IB SPORT, EXERCISE & HEALTH SCIENCE TRANSITION BOOKLET

NAME:

How the skeletal system provides a framework for movement (in conjunction with the muscular system):

- The skeletal system allows movement at a joint
- The shape and type of the bones determine
- The amount of movement (short bones enable finer controlled movements/long bones enable gross movement)
- Flat bones for protection of vital organs
- The different joint types allow different types of movement
- The skeleton provides a point of attachment for muscles – when muscles contract they pull the bone.

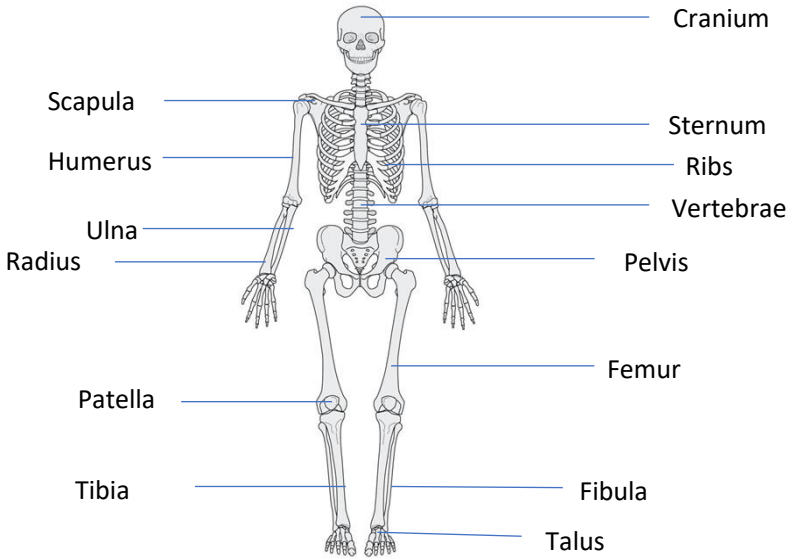
Types of Bones

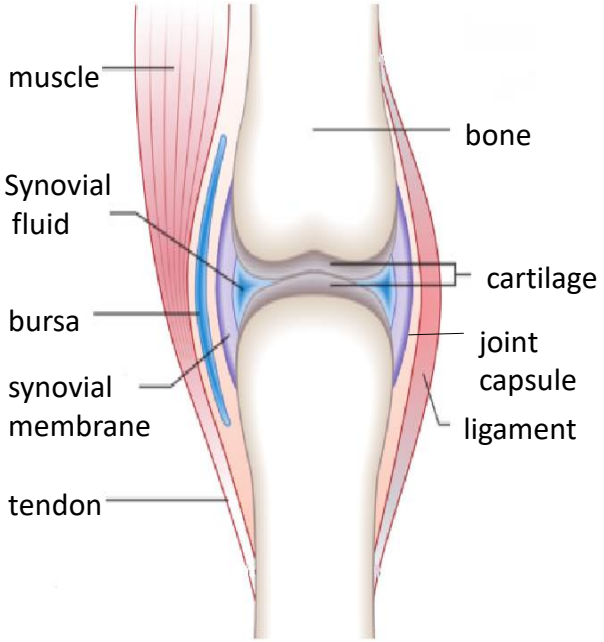
***Flat Bones*:** protect vital organs e.g. cranium protects your brain, *ribs* protect heart and lungs.

***Long Bones*:** enable gross (large) movements e.g. *femur, tibia and fibula* in the leg which allow us to run, *humerus, radius and ulna* in arm which allows us to throw a ball.

***Short Bones*:** enable fine (small) movements e.g. fingers allowing you to spin a cricket ball.

Irregular Bone: provide shape and protection e.g. vertebrae



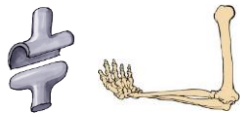


Bones Located at Joints

Head and Neck = Cranium and Vertebrae
Shoulder = Scapula and Humerus
Chest = Ribs and Sternum
Elbow = Humerus, Radius, Ulna
Hip = Pelvis, Femur
Knee = Femur, Tibia, Patella
Ankle = Tibia, Fibula, Talus

Types of Joint

Hinge Joint
Knee & Elbow
Flexion & Extension

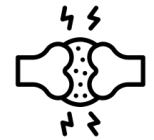


Ball & Socket Joint
Shoulder & Hip
Flexion, Extension, Adduction, Abduction, Rotation

Synovial Joints

Ligaments: Attaches bone to bone to keep the joint stable eg knee when kicking the ball or restricts movement/prevents movement to stop injury.

Tendons: Attach muscle to bone. When a muscle contracts to move a joint, it is the tendon which pulls on the bone, keeps muscles/bones stable or holds join in place.



Cartilage: A tough elastic, fibrous connective tissue. Prevents friction by stopping the bones from rubbing together and acts as a shock absorber.

Synovial Membrane: Secretes synovial fluid to keep joint lubricated.

Synovial Fluid: Produced by the synovial membrane and helps lubricate the joint, reduce friction, source of nutrients and removes waste.

Joint Capsule: This is lined with synovial membrane. It encloses the joint making sure the cartilage and synovial fluid remain in place and the joint stable.

Bursae: Fluid filled sac providing cushion between bones and tendons. Acts as a cushion and stops friction at the joint.

Function of the Skeleton

Support: The bones are solid and rigid. They keep us upright and hold the rest of the body – the muscles and organs – in place.

Movement: the skeleton helps the body move by providing anchor points for the muscles to pull against.

Structural shape and points for attachment: the skeleton gives us our general shape such as height and build and provides anchorage points for the muscles to attach via tendons.

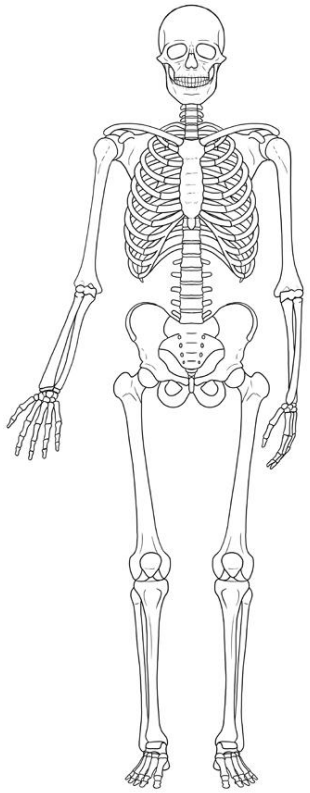
Protection: certain parts of the skeleton enclose and protect the body's organs e.g. the brain is inside the cranium. This function is especially important in activities that involve contact. E.g. rugby, boxing.

Production of Blood Cells: the bone marrow in long bones and ribs produce red and white blood cells.

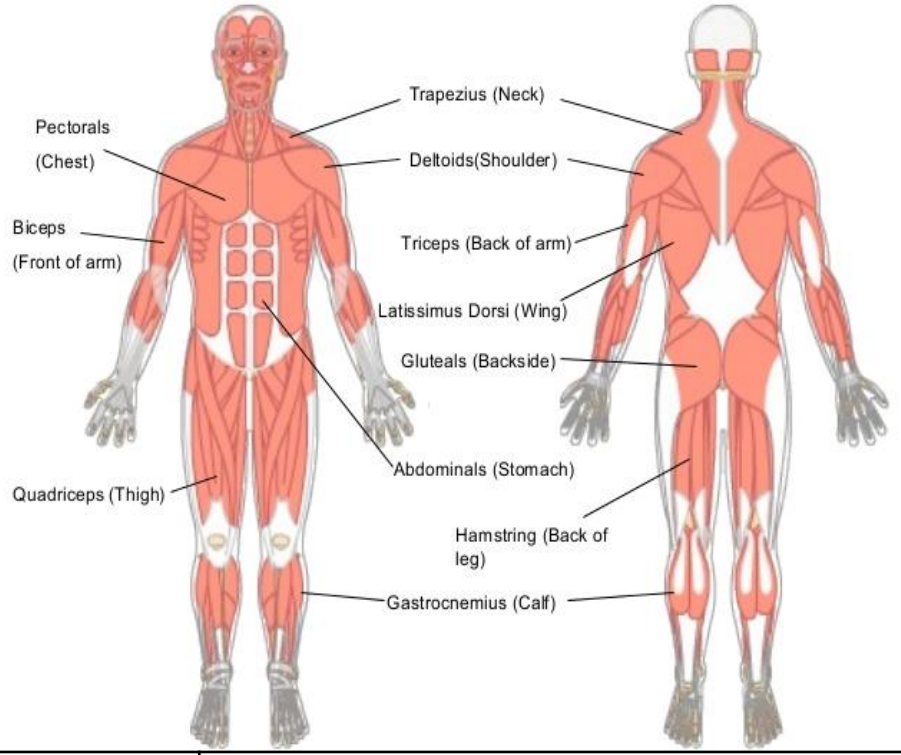
Mineral Storage: bones store several minerals e.g. calcium, which can be released into the blood when needed.

Tasks

1. Label a skeleton with all the major bones.
2. Highlight the different types of bones and describe their function.
3. Circle the the hinge joints on the skeleton, are they hinge or ball and socket?
4. Label a synovial joint and annotate with the function of each component.
5. Create a memory tool the remember the functions of the skeleton.



Question	Cover/Answer	Attempt
Identify two hinge joints on the body.	Elbow and knee	
Identify four functions of the skeletal system	Blood production, movement, protection, shape, support, mineral storage	
Identify two ball and socket joints on the body.	Hip and shoulder	
Which bones meet at the neck and head?	Vertebrae, cranium	
Which bones make up the shoulder joint?	Humerus, scapula, clavicle	
Which bones make up the knee joint?	Femur, tibia	
Which bones make up the elbow joint?	Radius, ulna, Humerus	
Which bones make up the ankle joint?	Talus, tibia, fibula	
Give an example of a flat bone.	Pelvis, sternum, ribs, cranium, scapula	
What is the function of a flat bone.	Protection	
Give the function of a tendon	Attaches a muscle to a bone	
Give the function of a ligament	Attaches bone to bone	
Give the function of the joint capsule	Surrounds synovial joints, supports the joint	
Give the function of the synovial fluid	Produced by synovial membrane to lubricate the joint	
Give the function of the synovial membrane	Produces synovial fluid	
Give the function of cartilage	Covers the ends of bones providing smooth, friction free surface	
What is the function of a long bone?	Movement	
What is a joint?	A place where two or more bones meet	
Give the function of bursae	Fluid filled sacs that helps reduce friction in a joint	
Which bones make up the hip joint?	Pelvis, femur	
Which bones make up the chest?	Ribs, sternum	



Muscle Contraction	Characteristics
Isometric	1. Muscle contracts but NO MOVEMENT takes places 2. Example: ski sit, tug of war, handstand
Isotonic Concentric	1. Muscle contracts and movement takes place 2. All movements except stationary ones and ones going down 3. Example: kicking a ball, throwing, shooting
Isotonic Eccentric	1. Muscle contracts and lengthens when tensed 2. All movements that go against gravity e.g. Downwards 3. Example: downwards part of press up.

Antagonistic Muscle Pairs

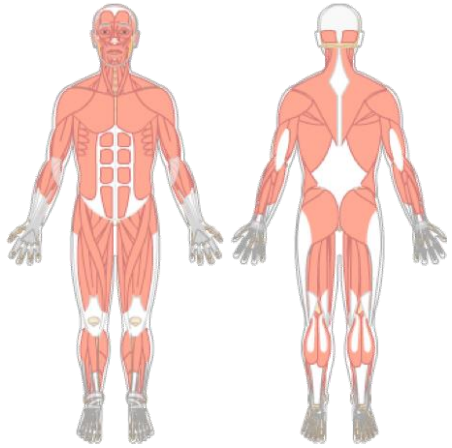
Muscles have to be arranged in pairs as they cannot push – they only pull:

- The prime mover (or agonist) is the muscle which initially contracts to start a movement.
- The antagonist is the muscle which relaxes to allow a movement to take place.
- E.g. bending the elbow during a bicep curl Antagonist would be the tricep & the bicep would be the agonist.

