# Level 2 Fitness Instructor – Anatomy and Physiology for Exercise

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|---|---|
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| Course Start Date | 02/12/2020 |
| Course Location | EDUCATE FITNESS |
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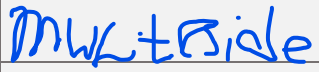
## Statement of Achievement

Assessor, by signing this statement of unit achievement you are confirming that all learning outcomes, criteria and range statements have been achieved under specified conditions and that the evidence gathered is authentic.

This statement of unit achievement table must be completed prior to claiming certification.

| Section | Pass/Refer | Assessor Full Name | Assessor Signature |
|---|---|---|---|
| Understand the structure and function of the circulatory system | PASS 26.2.21 | M SUGAI |  |
| Understand the structure and function of the respiratory system and skeleton (and joints) | | | |
| Understand the muscular system | PASS 26.2.21 | M SUGAI |  |
| Understand the life-course of the musculoskeletal system and its implications (special populations) |  |  |  |
| Understand energy systems and their relation to exercise | | | |
| Understand the nervous system and its relation to exercise |  |  |  |

| | | | |
|---|---|---|---|
| Learner Name | MARC WHITESIDE | IQA Name | |
| Learner Signature |  | IQA Signature | |
| Date | | Date | |

**Understanding the structure and function of the circulatory system**

Q1

Tick which statement is true from the two following statements.

| | Tick one |
|---|---|
| The heart is located on the left-hand side of the chest cavity | Tick |
| The heart is located on the right-hand side of the chest cavity | |

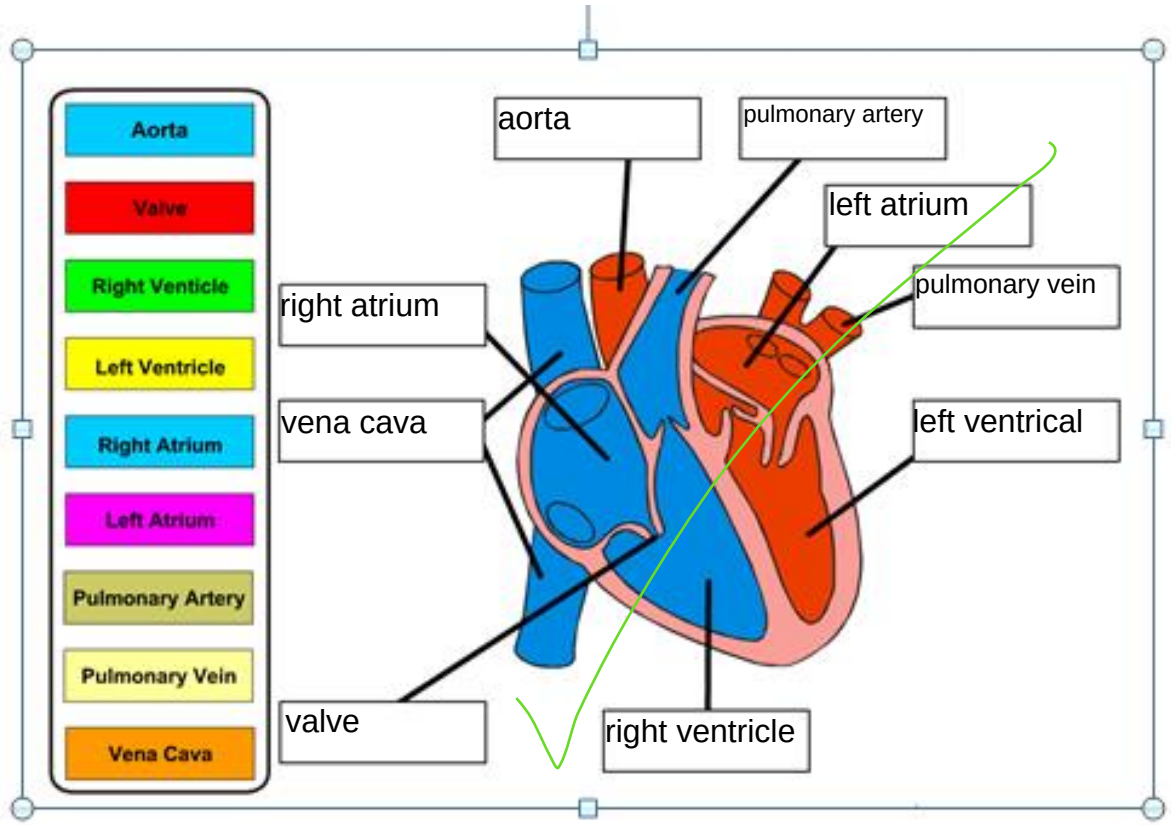
Q2

Describe the main function of the heart.

| |
|---|
| The heart is a muscular pump used for pumping blood around the body. |

Q3

Complete the diagram by identifying the different chambers and major blood vessels of the heart



Q4

Using all the answers given in the previous question complete the flow table of blood through the heart. You must provide a description of the functions of each of the structures.

Learner Guidance:

- You must describe where it receives blood from and transports it to
- Identify whether it carries oxygenated or deoxygenated blood

| Structure | Function |
|---|---|
| Pulmonary Vein | Major vein that carries oxygenated blood from the lungs to the heart |
| Left Atrium | The left chamber of the heart which is supplied Oxygenated blood from the lungs to the left atrium of the heart via the pulmonary vein. |
| Left Ventricle | Oxygenated blood is sent from the left atrium to the left ventricle which in turn is pumped to the aorta. |
| Aorta | From the aorta oxygenated blood is pumped from the heart to the rest of the body, this is known as the beginnining of the systemic system. |
| Working Muscles | Oxygenated blood is delivered to the working muscles |
| Vena Cava | Deoxygenated blood used by the working muscles is delivered by veins into the right atrium via the vena cava. |
| Right Atrium | Deoxygenated bood supplied from the vena cava is stored in the right atrium which is then supplied to the right ventricle. |
| Right Ventricle | Deoxygenated blood is pumped from the right ventricle to the lungs via the pulmonary artery. |
| Pulmonary Artery | The pulmonary artery pumps deoxygenated blood from the right ventricle of the heart to the lungs and there the oxygen is replenished and carbon dioxide is exhaled. |

Q5

Describe the role of the valves in the heart.

