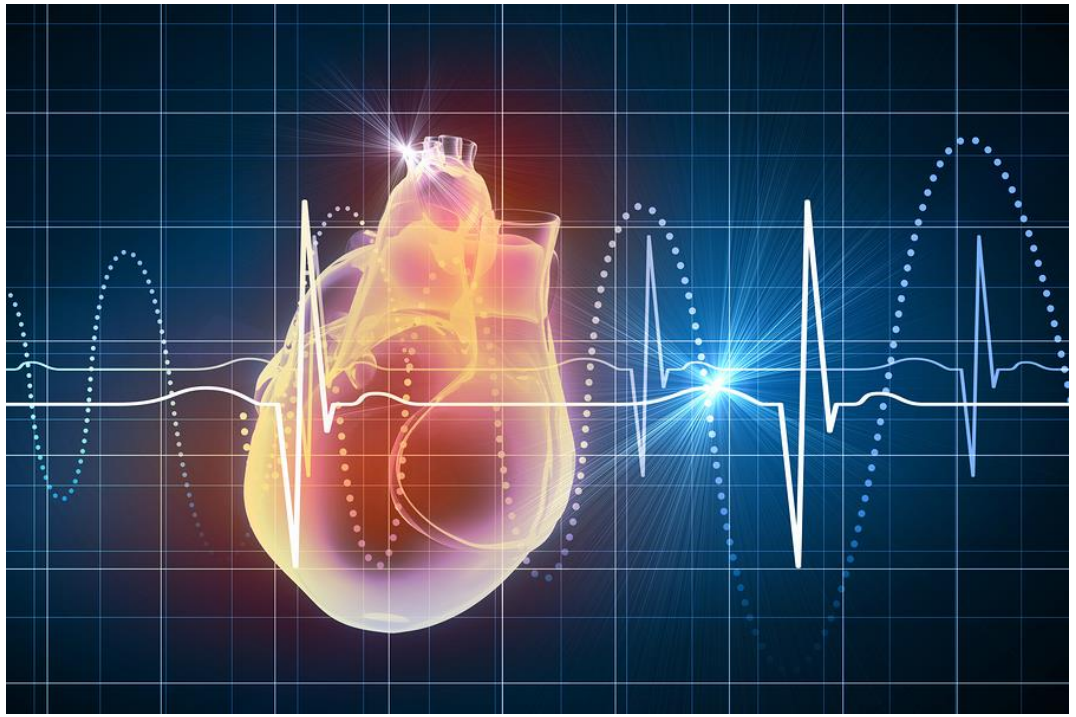


VIDEO CLIPS ON BLOOD FLOW IN HEART

TEST YOURSELF – ACTIVITY TWO

Explain in details the blood flow in the heart using your own words.

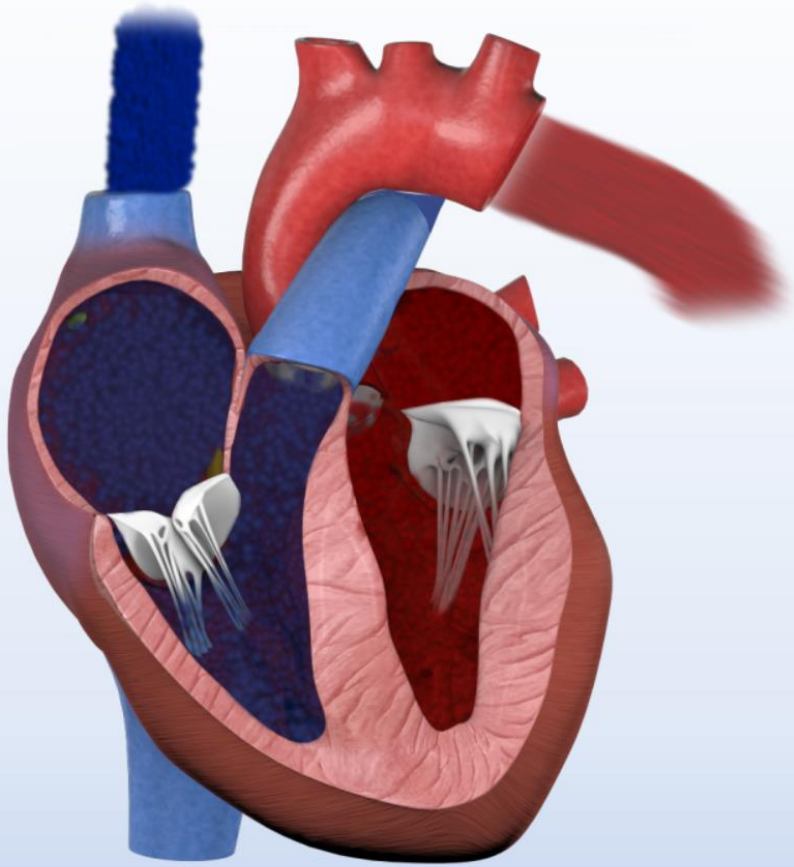
Heart Rate



Acceptable Ranges of Heart Rate	
Age	**Heart Rate (Beats per Minute)**
Infant (6 months)	120-160
Toddler (2 years)	90-140
Preschooler	80-110
School-age	75-100
Adolescent	60-90
Adult	60-100