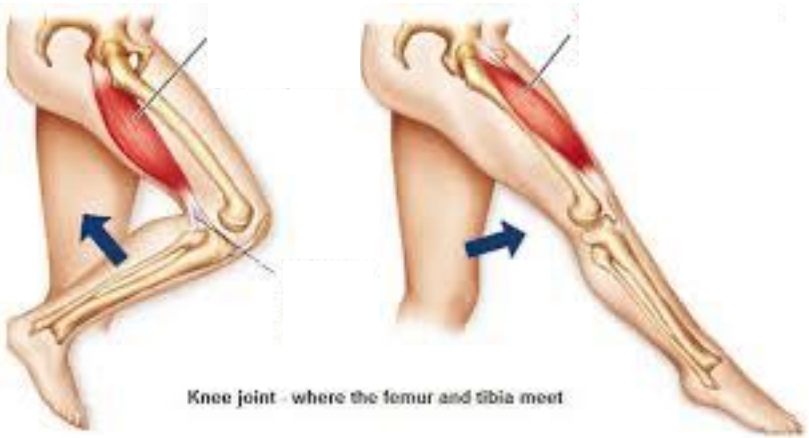
Joint	Movement	Description	Agonist	Antagonist	Sporting Example
Hip	Flexion	Bringing the leg backwards	Hip flexors	Gluteus maximus	Backswing before kicking a football
	Extension	Bringing the leg forwards	Gluteus maximus	Hip flexors	Follow through when kicking a rugby ball
Knee	Flexion	Decreases the angle of the joint at the knee by bending the leg	Hamstrings	Quadriceps	Backswing before kicking a football
	Extension	Increases the angle of the joint at the knee by straightening the leg	Quadriceps	Hamstrings	Follow through when kicking a rugby ball
Ankle	Plantar flexion	Increasing the angle at the ankle by pointing the toes	Gastrocnemius	Tibialis anterior	Pointing toes on the trampoline
	Dorsiflexion	Decreasing the angle at the ankle by bringing toes up towards knee	Tibialis Anterior	Gastrocnemius	Controlling a football with the bottom of the foot
Elbow	Flexion	Decreases the angle of the joint at the elbow by straightening the arm	Biceps	Triceps	Downward phase of a bicep curl
	Extension	Increases the angle of the joint at the elbow by straightening the arm	Triceps	Biceps	Upward phase of a bicep curl

Tasks

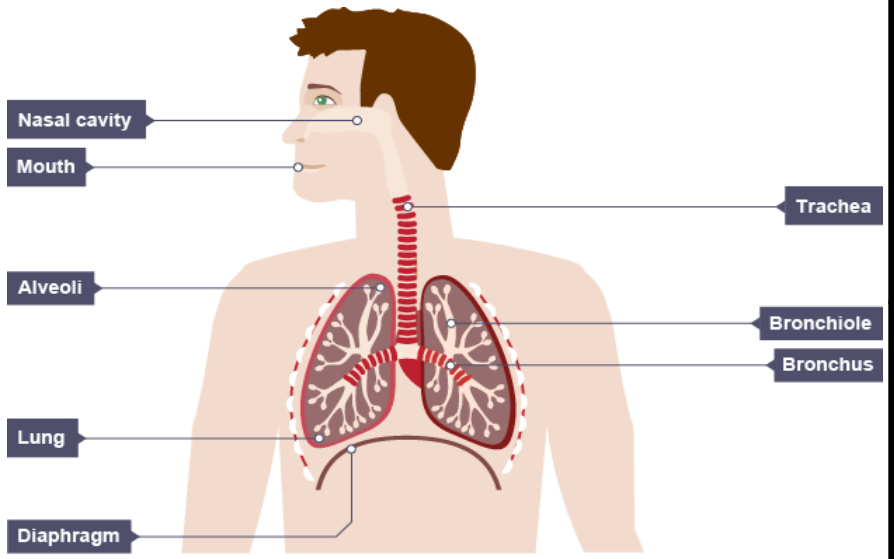
1. Label the major muscles.



2. Using a sporting action of your choice, e.g. kicking a football. Analyse the movement. What muscles are involved? What joint action is occurring? What is the agonist? Antagonist? What muscle contractions are occurring?
3. Annotate the picture to explain how the muscles are working as a pair to produce movement.



Question	Answer/Cover	Attempt
Define what is meant by abduction.	Movement of a body part away from the body	
Define what is meant by adduction.	Movement of a body part towards the body	
Define what is meant by flexion.	Decrease in the angle at a joint	
Define what is meant by extension.	Increase in the angle at a joint	
Define what is meant by rotation.	Turning a limb along its long axis	
Define what is meant by circumduction.	This is where the limb moves in a circle	
Describe concentric muscle contraction	Where the muscle shortens during contraction	
Describe eccentric muscle contraction	When the muscle lengthens during contraction	
Which movements are performed at hinge joints?	Flexion and extension	
Which movements are performed at ball and socket joints?	Flexion, extension, abduction, adduction, rotation, circumduction	
Define plantar flexion	Pointing of the foot towards the floor	
Define dorsiflexion	Pointing the toes upwards from the floor	
Which movements can occur at the shoulder joint?	Flexion, extension, abduction, adduction, rotation, circumduction	
Which movements can occur at the knee and elbow joints?	Flexion and extension	
Which movements can occur at the hip joint?	Flexion, extension, abduction, adduction, rotation	
Which bones make up the hip joint?	Pelvis, femur	
Which movements can occur at the ankle joint?	Plantar flexion and dorsiflexion	
Which bones make up the chest?	Ribs, sternum	
Name four muscles in the legs?	Hamstrings, quadriceps, tibialis anterior, gastrocnemius,	
Which muscle extends the knee?	Quadriceps	
Which muscle flexes at the knee?	Hamstrings	
When throwing a ball, which muscle is the agonist?	Triceps	
When throwing a ball, which muscle is the antagonist?	Biceps	



The Pathway of Air into the Body

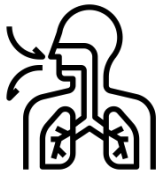
1. When we breathe in, air moves through the ***mouth and nose.***
2. It then travels down the ***trachea***.
3. Near the lungs the trachea divides into two tubes called ***bronchi*** (one enters left lung and the other the right).
4. Once in the lungs the bronchi split into smaller bronchi before dividing into even smaller tubes called ***bronchioles***
5. At the end of each bronchiole are openings to the ***alveoll.***
6. At the alveoli gaseous exchange occurs.
7. Capillaries carrying blood surround each alveoli, oxygen is passed into the bloodstream from the alveoli in exchange for carbon dioxide
8. Carbon Dioxide then leaves the body through the reverse pathway.

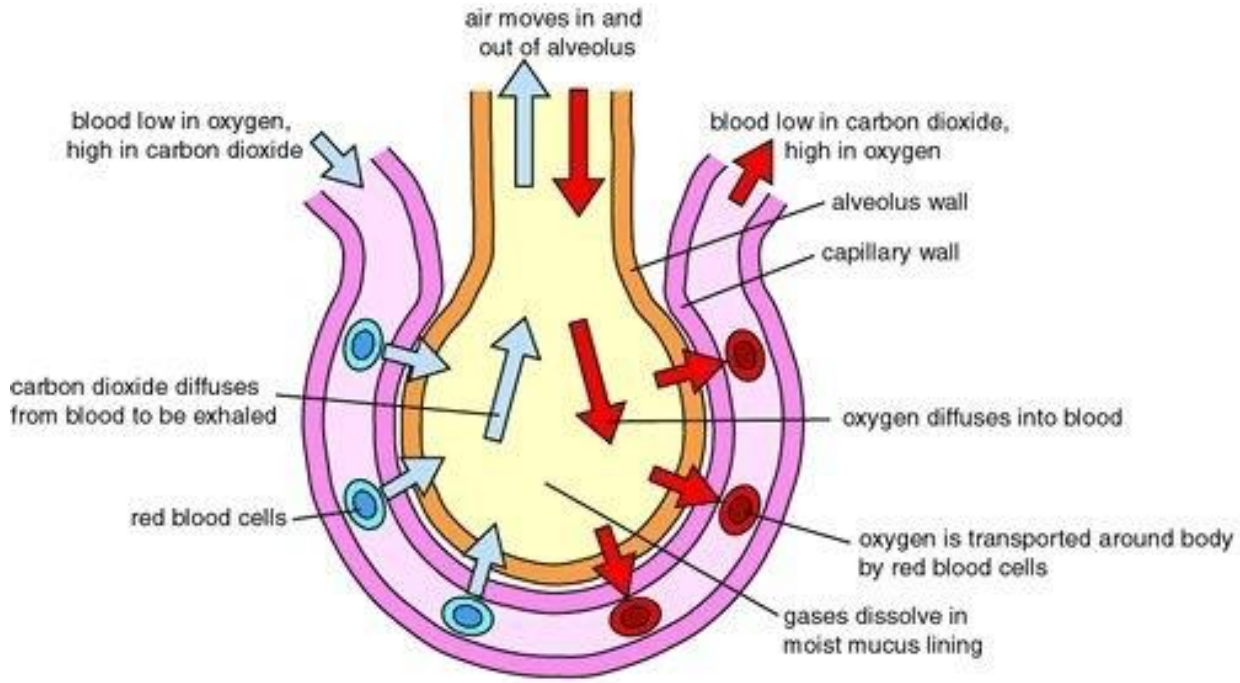
Gaseous Exchange

- Takes place in the ***alveoli*** through ***diffusion***
- Oxygen (high concentration) diffuses through the capillaries into the blood stream (low oxygen concentration) to be sent to the heart.
- Carbon dioxide (high concentration) In the capillaries replaces the oxygen (***exchanged***) in the alveoli (low carbon dioxide concentration) so that it can be removed from the body.

Components of The Respiratory System

- Mouth
- Nose
- Trachea
- Bronchi
- Bronchioles
- Lungs
- Alveoli
- Intercostal Muscles
- Rib Cage
- Diaphragm



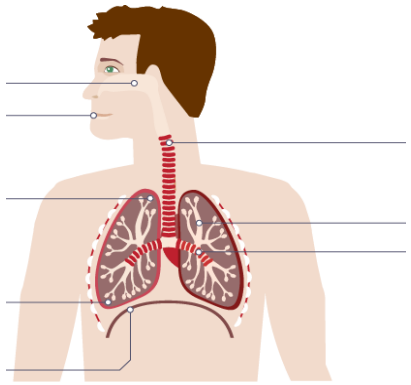


Key Features – Diffusion

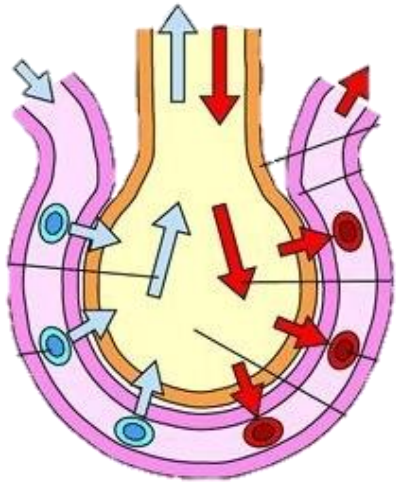
- The large surface area of the alveoli greatly assists this process
- The alveoli consist of moist thin walls which are only one cell thick, making diffusion easy.
- There is only a very short distance for the gases to travel for diffusion – this is known as the short diffusion pathway.
- There are a great number of capillaries so there is an excellent blood supply.
- The large blood supply enables the process to be more efficient
- The actual movement of the gas is from high concentration to low concentrations.

