INVESTIGATE THE IMPACT OF SPORT AND ACTIVITY ON THE BODY SYSTEMS

Component 1: Learning aim A

THE BODY SYSTEMS

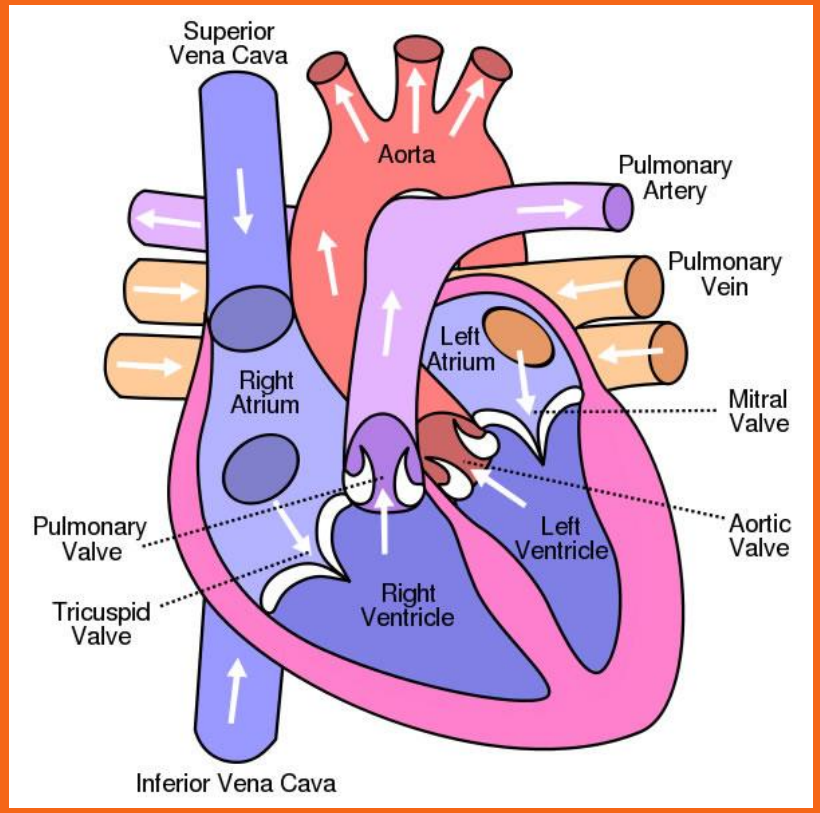
Cardiorespiratory system – made up of the cardiovascular and respiratory system.

Musculoskeletal system – made up the muscular and skeletal systems.

The two systems combine to enable our bodies to move and to respond to the demands of physical activity.

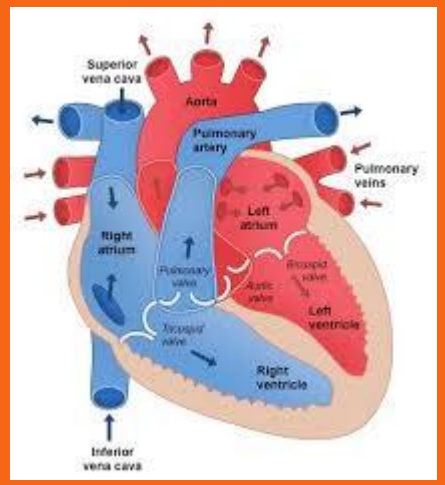
THE CARDIOVASCULAR SYSTEM

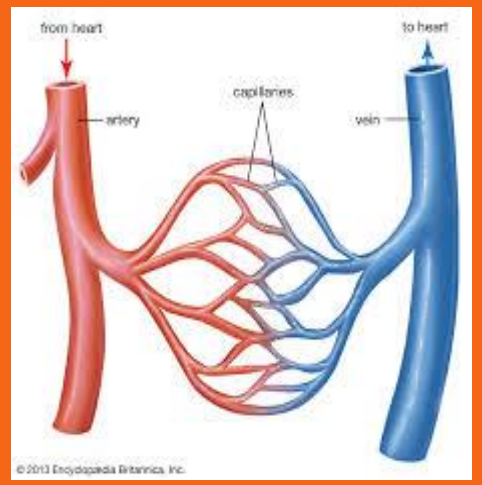
- https://www.youtube.com/watch?v=p-wilmN8oXE

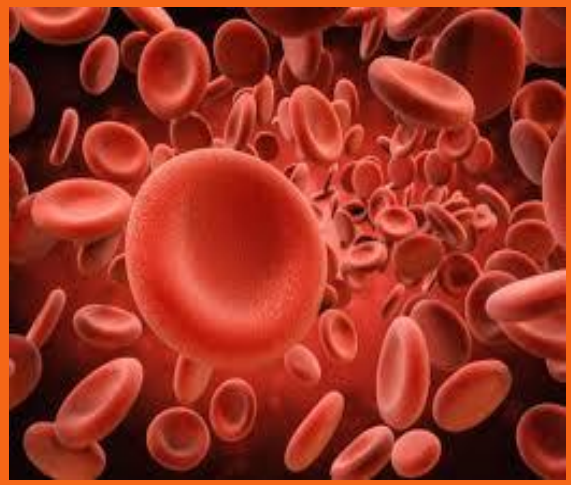


THE CARDIOVASCULAR SYSTEM

- The cardiovascular system is part of the cardiorespiratory system.
- It consists of the heart, the blood vessels (arteries, veins and capillaries), and the blood.



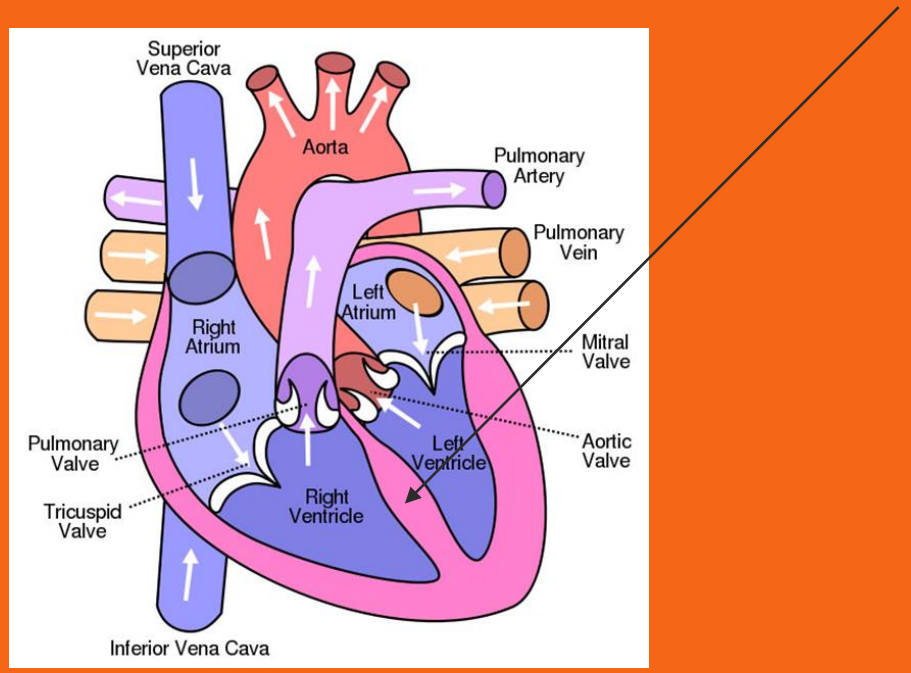




THE CARDIOVASCULAR SYSTEM

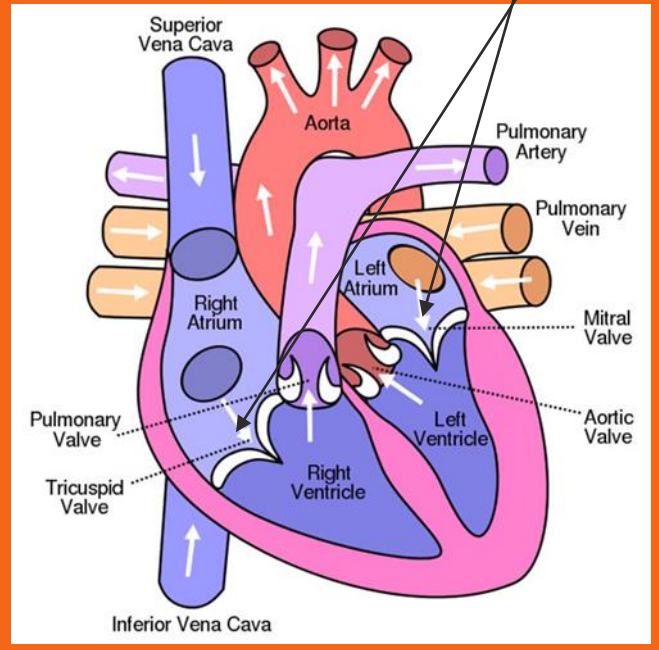
- The heart is a powerful muscular pump that sends blood around the body.

