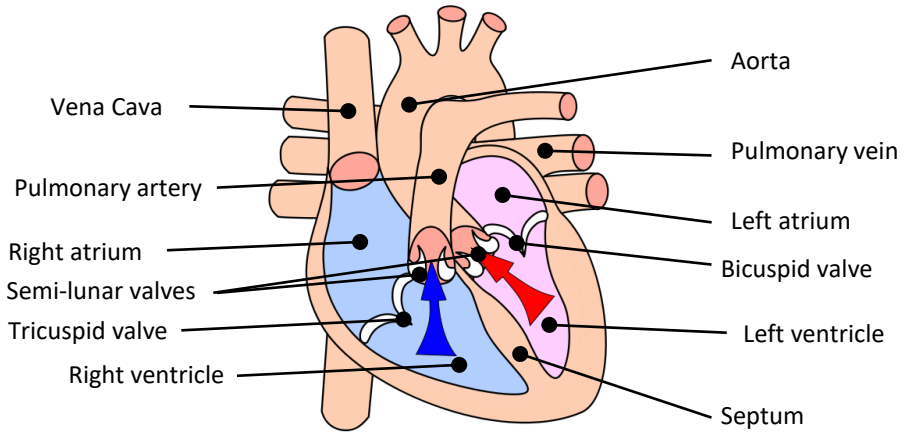
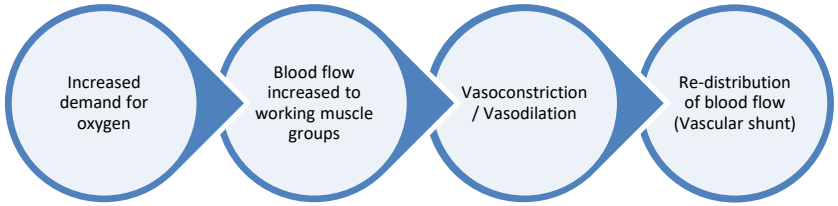
The structure and functions of the cardiovascular system

Structure of the cardiovascular system

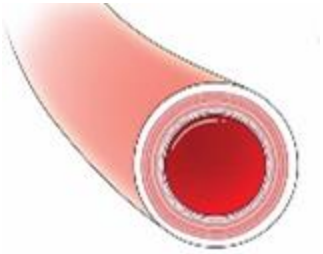


Deoxygenated blood = **BLUE** (Right side)
Oxygenated = **RED** (Left side)

Vascular Shunting



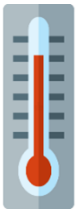
Vasoconstriction – NARROWING



Vasodilation - EXPANDING

Function of the cardiovascular system

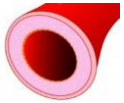
- Transport of oxygen, carbon dioxide and nutrients
- Clotting of open wounds
- Regulation of body temperature



Cardiac Output (Q) = Heart Rate x Stroke Volume
(l/min) (bpm) (mL per beat)

Blood vessels

Arteries	Veins	Capillaries
1. Away from the heart 2. Oxygenated blood (except pulmonary artery) 3. Thick/elastic walls 4. High pressure 5. Small lumen	1. Back to the heart 2. Deoxygenated blood (except pulmonary vein) 3. Thin walls + larger lumen 4. Lower pressure 5. Valves	1. In the tissue 2. Site of gaseous exchange 3. Very thin walls



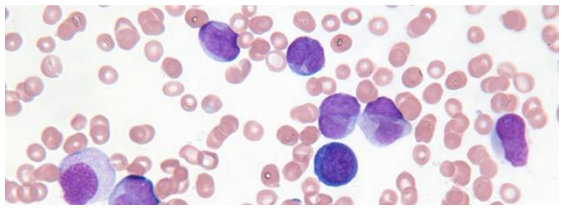
Components of blood - Red blood cells

Carry oxygen from the lungs to the working muscles + Removes CO_2.

Haemoglobin binds the oxygen

White blood cells

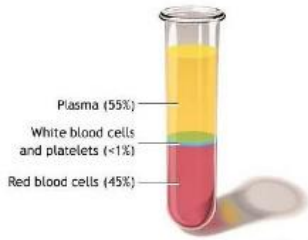
Are part of the immune system and **fight disease** and infection.