Tasks

1. Label the respiratory system.

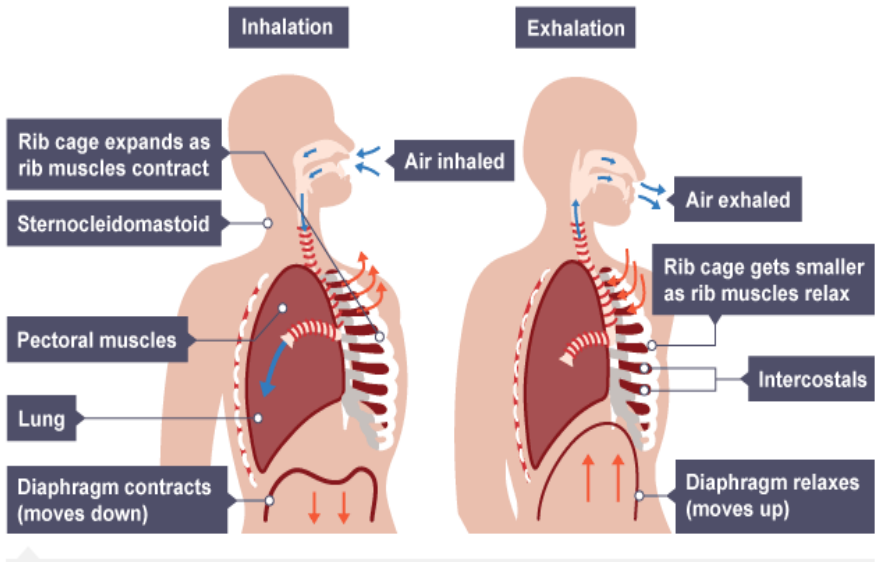


2. Use a flow map to describe the pathway of air through the respiratory system.
3. Annotate the picture to explain the process of gaseous exchange.



4. Create a memory tool to remember the factors that assist diffusion.

Question	Answer/Cover	Attempt
State the components of the respiratory system.	Mouth, Nose, Trachea, Bronchi, Bronchioles, Lungs, Alveoli, Intercostal Muscles, Rib Cage, Diaphragm	
Identify the order of the pathway of air.	Nose/mouth, trachea, bronchi, bronchioles, alveoli	
Where does gas exchange take place?	Alveoli	
Which structure in the lungs is one cell thick?	Alveoli	
Describe gaseous exchange	Oxygen passes through alveoli into red blood cells in capillaries, oxygen combines with haemoglobin, enzyme breaks down carbon dioxide which passes through alveoli and is breathed out.	
Which features assist with gaseous exchange?	Large surface area of alveoli, thin walls, large blood supply, short diffusion pathway, oxygen combines with haemoglobin, gas moves from high to low concentration	



Inspiration and Expiration

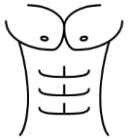
Inspiration (How we breathe in):

- The diaphragm contracts and flattens.
- The intercostal muscles contract which causes the rib cage to rise.
- Both these actions cause the chest cavity to increase in size / volume.
- This reduces the pressure in the chest cavity, due to this the air passes from the higher pressure outside of the lungs to the lower pressure inside the lungs.
- This causes the lungs to expand and fill the chest cavity

Expiration (How we breathe out):

- The diaphragm relaxes and bulges up, returning to its original dome shape.
- The intercostal muscles also relax causing the ribs cage to lower.
- Both these actions cause the chest cavity to decrease in size / volume.
- The reduction in the size of the chest cavity increases the pressure of the air in the lungs and causes it to be expelled.
- The air passes from the high pressure in the lungs to the low pressure in the bronchi and trachea.

Additional muscles used during inspiration and expiration during exercise:



During inspiration*:** The ***pectorals and ***sternocleidomastoid*** muscles contract assist the performer inhale air. These allow the chest cavity to further increase in size (have a larger volume) so more air can enter the lungs.
During expiration*:** the ***abdominals contract assisting the performer exhale air. They help force air out of the lungs faster and so speed up expiration.

Spirometer Trace

Spirometer Trace Definitions

Pulmonary ventilation: inflow and outflow of air between the atmosphere and the lungs (also called breathing).

Total lung capacity: volume of air in the lungs after a maximum inhalation. The average is about 6L

Vital capacity: maximum volume of air that can be exhaled after a maximum inhalation.

Tidal volume: volume of air breathed in and out in any one breath. The average tidal volume is 0.5L

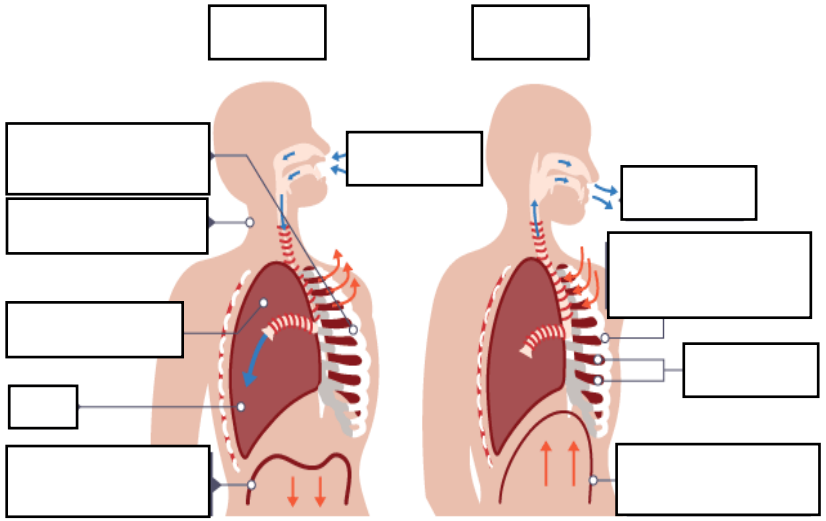
Expiratory reserve volume: volume of air in excess of tidal volume that can be exhaled forcibly.

Inspiratory reserve volume: additional inspired air over and above tidal volume.

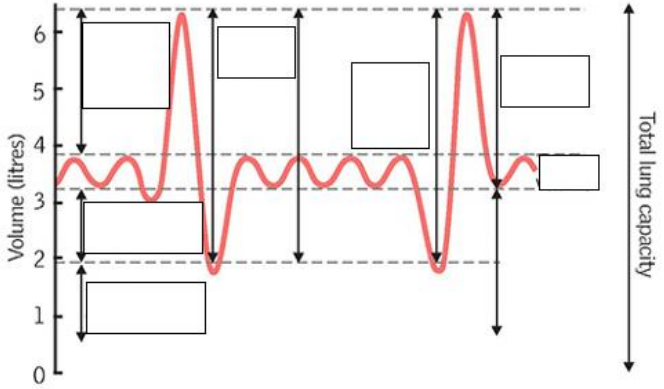
Residual volume: volume of air still contained in the lungs after a maximal exhalation.

Tasks

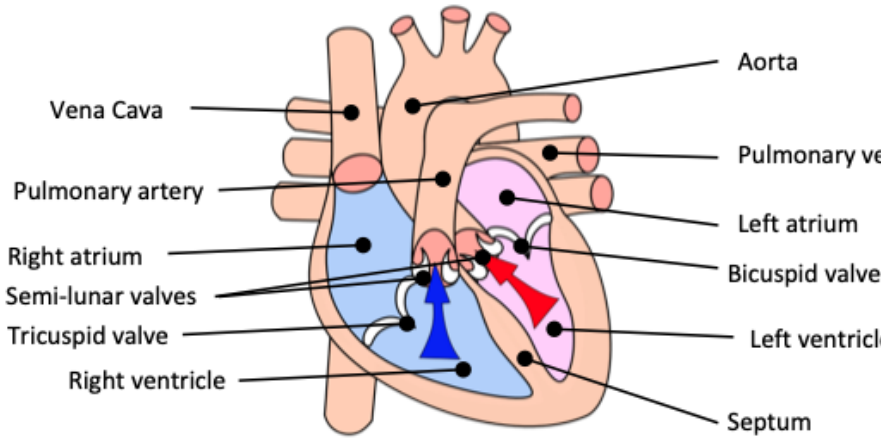
1. Annotate the picture to describe the mechanics of breathing.



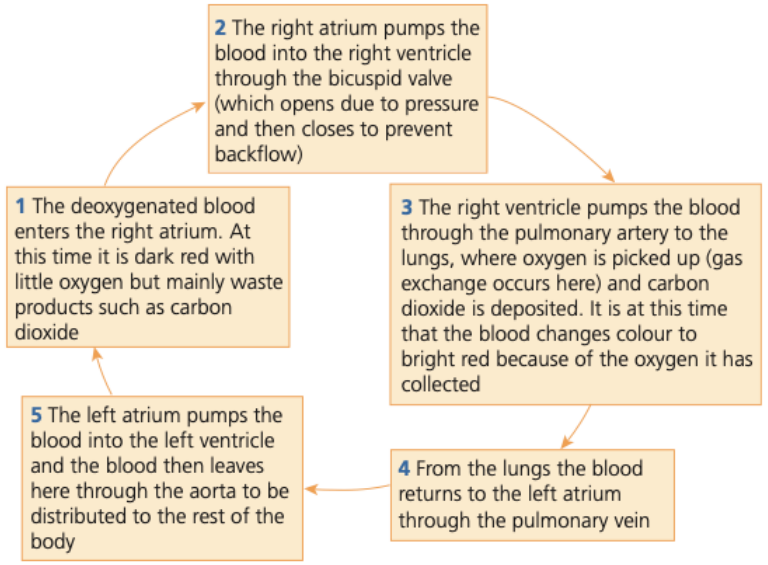
2. Create a memory tool to remember the muscles that are recruited for breathing during exercise.
3. Draw a spirometer trace and annotate with definitions of the key term.



Question	Answer/Cover	Attempt
Which device measure lung volumes?	Spirometer trace	
Define tidal volume	The volume of air inspired or expired in each breath	
Define inspiratory reserve volume	The amount of air that could be breathed in after tidal volume	
Define expiratory reserve volume	The amount of air that could be breathed out after tidal volume	
Define pulmonary ventilation	inflow and outflow of air between the atmosphere and the lungs (also called breathing).	
Define vital capacity	maximum volume of air that can be exhaled after a maximum inhalation.	
Define total lung capacity	volume of air in the lungs after a maximum inhalation. The average is about 6L	
Define tidal volume	volume of air breathed in and out in any one breath. The average tidal volume is 0.5L	
Define residual volume	volume of air still contained in the lungs after a maximal exhalation.	
Which muscles are involved in the mechanics of breathing?	Intercostal muscles and diaphragm	
Which muscles are involved in the mechanics of breathing for inhalation during exercise?	The pectorals and sternocleidomastoid muscles	
Which muscles are involved in the mechanics of breathing for exhalation during exercise?	Abdominals	
Which muscles cause the rib cage to rise?	Intercostals	



Deoxygenated blood = BLUE (Right side)
Oxygenated = RED (Left side)



Functions of the Cardiovascular System

1. Deliver oxygen and nutrients to the body
2. Remove the waste products such as carbon dioxide and lactic acid
3. Protection against disease and infection
4. Maintain body temperature

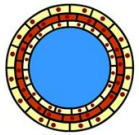
Blood Pressure

When the heart contracts it pushes blood into blood vessels which creates blood pressure.
A blood pressure reading consists of two values:

- Systolic value – blood pressure while the heart is squeezing
- Diastolic value – blood pressure while the heart is relaxing

The average blood pressure for an adult is 120/80 mmHg. The first number is the systolic value and the second number is the diastolic value.

Structure of Blood Vessels

	Function	Diameter/Thickness	Pressure
Arteries 	Carry blood away from the heart	• Small to alleviate pressure. • Thick walls to withstand high pressure	High
Veins 	Carry blood back to the heart	• Wide to carry large volumes of blood. • Thin walls as under low pressure	Low
Capillaries 	Gaseous exchange (diffusion) takes place	• Large surface area for gaseous exchange • One cell thick	Low

Redistribution of Blood – Vascular Shunt Mechanism

During exercise, the cardiovascular system redistributes the blood so that more of it goes to the working muscles and less of it goes to other body organs such as the digestive system.

Vasoconstriction

Narrowing of the internal diameter of a blood vessel to decrease blood flow, such as the arteries constricting during exercise so that less blood is delivered to inactive areas. For example, in the digestive system.

