THE CARDIOVASCULAR SYSTEM...

Impact on Health and Fitness

Physical activity can have the following effects on health and fitness:

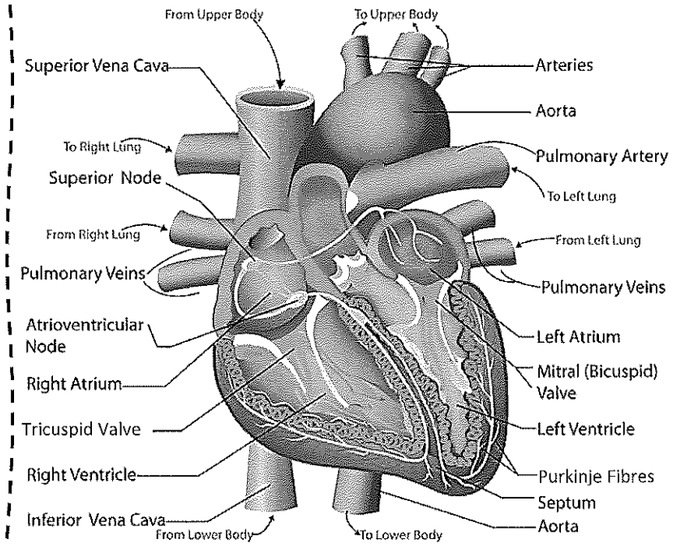
Health	Fitness
↓ Blood pressure	↑ Gaseous exchange
↓ Risk of coronary heart disease	↑ Lung volume
↓ Risk of stroke	↑ Oxygen available
↓ Plaque accumulation	↑ Stroke volume
↓ LDL cholesterol	↑ Cardiac output
↑ HDL cholesterol	↑ Heart efficiency
↑ Blood vessel width	↑ Capacity for exercise
	↑ Intensity of exercise

Coronary heart disease is the blockage of the coronary arteries (arteries that supply the heart muscle) caused by fatty build-up.

High blood pressure is a raised force of blood against the wall of the blood vessel which can be diagnosed by a systolic blood pressure greater than 140 mmHg and a diastolic pressure greater than 90 mmHg.

High levels of low-density lipoprotein **(cholesterol)** can lead to the formation of cholesterol plaques and restrict the size of the arteries.

Strokes occur when the amount of blood supplied to the brain is restricted by a blockage in the arteries supplying the brain.



Cardiac Conduction System

The conduction system involves the electrical impulses that cause the cardiac cycle of the heart. **The cardiac muscle is myogenic**, meaning it generates its own impulses. The electrical impulse occurs in the following order:

1. Sinoatrial node: the pacemaker of the heart – produces an electrical stimulus, resulting in the atria contracting.

2. Atrioventricular node: enables the ventricles to completely fill with blood by delaying the stimulus until after the AV valves shut.

3. The bundle of His: group of conduction cells, which branch into the Purkinje fibres.

4. Purkinje fibres: in the ventricular wall, conduct the electrical impulse from the bundle of His and cause ventricular contraction.

Atrial depolarisation:
Stimulus from the SA node travels across the atria, causing atrial contraction.

Ventricular depolarisation:
The effect that the AV node has on the ventricles by causing them to contract by providing an electrical stimulus.

Atrial and ventricular repolarisation:
Occurs during a brief time period following depolarisation and describes the electrical impulse returning to a baseline value.

The Relationship between Heart Values...

Cardiac output (Q): The volume of blood ejected by the heart per minute (ml/min) = **Heart rate (HR):** The number of times the heart beats per minute (bpm) × **Stroke volume (SV):** The volume of blood ejected from the heart per beat (ml)

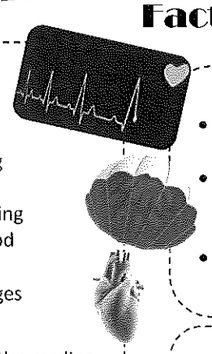
Heart values can differ according to whether someone trains or not and according to different intensities of exercise:

- **Trained individuals** will have a **lower resting HR** than untrained individuals and a **greater Stroke Volume**. Cardiac outputs will be similar but the trained athlete's heart will work less (fewer beats) as it can force more blood out with each contraction.
- **Sub-maximal exercise** will see a plateau in cardiac output when a steady state is reached as the cardiovascular system is able to supply the working muscles with adequate oxygen.
- **Maximal exercise** will result in a greater cardiac output than sub-maximal exercise and this will peak and then rapidly decline as maximal exercise cannot be sustained.

Cardiovascular Drift and A-VO_2 Difference

- **Cardiovascular drift** – the increase in heart rate which occurs despite no change in the intensity of exercise.
- **Arteriovenous oxygen difference (A-VO_2 diff)** – the difference in oxygen concentration between the arteries and veins.
- High-intensity exercise will result in a greater A-VO_2 diff as more oxygen is taken out of the arteries to fuel muscular contractions. However, a plateau will be reached when more oxygen cannot be removed from the arteries.
- Trained athletes will have higher starting A-VO_2 diffs and will experience a bigger change during exercise.
- Regular training can increase the A-VO_2 diff due to: *greater capillary density, greater alveoli density* and *greater myoglobin in the muscles.*

Factors Regulating Heart Rate



Neural

The vasomotor centre responds to changes detected by:

- **Baroreceptors:** sensors detecting changes in blood pressure
  Chemoreceptors: sensors detecting chemical changes within the blood
- **Proprioceptors and mechanoreceptors**: detect changes in body position

These receptors send an impulse to the cardiac control centre in the medulla oblongata which sends an impulse to the SA node either via:

- **Parasympathetic nervous system** (Vagus nerve) to slow heart rate
- **Sympathetic nervous system** (acceleratory nerve) to increase heart rate

Hormonal

- **Adrenaline** and **noradrenaline** released from adrenal glands.
- Adrenaline is released into the bloodstream, and stimulates the adrenergic receptors and SA node found in the heart, increasing heart rate.
- Release of adrenaline before exercise is known as the **anticipatory rise**.

