Level 2 Fitness Instructor – Anatomy and Physiology for Exercise

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Course Start Date	
Course Location	
Tutor Name	

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			
Understand the structure and function of the respiratory system and skeleton (and joints)			
Understand the muscular system			
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	Kasper Nico Raphael	IQA Name	
Learner Signature		IQA Signature	
Date	18/10/2020	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	X
The heart is located on the right-hand side of the chest cavity	

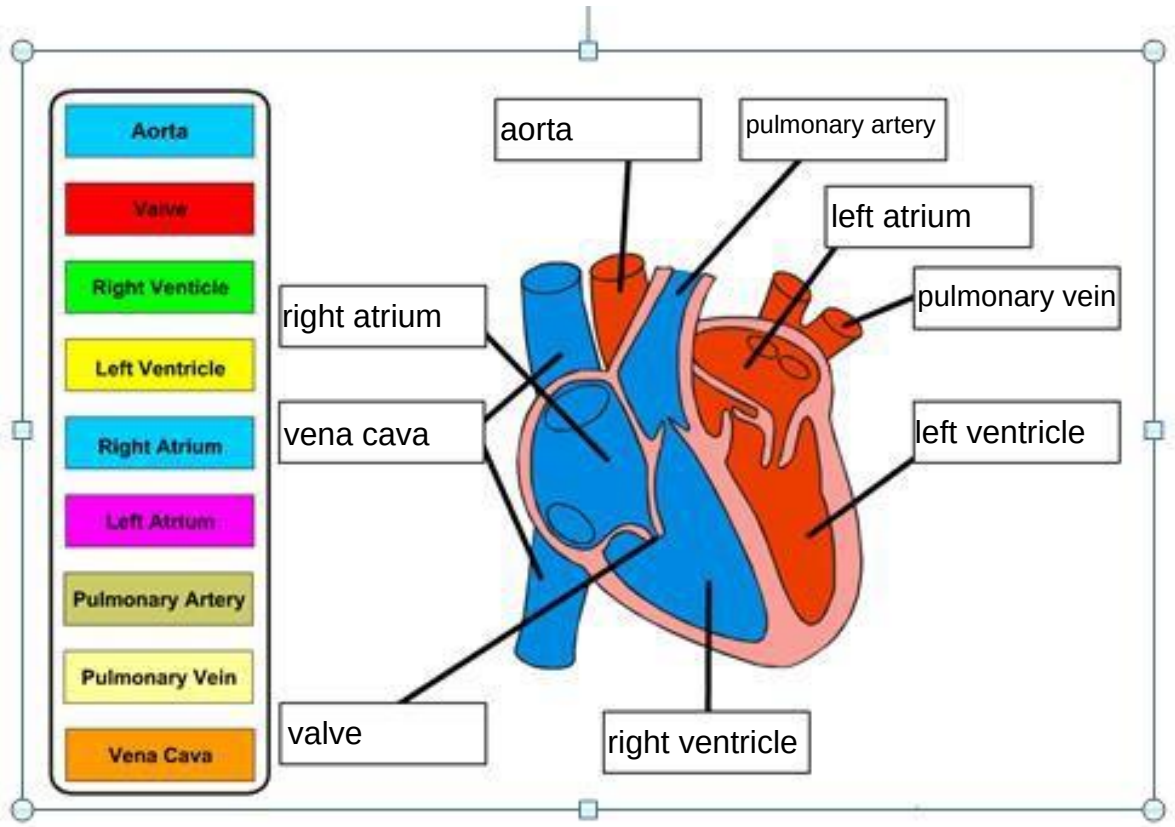
Q2

Describe the main function of the heart.

The heart pumps blood around the body. It receives deoxygenated blood from the limbs and organs via the vena cava and then pumps it into the lungs via the pulmonary artery. The blood is then oxygenated in the lungs and pumped back into the heart, where it is transported to the rest of the body via the aorta.

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	receives oxygenated blood from the pulmonary vein and transports it to the left ventricle
Left Ventricle	receives oxygenated blood from the left atrium and transports it to the body via the aorta
Aorta	receives oxygenated blood from the left ventricle and transports it to the body
Working Muscles	Oxygenated blood is delivered to the working muscles
Vena Cava	receives deoxygenated blood from the working muscles and organs and transports it to the right atrium
Right Atrium	receives deoxygenated blood from the body via the vena cava and transports it to the right ventricle
Right Ventricle	receives deoxygenated blood from the right atrium and transports it to the lungs via the pulmonary artery
Pulmonary Artery	receives deoxygenated blood from the right ventricle and transports it to the lungs

Q5

Describe the role of the valves in the heart.

the valves in the heart prevent blood from flowing back into the left and right atrium from the ventricle (the tricuspid on the right and mitral on the left side of the heart). the pulmonary valve and aortic valve stop blood from flowing back from the pulmonary artery and aorta into the heart.