Vasodilation

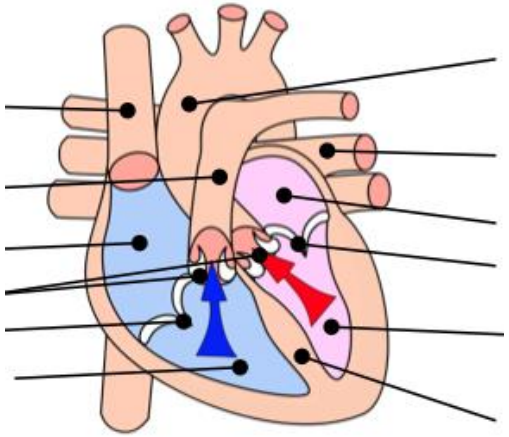
Widening of the internal diameter of a blood vessel to increase blood flow, such as the arteries dilating during exercise so that more blood is delivered to active areas, effectively increasing their oxygen supply

Cardiac Output

Cardiac Output Equation	(Q = SV x HR)
Cardiac Output	(Q) is the amount of blood pumped from the heart every minute and can be calculated by multiplying heart rate (HR) by stroke volume (SV).
Stroke Volume	(SV) is the amount of blood pumped out of the ventricles each time they contract. The average resting SV is approximately 70 ml. The fitter you are, the larger your stroke volume.
Heart Rate	(HR) is the number of times the heart beats (or the ventricles pump blood out) in one minute. The average resting HR is approximately 70 beats per minute (bpm).

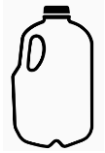
Tasks

1. Label the heart.



2. Flow map the pathway of blood through the heart.
3. Create a triple bubble map to compare the blood vessels.
4. Calculate your cardiac output at rest and during exercise using the following: rest 70ml, exercise 120ml.
5. Explain how blood is redistributed for the performer below.

Question	Answer/Cover	Attempt
Name three blood vessels involved in the transport of blood?	Veins, arteries, capillaries	
Identify three characteristics of veins	Carry deoxygenated blood back to the heart, thinner and less elastic walls, have valves to prevent backflow of blood	
Identify three characteristics of arteries	Have thick walls, carry oxygenated blood at high pressure away from heart, have no valves, have more elastic walls, arterioles	
Identify three characteristics of capillaries	Small, allow carbon dioxide, water and waste products to pass through, have thin walls	
Define vasoldilation	Widening of the diameter of a blood vessel to increase blood flow	
Define vasoconstriction	Narrowing of the diameter of a blood vessel to decrease blood flow	
Define systolic blood pressure	When the heart is contracting	
Define diastolic blood pressure	When the heart is relaxing	
Define hypertension	High blood pressure in the arteries	
Describe the cardiac cycle	The process of the heart going through the stages of systole and diastolein the atria and ventricles	
Identify the formula for Cardiac Output (Q)	Cardiac Output (Q) = stroke volume x heart rate	
What is meant by cardiac output?	The amount of blood pumped from the heart in one minute	
What is meant by stroke volume?	Amount of blood pumped out of the heart by each ventricle during one contraction	
Define heart rate	The number of times the heart beats (measured in BPM)	

Element	Source	Purpose	Purpose for Athlete
Carbohydrates (55-60%) 	• Simple – sugar, glucose, fructose; energy gels • Complex – bread, pasta, rice, potatoes	• Source of energy. • Main and preferred source of energy for exercise at all intensities – glucose. • Divided into simple carbohydrates – sugars and complex carbohydrates – starches.	• Athletes need to consume larger quantities of carbohydrates to fuel their training and performance. Prior to an endurance event, athletes might 'carbo-load' to ensure they have enough to finish the race
Fats (25-30%) 	• Monounsaturated – olive oil, avocados; polyunsaturated – oily fish, nuts, sunflower oil, soya beans; saturated – full-fat dairy, fatty meats; and trans fats – many snack foods	• Source of energy at low intensity – provides more energy than carbs. • Carries vitamins around the body. • Fats are stored under the skin and are essential for health.	• Too much fat can limit an athlete's performance due to increased weight.
Proteins (15-20%) 	• Animal products – meat, fish, dairy; plants – lentils, nuts, seeds; protein supplements and shakes	• Growth and repair of tissue and muscle – known as the body's building blocks.	• Athletes frequently use protein supplements in their diet to aid growth and repair of body tissue. Especially strength/ power athletes.
Vitamins 	• A – dairy, oily fish, yellow fruit; B – vegetables, wholegrain cereals; C – citrus fruit, broccoli, sprouts; D – oily fish, eggs, fortified cereals.	• Essential for many processes, e.g bone growth, metabolic rate, immune system, vision, nervous system. Need small amounts only.	• Required by athletes to maintain efficient body functions allowing them to continue training and improve performance.
Minerals 	• Calcium – milk, canned fish, broccoli; iron – watercress, brown rice, meat; zinc – shellfish, cheese, wheatgerm; potassium – fruit, pulses, white meat.	• Essential for many processes, eg bone growth/strength, nervous system, red blood cells, immune system. Need small amounts only.	• Required by athletes to maintain efficient body functions allowing them to continue training and improve performance.

Balanced Diet

- Eating the right amount of calories to deal with the energy that will be needed.
- It is also eating different food types to provide the body with the right nutrients, vitamins and minerals to remain healthy.
- Unused energy is stored as fat which can lead to obesity.

Water

Water is vital to maintain hydration levels (water balance) as it assists in how the body functions - reactions, lubrication of joints, blood flow and maintaining body temperature.

Hydration: having enough water (water balance) to enable normal functioning of the body.
Rehydration: consuming water to restore hydration.

The amount of water we need to drink depends on:

- The environment you are in – the hotter the environment the more water is required to keep you hydrated.
- The temperature in which you are in – due to you sweating more you require more water to keep you hydrated.
- The amount of exercise / activity you are doing – exercise means you need to replace the water lost in sweat.

Dehydration: excessive loss of body water interrupting the function of the body.

- The blood thickens (increased viscosity), which slows blood flow down.
- The heart rate increases which means that the heart has to work harder.
- The body temperature is likely to increase, meaning that the body may overheat.
- Reaction time increases (it gets slower) which has a negative effect on decision making.
- An individual may suffer muscle fatigue and muscle cramps.

Tasks

1. Create a meal plan for a day for an average male or female and justify your choices.

2. Complete a meal plan for one of the following athletes and justify why you have chosen these food sources:

Question	Answer/Cover	Attempt
What is meant by a balanced diet?	Eating the right amount of calories according to how much you are exercising and different food types to provide nutrients	
Why is it important to have a balanced diet?	Unused energy is stored as fat, body needs nutrients for energy, growth and hydration	
What percentage of a balanced diet should come from fat?	25-30%	
What percentage of a balanced diet should come from protein?	15-20%	
What percentage of a balanced diet should come from carbs?	55-60%	
What is the function of carbohydrates?	Main energy source of the body. Stored as glycogen in the liver and muscles.	
What is meant by carbo loading?	Eating foods that are high in starch to increase carbohydrate reserves in the muscles	
What is meant by a high protein diet?	Eating foods that contain a lot of protein while reucing the intake of carbohydrates and fats.	
What is the function of protein?	Growth and repair of muscle tissue	
What is the function of fats?	A source of energy and help insulate the body	
What is the function of vitamins and minerals?	Essential to help the body with good health.	
Define dehydration	Excessive loss of body water	
How does dehydration affect the body	Blood thickens (blood viscosity) which slows blood flow, increases heart rate which has to work harder, increase in body temperature, overheat	

Somatotypes

Endomorph
'Dumpy'

- High content of fat
- Fat round middle, thighs and upper arms
- Narrow shoulders
- Wide hips
- 'Pear Shaped'

Suited Sports

- Sumo-wrestling – large size is difficult to force out of the ring and can be used to create short powerful actions.
- Shot Putter – Extra bulk allows for a more powerful release of shot.
- Rugby – Prop forwards

Mesomorph
'Muscular'

- Broad shoulders and thin waist (narrow hips)
- Large amount of muscle
- Strong arms and thighs
- Little body fat

Suited Sports

- Sprinting – large arms and legs to help produce more power resulting in them running quicker.
- Weightlifter – Large muscles helps provide the force required to lift heavier weights
- Rugby player – Muscle helps generate force required when making contact with opponents.

Ectomorph
'Tall & Thin'

- Very thin, lean and usually tall
- Narrow shoulders, hips and chest
- Not much fat / muscle
- Long arms and legs

Suited Sports

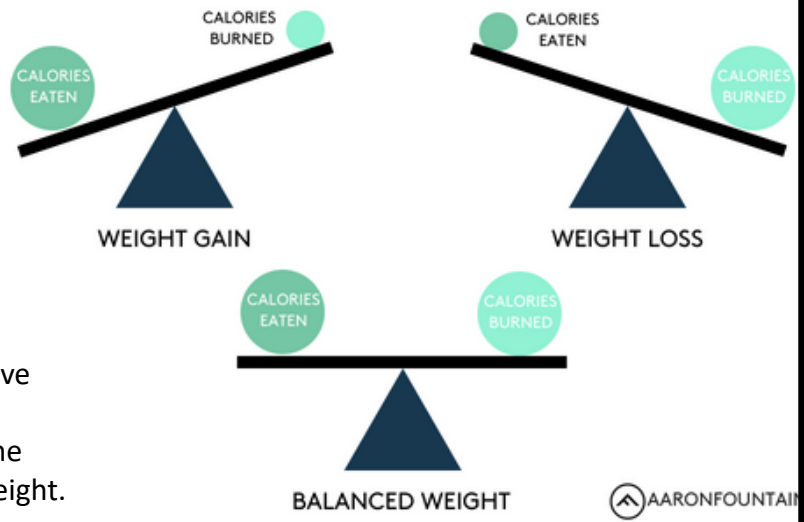
- High Jump / Pole Vault – lighter so less weight to lift in the air over the bar.
- Marathon runner / Long distance runners – Lighter so less weight to carry + longer stride length so can cover larger distance with each stride.

Energy Balance

Calories:
Energy is measured in calories. These calories are obtained from the food and drink we consume.

Recommendations:
Male = 2500 kcal/day
Female = 2000 kcal/day
Athletes – Up to 6000kcal/day

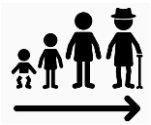
Energy in and energy out do not have to balance every day. The energy equation needs to balance over time for people to maintain a healthy weight.



Factors affecting Calorie Intake

Age
Younger people need more calories than older

- After 25 the calorie needs of individuals starts to fall.
- Older people have a slower metabolism and so burn less calories.
- When you get old your body replaces muscle with fat and fat burns fewer calories



Height
Taller people need more calories

- The taller you are = more calories
- Taller people have larger skeletons

Gender
Men need more calories than women

- Men are usually bigger and heavier

Energy Expenditure
More exercise = more calories

- The more exercise you do the more calories you will need
- As you need more energy to carry out the exercise

Basal Metabolic Rate (BMR)
How fast energy is used

- This is now fast energy is being used and varies from individual to individual.

Tasks

1. Analyse the body types of the three athletes below

2. Analyse the energy requirements of the family below:

2. Explain what happens if their energy is not balanced.

Question	Answer/Cover	Attempt
Identify three somatotypes	Ectomorph, mesomorph, endomorph	
Identify three characteristics of an ectomorph	Long arms and legs, narrow shoulders and hips, little body fat and muscle, slim, skinny, tall	
Identify three characterisitcs of a mesomorph	Broad shoulders, narrow hips, lots of muscle, muscular, little body fat	
Identify three characteristics of an endomorph	Lots of fat, little muscle, wide shoulders and hips, dumpy	
State an example of a sport suited to an ectomoprh	Shot put, javelin, sumo wrestler, hammer thrower	
State an example of a sport suited to an mesomoprh	Swimmer, sprinter	
State an example of a sport suited to an endomorph	High jump, pole vault	
What is energy measured in?	Calories (kcal)	
What is the average calories required by males in a day?	2500	
What is the average calories required by females in a day?	2000	
What factors can affaect energy usage?	Age, gender, height, exercise levels	

Aerobic Exercise

'With Oxygen'

The aerobic respiratory system is responsible for producing the majority of our energy while our bodies are at rest or taking part in low-intensity exercise for long periods of time such as jogging or long-distance cycling.