Platelets & Plasma

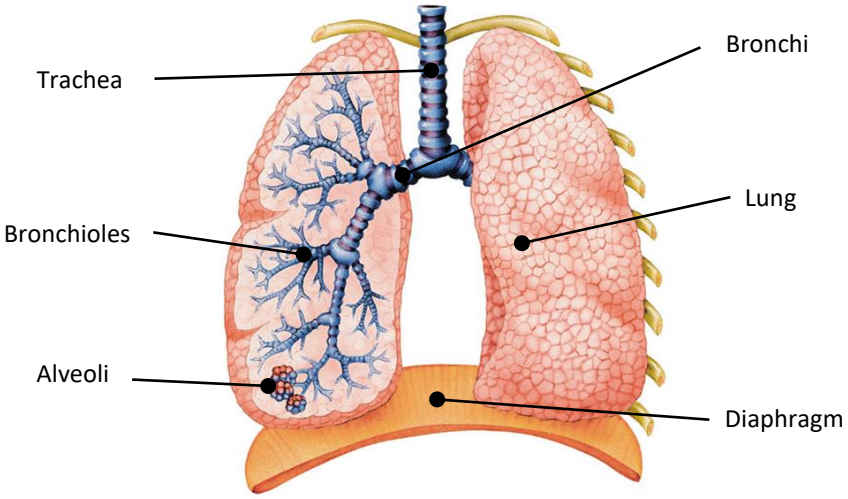
Platelets **clot blood** and form a scab around the site of injury.

Plasma is the **liquid/fluid** part of blood that allows it to flow.



The structure and functions of the respiratory system

Structure of the respiratory system

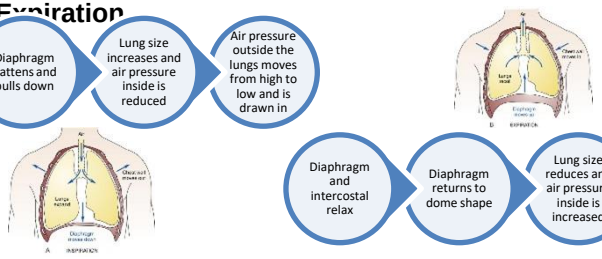


Composition of inhaled and exhaled air

Gas	Inhaled air	Exhaled air
Oxygen	21%	16%
Carbon dioxide	0.04%	4%
Nitrogen	78%	78%

Inhalation/Inspiration

Diaphragm and intercostal contract → Diaphragm flattens and pulls down → Lung size increases and air pressure inside is reduced → Air pressure outside the lungs moves from high to low and is drawn in



Exhalation/Expiration

Diaphragm and intercostal relax → Diaphragm returns to dome shape → Lung size reduces and air pressure inside is increased → Air pressure outside the lungs is lower and therefore air is exhaled

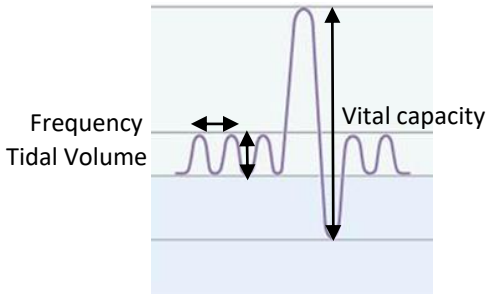
Respiratory values

Tidal Volume – the amount of air inhaled and exhaled per breath. Resting value = 500ml

Vital Capacity – The maximum amount of air exhaled following a maximal breath in.

Frequency – The number of breaths taken per minute. Resting value – 12-20 breaths.

Minute Ventilation – The amount of air inhaled and exhaled per minute. Measured in litres.

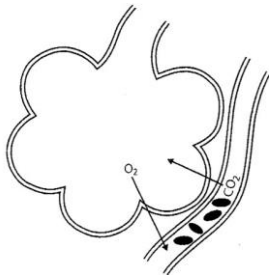


Gaseous exchange at the alveoli

- Diffusion is the movement of molecules from an area of high concentration to a low one.
- The alveoli have thin moist walls to allow diffusion to occur.
- Capillaries are closely wrapped around the alveoli to reduce the distance o diffusion and increase efficiency.

During inhalation:

- The concentration of **oxygen** in the air is higher than the alveoli.
- The concentration of **carbon dioxide** in the blood is higher than that in the

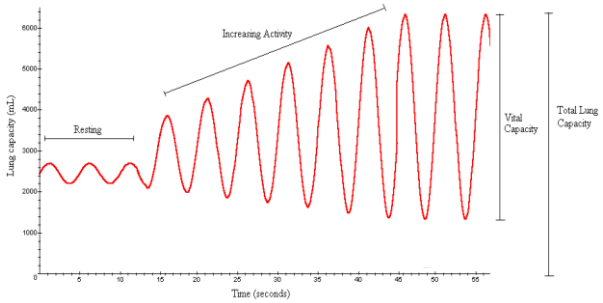


During exercise

Gaseous exchange increases as the intensity of the activity increases to cope with:

- An increase demand for oxygen at working muscles
- An increase in carbon dioxide production and the need to rid this waste product.