- The heart is divided into the left side and the right side by the septum.



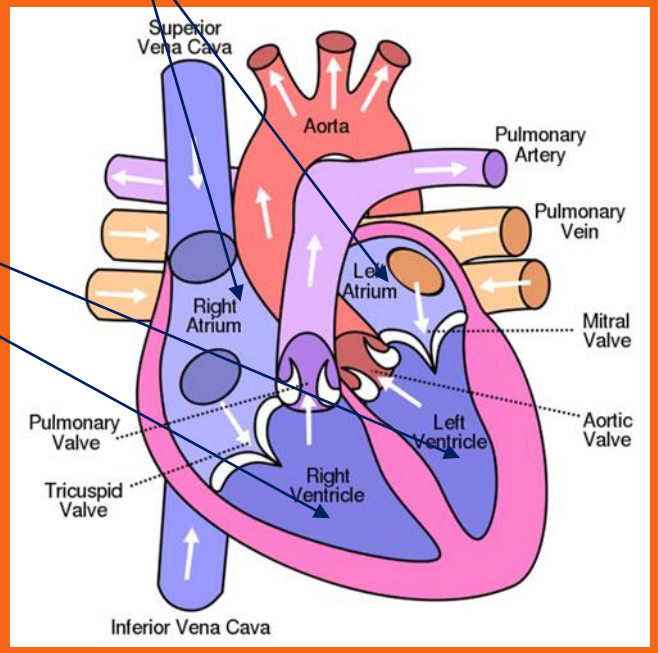
THE CARDIOVASCULAR SYSTEM

- Each side has two chambers, separated by non-return valves that prevent backflow and force the blood to travel in just one direction.



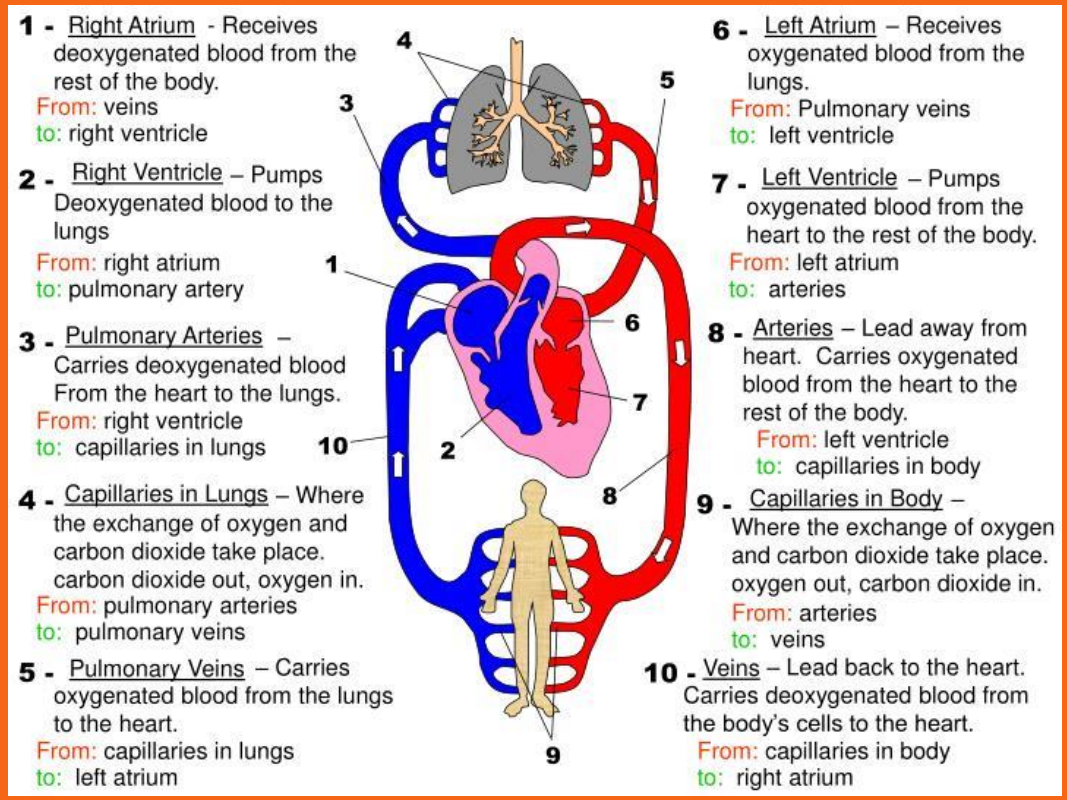
THE CARDIOVASCULAR SYSTEM

- The sound you can hear when you listen to your heart beat is the sound of the valves opening and closing.
- The top chambers are called the atria and the bottom chambers are called the ventricles.



CARDIOVASCULAR SYSTEM

- The diagram below shows how the cardiovascular system transports oxygenated and deoxygenated blood around the body.



CARDIOVASCULAR SYSTEM

1. The right atrium receives deoxygenated blood containing a low concentration of oxygen from the body through two large veins called the superior and inferior vena cava.
2. The deoxygenated blood is pumped from the right atrium, through the tricuspid valve into the right ventricle, and then through the semi-lunar valve to the pulmonary arteries.
3. The pulmonary arteries carry deoxygenated blood to the lungs, where it becomes oxygenated.

CARDIOVASCULAR SYSTEM

4

- Oxygenated blood (blood containing a high concentration of oxygen) leaves the lungs and returns to the left atrium of the heart via the pulmonary veins.

5

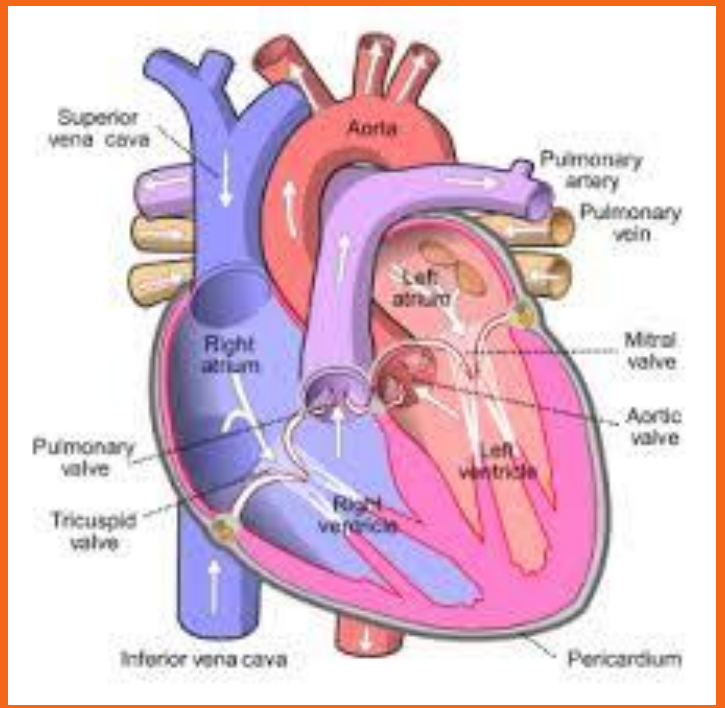
- The oxygenated blood is pumped from the left atrium, through the bicuspid valve into the left ventricle and then through a semi-lunar valve to the aorta.

6

- The aorta, the largest artery in the body, carries oxygenated blood to the rest of the body, where it becomes deoxygenated.