Glucose + oxygen → energy + water + carbon dioxide

- This is the most efficient energy system and with enough O^2 can work for extended periods (20 minutes minimum)
- Aerobic activities last for a long time (20 mins+)
- Aerobic activities undertaken at a low/moderate pace
- e.g. Long Distance running, cycling & swimming
- 60-80% of MHR (220-age)
- Energy sources – carbohydrates or fats
- Waste products – CO_2 - exhaled and H_2O - sweating

Anaerobic Exercise

'Without Oxygen'

The anaerobic respiratory system supplies energy very quickly for sports such as vaulting in gymnastics or throwing a javelin where the activity only lasts a few seconds.

Glucose → energy + lactic acid

- Doesn't used O_2 therefore can only be maintained for short periods.
- Short intense periods of exercise – 30secs
- e.g. Sprinting - running, swimming, cycling
- During intense activity, muscles need large amounts of energy. The body cannot deliver enough O_2 so they begin to respire anaerobically.
- 8—9-% of MHR (220-age)
- Glucose (carbohydrates) still main source of energy
- Lactic acid is a by product - can cause cramp.
- Finished activity – deep breathing to repay O_2 debt.

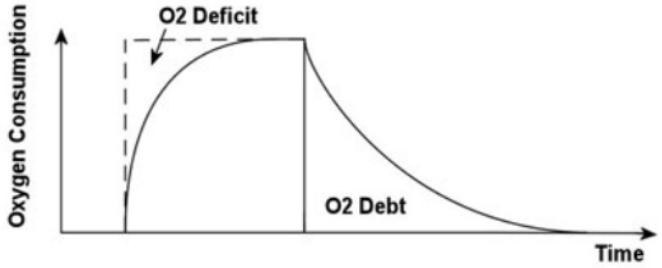
Oxygen Debt - Excess Post-exercise Oxygen Consumption (EPOC)

'The extra oxygen intake after high intensity exercise'

EPOC (oxygen debt) is caused by anaerobic exercise (producing lactic acid).

After taking part in exercise, a person continues to breathe more deeply and rapidly than when at rest to take in additional oxygen to repay this oxygen debt. The oxygen is then used to:

- Maintain higher than resting breathing rate, heart rate and temperature
- Break down and oxidise lactic acid
- Gradually reduce body temperature
- Remove excess carbon dioxide from the body



Recovery after Exercise

Following exercise athletes may include the following depending on the activity to aid recovery:

- Cool Down
- Ice Baths
- Massage
- Manipulation of Diet
  - Rehydration
  - Carbohydrates

Cool Down

- 5-10 minutes of low/moderate paced aerobic activity.
- Gradual decrease of heart rate.
- Reduces body temperature.
- Aids lactic acid removal/dispersal and so minimises stiffness.
- Bring breathing rate back to normal maintaining blood flow.
- No blood pooling reduces risk of dizziness/fainting.
- Followed by 5-10 minutes of static stretching.

Ice Baths

- 5-10mins
- Constrict blood vessels and so limits blood flow to muscles – this helps remove products such as lactic acid.
- Helps prevent Delayed Onset Muscle Soreness (DOMS)
- Speeds repair of microtears – linked to DOMS.
- Muscles gradual warm and blood flow increases.

Massage

- Rubbing muscles and joints with hands.
- Prevents DOMS
- Increases blood flow
- Prevents swelling

Manipulation of Diet

Rehydration

- Replacing fluids and minerals - before, during and after activity.
- Prevents dehydration
- Prevents nausea

Carbohydrates

- Glucose used for energy during activity so needs replacing asap.
- Glycogen stores can be replenished.

Tasks

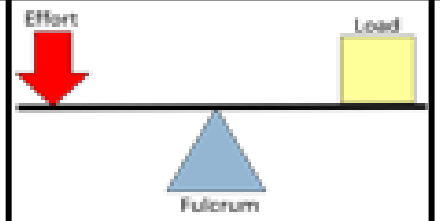
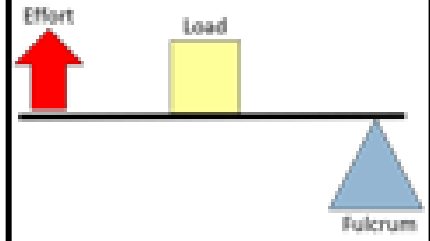
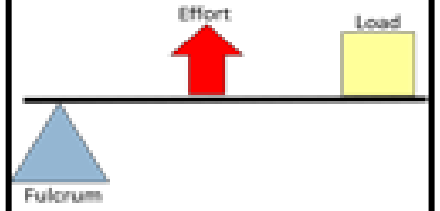
1. Analyse the two different athletic events and justify why they are either anaerobic or aerobic.

2. Discuss what happens to Usain Bolt's breathing after completing the 100m sprint.

2. Suggest how these athletes may recover from their physical activity.

Question	Answer/Cover	Attempt
Describe the difference between aerobic exercise and anaerobic exercise.	Aerobic is with oxygen, anaerobic is without	
Describe aerobic exercise	Occurs during the presence of oxygen, occurs when exercising for long periods of time e.g. marathon runner, swimming, cycling, 800m	
Describe anaerobic exercise	Occurs when no oxygen is available, used only for short periods of time, short intense bursts of activity e.g. 100m, 200m sprinting	
Define what is meant by EPOC.	Means oxygen debt, occurs during anaerobic exercise due to lack of oxygen, additional oxygen is needed during recovery, maintain breathing after exercise to repay the debt	
What is lactic acid?	Mild poison that builds up in muscles due to anaerobic exercise and can cause pain, fatigue and cramp	
Identify three methods of recovery.	Cool down, massage, ice baths, replenish carbohydrate stores	

Types of Lever

Lever	Drawing	Life Example	Sporting Example
1st Class Lever			At the elbow during a throw in in football
2nd Class Lever			At the ankle during take off for long jump
3rd Class Lever			At the elbow during the upward phase of a bicep curl

Components of a Lever

Fulcrum (F) – A fixed pivot point.

Effort (E) – The source of energy

Load (L) – The weight/resistance

Mechanical Advantage

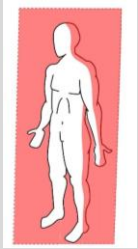
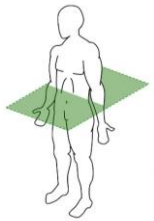
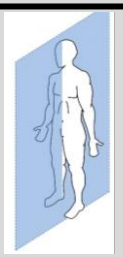
Mechanical advantage = effort arm ÷ resistance arm

The greater the effort arm in comparison to the resistance arm, the greater the mechanical advantage.

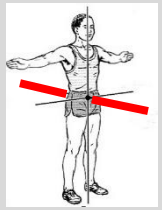
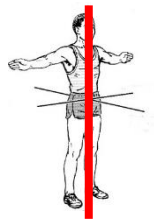
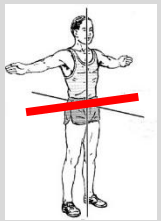
Mechanical Advantage
This is were a lever's *effort arm* is greater than its *load arm* – 2nd Class Lever.

Mechanical Disadvantage
This is were a lever's *load arm* is longer than its *effort arm.*

Planes – Imaginary lines that divide the body in two.

Frontal Plane	Transverse Plane	Sagittal Plane
A vertical plane but this divides the body into front and back.	A horizontal plane that divides the body into upper and lower halves.	A vertical plane that divides the body into right and left sides.
		

Axes - imagery lines that the body rotates around.

Sagittal Axis	Longitudinal Axis	Transverse Axis
Runs through the body horizontally from the back to front.	Runs through the body vertically from the top to bottom.	Runs through the body horizontally from the left to right.
		
Cartwheel 	Full Twist 	Somersault 

Tasks

1. Analyse the three sporting examples for the:
   - Lever System (Draw & Label)
   - Mechanical Advantage
   - Plane
   - Axis

Question	Answer/Cover	Attempt
Describe a first class lever system	Fulcrum lies between the effort and the resistance e.g. elbow joint	
Describe a second class lever system	The fulcrum lies at one end with the effort at the other end and the resistance in the middle e.g. the ankle joint - set shot	
Describe a third class lever system	The fulcrum lies at one end and the resistance is at the other end with the effort located between the fulcrum and the resistance e.g. elbow joint	
Describe what is meant by mechanical advantage	The efficiency of a working lever, calculated by effort/weight (resistance) arm	
Identify the three parts of a lever system	Load (resistance), fulcrum, effort	
Identify three planes of the body	frontal, transverse, sagittal	
Identify three axes of the body	sagittal, transverse, longitudinal	
Describe sagittal axis	Through the belly button	
Describe trasnverse axis	Through the hips	
Describe longitudinal axis	Head to toe	
Describe sagittal plane	Forwards and backwards	
Describe frontal plane	Left or right	
Describe transverse plane	Rotation along the longitudinal axis	

Skill Continuums

Basic ⟷ Complex

Basic

'Little thought process'

- Require less concentration and coordination
- Simple skill - easy to execute
- May be autonomous

e.g. Sprinting

Complex

'Much practice needed'

- Take longer to learn and requires greater concentration and coordination to perform
- Learnt in phase and practice needed

e.g. Pole Vault

Open ⟷ Closed

Open

'Affected by the environment'

- Usually externally paced.
- Occur when performers have to make decisions and adapt their skills to a changing or unpredictable environment.

e.g. Lofted pass in football

Closed

'Not affected by the environment'

- They are usually self-paced
- Fixed/predictable situations.
- The performer uses the same technique and is in control of what happens next.

e.g. Serve in tennis

Self-Paced ⟷ Externally-Paced

Self-Paced

'Performer initiated'

- Started when the performer decides to start it.
- The speed, rate or pace of the skill is controlled by the performer.

e.g. Serve in table tennis

Externally-Paced

'Initiated by external factor'

- Started because of an external factor.
- The speed, rate or pace of the skill is controlled by external factors, e.g. an opponent.

e.g. WA marking WD in netball

Gross ⟷ Fine

Gross

'Large movements'

- Using large muscle groups to perform
- Big, powerful movements.

e.g. Tackle in rugby

Fine

'Small movements'

- Small and precise movement
- High levels of accuracy and coordination. It involves the use of a small group of muscles.

e.g. Spin bowling in cricket

SMART Targets

Specific: *'State exactly what will be done'*

- Have a clear detailed goal or target to aim for. e.g. Improve my PB by 0.3secs in 6 weeks.

Measurable: *'Clear what success will look like'*

- Can it be measured, tested or timed? e.g. I will time my runs every training session for the next five week.

Accepted: *'Decided on by all participants'*

- By the performer & coach. e.g. My coach and I devised the training programme around improving leg power for my start"

Realistic : *It is doable – steps can be taken'*

- Is the goal suitable for the athlete. E.g 0.5 seconds off my personal best is realistic for my current ability and status"

Time-Bound: *'State when it will be achieved'*

- Set for a particular time to be completed. e.g. "We agreed to do the training programme four times per week for the next five weeks"

Skill and Ability

- Skills are *learned* and when mastered are consistently done in a way that looks easy, uses minimum time and energy as well as the correct technique.
- Abilities are *inherited* from your parents, abilities are stable traits that determine an individuals potential to learn skills.

Goal Setting

Helps motivate performers and provides a target to aspire to which helps them prepare both physically and mentally.

- Targets focus training
- Motivate performers
- Improve and optimise training
- Goals should be short and long term and assessed regularly.

Performance Goals

'Personal standards to be achieved without comparison with other performers'

- The performer looks at personal improvements.
- E.g. Win 75% of headers in a game of football/decrease my 50m freestyle time by 0.25secs
- Beginners are better concentrating on performance goals as they do not need to worry about comparing the result to others.
- Elite performers use performance goals to help motivate themselves to work on individual aspects of their performance.

Outcome Goals

'Judging the end result by comparison with other performers'

- Focus on end result and not personal standards
- E.g 100m runner aims to win the race.
- They usually involve comparison with other competitors.
- The performers standards may not be seen as important, it is the final outcome that matters.
- Beginners prefer to avoid outcome goals as failure demotivates them and winning may be unrealistic.
- Elite performers are sometimes driven by outcome goals as they always have the desire to win.