The role of the valves in the heart are to regulate  the bloodflow through the heart.

Q6

Describe systemic circulation.

The start of the systemic circulation is when the oxygenated blood is pumped from the left ventricle to the arteries.

Q7

Describe pulmonary circulation.

The pulmonary circulation is when the deoxygenated bood is pumped from the right ventricle to the lungs via the pulmonary artery to be replenished with oxygen, which is then sent back to the hearts left ventricle with oxygenated blood.

Q8

Describe two differences between the structure of arteries and veins

Veins have thin walls compared to the arteries thick walls. The veins thick walls are fibrous whereas the arteries thick walls can be described as muscular tubes.

Veins tend to be smaller than arteries.

Q9

Describe two differences between the function of arteries and veins

Veins have one way valves to prevent back flow of blood whereas arteries have smooth elastic walls which help regulate blood pressure.

Veins are structured to carry deoxygenated blood to the heart compared to the arteries which carry oxygenated away from the heart to the body.

Q10

Describe the role of capillaries.

Capillaries play an important role in the diffusion process of exchanging gases in the body.

Q11

Describe one feature of a capillary that enable them to perform their role.

Capillaries are thinned out arteries that have very thin walls and are able to spread throughout the body, including the smallest area of tissue.

Q12

Define the following terms.

| | |
|---|---|
| Blood Pressure | Blood pressure measurement is directly linked to the cardiac cycle, it is measured in millimetres of mercury (mmHg) and expressed as a fraction using two numbers: the systolic pressure over the diastolic pressure. |
| Systolic Pressure | The systolic measurement indicates the pressure exerted on the walls of the artery when the cardiac muscle is contracting. |
| Diastolic Pressure | The diastolic pressure is the measurement of pressure exerted on the walls of the artery when the heart relaxes. |
| Hypotension | Hypotension is considered to be low blood pressure. |
| Hypertension | Hypertension is considered to be High blood pressure. |

Q13

According to the NHS what range of blood pressure would be classified as normal?

| |
|---|
| According to the NHS Normal blood pressure is considered to be between 90/60mmHg and 120/80mmHg. |

Q14

According to the NHS, at what reading or higher would classify as high blood pressure?

A rate of 140/90mmHg or higher would be classified as high blood pressure according to the NHS.

**Pass/Refer**

**Understand the structure and function of the respiratory system**

Q1 Describe where in the body the lungs are located.

The lungs are located with in the chest cavity, surrounded and protected by the rib cag

Q2

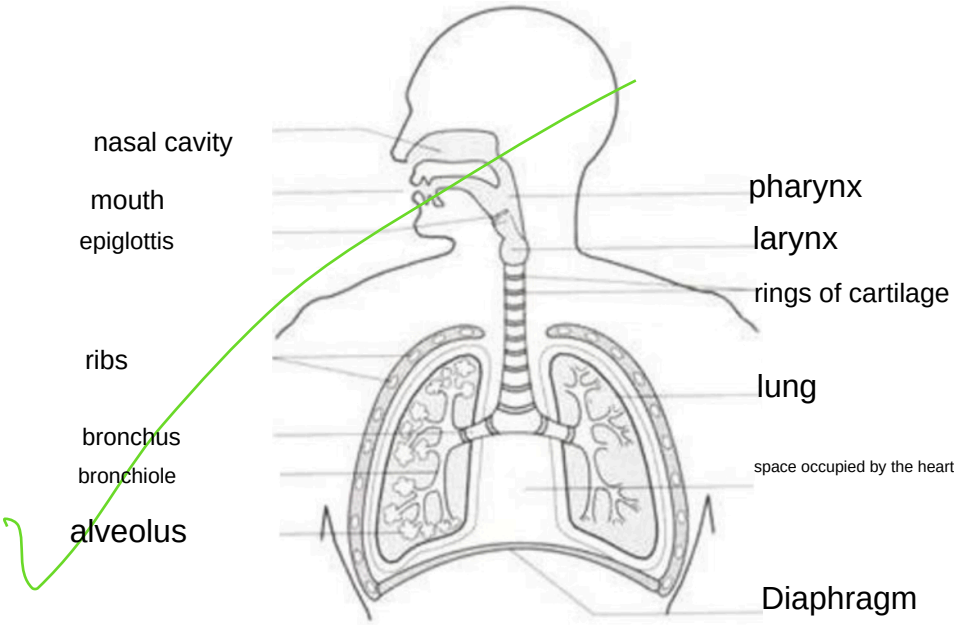
Describe the function of the lungs.

The function of the  lungs in our body is to allow respiration to take place by processing gasses.

Q3

Complete the diagram below by filling in the boxes and identifying the different structures of the respiratory system.

| |
|---|
| Diaphragm |
| Lung |
| Pharynx |
| Bronchiole |
| Bronchus |
| Ribs |
| Mouth |
| Alveolus |
| Nasal Cavity |
| Rings of Cartilage |
| Space occupied by the heart |
| Larynx |
| Epiglottis |




Q4

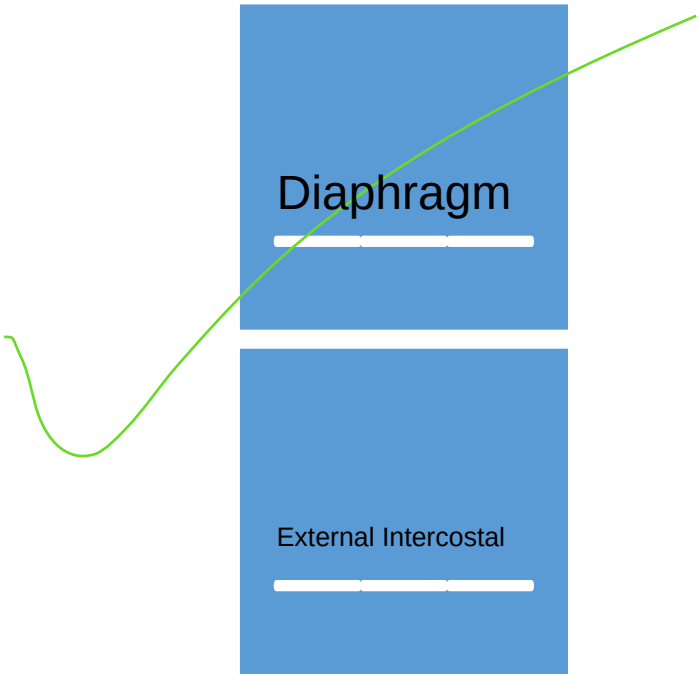
Using some of the answers given in the previous question complete the flow table of air through the respiratory system. You must provide a description of the functions of each of the structures.