Q6

Describe systemic circulation.

systemic circulation carries oxygenated blood from the heart to the body (organs, limbs, working muscles) and carries deoxygenated blood back to the heart. the systemic circulation starts in the left side of the heart

Q7

Describe pulmonary circulation.

pulmonary circulation carries deoxygenated blood from the heart to the lungs where it it oxygenated. the blood is then carried back to the heart and pumped around the body.

Q8

Describe two differences between the structure of arteries and veins

arteries are (usually) more muscular and have thicker walls than veins.

veins have valves that stop blood from flowing back in the wrong direction, which arteries don't

Q9

Describe two differences between the function of arteries and veins

arteries carry blood away from the heart to the pulmonary and systemic circulation, veins carry blood to the heart

arteries transport oxygenated blood and veins transport deoxygenated blood, with one exception: the pulmonary vein

Q10

Describe the role of capillaries.

capillaries are small endings which the arteries branch into. they play an important role in exchanging nutrients and gases in the body.

Q11

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

the walls of a capillary are very thin (sometimes only one cell thick) meaning it is easier to exchange gases.

Q12

Define the following terms.

Blood Pressure	blood pressure is the pressure exerted by blood on the walls of the blood vessels. it is measured in systolic and diastolic pressure.
Systolic Pressure	systolic pressure is the pressure on the walls of arteries when the heart is contracting. it is the top/first number in a reading of blood pressure. so if the blood pressure is 100/80 the systolic pressure is 100.
Diastolic Pressure	diastolic pressure is the pressure on the walls of the artery when the heart relaxes. it is the bottom number in a blood pressure reading. so if the blood pressure is 120/90 the diastolic pressure is 90.
Hypotension	hypotension is when the blood pressure is lower than usual. hypotension starts when it falls below 90/60 systolic and diastolic reading.
Hypertension	hypertension is when the blood pressure is higher than usual. hypertension starts with pressures higher than 140/90.

Q13

According to the NHS what <u>range</u> of blood pressure would be classified as normal?

between 90/60 and 120/80 is classified as normal blood pressure

Q14

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

140/90 or higher

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 on either side of the chest (thorax) in the thoracic cavity

Q2

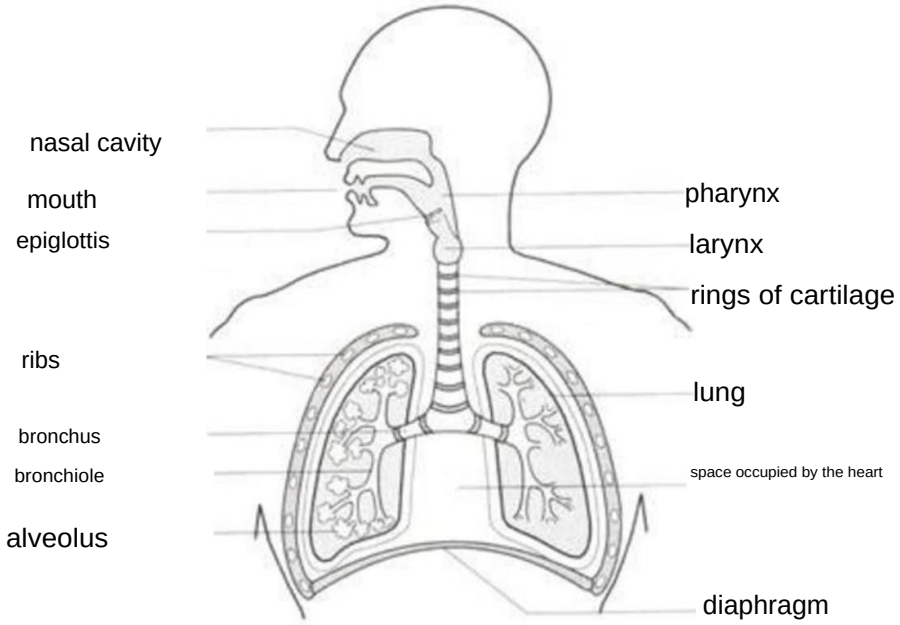
Describe the function of the lungs.

the lungs are the respiratory organ. they are responsible for the breathing process. air is drawn into the lungs (inhalation) and expelled out of the lungs (exhalation). the lungs are also the part of the body where exchange of gas takes place. oxygen is delivered to the bloodstream via the lungs and carbon dioxide is breathed out of the body via the lungs.