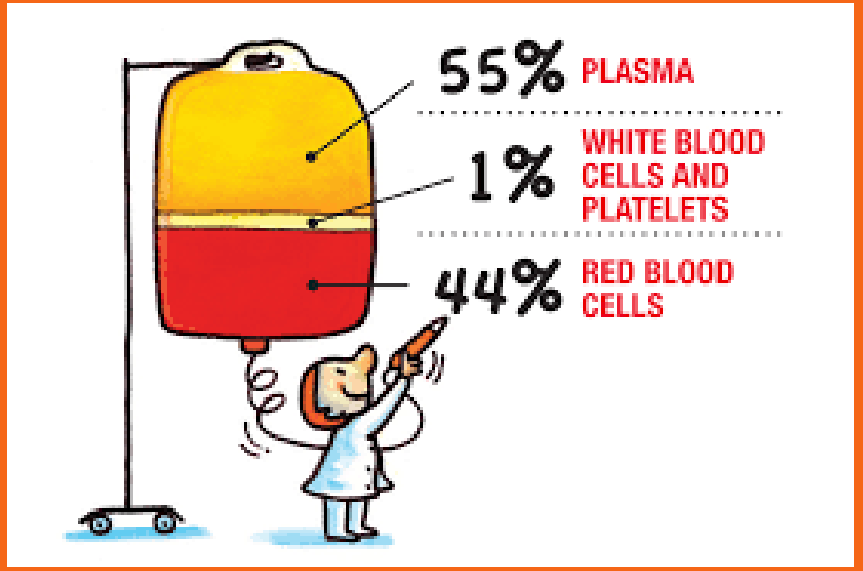
TASK 1

- Imagine you are in a tiny submarine that can travel alongside blood cells around the cardiovascular system.
- Starting at the right atrium, describe your journey through the body.

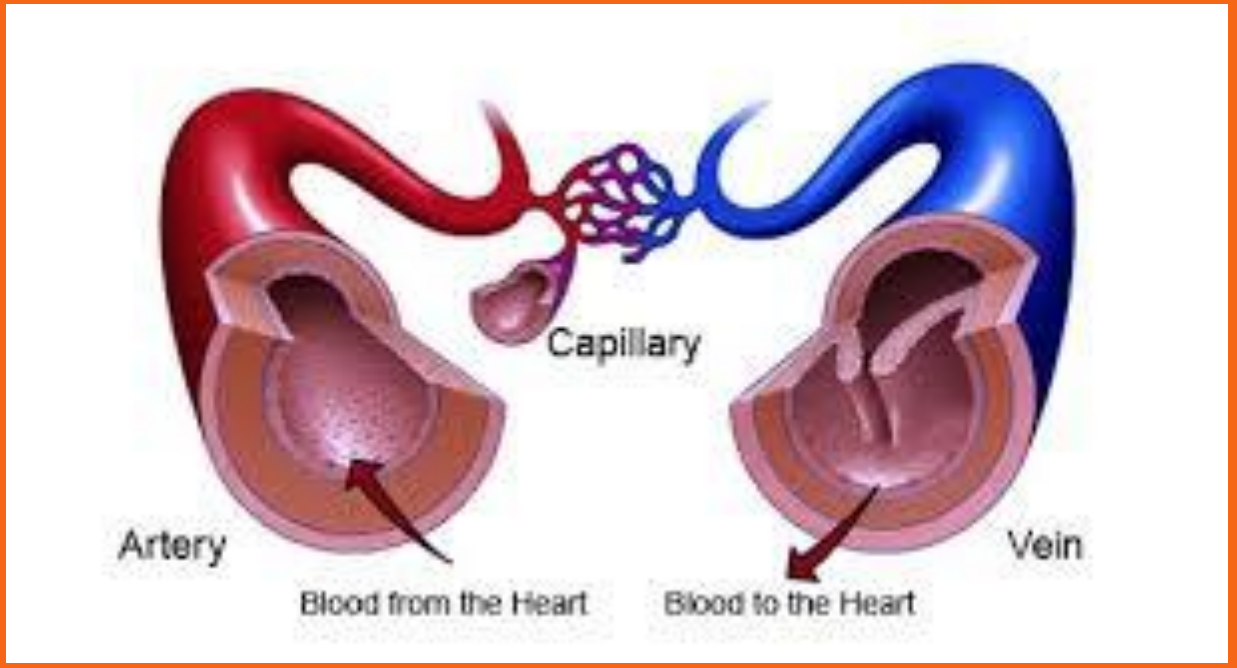


BLOOD COMPONENTS

- https://www.youtube.com/watch?v=qrE6YoSe8bw
- https://www.youtube.com/watch?v=xioe5KDKqXQ

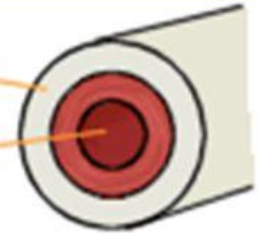
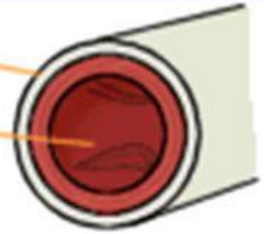


BLOOD VESSELS



BLOOD VESSELS - STRUCTURE

Blood Vessels

Artery	thick, elastic wall small lumen 
Vein	thin wall large lumen valve 
Capillary	single cell wall 

TASK 3

- Produce a diagram of all three blood vessels (arteries, veins and capillaries) and label each vessel with facts linked to their structure.

- Practical activity – complete the following exercises in pairs
- Two minutes of steps ups
- Two minutes of the wall sit
- Two minutes of the plank

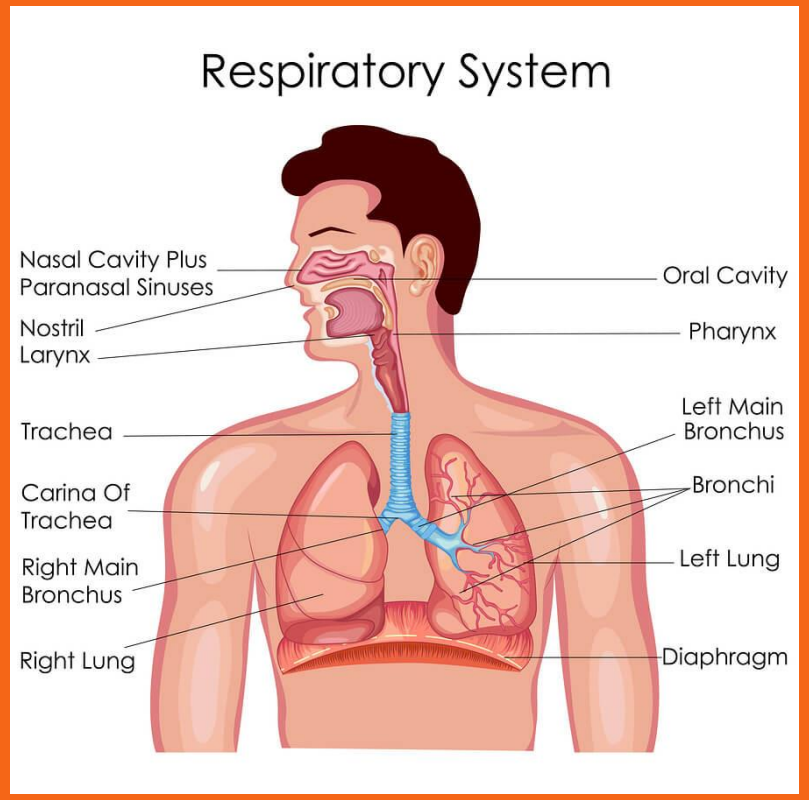
- Discuss the physiological effects of exercise shown both people in the pair – who showed the most physiological effects?

BLOOD VESSELS - 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

THE RESPIRATORY SYSTEM

- The respiratory system is part of the cardiorespiratory system.
- The structures of the respiratory system enable us to breathe.



RESPIRATORY SYSTEM

1. • Air is drawn into the body through the nose and mouth when we inhale (breathe in). It travels down the trachea to the bronchi, down the bronchi to the bronchioles, and eventually reaches the alveoli.

2. • When we exhale (breathe out), the air goes in the opposite direction. It starts at the alveoli, and travels up the bronchioles, up the bronchi, up the trachea, and leaves the body via the nose and mouth.