| Structure | Function |
|---|---|
| Nasal Cavity | Air is inhaled via the nasal cavity, this would be the recommended method rather than using the mouth as the nasa cavity acts like a filter. It heats and filtrates the air we inhale. |
| Pharynx | The function of the pharynx is to fiter the air we inhale. It accomidates the transition of air from the nose and mouth to the larynx when we breath in. |
| Larynx | The larynx or (wind pipe) transports the air from pharynx to the respiratory organs for gaseous exchange process. |
| Epiglottis | The epigolottis function is to cover the oesophagus when breathing in air and it covers the trachea when food is consumed as it travels through the digestive system. |

| | |
|---|---|
| Bronchus | There are two bronchus and the function of these are to receive air filtered from the trachea, and then direct the air to the left and right bronchioles. |
| Bronchiole | The bronciole receives air from the bronchus and then transports the air to the alveolus in order for the gaseous exchange process to happen. |
| Alveolus | The alvoeolus are recipents of air from the bronchiole, it is here that the gaseous exchange process happens. |
| Diaphragm | The diaphragm muscles contracts which expands the lungs whilst breathing in (inhale), and then the diaphragm muscles relax as we breath out (exhale). |

Q5

Identify two major muscles involved in respiration.



Q6

Where in the lungs does gaseous exchange take place?

| |
|---|
| Gaseous exchange takes place in the alveoli in the lungs. |

Q7

Describe the movement of oxygen and carbon dioxide in the lungs during gaseous exchange.

| |
|---|
| Gas exchange happens through a process known as diffusion, which is the movement of gas molecules, from a region of high concentration to a region of low concentration. Breathed in air arrives in the alveoli, here the concentration of oxygen is high. Once the O2 reaches the alveoli, it will continue to follow this concentration gradient and will diffuse into the bloodstream from where oxygen enters the red blood cells and combines with haemoglobin to form oxyhaemoglobin. This happens because the alveoli have tiny capillaries running over and around them and the alveolar walls and the capillary walls are so thin that gases can pass through them. Hence, as O2 passes into the blood at the same time, CO2 passes back into the lungs to be exhaled. |

## Pass/Refer

**Understand the structure and function of the skeleton**

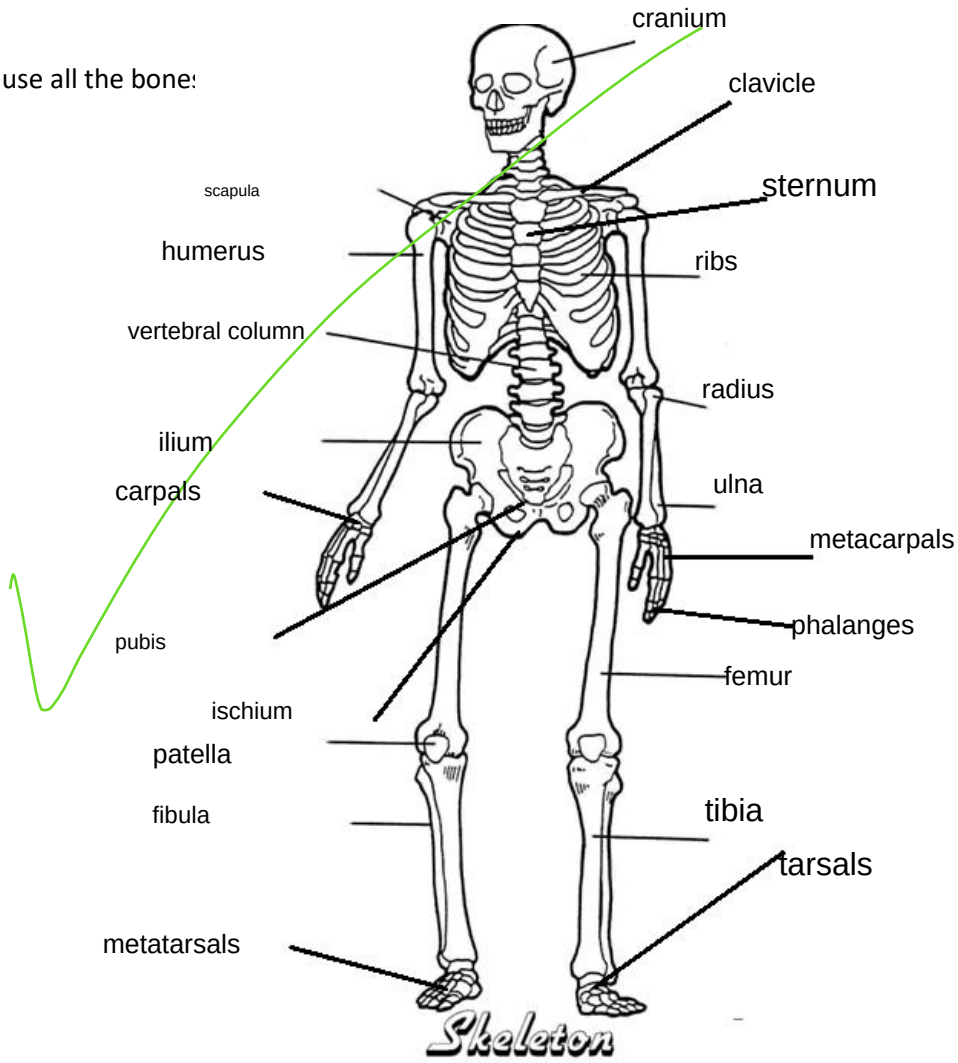
Q1

Describe the five functions of the skeleton.