Tasks

1. Put the following skills on the continuums and justify why.
   - Open/Closed
   - Basic/Complex
   - Self-Paced/Externally Paced
   - Gross/Fine



2. Create yourself a SMART Target and justify why you have made it this way.

3. Create a performance goal for you.

4. Create an outcome goal for you.

5. Justify why goal setting is important for you and why you prefer performance/outcome goals.

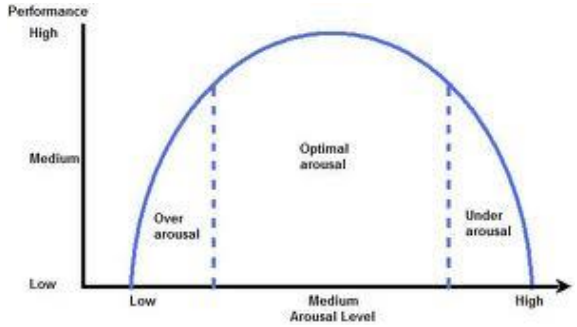
Question	Answer/Cover	Attempt
Define Skill	Learned actions or learned behaviours with the intention of bringing about predetermined results	
Define Ability	Inherited, stable traits that determine an individuals potential to learn or acquire a skill	
Identify a characteristic of a basic skill	Involves very little decision making, performed by beginners	
Give an example of a basic skill	Walking, jumping, jogging, throwing	
Identify a characteristic of a complex skill	Involves lots of decision making, performed by more experienced performers	
Give an example of a complex skill	Pole vault, long jump, triple jump	
Identify a characteristic of an open skill	Skill performed in an unstable changing environment, externally paced, depends on opponents/others	
Give an example of an open skill	Tackling in rugby, dribbling in basketball, shooting in hockey	
Identify a characteristic of a closed skill	Stable environment, self paced, skill perofmed same way each time as not affected by environment	
Give an example of a closed skill	Gymnastics routine, javelin throw, penalty in football	
Identify a characteristic of a self paced skill	Start of movement is controlled by performer, speed and pace controlled by performer	
Give an example of a self paced skill	Long jump, marathon	
Identify a characteristic of an externally paced skill	Skill is started by an external factor such as an opponent	
Give an example of an externally paced skill	Receiving a serve in tennis	
Identify a characteristic of a fine skill	A small and precise movement showing high levels of accuracy, coordination and precision	
Give an example of a fine skill	Darts, badminton serve, snooker, archery	
Identify a characteristic of a gross movement skill	Large muscle groups used, high levels of arousal	
Give an example of a gross movement skill	rugby tackle, pass in football, shooting in netball	
Explain what is meant by a performance goal	These are personal standards to be achieved e.g. improve take off in the long jump	
Explain what is meant by an outcome goal	These are where the focus is on the end result such as winning.	
What does SMART stand for?	Specific, measurable, accepted, realistic, time bound	
Describe what is meant by a specific goal.	Goal must be specific to the demands of the sport or the muscles/movement used	
Describe what is meant by a measurable goal.	It must be possible to measure whether the goals set have been met	
Describe what is meant by an accepted goal.	Goals that are accepted by the performer and others e.g. coach, parents, teacher	
Describe what is meant by a realistic goal.	the goals must actually be possible to complete or achieve	
Describe what is meant by a time bound goal.	A set period of time must be imposed e.g. by the end of the season	

Arousal

A physical and mental (physiological and psychological) state of alertness/readiness, varying from deep sleep to intense excitement/alertness.

The 'Inverted-U Theory'

Optimal performance occurs when a performer reaches an optimal level of arousal.



- As arousal levels increase so does performance.
- Up to the optimal level where performance is high.
- If arousal continues to increase further, performance will decrease as the performer will become over aroused.
- **Low arousal** levels - performance quality is low.
  - This is described as *under-arousal.*
  - E.g.an elite tennis player playing a lowly ranked opponent.
- **Medium arousa**l levels - sporting performance peaks.
  - This can be described as *optimal arousal*
  - E.g. A boxer gets themselves in the right 'zone' to perform
- **High arousal** levels - performance quality deteriorates.
  - This can be described as *over-arousal*
  - E.g. might explain a football player performs very poorly when their team is losing 3-0.
- Fine Skills that involve precise movements (linked to accuracy) require a low optimal level of arousal.
- Gross skills that involve large muscle movements (linked to power and strength) require a high level of arousal.

Controlling Arousal Levels

Methods to help the performer control their arousal and focus their thoughts on the task ahead of them.

Deep Breathing

- A somatic technique which involves the performer exaggerating their breaths in and out.
- Helps performers to breathe slowly and steadily from the diaphragm instead of the upper chest. This reduces anxiety.

Mental Rehearsal/Visualisation/Imagery

- Visualisation and imagery are all cognitive techniques done in the performers mind to control arousal.
- Mental rehearsal involves the performer picturing themselves performing the skill perfectly before attempting it e.g. goal kick in rugby.
- Visualisation and imagery involves the performer imagining themselves in a calm, relaxing environment or recreate a good past performance.

Positive Self-Talk

- A cognitive technique where the performer talks to themselves in their head.
- This reassures the performer that they can do it or that they are doing well.

Aggression

Direct Aggression - Physical contact between performers e.g. rugby tackle

Indirect Aggression – Does not involve physical contact. The aggressive act is taken out on a object to gain an advantage over an opponent e.g. smash in badminton.

Personality

Introvert	**Extrovert**
'A quiet, passive, reserved, shy personality type, usually associated with individual sports performance.'	*'Sociable, active, talkative, out-going personality type usually associated with team sports players'*
Sports • Individual sports • Concentration • Lower level of arousal e.g. archery, pistol shooting.	**Sports** • Team sports • Little concentration • Mainly gross skills • Higher level of arousal e.g. rugby player.

Motivation

'*The drive to succeed or the desire to achieve something.'*

Intrinsic Motivation

- The drive that comes from within the performer.
- A feeling of pride, satisfaction or achievement.

Extrinsic Motivation

- The drive experienced by a performer when striving to achieve a reward.
- The external reward is provided by an outside source or person and can be divided into two categories:
- *Tangible rewards* – certificates, trophies, medals etc.
- *Intangible rewards* **–** praise or feedback from others, applause from the crowd.

Intrinsic motivation is seen as a more effective motivational tool as: performers may become too reliant on extrinsic motivation; intrinsic motivation is more likely to lead to continued effort and participation; the overuse of extrinsic can undermine the strength of intrinsic.

Tasks

1. Draw and explain The Inverted-U Theory using sporting examples.
2. Describe the type of aggression that the below two athletes are displaying.

3. Explain how these athletes may be able to control their arousal levels in order to improve their performances.

4. Research an introvert and an extrovert athlete and explain what this means.

5. Double bubble map the two types of motivation. In the FoR discuss which is more suited to a beginner and an expert.

Question	Answer/Cover	Attempt
What are the characteristics of an introvert	Shy, quiet, thoughtful, low levesl of arousal, loner, fine skills	
What are the characteristics of an extrovert	Gross skills, talkative, enthusiastic, get bored when on their own, sociable	
Which sports are suited to introverts?	Individual sports e.g. tennis, weight lifting, cheerleading, boxing	
Which sports are suited to extroverts?	Team sports e.g. basketball, football, handball, netball	
Define direct aggression	Aggression that is aimed at another player and invoves physical contact	
Define indirect aggression	Aggression that does not involve any physical contact	
Define motivation	The drive to succeed or the desire to want to achieve something	
Define arousal	A physical and mental state of readiness or alertness varying from deep sleep to excitement	
Draw the inverted U theory	An inverted U shape with the axis labelled as arousal level (x axis) and performance (y axis)	
Describe the inverted U theory	As arousal increases so does performance upto optimal level, if arousal increases further performance decreases	
Identify three ays of controlling arousal	Deep breathing, positive self talk, visualisation, imagery, mental rehersal	
Give an example of direct aggression	Punching in football or body tackle in rugby	
Give an example of indirect aggression	Hitting a tennis ball or shuttlecock harder	
Explain positive self talk	This involves you mentally reflecting and reframing your thoughts relacing negative thoughts with positive ones	
Explain visualisation/imagery	Changing the way you think in order to change the way you behave. Recalling a positive outcome.	
Explain deep breathing	Controlling arousal by deep and slow breaths to increase oxygen suppy to the brain	
Define intrinscis motivation	Comes from within, pride, self satisfaction, personal achievement	
Define extrinsic motivation	Comes from others e.g. coaches, tangible rewards include trophies and medals, intangible such as praise, applause	

Information Processing Model

'Gathering data from the display (senses), prioritising the most important stimuli to make a suitable decision.'

Input	• Take in information from the display (senses). • Performers receive lots of information so have to prioritise the most important stimuli to make a suitable decision - choose what to focus on (selective attention)
Decision Making	• Selection of appropriate response from memory. • Information is initially stored in the short term memory. • If rehearsed and learnt it is stored in the long term memory with other past experiences
Output	• Decision is acted upon. • Information sent to muscles to carry out the response.
Feedback	• Information a performer receives about their performance - during and/or after performance. • It is received via self (intrinsic - received from performer through thoughts and emotions) and/or others (extrinsic – coach, spectators and/or video).

Feedback

	Description	Advantage	Disadvantage
Positive Feedback	*What's good or correct about performance*	• Motivating • Highlights success	• Can suggest performance was better than it was
Negative Feedback	*What's bad or incorrect about performance*	• Enables coach to provide guidance on how skill can be performed better • Helps performer to prioritise improvement	• Demotivating • Beginners may struggle to know how to respond
Extrinsic Feedback	*Received from outside of the performer, eg from a coach*	• Beginners need feedback from coaches to be made aware of technique	• Not always available
Intrinsic Feedback	Feedback from within e.g. how a shot feels	• Experienced performers can make immediate adjustments	• Requires high level of knowledge to know what to do next
Knowledge of Results	*Information about time/placing*	• Quick measure	• Demotivating
Knowledge of Performance	*Feedback on success of performance and technique*	• Many aspects to one performance so feedback can be detailed for or focused	• Hard to break a performance down to provide detail

Guidance

A method to convey information to a performer.

Visual *(seeing)*
- Live demo, poster, film, chart or court markings
- Adv: useful for all levels, good for novices, performer sees what is required, vision is dominant sense, can copy others
- Disadv: Must be of good quality, some skills too complex

Verbal *(hearing)*
- Spoken information from coach
- Adv: Useful for high level, highlights key points, quick to share information, questioning can make performers think
- Disadv: Can lead to information overload, difficult to hear in noisy environments, complex things are difficult to explain

Manual *(physically assist movement)*
- From coach moving performer
- Adv: Useful for complete beginners, allows performer to develop correct feel
- Disadv: May not think they are really performing skill

Mechanical *(use of objects/aids)*
- e.g. floats in swimming, harnesses in trampolining.
- Adv: good for potentially dangerous skills, performer gains a feel for skill without fear, builds confidence.
- Disadv: equipment may be expensive and performer may become reliant on the aid.

Tasks

1. Use a sporting example of your choice to explain the information processing model:

2. Using a skill of your choice, explain how a coach might use the different types of guidance to aid a performer learning a new skill.