3. • The diaphragm and the intercostal are muscles that enable us to breathe. When we breathe in, the diaphragm and intercostal muscles contract, the space inside the lungs gets bigger, and air is pulled into the lungs. When we breathe out, the diaphragm and the intercostals relax and the space inside the lungs return to normal, and the air inside the lungs is forced out of the body.

https://www.youtube.com/watch?v=MF9DBxLRGlU

TASK 2

- Explore your respiratory system by identifying the parts of your anatomy involved in breathing.
- Breathe in and out slowly and explain what you can feel. Try to use technical vocabulary in your explanation.
- The respiratory system is often compared to an upside-down tree. Draw a diagram to illustrate this comparison. Think about the different thicknesses of branches on a tree and what you find at the end of the tree branches.

THE FUNCTIONS OF THE CARDIORESPIRATORY SYSTEM

- **Gaseous Exchange**

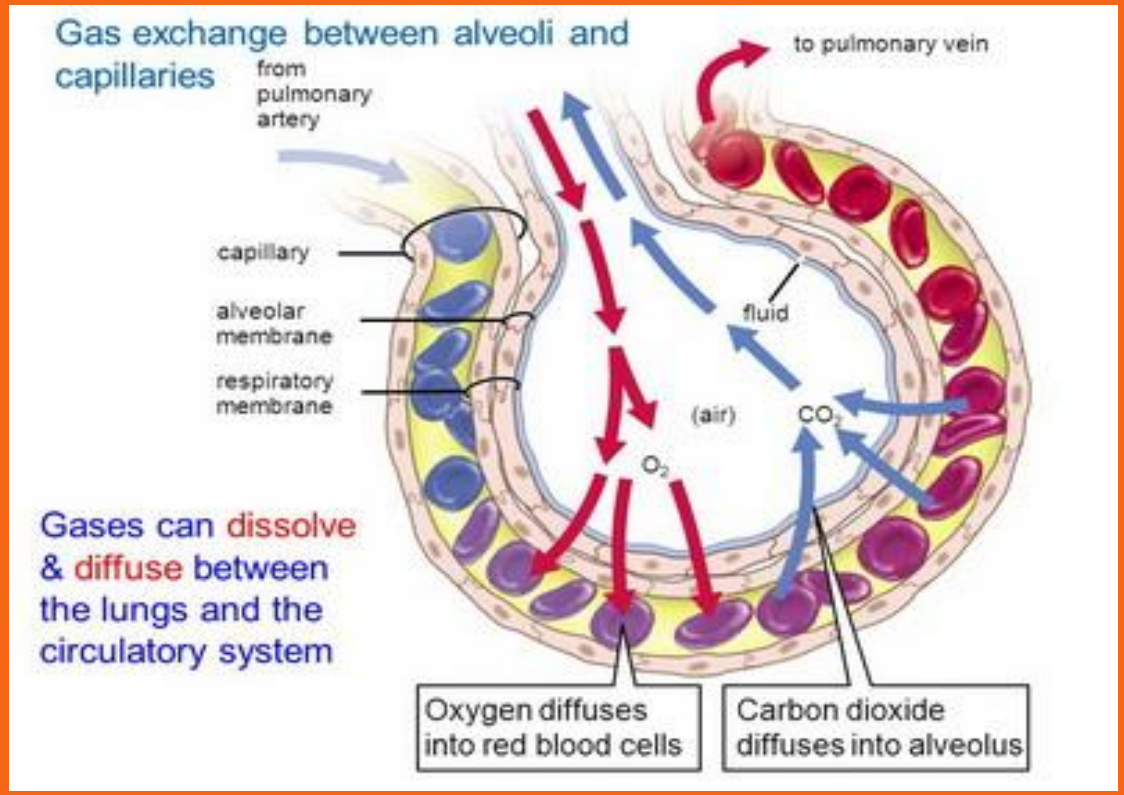
- The respiratory system is responsible for taking in oxygen through breathing in. This process is called inspiration.

- In the lungs, a process called gaseous exchange takes place.

- Gaseous exchange is a process where oxygen is transferred to the blood stream (known as oxygen uptake and carbon dioxide is transported from the blood into the lungs and breathed out.

THE FUNCTIONS OF THE CARDIORESPIRATORY SYSTEM

- The cardiovascular system then transports this oxygen-rich blood around the body and brings carbon dioxide produced by the body's cells to the lungs through expiration.

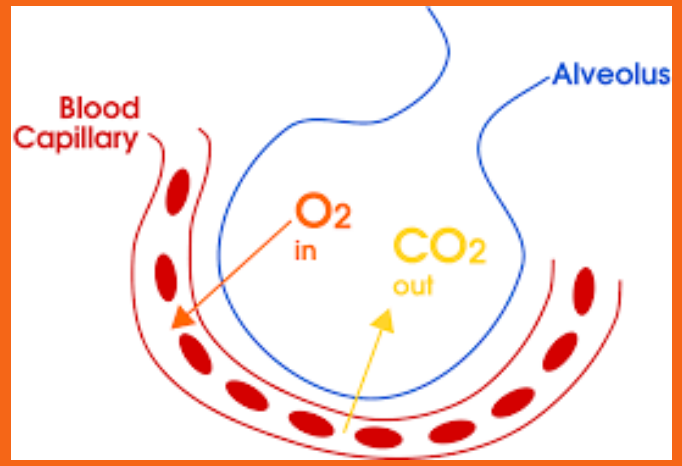


THE FUNCTIONS OF THE CARDIORESPIRATORY SYSTEM

- 4 mains functions

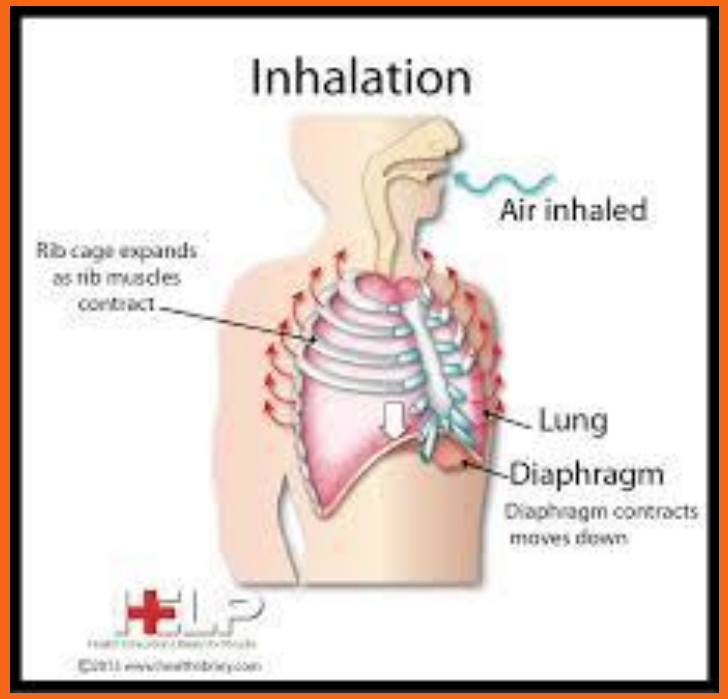
1. Gaseous Exchange

The cardiovascular system and the respiratory system work together to bring oxygen into the body and transport it to the working muscles and organs, and to remove the carbon dioxide created by the body when we move.



GASEOUS EXCHANGE

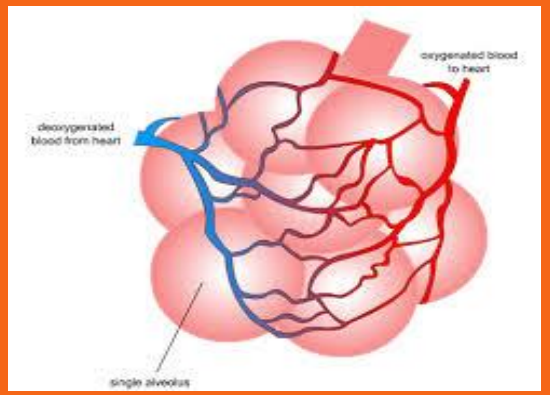
- When we inhale, oxygen intake occurs.
- The air we breathe in, approximately 21% of which is oxygen, travels through the respiratory system to the alveoli in the lungs.

