Circulatory, Aerobic and Anaerobic Systems

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 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.

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

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.
- 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:

- 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).

Pathway of Blood Around the Body:

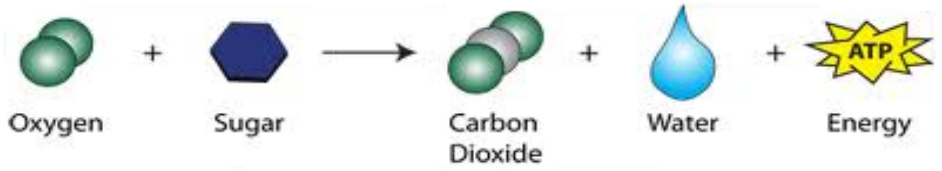
- Deoxygenated blood from the right atrium passes through valves into the right ventricle. The valves prevent the blood from returning to the atrium.
- The deoxygenated blood is then sent from the right ventricle to the lungs via the pulmonary artery.
- At the lungs gaseous exchange takes place in capillaries 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.

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 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.
- 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.

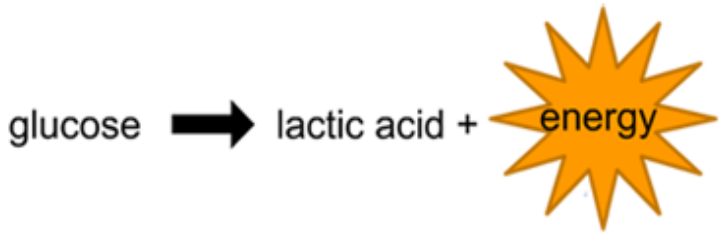
Aerobic Respiration / Exercise:

- 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, a state in which the body needs more oxygen than it can provide. (temporary oxygen shortage in the body due to strenuous exercise).

- 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 delayed onset of muscle soreness (DOMS). This is when the muscles get sore and stiff several hours after exercise.