| Function | Description |
|---|---|
| Shape/Structure | The skeleton gives the human body its shape and provides a framework for the development of the body. |
| Movement | The skeleton provides a series of movable bones that act as levers to allow movements. |
| Soft tissue attachment | The skeleton provides surfaces for the attachment of soft tissues e.g. muscles and ligaments that contract and pull on the bones (levers) causing movement. |
| Protection of organs | The skeleton protects vital internal organs such as the brain via the skull and the heart via the ribs. |
| Storage of minerals | The human body needs to store important minerals such as calcium, phosphorus and salt for quick release when required. The bones provide storage areas for these minerals. |

Q2 Correctly label the skeleton, use all the bones

| |
|---|
| Cranium |
| Clavicle |
| Ribs |
| Sternum |
| Humerus |
| Radius |
| Ulna |
| Scapula |
| Ilium |
| Pubis |
| Ischium |
| Carpals |
| Metacarpals |
| Phalanges |
| Femur |
| Patella |
| Tibia |
| Fibula |
| Tarsals |
| Metatarsals |
| Vertebral Column |




Q3

Identify three bones that are part of the axial skeleton

cranium

vertebral column

Sternum

Q4

Identify four bones that are part of the appendicular skeleton

Scapula

Humerus

PELVIS

FEMUR

Q5

There are five different classifications of bone, complete the table below by providing an example and explaining its function.

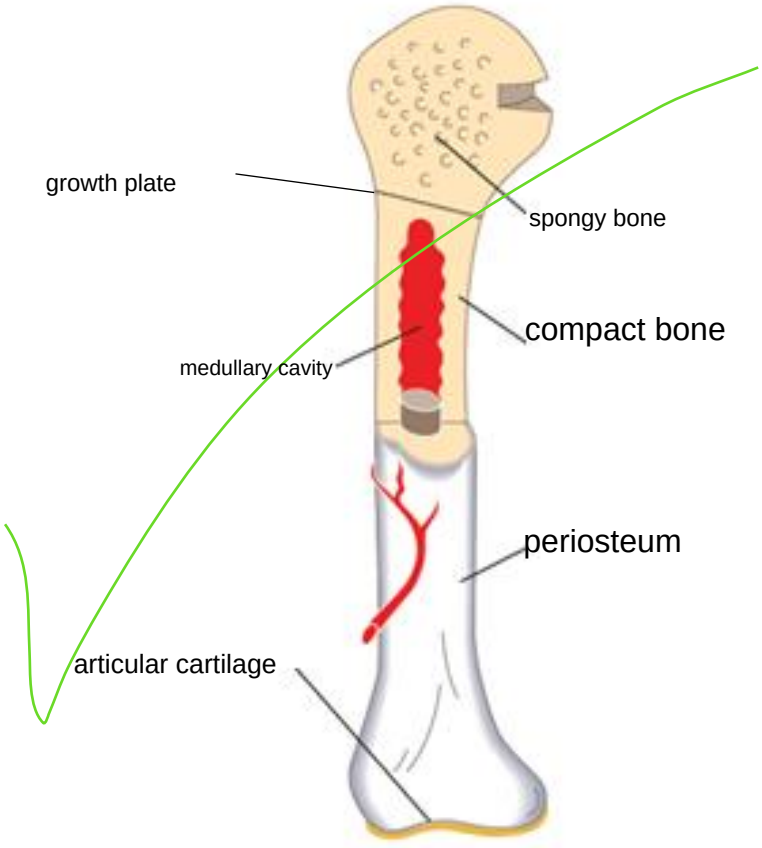
- Learner Guidance: Explain requires more analysis to demonstrate your understanding of the topic, short paragraph.

| Type of bone | Example | Function |
|---|---|---|
| LONG BONES | FEMUR | LONG BONES ARE HARD AND DENSE, GREATER IN LENGTH THAN WIDTH. THEY PROVIDE STRUCTURE AND STABIITY AND ACT AS LEVERS. |
| SHORT BONES | CARPALS AND TARSALS | SHORT BONES ARE ALMOST EQUAL LENGTH AS WIDTH, |
| FLAT BONES | SCAPULA | FLAT BONES ARE THIN AND SANDWICHED BETWEEN 2 COMPACT LAYERS. THEY PROVIDE PROTECTION TO THE INTERNAL ORGANS AND ALLOW MUSCLE ATTACHMENT. |
| IRREGULAR BONES | VERTEBRAL COLUMN | THEY ARE IRREGULAR, CMPLICATED SHAPES. THERE SHAPES ARE DUE TO THE FUNCTION THEY PERFORM IN THE BODY FOR EXAMPLE TO PROTECT ORGANS. |
| SESAMOID | PATELLA | SESAMOID BONES IMPROVE LEVERAGE AND PROTECT JOINTS FROM DAMAGE. |

Q6

Identify the structure of a long bone by labelling the diagram.

Learner guidance: use structures of the long bone found on question 7 on the next page



Q7

For each of the structures of the long bone you have labelled in the previous question, complete the table below to explain their structure in more detail.

| Structure | Explanation |
|---|---|
| Medullary Cavity | Medullary cavity is the hollow tube down the centre of the compact bone. |
| Articular Cartilage | Articular (hyaline) cartilage is connective tissue covering the ends of the bone. |
| Spongy Bone | Spongy bone {Epiphysis} is the expanded portion at each end of the bone. It consists of cancellous or spongy bone tissue giving the ability to endure compression. |
| Compact Bone | Compact bone makes up the Diaphysis which is the shaft (longest part) of the bone. It is of rod like structure, strong and dense, which makes this part resistant to bending. |
| Periosteum | Periosteum is a tough fibrous sheath covering the entire bone, excluding the ends. It contains supply for blood vessels that brings nutrients for bones and removes waste. |
| Growth Plate | Growth plate {Epiphyseal plate} is a hyaline cartilage plate at each end of a long bone found in bodies that are still growing. Once a body reaches full maturity the plate is replaced by an epiphyseal line. |