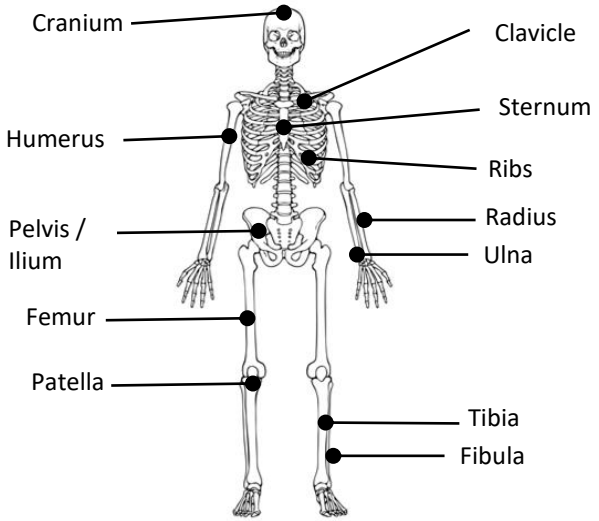
Frequency ⍰ + Tidal Volume ⍰



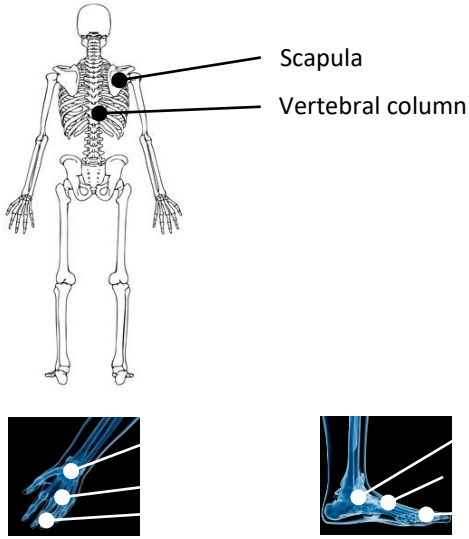
Training increases total lung capacity and vital capacity readings.

The structure and functions of the skeletal system

Structure of the skeletal system



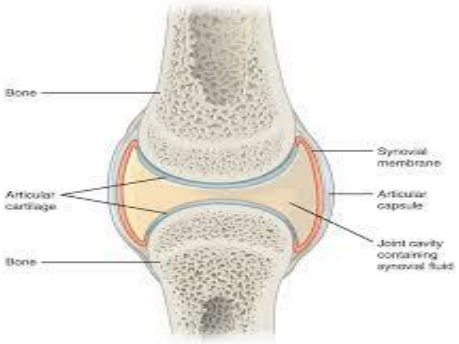
Structure of the skeletal system



Synovial Joints

These are **freely movable** joints where the joint surfaces are covered in **cartilage**, they are connected by a fibrous tissue capsule (joint capsule) and lined with fluid (synovial fluid).

Common joints are hip and shoulder

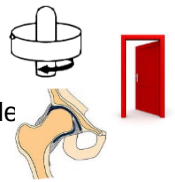


Function of the skeleton

- **Shape and Support** – posture
- **Movement** - muscle attachment & joint movement
- **Protection** of vital organs
- **Production** – platelets, red and white blood cells
- **Storage** - of minerals (calcium, phosphorus, iron, potassium)

Classification of joint

- Pivot (neck – atlas and axis)
- Hinge (elbow and knee)
- Ball and socket (hip and shoulde



Connective tissue

Ligaments – attaches bone to bone to add joint stability.

Tendons – attaches muscles to bone and contributes to joint movement as a result of muscle contraction.

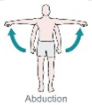
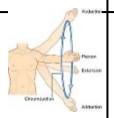
Cartilage:

Used to reduce friction at a joint

Hyaline cartilage (articular) – on the ends of bones at a synovial joint to stop rubbing

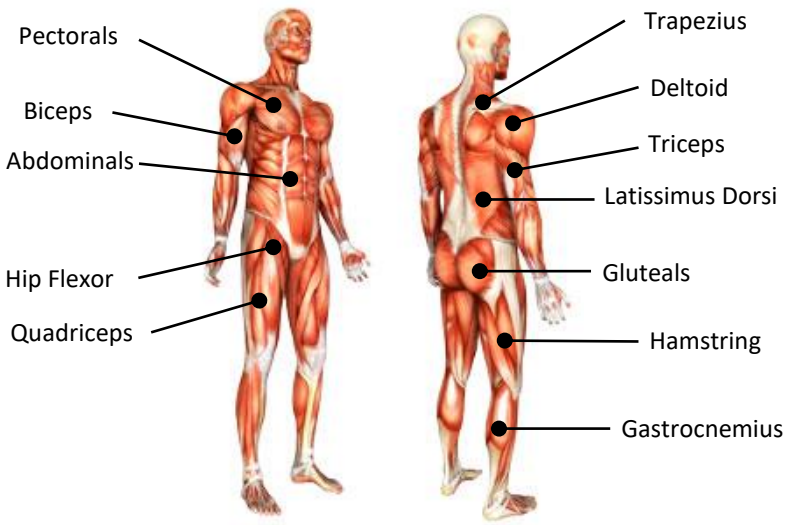
White Fibro-cartilage – between bones as a shock absorber e.g. vertebrae, knee