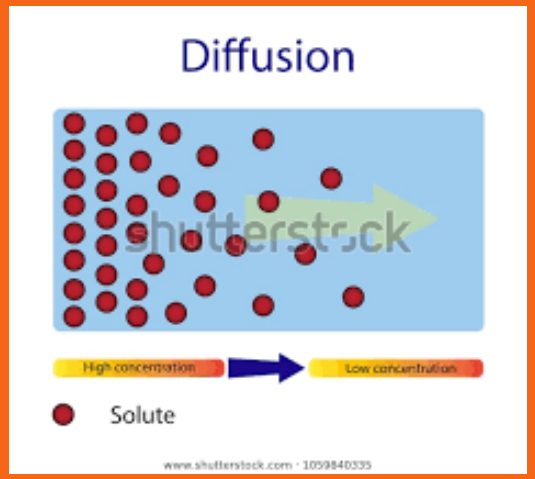


GASEOUS EXCHANGE

- When the alveoli fill with air, a process known as gaseous exchange takes place.
- Oxygen moves from the air in the alveoli into the blood in the capillaries.
- At the same time, carbon dioxide moves from the blood in the capillaries to the air in the alveoli.
- This happens because of a process called diffusion, when molecules move from an area of high concentration to an area of low concentration in an attempt to reach a balance.

GASEOUS EXCHANGE

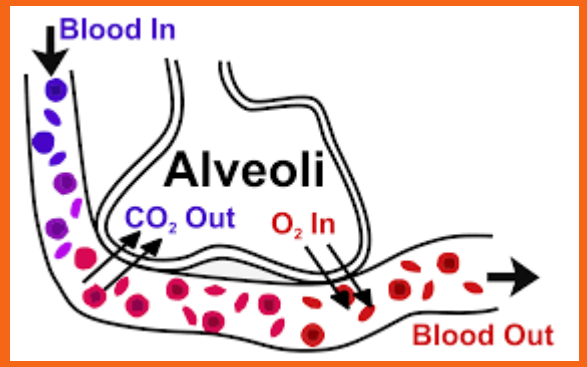




GASEOUS EXCHANGE

- Diffusion is possible because the capillaries, which are very small blood vessels, are wrapped tightly around the alveoli.

- The walls of the capillaries and the alveoli are very thin, only one cell thick, so oxygen and carbon dioxide can easily pass through them.



GASEOUS EXCHANGE

- Once oxygen uptake has taken place at the alveoli, the oxygenated blood is carried to the heart and then to the working muscles and organs, where it is used to release energy.
- The deoxygenated blood is then carried back to the alveoli via the heart.
- The deoxygenated blood contains carbon dioxide, a waste product created when oxygen is used to release energy.
- The carbon dioxide then passes through the respiratory system and is breathed out.

GASEOUS EXCHANGE

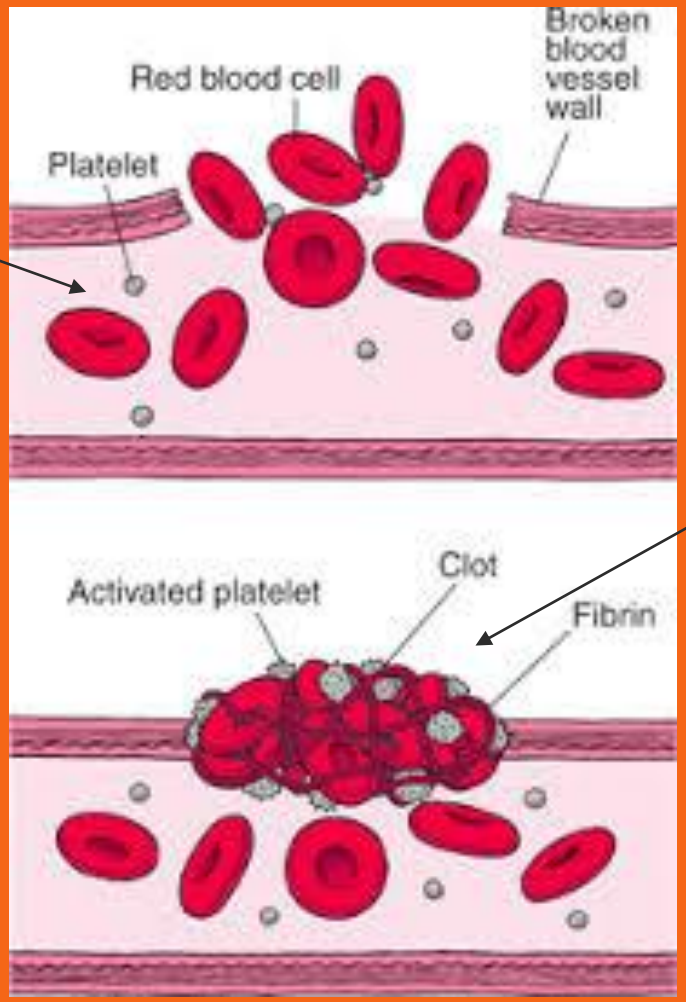
- Both oxygen intake and oxygen uptake increase during exercise because the working muscles demand more oxygen.

- https://www.youtube.com/watch?v=ylEknRfojLU

CLOTTING

Platelets are a component of blood which are transported all around the body.

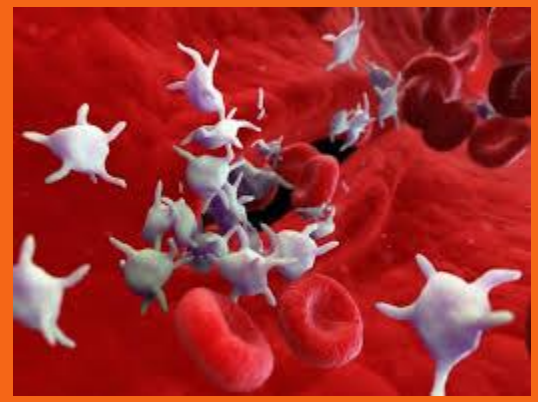
https://www.youtube.com/watch?v=gExUCrpAKyQ



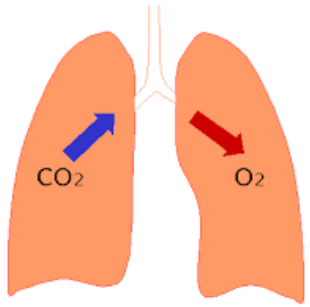
If a person cuts themselves, platelets from the bloodstream gather around the wound to produce a clot which stops the wound from bleeding, preventing the body from losing too much blood.

CLOTTING

- When the body is damaged, by a cut or other trauma, blood vessels leak blood.
- In response, blood flow to the damaged area is restricted.
- Platelets in the blood are activated and become sticky, grouping together over the wound to plug the hole and stop the bleeding, allowing the blood vessel to heal. This is known as blood clotting.

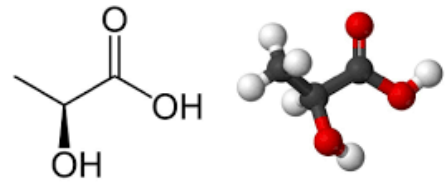


REMOVING WASTE PRODUCTS



- The process of producing energy for muscle contraction produces waste products such as lactic acid and carbon dioxide.
- If these waste products build up in the muscle tissue they will stop the muscle from working.
- The cardiovascular system removes these waste products from the muscles in the bloodstrea,.

REMOVING LACTIC ACID



Lactic Acid

- The body can release energy aerobically (with oxygen) and anaerobically (without oxygen).
- When energy is released anaerobically, a waste product called lactic acid is produced.
- If lactic acid builds up in our working muscles, we experience pain and fatigue.
- The cardiovascular system reduces the build-up of lactic acid by carrying it away from the working muscles in the blood to be broken down by the body.

REMOVING LACTIC ACID

- When your body works at a low intensity (when you are strolling along a flat road) you can work aerobically and lactic acid is not produced.

- When the intensity of the activity increases (when you start to walk faster because you realise you are late) your body will release some of the energy required anaerobically but there is still time for oxygen to be delivered to the working muscles and for lactic acid to be carried away.

REMOVING LACTIC ACID

- However, when your body works at a high intensity (when you sprint for the bus) energy will mostly be released anaerobically because oxygen cannot reach the working muscles quickly enough.