Q8

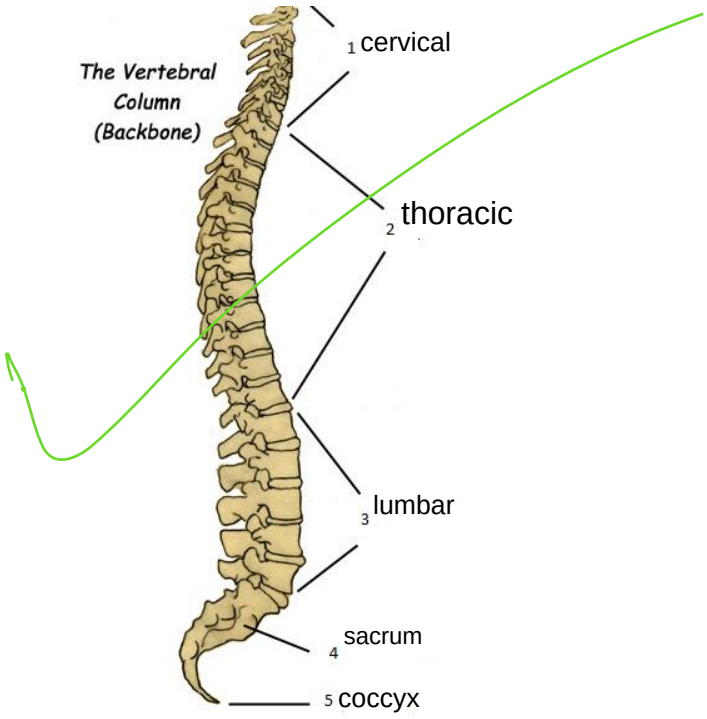
Explain the five stages of ossification (bone growth).

| | |
|---|---|
| 1 | There are no bones at the beginning, the foetus stage, instead the sac comprised of pure cartilage. |
| 2 | Periousteum is the outer cover of bone. To start pregressing bloodflow, it begins to grow the cartilage and transports nutrients to the centre. |
| 3 | After this osteoblasts occur, these are cells that help build bones. Osteoblasts start to build the primary ossification centre. This is the start of diaphysis which is the main part or midsection of the bone. |
| 4 | These primary ossification centres then divides, creating secondary ossification centres.Further building cells are set down and the epiphysis structure is made into bone. |
| 5 | The ossification process is now complete around the age of 25. The Epiphyseal plate is  eventually substituted with solid bone and this competes the procedure. |

Q9

Label the different sections of the spine using all the sections in the box below.

Lumbar
Thoracic
Sacrum
Cervical
Coccyx



Q10

From the different sections labelled in the previous question, describe the potential ranges of motion of each section.

| Section | Potential Ranges of Motion |
|---|---|
| cervical | The most mobile part with potentially rotational, flexion and extension, lateral flexion and extention ranges of motion. |
| thoracic | Less mobile than cervical, with potentiallyrotational, flexion, extension, lateral flexion and lateral extension ranges of motion. |
| lumbar | Has a very limited range of potentially flexion and extension ranges of motion. |
| sacrum | No movement possible. |
| coccyx | No movement possible. |

Q11

Describe what is meant by the term 'neutral spine'.

A ' neutral ' spine has four natural curves that are named after the vertebrae that form them: cervical curve, thoracic curve, lumbar curve and sacral curve. These curves centre the skull over the rest of the body, enabling a person to maintain an upright position and be mobile. The curves also contribute to reducing the amount of impact through the skeleton to the brain from shocks caused by physical activities, protecting the brain from shock waves.

Q12

Which area of the spine would you expect to see the following natural curves?

Kyphotic

In the thoracic section of the spine you would expect to see kyphotic curves.

Lordotic

In the lumbar section of the spine is where you wuld expect to see lordotic curves.

Q13

Describe how a Lordotic spine affects the normal shape of the spine.

A lordotic spine curves the lumbar section of the spine inwards.

Q14

Describe how a Kyphotic spine affects the normal shape of the spine.

A Kyphotic spine can have a rounding or hump of the thoracic section of the spine.

Q15

Describe how Scoliosis of the spine affects the normal shape of the spine.

A scoliosis of the spine can cause the spine to curve sidewards.

Q16

Describe how pregnancy can affect the normal shape of the spine.

Very often, postures alter during pregnancy, looking like a lordosis curve at the lumber spine. This is due to the extra weight at the front, which lengthens the abdominal muscles and alters the position of the pelvis.

**Pass/Refer**

These are all "synovial joints"

As all 3 of the classifications will change, the locations and ROM will need to be changed too

**Understand joints in the skeleton**

Q1

Complete the table below of the different classification of joints, include the potential movement available at each.

| Classification of joint | Location of joint | Potential movement of joint |
|---|---|---|
| Synovial Joint. | Synovial Joint- freely movable joints such as the knee and shoulder joints and are the most common type of joints in the body | Freely Moveable. |
| Cartilaginous Joint. | Spinial Joint- the joints in the spine are commonly called facet joints located at the back of the spine. | Slightly moveable bones in the vertebre which allow more movement than a fibrous joint but less than the highy mobile synovial joint. |
| Fibrous Joint. | Fibrous Joint- interlocking bones sch as the plates of the skull are united via fibrous joints or the fibrous joint that holds our teeth in their socket. | Immoveable and interlocking bones. |

Q2

Describe the structure of the synovial membrane.

The synovial membrane is found in the Synovial joints which like other joints are stabilised by ligaments, but they also have a capsule that encloses a narrow lubricated space between the bones, which is known as the synovium. This is lubricated by the synovial fluid.

Q3

Describe the structure of the articular cartilage.

Articular cartilage is hyaline cartilage and is 2 to 4 mm thick, it is thin to look at, strong and smooth in texture and bluey-white in colour. The cartilage tends to become slippery when lubricated with synovial fluid and will help reduce friction allowing optimal joint movement.

Q4

Describe the six different types of synovial joints and state the range of motion available at each.

Pivot Joints, these joints allow rotational movement around an axis, for example circumduction and rotation such as turning the thoracic spine to the side or turning the head.

Hinge Joints are formed between 2 or more bones where the bones can only allow movement between one axis allowing for example flexion and extension of the arms and legs.

Ball and socket Joints, these type of joints allow virtually any type of movement, for example flexion, extension, lateral flexion and lateral extension at the hip joint.

Condyloid Joints, these joints are simiar to a ball and socket joint. They allow the same type of movement but to a lesser magnitude. They allow Pronation and supination of the palm of the hand.

Gliding Joints, these joints allow two bones to slide past each other, allowing plantar fexion and dorsi flexion of the foot.

Saddle Joint, these are joints where one of the bones is shaped like a saddle with the other bone resting on it. They provide stability and more flexibility than a hinge or gliding joint.

Q5

What joint actions are possible at the following joints?