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

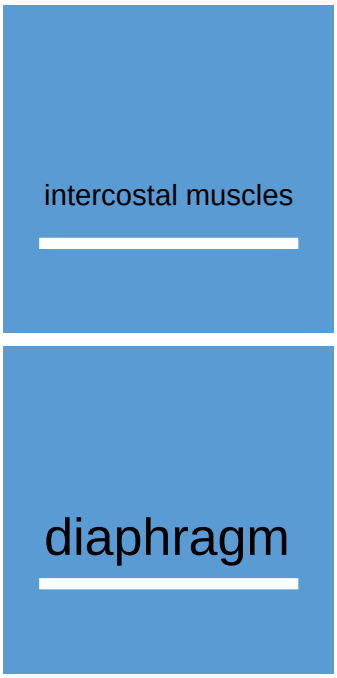
Using some of the answers given in the previous question complete the flow table of air through the respiratory system. You must provide a description of the functions of each of the structures.

Structure	Function
Nasal Cavity	air comes into the nasal cavity when we breathe in and then flows to the pharynx. air is filtered and also warmed up in the nasal cavity
Pharynx	the air we inhale through our mouth and nose passes through the pharynx (throat). the pharynx further filters air and also helps with swallowing
Larynx	the larynx transports air through the respiratory system to allow the exchange of gases. the larynx prevents food from entering the trachea when swallowing.
Epiglottis	the epiglottis covers the oesophagus while breathing air in and transports it to the trachea. it also covers up the trachea when food is travelling down the digestive system.

Bronchus	the bronchus receives filtered air from the trachea. it transports air to the left and right bronchiole.
Bronchiole	the bronchioles deliver air to the alveoli so gaseous exchange can happen. the bronchioles have mucus inside them which traps dust particles and other external objects so they cant travel further down the respiratory system
Alveolus	the alveoli receive air from the bronchioles. the alveoli are where the gaseous exchange between co2 and o2 happen. alveoli are very thin (only one cell thick) allowing for the gas to be exchanged more easily.
Diaphragm	the diaphragm is a muscles located under the lungs. when it contracts it allows the chest cavity to expand in size allowing air to flow in, and when it relaxes the lung size decreases. this way it aids in the movement of air in and out of the lungs.

Q5

Identify two major muscles involved in respiration.



Q6

Where in the lungs does gaseous exchange take place?