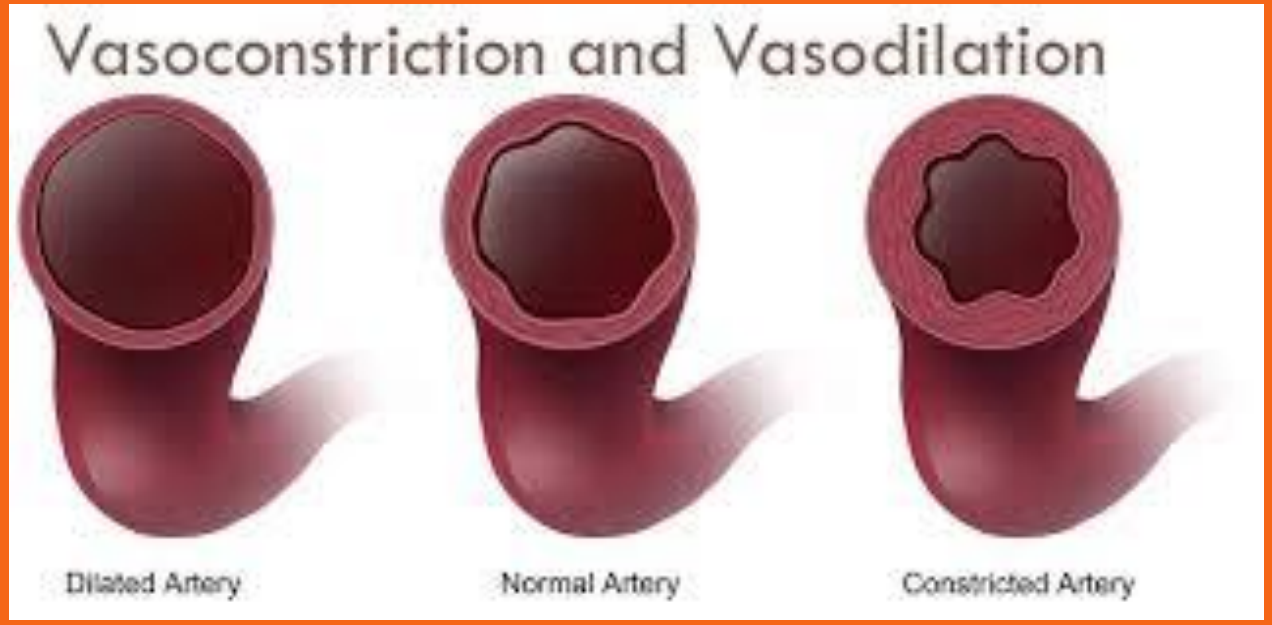
- Lactic acid is created and will rapidly build up if you continue sprinting.

TEMPERATURE REGULATION

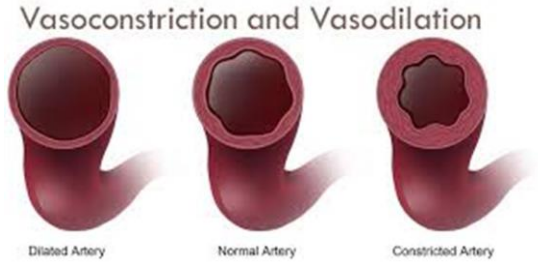
- It is important to keep the body's internal temperature steady at 36.1-37.8 degrees.
- A significant increase in the body's internal temperature can lead to dehydration and heatstroke.
- While a decrease in the body's internal temperature can lead to hypothermia.
- Both can, in extreme cases, lead to death.
- The cardiovascular system plays an important role in temperature regulation.

VASODILATION

https://www.youtube.com/watch?v=vJhsyS4lTWo

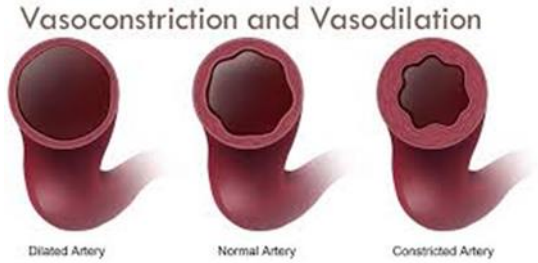


VASODILATION



- During exercise, your working muscles generate heat.
- Blood vessels near the surface of the skin widen to allow more blood to flow towards the surface of the skin.
- This is called vasodilation.
- The heat generated by the muscles, carried by the blood, is then able to escape through the skin.

VASOCONSTRICTION



- When you are cold, the blood vessels near the surface of the skin narrow, decreasing the volume of blood flowing towards the surface of the skin.
- This is called vasoconstriction.
- This ensures any heat generated by the body stays in the core of the body.

THE EFFECT OF REGULAR PARTICIPATION IN SPORT AND ACTIVITY ON COMPONENTS OF FITNESS

- Regular participation in sport and activity is classed as usually at least three times per week for a minimum six week period.

- This type of participation has a positive effect on the components of fitness that are being trained during the sport or activity session and will help the person to become more effective in that sport or activity each time they participate.

THE EFFECT OF REGULAR PARTICIPATION IN SPORT AND ACTIVITY ON COMPONENTS OF FITNESS

- Aerobic Exercise

Aerobic means 'requiring air' and aerobic activities increase your breathing and heart rates.

Long term training is classed as regular participation in sport or exercise for at least six weeks

Cardiovascular fitness is increased by taking part in these types of sport and activities.

Cardiovascular fitness therefore means that the cardiorespiratory system can work efficiently, supplying nutrients and oxygen to working muscles during sustained physical activity.

Cardiovascular fitness is the ability to exercise continuously for a certain period of time without becoming tired.

THE EFFECT OF REGULAR PARTICIPATION IN SPORT AND ACTIVITY ON COMPONENTS OF FITNESS

- Muscular Endurance

Muscular endurance can also be improved from taking part in aerobic exercise.

Muscular endurance is related to how efficiently your muscular system works.

The greater a person's muscular endurance, the increased ability they have to perform an exercise that involves repetitive contractions of a muscle over an extended period of time.

For example, a person that takes part in cycling will gain improved muscular endurance in their leg muscles but their arm muscles are not exercised in the sport so these muscles will not develop muscular endurance.

Because there are many muscles in our body, it is possible to have good muscular endurance in some muscles but poor muscular endurance in others.

THE EFFECT OF REGULAR PARTICIPATION IN SPORT AND ACTIVITY ON COMPONENTS OF FITNESS

- Muscular Endurance/Aerobic Endurance

Body composition can be improved by regular participation in aerobic sport and activity, as this type of activity will use calories for the repeated muscle contractions .

The longer a person carries out aerobic sports or activities, the more calories they will use. This will help prevent any excess calories consumed being stored as body fat.

Participation in aerobic sports and activities combined with a calorie-controlled diet will help them lose excess body fat, which will therefore help to improve body composition.

THE EFFECT OF REGULAR PARTICIPATION IN SPORT AND ACTIVITY ON COMPONENTS OF FITNESS

- Resistance Exercise

Resistance is a form of sport or activity where you are working against some type of force that 'resists' your movement, such as lifting weights or pulling on elastic resistance bands.

Muscular strength is increased from taking part in resistance exercise.

One Newton is the force needed to move 1kg of mass at a rate of 1 metre per second squared.

Strength is related to how much muscle mass a person has-the larger the muscle mass, the more strength the person has.

This is because muscle tissue produces force.

Force is any interaction that, if not stopped, will change the motion of an object.

Force is measured in Newton's (N) named after Isaac Newton.

THE EFFECT OF REGULAR PARTICIPATION IN SPORT AND ACTIVITY ON COMPONENTS OF FITNESS

- Resistance Exercise
- To increase muscular strength through training, it is necessary to have a high resistance with low repetitions in relation to how many times the resistance is lifted.

While it is not necessary to have high levels of strength for health reasons, a certain level of strength is required to support daily activities.

Strong postural muscles are required to keep an upright stance and prevent back pains.

Strong leg muscles are required to allow us to hold our body weight and move around.

Muscular endurance can also be improved by resistance training.