Elbow

The joint actions possible at the elbow are Flexion and Extension.

Spine Learner guidance: name at least 3 joint actions

The joint actions possible at the spine varies between the vertebrae, examples of such would be flexion, extension, rotation, lateral flexion and lateral extension.

Hip Learner guidance: name at least 4 joint actions

The joint actions possible at the hip are: Flexion, extension, Abduction, adduction, Rotation and circumduction.

Q6

Describe each of the following joint actions and provide an example of a joint where it can occur.

Extension

This is the opposite action of flexion by increasing the angle of the joint, for example the straightening of the arm.

Abduction

This is the joint action to bring towards or across the mid-line of the body, for example moving the arms in towards the body.

Plantar Flexion

This is the joint action of bending the ankle joint so toes point downwards.

**Pass/Refer**

**Understand the muscular system**

Q1

Complete the table below.

| Different types of muscle tissue | Main characteristics | Main role |
|---|---|---|
| skeletal muscle | skeletal muscles are the main group of muscles in the body They attach to bones and have the main function of stabilising the bodys movable joints contracting to facilitate movement. They are regarded as voluntary muscles because we have direct control over them through the brain sending signals to them. They also generate a significant amount of body heat. | Its main role is to facilitate voluntary movement and provide body heat. |
| smooth muscle | Smooth muscles are described as involuntary as they are controlled by the autonomic nervous system and therefore we cannot consciously control them. Smooth muscles found in the walls of the internal organs, such as the stomach, bladder, intestine and blood vessels (excluding the heart). | Its main role is to faciitate the involuntary movement via the walls of internal organs, such as the stomach, bladder, intestine and bood vessels (excuding the heart). |
| cardiac muscle | The cardiac muscle is classified as an involuntary muscle. It is found in the heart and pumps blood and oxygen around the body. The contraction of the heart is controlled by the sinoatrial node (SAN). | its main role is to facilitate the involuntary movement of the heart allowing the heart to pump blood and oxygen around the body. |

Q2

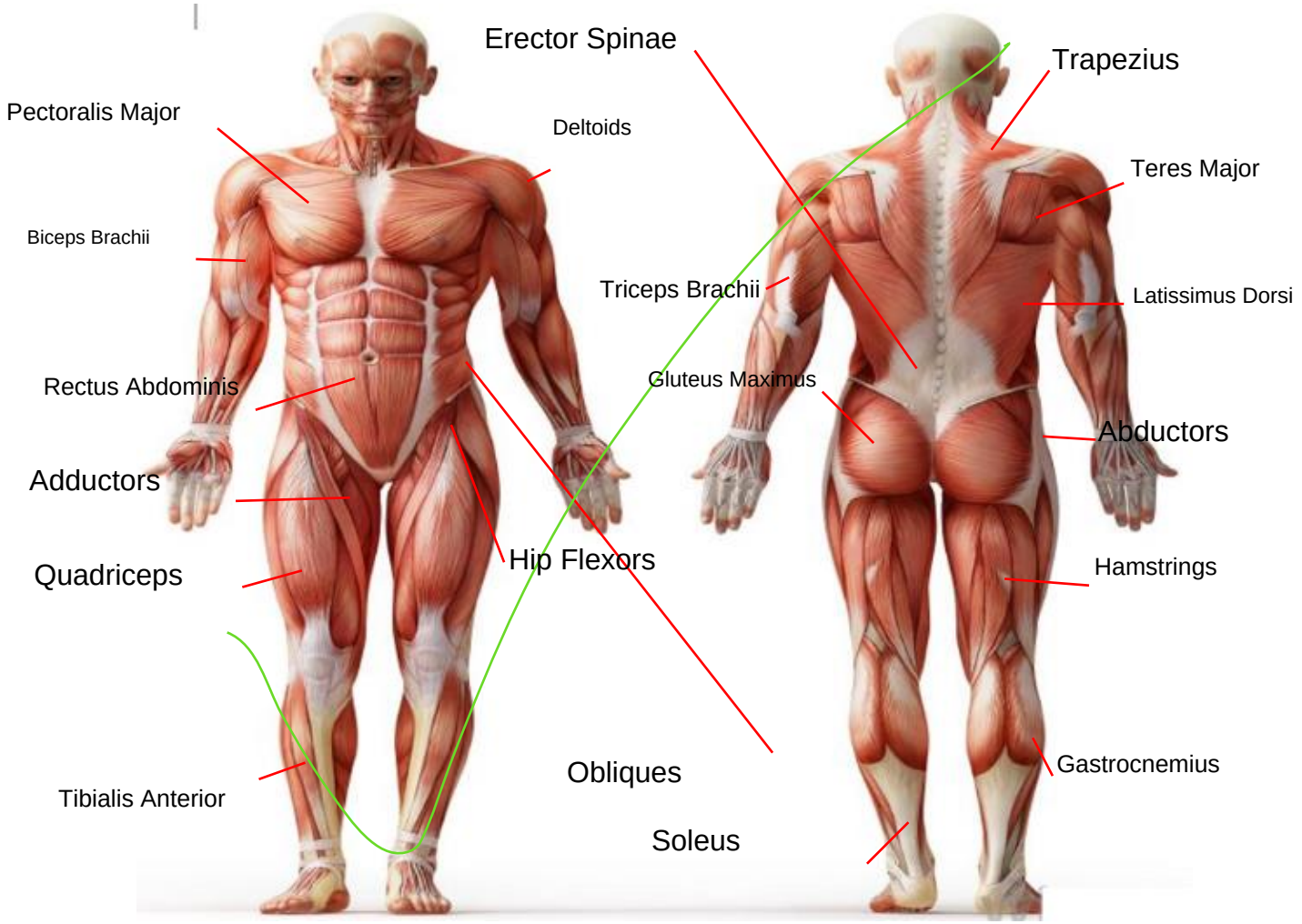
Complete the table below by describing the main structural points of a skeletal muscle.

| Structure | Description |
|---|---|
| Muscle Fibre | Each fibre contains blood vessels and is made up of myofibrils aligned in long strips. |
| Fascicle | A muscle fascicle is a bundle of skeletal muscle fibres surrounded by perimysium, a type of connective tissue. |
| Fascia | Fascia is a band or sheet of connective tissue, primarily collagen, beneath the skin that attaches, stabilises, encloses, and separates muscles and other internal organs. |
| Sarcomere | Within the myofibril, there are filaments of actin and myosin organised in repeating subunits called sarcomeres. |
| Myofibril | Within the myofibril, there are filaments of actin and myosin. |

Q3 Label the skeletal muscles using the muscles from the list below, and identify what joint action each one allows.