in the surface between the alveoli and the capillaries that are near them

Q7

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

during the gaseous exchange, oxygen is diffused into the blood

Pass/Refer

Understand the structure and function of the skeleton

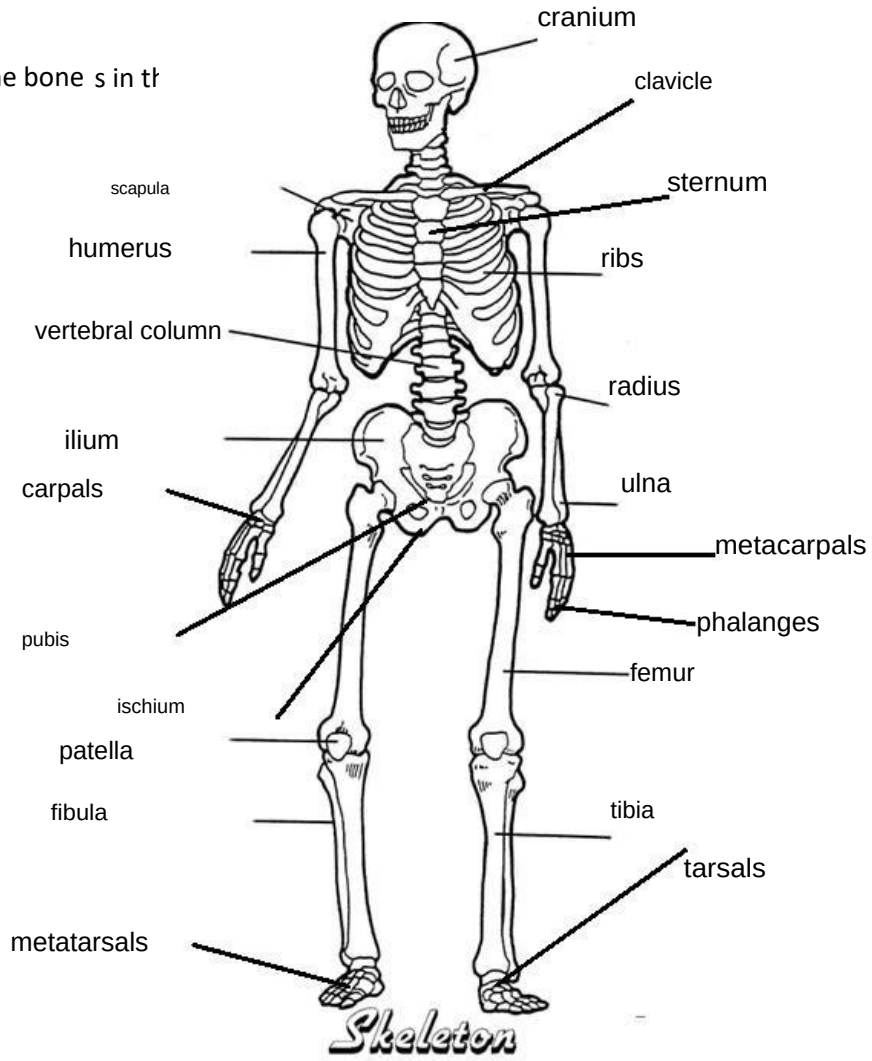
Q1

Describe the five functions of the skeleton.

Function	Description
structure	the skeleton gives the body shape and provides structure. it is also vital in the development of the human body.
movement	the skeleton is made up of movable bones that allow different types of movement, depending on the type of bone structure and placement of the bone
protection	the skeleton plays an important role in protecting the vital organs, for example the heart and lungs via the ribs and the brain via the skull
storage of minerals	the human body needs a lot of minerals available at all times. bones provide good storage for these minerals
production of cells	red and white blood cells are made in the marrow of bones, both of which are vital for a healthy body

Q2 Correctly label the skeleton, use all the bone s in th

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

skull

ribs

spine

Q4

Identify four bones that are part of the appendicular skeleton

scapula

fibula

radius

femur

Q5

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

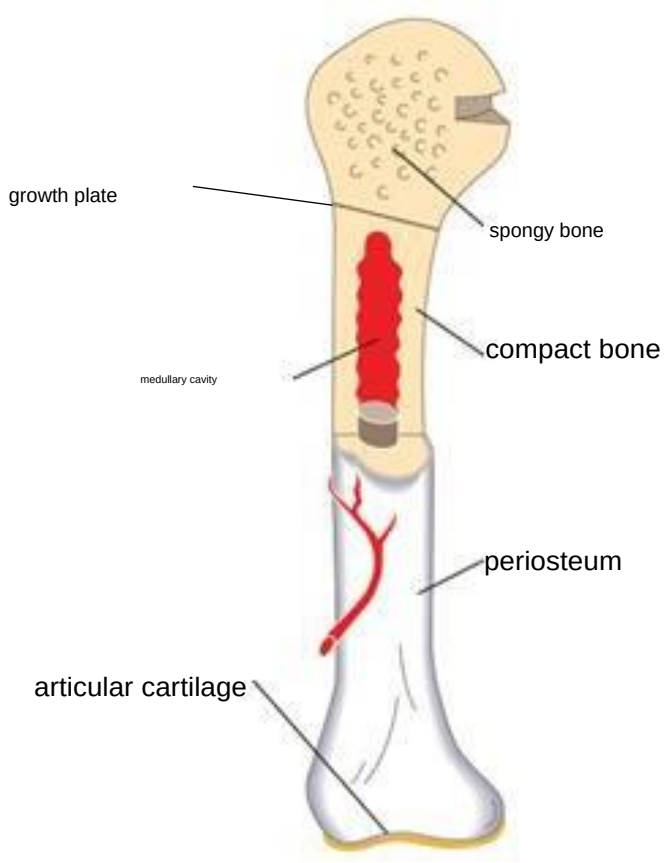
- Learner Guidance: Explain requires more analysis to demonstrate your understanding of the topic, short paragraph.

