Heart as a Double Pump:

- Left side pumps oxygenated blood to the body (cells and working muscles)
- Right side pumps deoxygenated blood to the lungs.

Terms:

- 1) Heart rate - beats per minute
- 2) Stroke volume - blood pumped out per beat
- 3) Cardiac output = stroke volume x heart rate - amount of blood pumped out per minute
- 4) Maximum heart rate - 220 - age
- 5) Resting heart rate - lowest possible heart rate when you are inactive
- 6) Recovery rate - time taken for heart rate to get back to normal

Exam examples:

Explain why it is important that a performers heart rate increases during exercise?

- Need oxygen for muscles due to exercise/ need to get O2 to the working muscles quicker to sustain performance.
- More CO2 is produced by the muscles and this needs to be removed.

Explain why resting heart rate is lower than recovery heart rate?

- Resting heart rate is lower because this is the heart rate whilst the individual is inactive (1)
- At rest the body has its lowest demand on the circulatory system/lower demand for oxygen/less blood flow/less CO2 (1)
- recovery heart rate is higher as the body needs increased blood flow/ more oxygen to recuperate after exercise/pay back oxygen debt (1)

Structure of the Heart:

- Left / Right Atriums Upper Chambers
- Left / Right Ventricles Lower Chambers
- The heart contains valves to prevent the backflow of blood
- Vena Cava Vein that brings deoxygenated blood back to the right side of the heart.
- Aorta Artery that takes oxygenated blood from the left side of the heart to ٠ the body tissues / cells.
- Pulmonary Artery only artery in the body that carries deoxygenated blood. This artery takes the blood from the right side of the heart to the lungs.
- Pulmonary Vein only vein in the body that carries oxygenated blood. This vein takes blood from the lungs and returns it to the left side of the heart.

Pathway of Blood Around the Body:

- Deoxygenated blood from the right atrium passes through valves into the right ventricle. The valves prevent the blood from returning to the atrium.
- The deoxygenated blood is then sent from the right ventricle to the lungs via the pulmonary artery.
- At the lungs gaseous exchange takes place in capillaries around the alveoli. Carbon-dioxide is passed from the blood stream into the alveoli in exchange for oxygen.
- The now oxygenated blood is taken back to the left atrium via the pulmonary vein.
- The oxygenated blood then passes from the left atrium to the left ventricle.
- From the left ventricle the oxygenated blood is sent around the body at high pressure through the aorta.
- At the body gaseous exchange takes place again. This time oxygen is taken from the red blood cells and passed to the body tissues in exchange for carbon-dioxide.
- The deoxygenated blood is taken back to the right atrium at low pressure by the vena cava.

Blood Pressure:

- The force exerted by circulating blood on the walls of the blood vessels.
- Systolic = when the heart contracts (beats)
- Diastolic = in between heart beats when the heart is relaxed.

Systolic

Diastolic

Red Blood Cells:

- Carry oxygen around the bodv
- Produced in the bone marrow of our long bones.
- Contain haemoglobin to which the oxygen attaches to create oxyhaemoglobin

Circulatory, Aerobic and **Anaerobic Systems**

Cardiac Cycle

Two phases: Diastole Phase – When the heart relaxes and fills with blood Systole Phase – When the heart contracts and sends blood out of it.

Arteries:

- Carry blood away from the heart.
- ٠ Most arteries carry oxygenated blood (oxygen rich).
- Thick walls to withstand the high blood pressure.
- Small / narrow lumen so that the blood is forced around the body at a high pressure.
- Strong elastic walls that can easily increase and decrease in diameter.

Veins:

- Veins carry blood towards the heart.
- Most veins carry deoxygenated blood (carbon dioxide rich).
- Thinner walls than arteries as the blood is pumped through at a low pressure.
- Due to the low pressure veins contain valves to prevent the backflow of blood.
- They also have a large lumen to allow more blood to pass through them

Capillaries:

- ٠ In Capillaries gaseous exchange takes place.
- Capillaries are one cell thick to enable substances to enter and leave the blood stream (allows rapid diffusion).
- Capillaries surround our alveoli and body tissues (e.g. muscles) to allow gaseous exchange to take place (the exchange of oxygen and carbon-dioxide).
- Huge network throughout the body linking arteries and veins (large surface area for gaseous exchange to take place).

Vasoconstriction / Vasodilation

- Vasoconstriction and vasodilation work together to cause 'blood shunting' (the redistribution of blood around the body).
- Vasoconstriction is reducing the diameter of small arteries, so ٠ by reducing the blood flow to certain parts of the body.
- Vasodilation is increasing the diameter of small arteries to increase blood flow to certain parts of the body.
- ٠ This occurs during exercise. Vasoconstriction reduces blood flow to parts of the body not needed during exercise e.g. bladder / stomach, and that blood is redistributed to the muscles that are being used in the activity.
- Vasodilation occurs around the muscles so that more blood, carrying oxygen, can get to the muscles to create more energy. This will allow a performer to perform for longer and maintain their standard of play.

Aerobic Respiration / Exercise:

- Creating energy with the presence of oxygen.
- Occurs at low to moderate levels of exertion, where the performer usually performers for a long period of time.

Anaerobic Respiration / Exercise:

- Creating energy without the presence of oxygen.
- Occurs during high intensity activities, but can only be sustained for a short period of time.
- Due to the glucose only being partly broken down, lactic acid is produced. Lactic acid causes fatigue to occur in muscles causing the performer to slow down and eventually stop.
- The build up of lactic acid causes fatigue and results in OXYGEN DEBT, <u>a state in which the body needs more oxygen</u> <u>than it can provide. (temporary oxygen shortage in the body</u> <u>due to strenuous exercise).</u>
- Excess post-exercise oxygen consumption (EPOC) is maintaining an increased rate of oxygen intake after the anaerobic exercise.
- This allows the performer to repay the oxygen debt created.

Recovering from Anaerobic Exercise

Cool Down:

- Maintain elevated breathing / respiratory rate and heart rate (EPOC) to maintain blood flow around the body. This allows the body to remove all the lactic acid
- Stretching, Ice Baths / Massage to prevent of <u>delayed onset of</u> <u>muscle soreness</u> (DOMS). This is when the muscles get sore and stiff several hours after exercise.