3. How might this be different for a beginner and an expert?

4. What types of feedback might they receive?

5. What is more beneficial for a beginner and an expert?

Question	Answer/Cover	Attempt
Identify or draw the four stages of the information processing model	Input, decision making, output, feedback	
Describe the decision making stage of the information processing model	Selection of appropriate response from memory. Information is initially stored in STM. If rehearsed and learnt it is stored in the LTM with other past experiences.	
Describe the input stage of the information processing model	Info from the senses. Performers receive lots of info so have to prioritise the most important stimuli - (selective attention)	
Describe the output stage of the information processing model	Decision is acted upon - information sent to muscles to carry out the response.	
Describe the feedback stage of the information processing model	Info a performer receives about their performance. Feedback can be given during and/or after performance.	
Identify four types of guidance	Visual, verbal, manual, mechanical	
Explain verbal guidance	This involves using your sense of hearing and could involve listening to a coach give instructions.	
Explain visual guidance	This involves the performer being able to actually see something using sight which could be a demonstration, a video, you tube clip or photograph, chart, court markings.	
Explain mechanical guidance	This involves the use of objects or aids such as RoboGolfPro machine for golfers to practice the golf swing, floats in swim.	
Explain manual guidance	This is where the performer can be assisted in a physical movement e.g. supporting somebody do a gym vault.	
Give an example of manual guidance	Gymnastic vault	
Give an example of visual guidance	Looking at a demo of how to serve in badminton, looking at pictures, watching you tube videos	
Give an example of verbal guidance	Listeninig to a coach give instructions of how to move the arms in back crawl	
Give an example of mechanical guidance	Using a float in swimming, , RoboGolfPro machine	
Identify six types of feedback	Positive, negative, extrinsic, intrinsic, knowledge of results, knowledge of performance	
Describe extrinsic feedback	Received from outside of the performer e.g. coach	
Descrine intrinsic feedback	Feedback received from witin themselves e.g. how a shot at goal felt	
Describe knowledge of results	This is feedback the performer gets through the end result of a performance e.g. the score, how many runs made	
Describe knowledge of performance	This is how the performer feels about their actions from the performance that has just taken place	
Describe what is meant by positive feedback	Feedback about what was good and correct about a performance	
Describe what is meant by negative feedback	Feedback about what was bad or incorrect about a performance	

Component	Definition	Sporting Example	Fitness Test
Cardiovascular Endurance	The ability of the heart and lungs to supply oxygen to the working muscles	Endurance events	Multi-Stage Fitness Test (MSFT)
Agility	The ability to move and change direction quickly (at speed) whilst maintaining control.	Winger in rugby to sidestep an opponent	Illinois Agility Test
Balance	Maintaining the centre of mass over the base of support.	Static - holding a handstand Dynamic - cartwheel	Standing Stork Test
Flexibility	The range of movement possible at a joint	Splits in dance	Sit and Reach Test
Co-ordination	The ability to use different (two or more) parts of the body together smoothly and efficiently.	Catching a cricket ball	Anderson Wall Ball Toss Test
Muscular Endurance	Ability of a muscle or muscle group to undergo repeated contractions avoiding fatigue.	Endurance events	Abdominal Curl Test
Power	The product of strength and speed (strength x speed).	Smash in badminton	Vertical Jump Test
Reaction Time	The time taken to initiate a response to a stimulus.	Reacting to start gun in 100m	Ruler Drop Test
Speed	The maximum rate at which an individual is able to perform a movement or cover a distance in a period of time (speed = distance divided by time)	100m sprint	30m Sprint
Strength	The ability to overcome a resistance. **Maximal** – the largest force possible in a single maximal contraction **Dynamic** – repeated contractions **Explosive** – (see Power) **Static** – the ability to hold a body part in a static position.	Hammer throw Static – holding a scrum in rugby	Hand Grip Dynamometer Maximal – One Rep Max

Reasons for Fitness Testing

- To identify strengths and weaknesses, this allows them to work on
- To allow you to plan your training
- To show a starting level of fitness
- To monitor improvement
- To monitor the success of a training programme
- To compare against normative data
- To motivate and set goals

Limitations with Fitness Testing

- Tests are often not sports specific (e.g. ruler drop test in sport?)
- They do not replicate the movements in a sport
- They don't replicate the high pressure environment of sporting activities/non competitive
- Some are not reliable
- Some are maximal which means the performer is required to try their best
- Protocols must be followed or else the tests are invalid

Health

State of complete mental, physical and social wellbeing, not merely the absence of disease or infirmity.

Relationship between Health and Fitness

- Ill health can negatively affect fitness as the individual may be too unwell to train.
- Increases in fitness can positively affect health and well-being e.g. you may be less likely to get ill, you may feel better about yourself.

Fitness

Ability to meet the demands of the environment.

Tasks

1. For each component of fitness come up with a specific sporting example. Start with these:



2. Why do athletes use fitness testing? What are the limitations?

3. Research the fitness test associated with each component of fitness.
   - What is the protocol? (How do you conduct the test)
   - How suitable is it for testing that component of fitness?

Question	Answer/Cover	Attempt
Define static strength	the ability to hold a body part in a static position	
Define health.	A state of complete physical, mental and social well being and not merely the absence of disease	
Define fitness.	The ability to meet the demands of the environment	
Define agility	The ability to move and change direction quickly whilst maintaining control	
Define coordination	The ability to use different parts of the body together	
Define balance	the maintenance of the centre of mass over the base of support	
Define speed	the maximum rate at which an individual is able to perform a movement in a peiod of time	
Define muscular endurance	the ability of muscles to undergo repeated contractions without tiring	
Define cardiovascular endurance	the ability of the heart and lungs to supply oxygen to the working muscles	
Define strength	the ability to overcome a resistance	
Define power/explosive strength	the product of strength x speed	
Define flexibility	the range of movement at a joint	
Define reaction time	the time taken to initiate a response to a stimulus to starting a response	
Name the test for agility	Illinois agility test	
Name the test for coordination	Wall toss test	
Name the test for power	Vertical jump test	
Name a test for strength	handgrip dynamometer test	
Name a test for balance	Stork balance test	
Name a test for speed	30 metre sprint test	
Name a test of muscular endurance	Sit up bleep test	
Name a test for cardiovascular endurance	Mult stage fitness test (MSFT)	
Name a test for reaction time	Ruler drop test	
Name a test for flexibility	Sit and reach test	
Give three reasons for fitness testing	motivate, monitor improvement, set goals, inform training, provide variety to training	
Give three limitations of fitness testing	not sport specific, may not replicate movements of activity, must be carried out with correct procedures	
Name a test for maximal strength	One rep max test	

Method	Description	Sport	Advantages	Disadvantages
Continuous Training	• Involves a steady but regular pace at a moderate intensity (aerobic) which should last for at least 20 minutes. i.e. running.	Marathon Runner	• Ideal for beginners • It can be done with little or no equipment • Highly effective for long distance athletes	• Repetitive - boring & cause injury • Can be time consuming • It does not always match demands of the sport
Fartlek Training	• Referred to as **'speed play'** • This is a form interval training but without rest. Involves a variety of changing intensities over different distances and terrains. *i.e. 1 lap at 50% max, 1 lap walking, 1 lap at 80% (aerobic and anaerobic used)*	Games Players e.g. Hockey	• More enjoyable than interval and continuous training • Good for sports which require changes in speed • Easily adapted to suit the individuals level of fitness and sport.	• Performer must be well motivated particularly when intensity is high • Difficult to assess whether performer is performing at the correct intensity
Weight/ Resistance Training	• A form of training that uses progressive resistance against a muscle group. • Muscular strength - High weight x low repetitions • Muscular endurance - Low weight x high repetitions	Rugby Player	• Variety of equipment to prevent boredom • Strengthens the whole body or the muscle groups targeted. • Can be adapted easily to suit all sports	• Requires expensive equipment • If exercises are not completed with the correct technique it can cause injury to the performer
Circuit Training	• A series of exercises completed one after another. • Each exercise is called a station. • Each station should work a different area of the body to avoid fatigue. *i.e. press ups, sit ups, squats,*	All athletes	• Quick and easy to set up • Can be adjusted to be made specific for certain sports. *i.e. netball specific* • Easy to complete with large groups	• May require specialist equipment e.g. a medicine ball, kettle bell, agility ladders. • Hard to work out appropriate work/rest ratio • Must have motivation and drive to complete the set amount of repetitions and sets
Interval Training	• Involves periods of work followed by periods of rest. *i.e. Sprint for 20 metre + walk back to start.*	200m Sprinter	• Quick and easy to set up. • Can mix aerobic and anaerobic exercise which replicates team games.	• It can be hard to keep going when you start to fatigue • Over training can occur if sufficient rest is not allowed between sessions (48 hours)
Plyometric Training	• Involves high-impact exercises that develop **power**. *i.e. bounding/hopping, squat jumps.*	Long Jumper	• Rapid improvements in power.	• Incorrect technique it can cause injury to the performer
Static Stretching	• **S**tretching to the limit and holding the stretch isometrically for 30seconds • Intensity is measured as a percentage of range of motion (%ROM).	Gymnast	• It increases flexibility. • It can be done by virtually everyone, anywhere. • It is relatively safe.	• Time consuming to stretch the whole body. • It can get boring and repetitive. • Some muscles are easier to stretch. • Over-stretching can cause injury.

Tasks

1. Consider the training methods for the following athletes and justify why you have chosen these methods.

Question	Answer/Cover	Attempt
Describe circuit training	Training method consisting of a number of different exercises or activities arranged in a circuit	
Describe plyometrics	Training that includes hopping, jumping, bounding exercises designed to improve power.	
Describe continuous training	Taking part in sustained exercise at a constant rate without rest. Minimum of 20 mins.	
Describe static stretching	Training method that includes stretching to improve flexibility	
Describe fartlek training	Means 'speed play' Uses a variety of speed, terrain and work/rest ratios.	
Describe interval training	Also known as HIIT (high inenstity interval training). Period of work followed by peiod of rest.	
Describe weight training	Method used to improve strength, power or speed. Includes sets and repetitions.	

Principles of Training (SPORT)

Specificity (S)

'Training must be relevant to the individual and their sport'

- Training should be matched to the requirements of the sport or position the performer takes part in.
- Training must be specifically designed to develop the correct; muscles, components] of fitness and skills.

Progressive Overload (P and O)

'Gradually increasing training – FITT'

- Training must be increased over time to ensure that the body is pushed beyond its normal rhythm.
- Increases must be gradual so that the athlete avoids a plateau in performance or, worse, injury.

Principles of Overload:

Frequency (F) - How often training takes place.
Intensity (I) - How hard the exercise is.
Time (T) - The length of the session.
Type (T) - The method of training used.

Reversibility (R)

'*Adaptations are lost if training stops'*

- It is essential to avoid breaks in training to maintain motivation and training effects.
- Reversibility can happen when; suffering from illness and cannot train, injury or after an the post-season.

Tedium (T)

'Avoiding boredom'

- Athletes need variety in their training to prevent boredom but also some types of overuse injuries such as strains or even stress fractures.
- The principle of tedium is applied when a trainer builds variety into the training by changing the training method.

High Altitude Training

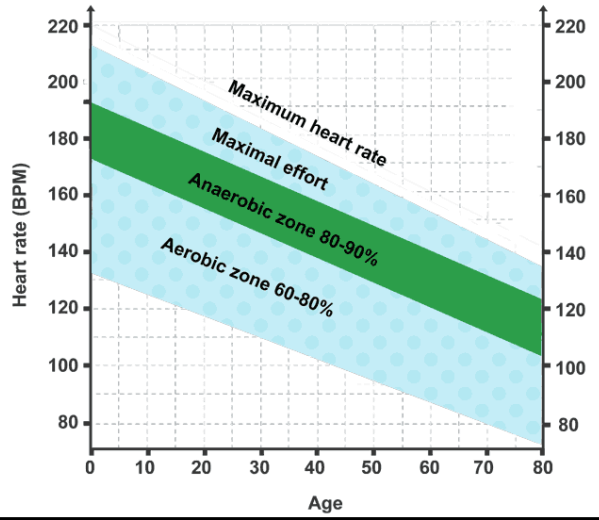
'Training significantly above sea level – 2000m'

- A form of aerobic training.
- Training at high altitude where there is less oxygen in the air and oxygen carrying capacity is reduced.
- The body adapts by making more red blood cells to carry oxygen.
- The additional oxygen carrying red blood cells is an advantage for endurance athletes returning to sea level to compete.
- Can result in altitude sickness - nausea caused by training at altitude
- Is expensive and not all athletes have access to mountains.

Training Intensities

- Training is effective when it specifically targets the individual athlete.
- For many athletes this involves calculating a specific working heart rate by first calculating maximum heart rate (MHR).

Maximum Heart Rate = 220 – age



Aerobic Training
Training Zone:
60-80% of MHR
Lower Threshold
60% MHR
Upper Threshold
80% MHR

Anaerobic Training
Training Zone:
80-90% of MHR
Lower Threshold
80% MHR
Upper Threshold
90% MHR

Seasonal Aspects

Training

A well-planned programme which uses scientific principles to improve performance, skill, game ability, motor and physical fitness.

Season

A period of time during which competition takes place or training seasons, dividing the year up into sectional parts for pre-determined benefits.