- The heart is made from cardiac muscle.
- This muscle tissue has a number of unique characteristics.
- As well as never tiring, it also has the ability to contract and relax in a natural rhythm.
- This produces the heart beat, which is started by an electrical impulse from an organ on the surface of the right atrium called the Sino-Atrial node (SA node).
- Heart Rate (HR) is defined as the number of pulses or heart beats per minutes.
- An average resting HR is 75 beats per minutes (bpm).

Stroke Volume

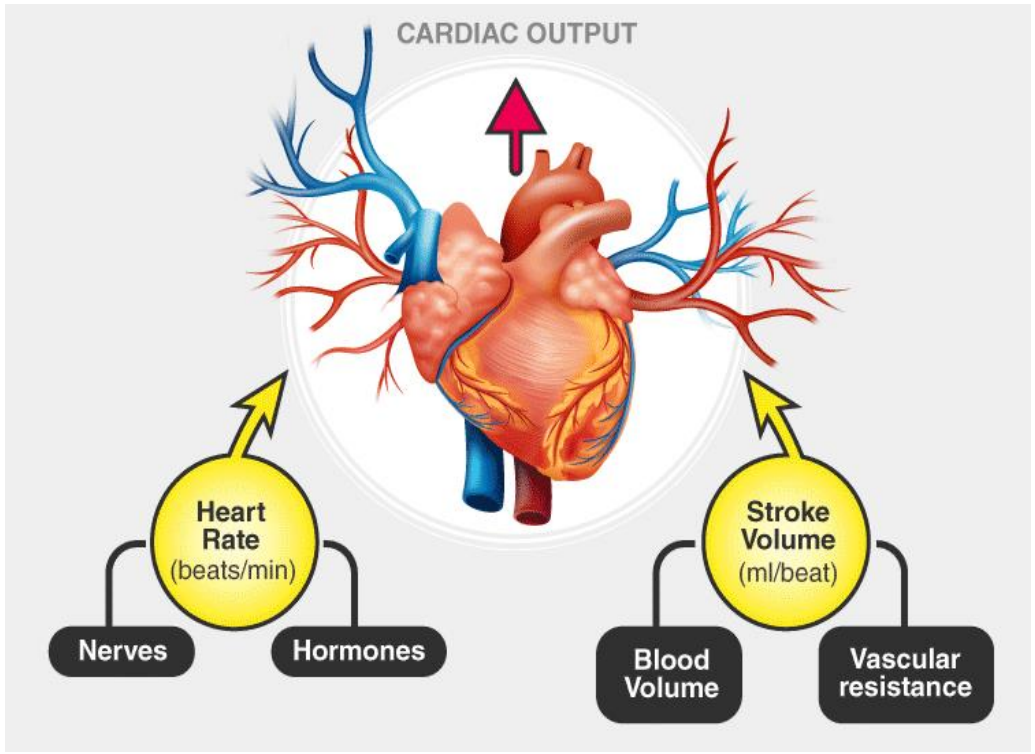


$$SV = EDV - ESV$$

Stroke Volume

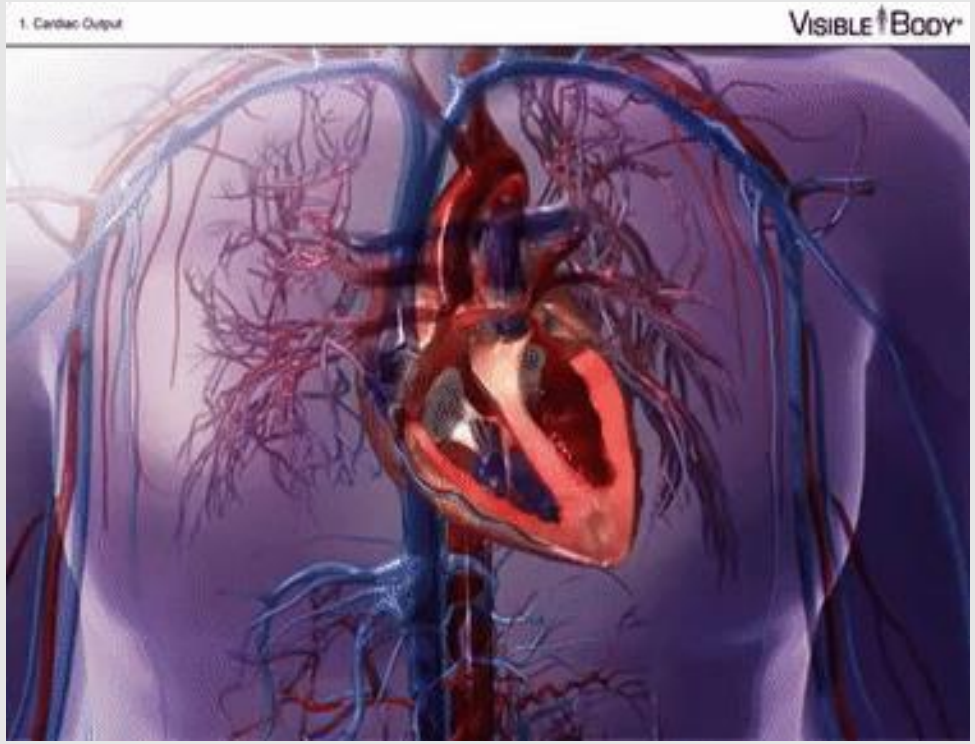
- The Volume of blood ejected from our heart in one beat is know as the Stroke Volume.
- It is measured in millilitres per beat (ml/beat).