Type of bone	Example	Function
long bones	tibia	long bones are hard and dense. they are longer than they are wide and slightly curved in order to give them more strength. the long bones act as levers for movement and provide structure to the body. long bones are made up of a tubular shaft (diaphysis) and two extremities (epiphyses)
short bones	tarsals	short bones are almost as wide as they are long. they provide stability and enable movement, for example in the wrist and ankle.
flat bones	pelvis	flat bones protect internal organs like the brain and heart and they form the place of attachment for a lot of muscles.
irregular	vertebrae	irregular bones have odd shapes and cannot be described as long, short or flat. irregular bones have various purposes, one of which is protection like the vertebrae protecting the spinal cord.
sesamoid	patella	sesamoid bones are embedded within a tendon or muscle. they help with leverage of the joints and prevent 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	this is the hollow tube in the centre of the compact bone
Articular Cartilage	articular cartilage is a connective tissue covering both ends of the bone. this makes the bones more moveable
Spongy Bone	spongy bone is porous and contains blood vessels and red bone marrow. spongy bone is usually surrounded by compact bone and is located at the ends of long bones.
Compact Bone	compact bone is much denser than spongy bone and forms the hard outer edge in most bones of the body. it is less flexible than spongy bone and provides protection to the rest of the bone structure.
Periosteum	the periosteum is a membrane covering the entire bone, excluding both endings. the periosteum is made up of two layers. the inner layer (cambrium) contains osteoblasts which are bone-forming cells. the outer layer contains blood vessels and nerves that brings nutrients for the bones and removes any waste.
Growth Plate	it is made up of hyaline cartilage that is located at both ends of all long bones in the body. it is only there when the body is still growing; when a body is fully matured it is replaced by an epiphyseal line.

Q8

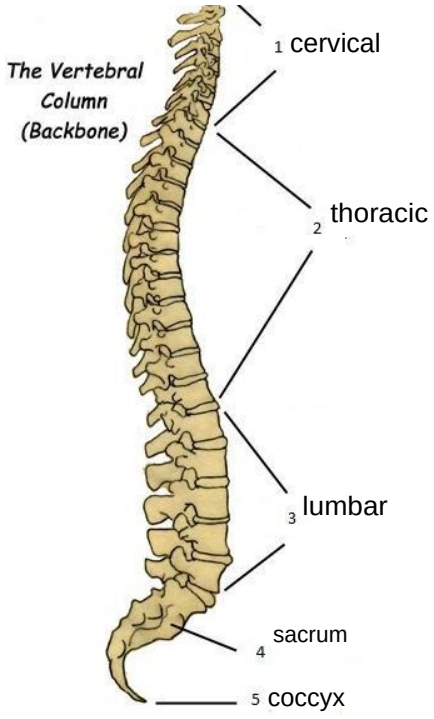
Explain the five stages of ossification (bone growth).

1	bone growth starts at the moment of conception. in the foetal stage there are no bones yet but the skeleton is made up of purely cartilage.
2	the periosteum (outer sheath of the bone) starts to grow around the cartilage. this enables blood flow and nutrients can now flow into the centre to help with the growth of bones.
3	osteoblasts occur. these are cells that help bones grow; in the early stages they start to form a primary ossification centre. this is the diaphysis or central section of the bone.
4	the primary ossification centre divides, creating secondary centres. more bone building cells are set down and the growth plate (epiphyseal) is made into bone.
5	around the age of 25 ossification is fully complete and the epiphyseal is replaced by solid bone. this complete the bone growth cycle.

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	most mobile part of the spine
thoracic	mobile but less mobile than cervical
lumbar	very limited range of motion
sacral	no movement possible
coccyx	no movement possible

Q11

Describe what is meant by the term ‘neutral spine’.

neutral spine is the position in which the neck and back are under the least amount of strain

Q12

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

Kyphotic

thoracic part

Lordotic

lumbar spine

Q13

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

the spine is curved inwards. lordosis means there is more space than normal between your back and the surface while lying down. lordosis is usually found in the lower part of the spine and in severe cases can affect the ability to move

Q14

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

kyphosis affects the upper part of the spine. it is easily recognised because of a hunchback type posture. kyphosis can mean back pain and stiffness or muscle and back fatigue. in some cases it can also affect the spinal cord and lead to neurological symptoms such as loss of sensation and weakness. in extreme cases kyphosis can also lead to pulmonary problems, when it limits the amount of space in the chest.

Q15

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

scoliosis is a spine that is curved sideward. it may not always appear obviously visible. scoliosis does not commonly lead to pain. muscle aches and lower back problems may occur due to scoliosis, as well as one shoulder hanging higher than the other and clothes not hanging straight.

Q16

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

during pregnancy there is added weight to the front, which can lead to a lordotic curve in the spine. the extra weight lengthens the abdominal muscles and can alter the pelvic position.

Pass/Refer

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	knee, shoulder, most common type of joint in the human body	freely movable.
cartilagious	spine	slightly movable. more motion possible than fibrous joints but less movable than synovial joint.
fibrous	skull, teeth	very little movement possible

Q2

Describe the structure of the synovial membrane.

the synovial membrane covers the inner surface of capsules in synovial joints. it is lubricated with synovial fluid and contains blood vessels.

Q3

Describe the structure of the articular cartilage.

articular cartilage is the tissue that covers the ends of bones where they come together to form joints. it allows bones to smoothly glide over each other. it is thin, strong and smooth in texture.