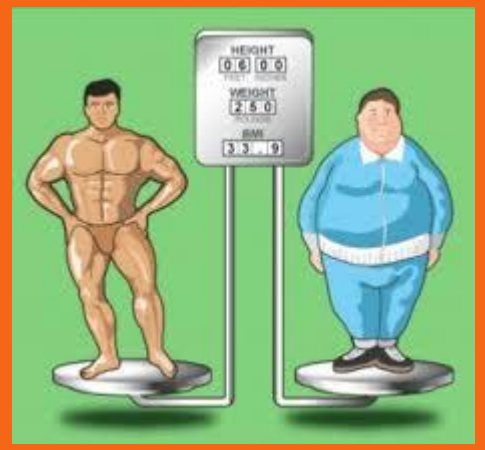
To train for muscular endurance it is necessary to have low resistance and complete a high number of repetitions.

THE EFFECT OF REGULAR PARTICIPATION IN SPORT AND ACTIVITY ON COMPONENTS OF FITNESS

- Body composition

Body composition can also be improved by increasing muscle mass.

This is because muscle tissue has a high metabolic rate when compared with other body tissues so it does help to 'burn calories' to prevent a person becoming over weight.



It is also important to note that as a person gets older, from about the age of 30, their muscle mass naturally starts to reduce unless the person takes part in resistance training to try and maintain or increase their muscle mass.

PHYSIOLOGICAL IMPACT OF ENGAGEMENT IN SPORT AND ACTIVITY ON THE BODY SYSTEMS

- Regularly taking part in sport or physical activity can bring about positive adaptations.

- These long term effects of exercise make the body systems more efficient, and mean you are better able to meet the demands of the sport or physical activity you are taking part in.

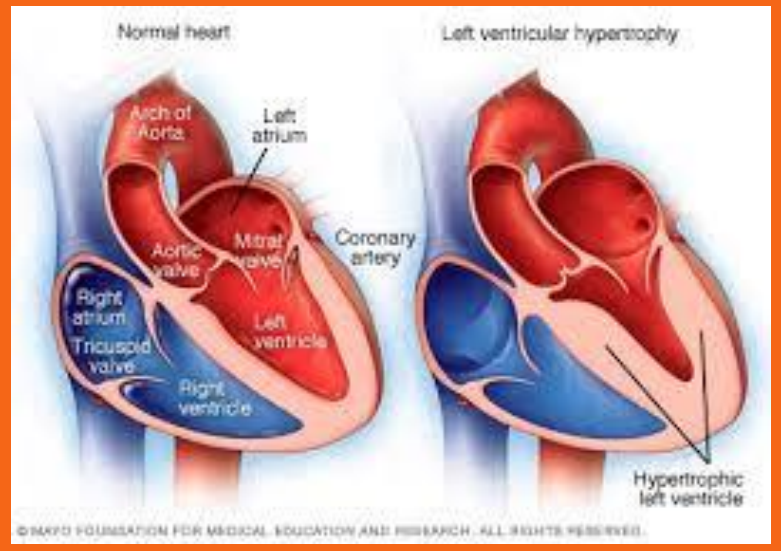
- https://www.youtube.com/wat[illegible]Do

LONG TERM EFFECTS OF THE CARDIORESPIRATORY SYSTEM
CARDIAC HYPERTROPHY

The heart is a muscle, just as with skeletal muscles, if the heart is exercised it will increase in size.

If you were to dissect the heart of a top aerobic endurance athlete, you will find the walls of the left ventricle are markedly thicker than those who did not perform regular aerobic exercise.

An increase in heart size can result in greater oxygen intake, resulting in more efficient delivery to the working muscles.



Increased muscle in the heart leads to…….

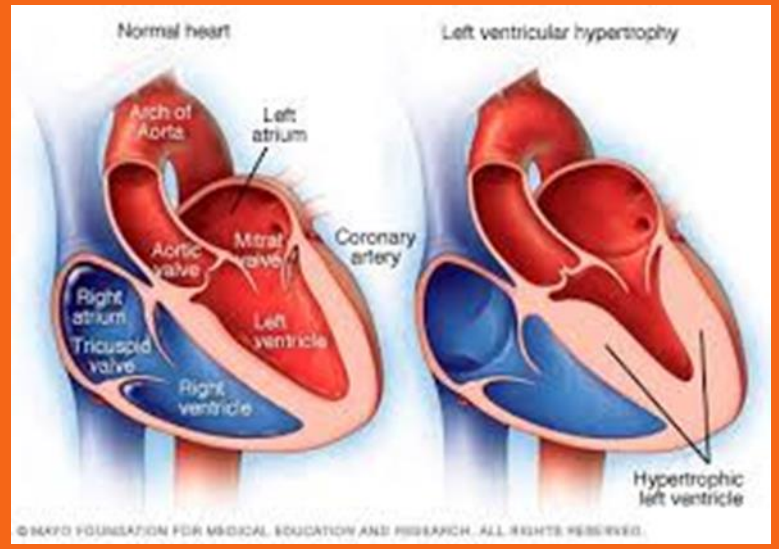
Lower resting heart rate

Your heart rate is the number of times your heart beats per minute.

Your resting heart rate is the number of times your heart beats in one minute when you are at rest.

LONG TERM EFFECTS OF THE CARDIORESPIRATORY SYSTEM
CARDIAC HYPERTROPHY

An efficient heart, that pumps more blood per beat, does not need to work as hard to deliver enough blood to your muscles and organs when you are at rest, hence resting heart rate is lower with cardiac hypertrophy.



Lower resting blood pressure

Your blood pressure is the pressure that blood leaving the heart exerts on your arteries.

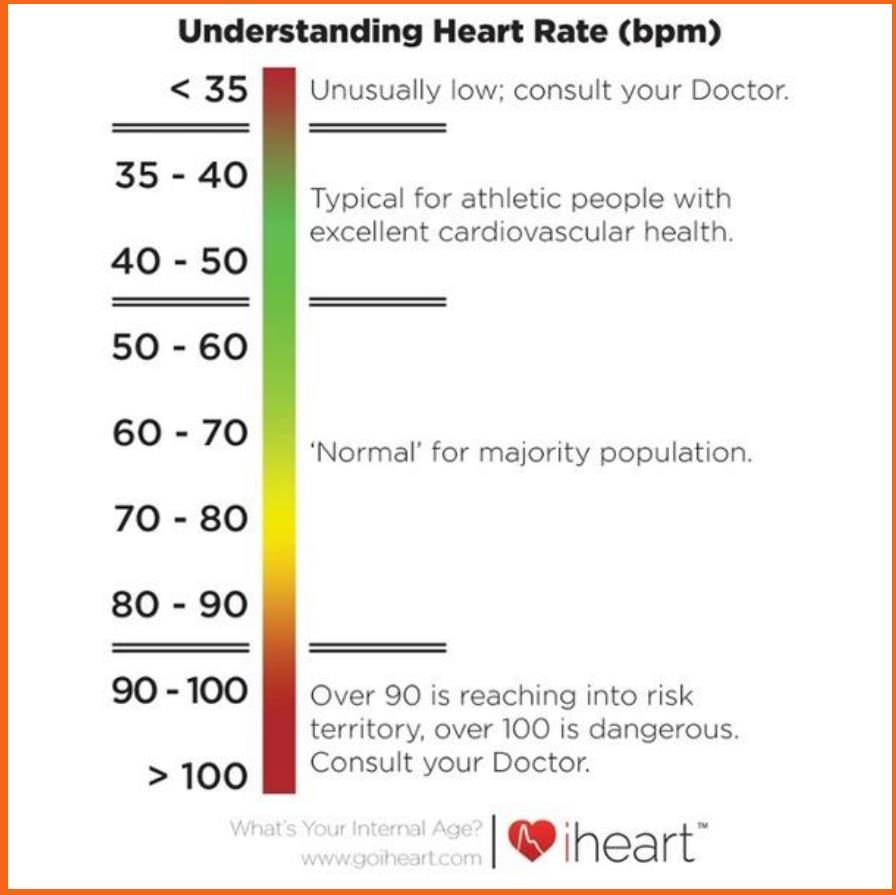
An efficient heart, that pumps more blood per beat, does not need to beat as powerfully to deliver blood to your muscles and organs when you are at rest, hence resting blood pressure is lower with cardiac hypertrophy.

LONG TERM EFFECTS OF THE CARDIORESPIRATORY SYSTEM
DROP IN RESTING HEART RATE

Because the heart increases in size it is able to pump out more blood each time it beats – this is called **stroke volume**.

As the stroke volume is increased, the heart no longer needs to beat as often to get the same amount of blood around the body.