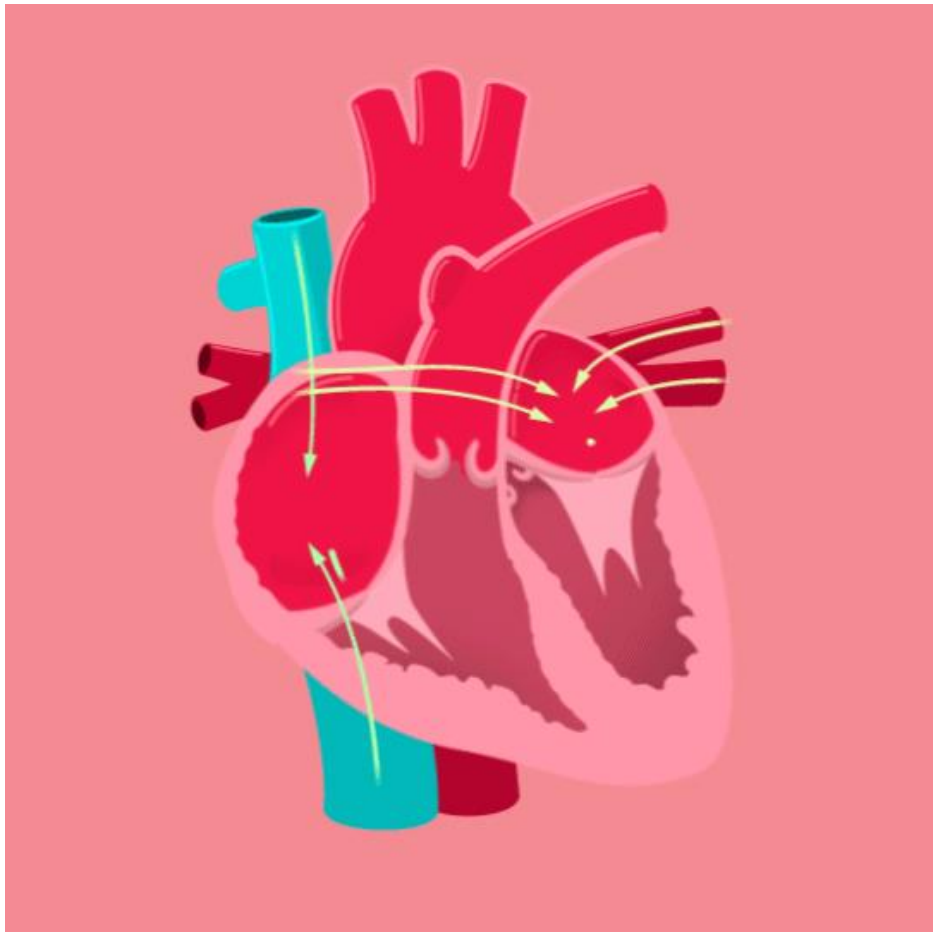
Cardiac Output



Cardiac Output = Stroke Volume × Heart Rate

- Cardiac Output refers to the volume of blood ejected from the left ventricle in one minute measured in (l/min).





The Effect of Exercise on the Heart

Short Term Effects

- Increase pulse rate
- Increase blood pressure

Long Term Effects

- Heart increase in size
- Pulse rate 'at rest' decreases
- Stroke Volume increases
- The heart pumps more blood with each heartbeat.

SUMMARY

TEST YOURSELF – ACTIVITY THREE

1. Explain why an increase in a person's stroke volume could be linked to an improvement in performance.
2. An efficient circulatory system is important to a performer. Give two functions of haemoglobin.
3. Explain the short-term and long-term effects of exercise on the heart with appropriate key words.