**Acute Responses to Exercise: Match it**

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| **Response** | **Definition** | **Type of Response** | **Effect of Exercise** | **The benefit of this response / why it happens** | **How it occurs** |
| Ventilation | The amount of air breathed in and out per minute. Tidal volume x Respiratory Rate | Respiratory | Increases | To increase the volume of oxygen in the lungs that can be diffused into the blood and transported to the working muscles | Greater contraction of the intercostal muscles and diaphragm |
| Diffusion | The movement of oxygen and carbon dioxide to an area of high concentration to an area of low concentration. Occurs in the alveoli of the lungs and the muscle capillaries | Respiratory | Increased Capacity | In order to increase the transfer or oxygen into the blood stream and delivery to the muscle cells. Also to dispose of carbon dioxide which is produce as a result of the aerobic energy system | Caused by an increased surface area of the alveoli and muscle tissue |

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| Cardiac Output (Q) | The product of stroke volume x heart rate  The amount of blood pumped out of the left ventricle per minute | Cardiovascular | Increases | So that more blood can be ejected out of the heart per minute and therefore more oxygen can be delivered to the muscles | Caused by a stronger ventricular contraction – results in more blood being ejected |
| Blood Pressure | The amount of pressure exerted on the arteries when the ventricles contract (systolic) and relax (diastolic) | Cardiovascular | Systolic increases, diastolic stays the same | Because more blood is being pumped out per beat/minute and therefore it causes an increase in pressure | Through an increase in cardiac Output |
| Venous Return | The amount of blood that is returned back to the heart via the veins | Cardiovascular | Increased | So that an increase in cardiac output can take place. With more blood being delivered to the heart more can be pumped back out again for the delivery of oxygen to the muscles and carbon dioxide to the lungs | Three mechanisms:   * The muscle pump (muscular contractions) * The respiratory pump (diaphragm increases abdominal pressure) – veins in thorax and abdomen emptied towards heart * Veno constriction (constrictions of the veins) |
| Blood Volume | The amount of volume of blood | cardiovascular | Decreases | As a consequence of sweating | Caused by a decrease in plasma volume due to sweating. Depends on the intensity, duration and environmental factors |
| Redistribution of blood flow | The redirection of blood away from areas where it is not needed (e.g. spleen, kidneys) to areas where it is (e.g. working muscles) | Cardiovascular | Redistribution | To increase the amount of oxygen being delivered to the organs that need it during exercise (e.g. working muscles)  Increasing blood flow to the skin assists in the regulation of body temperature through heat exchange with environment | Vasoconstriction occurs in arterioles supplying oxygen to the inactive areas and vasodilation occurs in arterioles supplying oxygen to the working muscles |
| Oxygen Consumption / arteriovenous oxygen difference | The volume of oxygen that can be taken up and used by the body  The difference in oxygen concentration in the arterioles compared to the venules | cardiovascular | Increases | To increase the amount of oxygen that is delivered and used by the working muscles | Caused by an increase in cardiac output and the amount of oxygen extracted from the blood into the muscle capillaries |

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| Increased blood flow to working muscles | The amount of blood that is delivered to the working muscles | Muscular | Increases | To deliver more blood to the working muscles and therefore more oxygen | Caused by the opening (dilation) or skeletal capillaries. This:   * Allows more blood to flow to the muscles * Results in a larger blood volume reaching the muscle (but not an increase in velocity) * Increases the surface area resulting in increased diffusion rates |
| Motor Unit recruitment | A motor neuron and the muscle fibres it stimulated | Muscular | Increased number recruited / increase frequency of messages | To enable the correct number of muscle fibres to be recruited depending on the intensity of the activity – all or nothing principle. If a motor unit receives the impulse, all its fibres will contract | By electrical impulse signals that are sent from the central nervous system (brain and spinal cord) |
| Energy Substrates | The chemicals that are required to resynthesis ATP i.e. PC, glycogen, triglycerides | Muscular | decrease | Once ATP stores are depleted, PC, muscle glycogen and muscle triglycerides are all used to resynthesise ATP and so they get used up | As a result of the three energy systems which are used to resynthesise ATP |

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| Lactate | A biproduct of anaerobic glycolysis | Muscular | Increases at the start of exercise and then remains constant when production = removal  Increases past the lactate inflection point | It is produced at the start of exercise because the body cannot deliver enough oxygen to the working muscles to resynthesis ATP aerobically.  It remains constant when its rate of production = removal, but if it is being produced faster than it is being removed then it will continue to rise | As a result of ATP resynthesis via anaerobic glycolysis |
| Body Temperature | A change in the internal temperature of the body | Muscular | Increases until it is controlled by   * Sweat glands produce sweat * Increased blood flow to skin (via vasodilation) | Mechanisms work to prevent an increase in core body temperature.  (However, during high intensity, blood vessels vasoconstrict which hinders heat transfer) | Heat is a by-product of converting chemical energy into mechanical energy |