Q4

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

pivot joins. these joint allow rotation around one axis for example the neck joints.

hinge joints. these joints allow rotation along one axis to flex or extend.

ball & socket joints. these joints allow virtually any type of movement. eg the femur

saddle joints. these joints are where one of the bones is shaped like a saddle with another bone sitting on top. they are more flexible than a hinge or gliding joint. eg the wrist.

gliding joints. these joints allow two bones two slide past each other. eg between the ankle and tibia. these joints allow relatively limited rotation and movement

condyloid joints. these are similar to ball and socket joints; they allow for the same motion but have a lesser range of motion available.

Q5

What joint actions are possible at the following joints?

Elbow

flexion and extension

Spine Learner guidance: name at least 3 joint actions

rotation, flexion, extension

Hip Learner guidance: name at least 4 joint actions

flexion and extension, abduction and adduction, rotation and circumduction.

Q6

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

Extension

extension is when the angle at a joint increase. for example when straightening the arm.

Abduction

abduction is when a body part is moved away from the midline of the body. for example when doing a side arm raise.

Plantar Flexion

plantar flexion is when bending the ankle joint so the toes point downwards.

Pass/Refer

Understand the muscular system

Q1

Complete the table below.

Different types of muscle tissue	Main characteristics	Main role
smooth muscle	cannot be consciously controlled. they are controlled automatically by the nervous system. they are found in the walls of internal organs.	smooth muscles maintain the shape of internal organs and depending on the position have various roles. for example in arteries it helps push blood through
cardiac muscle	the cardiac muscle is involuntary like smooth muscle and is found in the heart.	it pumps blood and oxygen around the body.
skeletal muscle	skeletal muscle is the largest group of muscles in the human body. they are voluntary because we can control them through the brain sending signals to them. skeletal muscles also generate heat.	skeletal muscles facilitate moving by stabilising the body's movable joints

Q2

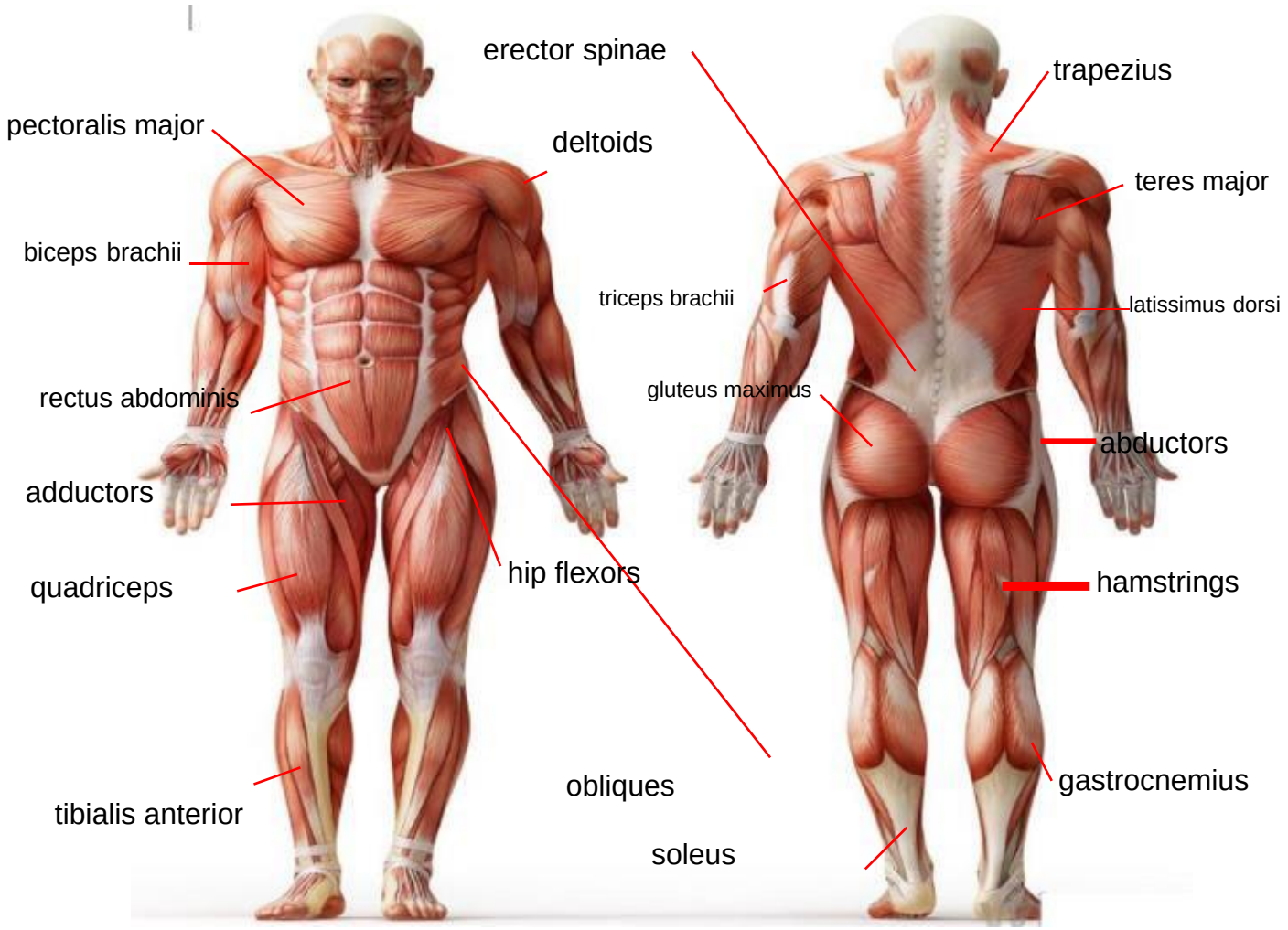
Complete the table below by describing the main structural points of a skeletal muscle.