Learner guidance: when describing joint actions please identify the limb/body part moving

| Muscle to locate | Action it allows |
|---|---|
| Rectus Abdominis | Flexion of the spine |
| Pectoralis Major | adduction, inward rotation, horizontal fexion of the shoulder joint. |
| Deltoids | abduction and flexion, extension and rotation of the shoulder. |
| Tibialis Anterior | dorsiflexion of the ankle. |
| Biceps Brachii | flexion of elbow and supination of the wrist. |
| Obliques | rotation and lateral flexion of the spine. |
| Soleus | planterflexion of the ankle. |
| Gastrocnemius | planterflexion of the ankle and flexion of the knee. |
| Teres Major | extension, adduction and medial rotation of the arm. |
| Gluteus Maximus | extention and onward rotation of the hips. |
| Triceps Brachii | extension of the elbow and extention of the shoulder. |
| Trapezius | elevation, retractraction and depression of the shoulder girdle. |
| Erector Spinae | extension and rotation of the spine. |
| Latissimus Dorsi | adduction, extension and inward rotation of the arms. |
| Hamstrings | hip extension and knee flexion. |
| Quadriceps | knee extension. |
| Abductors | abduction and inward rotation of the hips. |
| Adductors | adduction and outward rotation of the hips. |
| Hip Flexors | hip flexion. |



Q4

Describe the structure of the pelvic floor muscles.

The pelvic floor muscles are often described as sling or hammock shaped. The muscle is double layered with a deep and superficial layer of muscles tissue as well as a layer of connective tissue.

Q5

Describe two functions of the pelvic floor muscles.

One function of the pelvic floor muscles are to support the pelvic organs (bladder and bowel in men and bladder, bowel and uterus in women) which is responsible for contracting to provide control of incontinence.

Another function is to provide stability for the pelvic girdle.

Q6

Describe an concentric muscle contraction.

Concentric contractions are the most common types and these are muscle contractions that shorten the muscles. They occur every day when we carry out activities, for example, bending elbows, curling legs and grasping an item.

Q7

Describe an eccentric muscle contraction.

Eccentric contractions are the opposite of concentric and occur when the muscle lengthens as it contracts. This is less common as it only occurs during specific movement types, like kicking a ball. When you kick a ball the quadriceps muscle contracts concentrically to straighten the knee but the hamstrings contract eccentrically to decelerate the motion of the lower limb.

Q8

Describe an isometric muscle contraction.

Isometric contractions are those that do not change the length of the contracting muscle. During isometric contractions, the joints are not moving. However, the muscles continuously contract. A good example would be holding a glass of water in your hand.

Q9

Identify the joint action occurring in a barbell bicep curl during the concentric phase.

The concentric phase of a bicep curl allows contraction (shortening) of the bicep muscle and relaxation, lengthening of the tricep muscles causing flexion of the elbow joint and supination of the wrist allowing pulling on the radius to lift a barbell.

Q10

Identify the joint action occurring in a barbell bicep curl during the eccentric phase.

The eccentric phase of a barbel bicep curl allows the biceps muscle contracts concentrically to cause extension of the elbow but the triceps contract eccentrically to decelerate the motion of the radius.

Q11

Complete the table below by identifying three different muscle fibre types and their main characteristics.

| Muscle fibre types | Characteristics |
|---|---|
| Slow-twitch muscle fibres (slow oxidative glycolytic) | Slow-twitch muscle fibres are red in colour and are good for endurance activities as they can work for a long time with out getting tired. |
| | Muscles that contain a lot of slow-twitch fibres are red because they contain lots of blood vessels. |
| | Slow twitch fibres rely on a rich suppy of oxygenated blood as they use oxygen to produce energy for muscle cntraction. |
| Fast-twitch muscle fibres (fast glycolytic) | Fast-twitch muscle fibres are white in colour because they don"t use oxygen to make energy, so they don¬t need such a rich blood supply |
| | They contract quickly and produce small amounts of quick energy, but at the same time, they get tired quickly. |
| | These fibres are good for rapid movements like jumping to catch a ball or sprinting to catch a bus. |
| Intermediary muscle fibres (Fast oxidative glycolytic) | These fibres are pink in colour. |
| | They have a stronger contraction rate than the slow twitch, fibres but a slower rate than the fast-twitch fibres, making them an intermediary between the twomain fibre types. |
| | The fibre types are created by the body to support the slow twitch muscle fibres during the difficult stages of endurance events. |

**Pass/Refer**

**<u>Understand the life-course of the musculoskeletal system and its implications for special populations exercise</u>**

Q1

Describe two physical changes, and their implications for exercise, when training young people (in the 14-16 age range)

Leaner Guidance: Think about what effect training can have on tendons, ligaments, muscles, joint and bone mineral density changes.

| |
|---|
| Our bones are not fully formed until the age of about 18 to 25. By the time we are born many of our bones have partly ossified, but there is still a lot of development yet to take place and therefore a young persons bones are more vulnerable to fractures. Injuries to bones in childhood can affect the growth and development of bones as well as make joints unstable. Therefore the exercises and physical activities young people participate in should always be well thought out and monitored. |
| The muscular system we have, has actually been genetically inherited to some extent and muscle growth varies in young people depending on their age. Muscle growth does not correlate with bone growth and therefore extensive growth of muscles can make young people clumsy as well as limit movements in other ways, therefore choreographed styled training may not be advised, due to them not having fully developed motor skills. |

Q2

Describe two physical changes, and their implications for exercise, when training older people (50 plus age range)

Leaner Guidance: Think about what effect training can have on tendons, ligaments, muscles, joint and bone mineral density changes.

Many older people develop osteoporosis and this is due to the gradual loss of bone mineral. When bones lose minerals, they still remain the same size but just become fragile and porous. The term osteoporosis in actual fact means porous bones. The loss of bone minerals can be offset to some degree with medication, good intake of nutrition and exercise that stimulates increased bone formation to improve the bone mineral density (BMD).