This results in a decrease in resting heart rate, as the heart is working more efficiently.



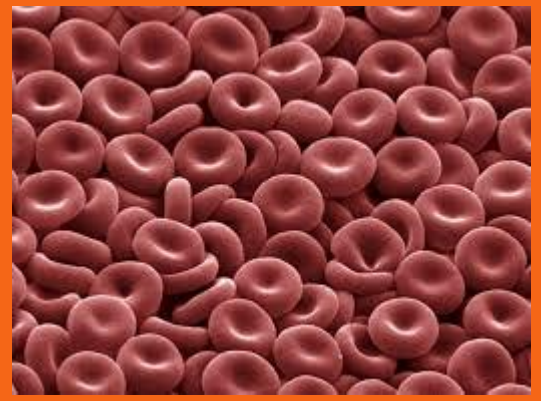
LONG TERM EFFECTS OF THE CARDIORESPIRATORY SYSTEM
INCREASE IN RED BLOOD CELLS

Exercise can result in an increase in red blood cells.

The main function of red blood cells is to transport oxygen to the body cells.

The increased need for oxygen during vigorous exercise stimulates your body to create more red blood cells.

By having a greater number of red blood cells in the blood, more oxygen can be transported to the body cells which can then be used for energy production.



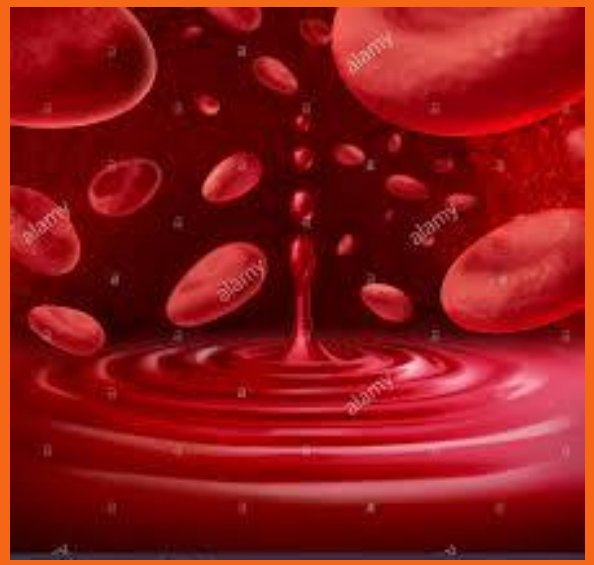
More red blood cells increases the efficiency with which oxygen is carried to your working muscles and organs, and carbon dioxide is carried away from them.

LONG TERM EFFECTS OF THE CARDIORESPIRATORY SYSTEM
DROP IN BLOOD VISCOSITY

Plasma is the watery fluid in blood, and the more plasma there is, the less viscous (thick) the blood becomes.

An adaptation to regular aerobic sport, or physical activity means an increase in plasma volume.

This helps the blood flow more easily in the blood vessels as it is less thick and will therefore have the effect of decreasing blood pressure, which is beneficial to health.



When your blood does not contain a lot of plasma, it is thick and sticky, it is viscous.

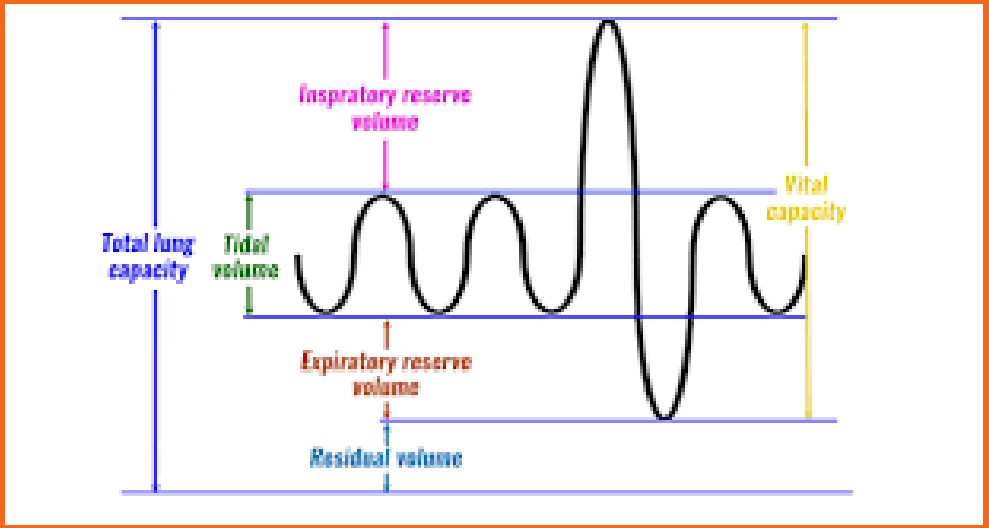
Viscous blood does not flow well, which means that oxygen does not reach your working muscles as quickly as it does when your blood is less viscous – when you have more plasma and your blood is runnier.

Regular aerobic exercise causes your body to produce more plasma.

LONG TERM EFFECTS OF THE CARDIORESPIRATORY SYSTEM
VITAL CAPACITY INCREASES

Vital capacity increases through regular participation in aerobic sport or physical activity.

The increased strength of the respiratory muscles is partly responsible for this as it aids lung inflation and deflation.



When your diaphragm and intercostal muscles are stronger they are better able to increase the space inside your lungs when you breathe in, pulling more air into your lungs, when you breathe in.

LONG TERM EFFECTS OF THE CARDIORESPIRATORY SYSTEM

IMPROVED EFFICIENCY OF GASEOUS EXCHANGE

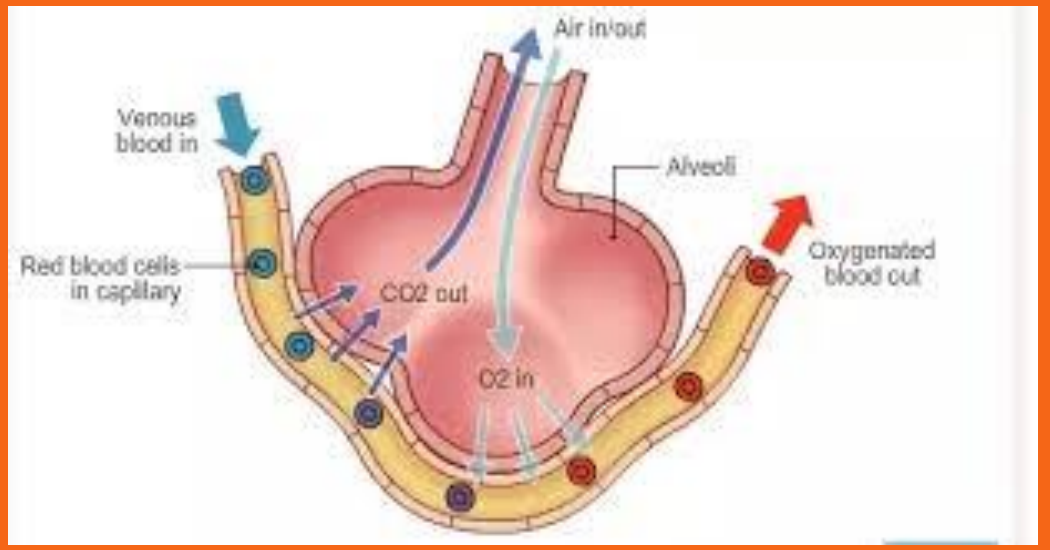
Gaseous exchange takes place between the lungs and the bloodstream.

Capillaries are the blood vessels in which gaseous exchange takes place.

Lots of capillaries are located around the tiny air sacs in the lungs called alveoli.

Oxygen diffuses from the alveoli across the capillaries and into the bloodstream, and carbon dioxide diffuses from the blood into the lungs.

https://www.youtube.com/watch?v=N3-htnYnb3c



This improves the oxygen flow to the working muscles and the removal of waste products, so the muscles have more energy and tire less quickly.

At the muscles, the oxygen from the blood diffuses out of the capillaries and into the muscles and carbon dioxide diffuses into the bloodstream.

Regular participation in sport or activity increases the capillarisation around the alveoli in the lungs and in the muscle tissues.

The increase in capillaries helps to increase the rate of gas exchange and the amount of oxygen entering the blood and carbon dioxide leaving the blood.