Structure	Description
Muscle Fibre	muscle fibres come in two types: slow twitch and fast twitch. slow twitch fibres contain a lot of blood vessels and are therefore red in colour. slow twitch fibres are good for endurance activities like running etc. fast twitch muscles are white because they don't use oxygen and therefore not a lot of blood vessels. fast twitch muscles are good for rapid movements.
Fascicle	a fascicle is a bundle of skeletal muscle fibres.
Fascia	the fascia is a sheet beneath the skin that stabilises, attaches and separates muscles and internal organs.
Sarcomere	sarcomeres are long threads made up of fibrous proteins that slide past each other as the muscle contracts.
Myofibril	myofibrils are composed of long proteins including actin, myosin and titin. they are comprised of thick filaments called myofilaments. muscles contract by sliding the myosin (thick) and actin (thin) filaments along each other.

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 flexion of the shoulder joint
Deltoids	abduction, flexion, extension and rotation of the shoulder
Tibialis Anterior	dorsiflexion of ankle
Biceps Brachii	flexion of elbow, supination of forearm
Obliques	rotation and lateral flexion of spine
Soleus	plantarflexion of ankle
Gastrocnemius	plantarflexion of ankle, flexion of knee
Teres Major	extension, adduction and medial rotation of the arm
Gluteus Maximus	extension and outward
Triceps Brachii	extension of elbow, extension of shoulder
Trapezius	elevation, retraction and depression of shoulder girdle
Erector Spinae	extension and rotation of the spine
Latissimus Dorsi	adduction, extension and inward rotation of the arm
Hamstrings	hip extension and knee flexion
Quadriceps	knee extension
Abductors	abduction and inward rotation of the hip
Adductors	adduction and outward rotation of the hip
Hip Flexors	hip flexion



Q4

Describe the structure of the pelvic floor muscles.

the pelvic floor muscles are double layered and hammock shaped, with a deep and superficial layer of muscle tissue and connective tissue.

Q5

Describe two functions of the pelvic floor muscles.

the pelvic floor muscles control the bladder and bowel in men, and the bladder, bowel and uterus in women

they also provide stability for the pelvic girdle

Q6

Describe an concentric muscle contraction.

concentric contraction shorten the muscle. it is the most common type of contraction.

Q7

Describe an eccentric muscle contraction.

in eccentric muscle contraction the muscles lengthen. eccentric contraction is less common than concentric and only happens with certain movements. it can put a lot of strain on the muscle, making this type of contraction more prone to causing injury.

Q8

Describe an isometric muscle contraction.

isometric contractions don't change the length of a muscle when it contracts; the joint also doesn't move. an example would be holding an object in your hand

Q9

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

flexion of elbow

Q10

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

extension of the elbow

Q11

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

Muscle fibre types	Characteristics
slow twitch muscle fibres	contain a lot of red blood vessels (red in colour)
	good for endurance activities
	rely on oxygenated blood as they use oxygen for energy
fast twitch muscle fibres	white in colour (no blood supply)
	good for fast movements
	they get tired quickly
fast oxidative glycolytic	pink in colour
	faster contraction than slow twitch, slower contraction than fast twitch
	work during difficult stages of endurance

Pass/Refer

Understand the life-course of the musculoskeletal system and its implications for special populations exercise

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.

bones are not fully grown yet at the age of 14-16 so when doing excessive training they could be more prone to fractures and injury. the joints are also more unstable
younger people have a smaller storage of anaerobic fuel meaning they cant do intense short burst of exercise like an adult can.