Pre-Season (Preparation)

- Period leading up to competition.
- Continuous/fartlek/interval training sessions to increase aerobic fitness.
- Weight training to build strength and muscular endurance
- Sport specific techniques in order to be fully prepared for matches at start of season and therefore be more successful

Competition Season (Peak)

- Playing season; taking part every week.
- Includes maintenance of fitness related to the activity being careful not to cause fatigue, which would decrease performance.
- Concentration on skills/set plays to improve team performance.
- Less intense training and tapering of training.

Post-Season (Transition)

- Period of rest/active recovery/light aerobic work after the competition season to recuperate.
- Maintain general level of fitness.
- Fully rested and ready for pre-season training.

Tasks

Mo Farah

Rachael Burford

Simone Biles

Nicola Adams

1. Pick one of the athletes above and complete the following:
   - How will they meet the principles of training?
   - Research their ages and calculate the correct training intensity/zone – it must match the demands of their sport and use their MHR
   - Consider what they do during their training season (you might need to research this)

Question	Answer/Cover	Attempt
What does SPORT stand for?	Specificity, Progressive Overload, Reversibility, tedium	
Define Specificity	Making training specific to the sport being played/movements/muscles used	
Define progressive overload	Gradual increase in the amount of overload so that fitness gains occur. Apply FITT principle.	
Define reversibility	Losing fitness levels when you stop exercising	
Define tedium	Training needs to be varioed to prevent boredom taking place	
What does FITT stand for?	Frequency, Intensity, Time, Type	
What is meant by frequency?	How often you train	
What is meant by intensity?	How hard you train	
What is meant by time?	How long you spend training	
What is meant by type?	The type of training being used	
Describe circuit training	Training method consisting of a number of different exercises or activities arranged in a circuit	
How do you calculate somebody's maximum heart rate?	220-age	
How do you calculate the aerobic training zone?	60-80% of MHR	
How do you calculate the anaerobic training zone?	80-90% of MHR	
How do you prevent injury in sport?	Warm up, correct technique, appropriate clothing, hydration, taping/bracing	
What is altitude training?	Train at high altitude, less 02 in air, endurance athletes, 2000m above sea level	
What are the disadvantages of altitude training?	altitude sickness, cost, short term benefits only	
Name the three training seasons	pre season, competition season, post season	
What is the purpose of pre season training?	general aerobic fitness, specific fitness	
What is the purpose of competition phase of a season?	maintain fitness levels, work on specifc skills/tactics	
What is the purpose of post season?	rest and light aerobic training to maintain fitness	

Stimulants

Increase alertness, reactions and aggression.

Amphetamines and caffeine.

Sprinters, Boxers, Sprint Cyclist

Benefits

- Increase alertness
- Reduce reaction
- Time
- Reduce tiredness
- Increase aggressiveness

Side Effects

- Highly addictive
- High blood pressure
- Strokes and heart and liver problems.
- Insomnia

Anabolic Agents (Steroids)

Increase muscle mass, strength and power.

Nandrolone and Stanazol

Sprinters, Weightlifters, Power Athletes

Benefits

- Build up body weight
- Increase muscle size,
- Increase strength
- Aggression
- Train harder for longer with less rest between sessions.

Side Effects

- Highly addictive
- High blood pressure, Damage to liver, heart and kidneys.
- Women may develop more body hair, smaller breasts and a deeper voice. Men shrink testicles

Narcotic Analgesics

Very strong painkillers, mask pain from injury.

Heroin and Morphine

Any injured athlete

Benefits

- Mask pain from an injury or overtraining.
- Allow athlete to compete when injured

Side Effects

- Highly addictive and can cause withdrawal symptoms when coming off.
- More damage to injury
- Depression & anxiety
- Low blood pressure
- Loss of concentration.

Beta Blockers

Reduce the effect of adrenaline on the body.

Prescribed by Doctors

Archery, Shooting, Target Sports

Benefits

- Increase precision and fine motor control.
- Decrease in effect of adrenaline
- Reduce heart rate and muscle tension
- Reduce nerves

Side Effects

- Nausea
- Less O2 delivery
- Poor circulation leading to heart problems
- Tiredness
- Weakness

Blood Doping

<u>Method</u> to increase performers red blood cells.

Approx. 2 pints of blood removed several weeks before competition. Body makes more blood to replace what has been lost. Removed blood is frozen until 1-2 days before competition when it is injected back into the body.

Endurance Athletes

Benefits

- Increase RBC so the ability of the athletes body to transport 02 to cells that are producing energy = less fatigue
- 20% improvement in carrying O2 to working muscles

Side Effects

- Thickening of the blood which requires heart to pump harder
- Can lead to increase risk of stroke or heart attacks.
- Infection from equipmet (HIV, Hep.)

Diuretics

Remove excess water from the body. Masking agent to flush out other drugs.

Frusemide

Jockeys, Boxers, Judo

Benefits

- Lose weight rapidly in sports that require the performer to be within a set weight limit
- Dilute the presence of illegal substances and aid their removal from the body in urine

Side Effects

- Severe dehydration
- Kidney damage
- Nausea/headache
- Low blood pressure
- Muscle cramps
- May be taken to hide other PED use

Peptide Hormones

Naturally occurring substances that improve muscle growth (HGH) and increase production of red blood cells (EPO)

Erythropoietin (EPO) and Human Growth Hormone (HGH)

EPO – Endurance Athletes HGH – Power Athletes

Benefits

EPO

- Increases RBC like blood doping

HGH

- Increases muscle mass acts like anabolic agents

Side Effects

EPO

- Thicker blood
- Clotting/Strokes

HGH

- Heart failure
- Abnormal hand/foot growth.

Advantages of PEDS

- Performer plays better, keep employed, keep careers going.
- Pressure can cause the performer to keep up with competition so PEDs can aid performance, increase in success leads to increase in income which may lead to increase in fame and greater recognition.

Disadvantage of PEDS

- Fines, bans, health risks and damage to reputation.
- Sports lose reputation because of the number of positive test results (athletics/cycling)
- Spectators become cynical about exceptional performances
- Sports could lose income through reduced numbers of spectators or through loss of sponsorship.

Tasks

1. Consider the PED's that these performers would take to improve their performance:
   - What would they take?
   - Why?
   - What are the side effects?







2. What are the advantages and disadvantages for taking PEDs in sport?

Question	Answer/Cover	Attempt
What is the function of stimulants?	They affect the central nervous systemIncrease alertness, reduce fatigue nad can increase competitiveness	
Who would benefit from using stiumlants?	Sprinters, speed swimmers	
What are the negative side effects of using stimulants?	Death, high blood pressure, anxiety, strokes, irregular heartbeat, addiction	
What is the function of narcotic analgesics?	Painkillers e.g. morphine used to mask pain from an injury or overtraining	
Who would benefit from using narcotic analgesics?	Anybody needing to recover from overtraining	
What are the negative side effects of using narcotic analgesics?	Low blood pressure, constipation, respiratory depression, exhaustian	
What is the function of anabolic steroids?	Increase muscle strength, help them train longer and harder	
Who would benefit from using anabolic steroids?	Weigh lifters	
What are the negative side effects of using anabolic steroids?	Liver damage, heart disease, addiction, aggression, sexual problems, deeper voice, kidney damage	
What is the function of peptide hormones (EPO)?	EPO regulates the production of red blood cells increasing ability of athletes blood to carry oxygen	
Who would benefit from using peptide hormones (EPO)?	Marathon runners, cycling	
What are the negative side effects of using peptide hormones (EPO)?	Thickening of blood, the heart has to work harder, heart attacks, stroke	
What is the function of beta blockers?	Reduce heart rate, muscle tension, and blood pressure, reduces affects of adrenaline, improve preciseness	
Who would benefit from using beta blockers?	Snooker players, archery, shooting events, darts	
What are the negative side effects of using beta blockers?	Nausea, weakness, heart problems	
What is the function of diuretics?	Reduce excess body fluids, reduce weight quickly, dilute the presence of illegal substances and remove them in urine	
Who would benefit from using diuretics?	Horse jockeys, boxers	
What are the negative side effects of using diuretics?	Dehydration, low blood pressure, cramps	
Which sports does blood doipng benefit?	Endurance sports e.g. marathon	
What is blood doping?	Involves the removal of blood a few weeks prior to competition, the blood is frozen and reinjected just before competition. Increases blood cells.	
What are the side effects of blood doping?	Thickening of the blood, infections, heart attack, blockage of blood vessels	

Technology can be used for:

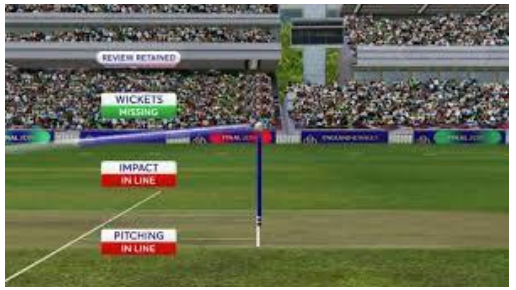
Making Decisions: Officials will use decision making technology to prevent wrong decisions, eg Hawkeye in tennis

Enhance Performance: Performance can allow for enhanced performance through heart rate monitors, monitoring diet / calorie counter

Analysing Performance: Analysis of performance can allow photos / videos / biomechanics

Rehabilitation: Rehabilitation through ice baths, hypoxic tents

Safety Reasons: Safety implications relating to cycle helmets, goal keeper protection in hockey



Impact of Technology on Spectators

- Creates excitement for the audience whilst they wait on decisions so it is a positive
- Audience can join in/interactive element by cheering / clapping / creates atmosphere
- Can frustrate spectators who do not like waiting or feel the entertainment has been interrupted
- Prevents unruly behaviour / hooliganism as the decision has been made by technology / less controversial
- Makes the event last longer / more value for money
- Less likely to criticise officials
- Performers recover quicker so spectators get to see their favourites more often
- Spectators can get involved in the analysis of their favourite performers, eg statistics / performance analysis
- Technology enhanced performers can perform to a higher standard which audiences will enjoy

Impact of Technology on Performers

- Greater care and support through the use of technology / prolonged career
- Quicker recovery rate means less time on the treatment table / more time performing
- Better understanding about their performance
- Over reliance on technology to understand performance / recovery is a negative
- Less frustrated with the official as the decision has been reviewed / proved / fairer outcome for the performers
- Reliance on technology to keep up with other competitors can cost money
- Easier to analyse competitors

Impact of Technology on the Sport

- Introduction of technology into the sport itself can make it more interesting and attract a larger audience and in turn bigger sponsorship deals.
- Officiating tech can slow the game down.
- More sponsorship opportunities, money can go back into the sport to improve it.

Impact of Technology on Officials

- Biggest improvements in recent years.
- Help make the correct decisions and ensure fairness.
- Take the pressure off having to make a decision and can ease the tension of players and spectators.
- Takes away a part of the referees job and can undermine decisions made.
- Officials can become over reliant.

Tasks

1. Technology is used for many reasons, research specific examples of technology that is used to/for:
   - Making Decisions
   - Enhance Performance
   - Analysing Performance
   - Rehabilitation
   - Safety Reasons

2. Consider the advantages and disadvantages of these types of technology for:
   - Performer
   - Sport
   - Spectator
   - Official

Question	Answer/Cover	Attempt
What are the negative effects of technology on sport?	Changes sport, slows down the game	
What are the positive effects of technology on sport?	Excitement, fairer, analysis of performance, improved design of sport, better viewing for spectators,	
What are the positive effects of technology on officials?	Helps make correct decisions, communicate between officials	
What are the negative effects of technology on officials?	Can be too reliant on technology, cost, slows game down	
Whata is the positive and negative impact of technology on sponsors?	Helps advertise products, leading to more sales, injuries, cheating and losing can negatively affect sponsor.	
What are the postive and negative impact of technology on spectators?	Enhanced experience at home, wider range of sports accessible, hawkeye, player cams, better informed about activity, can slow the game down	
What are the negative effects of technology on sport?	Changes sport, slows down the game	
What are the positive effects of technology on sport?	Excitement, fairer, analysis of performance, improved design of sport, better viewing for spectators,	
What are the positive effects of technology on officials?	Helps make correct decisions, communicate between officials	
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