Joint movements Extended Knowledge

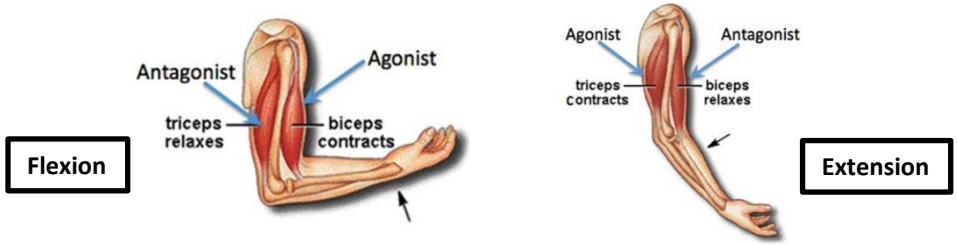
Flexion	Adduction	Rotation	Dorsi-Flexion (ankle joint)
Decreasing the angle at a joint (bending) 	Limbs moving towards the midline of the body 	A twisting/turning action around a joint. 	When the toes are turned up to the body. 
Extension	**Abduction**	**Circumduction**	**Planter-Flexion (ankle joint)**
Increasing the angle at a joint (straightening) 	Limbs moving away from the midline of the body. 	A combination of flexion, extension, adduction & abduction. 	When the toes pointed away from the body. 

The structure and functions of the muscular system

Structure of the muscular system



Antagonistic pairs - Muscles are arranged in antagonistic pairs.
As one muscle contracts (shortens) its partner relaxes (lengthens) *i.e. Biceps and Triceps.*



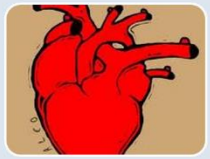
Agonist = the muscle that contracts to produce movement.
Antagonist = the muscle that relaxes to allow the movement to occur.
Fixator = the muscle that works to stabilise the origin of the prime mover (agonist)

Examples in the body:
- Biceps & Triceps
- Quadriceps & Hamstring
- Hip Flexor & Gluteus Maximus

Types of muscle

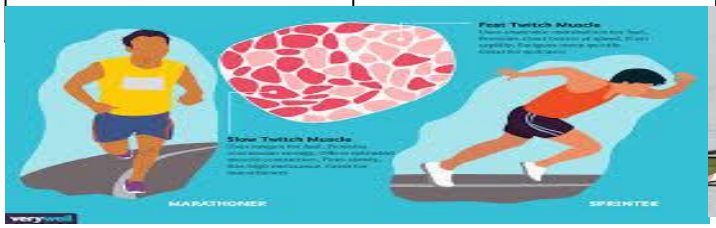
Voluntary muscles enable movement throughout the body.

Involuntary muscles are essential in maintaining healthy body systems.



Cardiac muscle is vital in sport because it makes the heart pump. Fitness training will strengthen cardiac muscle making the heart more efficient at pumping blood around the body.

Slow twitch muscle fibres (Type I)	Fast twitch muscle fibres (Type II)	Lactic Acid v Oxygen Debt
1. Smaller in size. 2. Work aerobically with high fatigue resistance. 3. Have a good oxygen supply = deep red in colour. 4. They contract slowly, but can work for long periods. **Marathon runner**	1. Larger in size 2. Work anaerobically & linked to high intensity activities. 3. Are paler (white) in colour and have limited oxygen supply. 4. They contract quickly and powerfully, but tire easily **100/200m runner**	1. Lactic acid is built up through lack of oxygen in working muscles and so they fatigue. This causes muscle pain reduces performance. Also linked to DOMS (delayed onset muscle soreness) 2. Oxygen debt has to be 'repayed' when anaerobic



The **short term effects** of exercise on the muscles:
1. Working muscles produce heat
2. Increased muscle fatigue due to lactic acid accumulation
3. Blood is re-distributed to working muscles (blood shunting)
4. Increase in cross sectional size

Link of the muscular and skeletal system – both systems work together to produce movement. *i.e. a contracting muscle pulls on a bone which changes the angle at a joint.*