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.

when we grow older changes in hormone levels, thinning of cartilage and diminishing of synovial fluid can make bones more fragile and thus more prone to fractures and injury. joints also become stiffer affecting mobility.

ligaments shorten with age and become less flexible, and tendons become less elasticated and weaker, making it harder to do some exercises.

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 there are increased level of a hormone called relaxin in the body. this can have an impact on the stability of the synovial joints, which can impair movement. relaxin may also increase the pliability of the muscle connective tissue which can have an impact on balance and coordination. it is beneficial to use short maintenance stretches as opposed to development stretches during training while pregnant to avoid damaging connective tissue.

during pregnancy the blood volume increases by about 30% and red blood cells are reduced as the blood becomes more dilute. cardiac output and stroke volume are increased and the heart rate increases by approximately 10-15 beats per minute. this can result in dizziness, so when training during pregnancy must be taken to avoid fainting and falling. shortness of breath can also occur in pregnant women due to the foetus pressing against the diaphragm and thus reducing the lung capacity.

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: stored in our muscle and liver cells in the form of glycogen. when the body requires energy, glycogen is broken down into glucose: this is the fuel for all the tissue in our body. 50-60% off all energy should come from carbohydrates.
fat: stored beneath the skin. serves as fuel and provides insulation to prevent heat loss. fat releases energy by breaking down the triglyceride molecules into fatty acids. no more than 35% of energy should come from fats.
protein: is not stored in the body; the body uses it for growth and repair of tissue. excess protein is converted into fat and stored under the skin. protein releases energy when it is broken down to amino acids. proteins tend to be used for prolonged endurance exercise, like running or cycling.

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 system is used when a muscle needs to generate a lot of force but there is a lack of sufficient O2 (anaerobic). the PC energy system uses chemical energy to produce ATP. it does not require oxygen, fat or carbohydrates during the production of ATP. When the ATP level in a muscle has been exhausted, it can be regenerated almost immediately by creatine phosphate, which is a chemical substance. the PC system is used for very high intensity exercise, near maximal effort. once the compound creatine phosphate is used up, fat and glycogen will be used to further supply energy to regenerate ATP.

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 burst of medium to high intensity exercise (sub maximal). when the phosphocreatine system cannot supply proficient ATP the lactic acid system will come into effect. lactic acid is a waste product of exercise. it is a by-product of breaking down glycogen to pyruvate and then ATP. there is a constant balance between the body producing lactic acids when converting glucose and at the same time it is also removing lactic acids to keep a balance. when there is too much lactic acid build up, the exercise has to be terminated because this is what leads to pain, breathlessness and other activity hindering sensations.

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

the aerobic system refers to the system that produces ATP when breaking down carbs and fats, with the presence of oxygen (O2). the aerobic system is dominant in ATP production when there is enough O2 in the cells to produce energy. the aerobic system is used for activity that lasts more than 90 seconds, eg running, swimming etc. glucose (carbs) and fatty acids are the two macronutrients required to supply the body with ATP during aerobic metabolism. the aerobic system occurs in the mitochondria, which is a specialised structure in a muscle cell which contains special enzymes that the cell requires to use oxygen.

Pass/Refer

Understand the nervous system and its relation to exercise

Q1

Describe three roles and functions of the nervous system.

sensory input. the nervous system senses changes in- and outside of the body; for example light and temperature.

interpretation. the nervous system analyses incoming information in the brain

motor output. the nervous system responds to 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

nerves are responsible for relaying information from the brain and spinal chord to the motor units in the rest of the body. impulses travel through nerves to stimulate a motor unit, and when the amount of stimulus sent to the muscle fibres is sufficient, the muscle will contract.

Q3

Describe the 'all or none' law.

Learner Guidance – Think about motor unit recruitment

the all or none law states that when a motor unit receives a stimulus of sufficient energy, all the muscle fibres within the motor unit will contract to the maximum possible extent at the same time. of the stimulus is not sufficient, the muscle fibres will not respond and the muscle will not contract.

Q4

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

the strength of the stimulus that is sent to the motor unit via the nerves has to be sufficient to trigger all muscle fibres, when this does not happen no contraction will take place (all or nothing principle)

Q5

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

regular exercise can grow new connections within the nervous system and strengthen the existing ones. this in turn increases the amount of muscle activation during exercise which improves motor fitness.

regular exercise improves the synchronous recruitment of motor units, which results in stronger muscle contractions.

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