As we age, changes occur to bones, joints and muscles. A decrease in activity along with changes in hormone levels can affect bone remodelling. The articular cartilage also tends to become thinner as we get older and the synovial fluid which lubricates joints tends to diminish slowly. Similarly, the ligaments shorten and become less flexible and tendons become weak and less elasticated with age. Overall joints become stiffer and less flexible and the number of muscle fibres and the size of muscle fibres reduces. All this has an impact on our movement abilities, slowing down movements and making it difficult to accomplish certain movement types. A balanced exercise programme focused on strengthening ligaments and tendons can help to offset some of the inevitable changes to the body as we age.

Q3

Describe two physical changes, and their implications for exercise, when training antenatal and postnatal women.

Leaner Guidance: Think about what effect training can have on tendons, ligaments, muscles, joint and bone mineral density changes.

During pregnancy a hormone called relaxin tends to have a significant impact on the stability of synovial joints, impacting movements. Pregnancy also impacts the muscles in the body as relaxin
increases mainly in the later stages of pregnancy increasing the pliability of the muscle connective tissue, which may have an impact on balance and coordination. Therefore, short maintenance
stretches can be beneficial during pregnancy, as opposed to development stretches in order to avoid damaging connective tissue

Post-birth exercise should also be gradually introduced as many of the physiological changes of pregnancy can remain for up to six months after giving birth.

**Pass/Refer**

**Understand energy systems and their relation to exercise**

Q1

What does ATP stand for?

Adenosine triphosphate.

Q2

Describe what the role of carbohydrates, fats and protein are in the production of energy.

Carbohydrates, fats and protein come from different foods and are broken down to nutrients via digestion in to fuel that the body uses to produce energy.

Q3

Explain the use of the creatine phosphate (CP) or phosphocreatine system during exercise.

Learner Guidance

- Include what nutrients or compound the energy system will use to resynthesis energy
- Explain the types of activity/exercise that the energy system will fuel.

The phosphocreatine (PC) energy system is utilised by the body when a muscle needs to generate a lot of force quickly but there is a lack of sufficient O2 (anaerobic).
The PC energy system will predominantly be used for very high-intensity activities, near maximal effort. The PC energy system uses chemical energy to produce ATP and does not require oxygen, carbohydrate or fat during the production process. As soon as the ATP supply in a muscle has been exhausted, it can almost immediately be regenerated by a chemical substance (compound) called creatine phosphate.

Similar to ATP, this compound has a high energy bond which when broken down by the enzyme creatine kinase, releases sufficient energy to yield an ATP molecule. The entire chemical reaction is very rapid and will only last for a very short period of time because of the limited storage of creatine phosphate within muscles eg. 100m sprint

Q4

Explain the use of the lactic acid system/anaerobic system during exercise.

Learner Guidance

- Include what nutrients or compound the energy system will use to resynthesis energy
- Explain the types of activity/exercise that the energy system will fuel.

The lactic acid system provides energy for quick bursts of medium/high-intensity activities (submaximal). It comes into effect when the phosphocreatine system cannot provide sufficient ATP during an activity or if during intense aerobic training the aerobic energy system cannot provide sufficient energy. Lactic acid is a waste product produced during exercise. It is a water-soluble liquid produced during anaerobic glucose metabolism in muscles. It is a by-product of breaking down glycogen to pyruvate and then ATP. The body in actual fact is constantly producing lactic acids by converting glucose and at the same time, it is also removing lactic acid from the body to keep a balance. This system is used for example after you have sprinted for 10secs and you are still running quite fast eg. 200m or 400m track.

Q5

Explain the use of the aerobic system during exercise.

Learner Guidance

- Include what nutrients or compound the energy system will use to resynthesis energy
- Explain the types of activity/exercise that the energy system

Aerobic simply means ‘ with oxygen ’, and refers to the energy system that produces ATP by breaking down carbohydrate and fat, in the presence of O2. The aerobic energy system is dominant when there is sufficient O2 in the cell to meet the energy production requirements.
Carbohydrate (glucose) and fat (fatty acids) are the two macronutrients that are required to supply the body with ATP during aerobic metabolism. Whether the body is resting or indulging in physical activities, to produce ATP a mixture of glucose and fatty acid is required, but in different proportions. The process of generating energy via the aerobic system occurs within a specialised structure in the muscle cell called mitochondria which contain special enzymes required by the cells to use oxygen.
The aerobic energy system is used for activities lasting more than 90 seconds such as distance running, cycling and swimming.

**Pass/Refer**

great!

## Understand the nervous system and its relation to exercise

Q1

Describe three roles and functions of the nervous system.

It has three functions, firstly sensory input to sense changes inside and outside the body.

Secondly interpretation to analyse and interpret incoming information.

Thirdly motor output to respond to the information by activating the relevant bodily system.

Q2

Describe the principles of muscle contraction.

Learner Guidance – What are the role of nerves in muscle contraction? Think about nerve impulses

The roles of nerves in muscle contractions are after the central nervous system receives. analysis and sends information to the relevant bodily system, the periphial nervous system sends either a vountary response via the somatic nervous system or a involuntary respnse via the autonomic nervous system causing all the muscle fibres within a unit to cause a contraction.

Q3

Describe the ‘all or none’ law.

Learner Guidance – Think about motor unit recruitment

The 'all or none' law is when a motor unit receives a stimulus of sufficient intensity to bring forth a response, all the muscle fibres within the unit will contract at the same time to maximum possible extent.

Q4

Describe what determines whether or not a contraction takes place within a motor unit.

If the stimulous is not of sufficent intensity, the muscle fibres will not respond and contraction will not take place.

Q5

Describe two adaptations that occur in the neuromuscular system with regular exercise that improves motor fitness.

One adaptation that occurs is strengthening and growing new connections within the nervous system.

Another adaptation that occurs is improved synchronous of motor units resulting in stronger muscle contractions.

**Pass/Refer**

## Assessor Feedback

Hi Marc,

Great job on your first attempt of your L2 AP workbook!

You did a really good job, giving good examples throughout as well as your spelling and grammar were excellent throughout.

There is only one correction left to pass this workbook:

complete bottom of p1
p18 Q1

Keep up the good work!

MS
26.2.21

**Assessor Feedback**