Intrinsic

- **Higher temperature** caused through exercising causes increased heart rate as heart works harder to get blood to the skin so heat can be lost as radiation.
- It also concerns the venous return mechanism.

Venous return:

The rate at which blood returns to the heart.

As intensity increases:
Blood redistribution needs to be quicker otherwise cardiac output decreases. Exercise increases it through the **muscle pump** and **respiratory pump** which force blood back to the heart. This process is also aided by **pocket valves** in the veins, **smooth muscle** in the walls of the blood vessels and **gravity**. Venous return is quickest in the arteries and during **systole** as systolic blood pressure is larger than diastolic.

During recovery the lower venous return results in a lower stroke volume. This is due to reduced stretching of the ventricles with a low venous return (**Frank-Starling law**).

Transportation of Oxygen

Oxygen is transported within the body in association with:

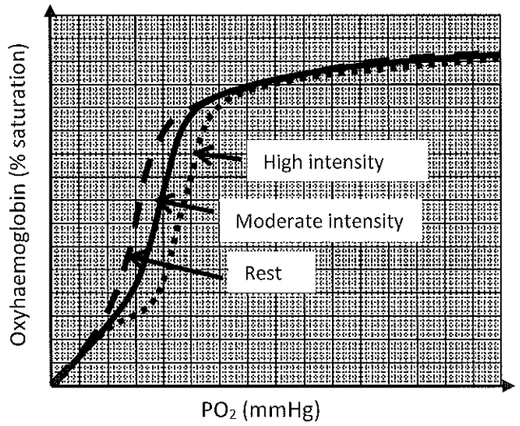
- **Haemoglobin** – the oxygen-carrying component of red blood cells
- **Myoglobin** – the oxygen-carrying component of the muscle tissue

The graph shows an oxyhaemoglobin dissociation curve which displays the **Bohr shift** during exercise of different intensities.

The Bohr shift is demonstrated by the line shifting to the right as the conditions within the blood become more acidic (reduced pH due to increased levels of CO_2) during higher-intensity exercise.

Factors influencing Bohr shift include:

1. Increase in CO_2
2. Decrease in pH – due to increase in CO_2
3. Increase in temperature



Redistribution of Cardiac Output

During exercise our blood needs to redistribute to working muscles. This is done via the methods outlined below:

Vascular shunt

Mechanism which directs blood to the exercising muscles through vasodilation and vasoconstriction.
Redistribution of blood during exercise:

- ↑ blood flow to the skeletal muscles in order to supply them with oxygen and nutrients and to remove carbon dioxide
- ↑ blood flow to the heart to provide additional oxygen, as it has to work harder during exercise
- ↑ blood flow to the skin in order to regulate body temperature
- ↓ blood flow to some abdominal organs to allow for greater blood flow to active body parts

Arterioles

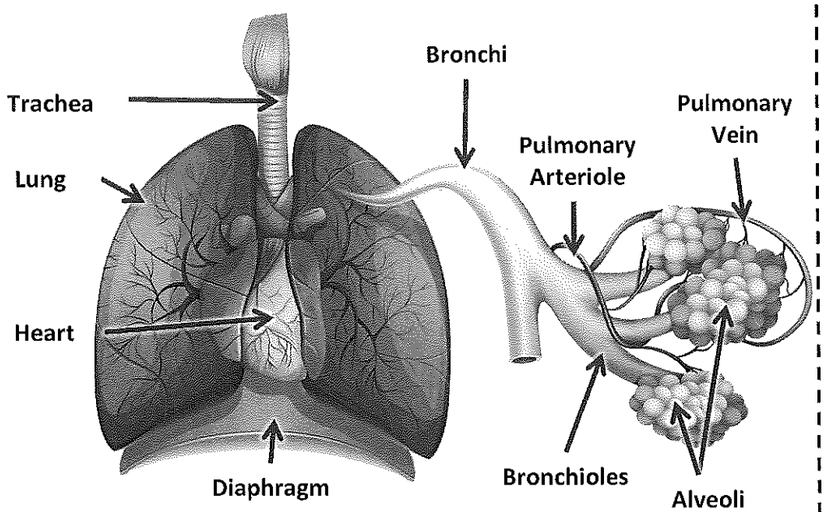
- Widen (vasodilation) to allow more blood through
- Narrow (vasoconstriction) to reduce blood flow

Pre-capillary sphincters

Allow / do not allow the flow of blood into the capillaries, where gas exchange occurs.

THE RESPIRATORY SYSTEM...

The respiratory system consists of a number of structures (outlined in the diagram below) which allow gasses to be transferred between the body and the external environment. This is an important process during exercise when large volumes of oxygen are required by the muscles and large volumes of carbon dioxide need to be removed from the body.



At the alveoli:
Oxygen moves from a highly concentrated area (alveoli) where it has a high partial pressure to an area of low concentration (the blood) where the partial pressure is lower. CO_2 diffuses in the other direction.

Gas exchange is efficient because:

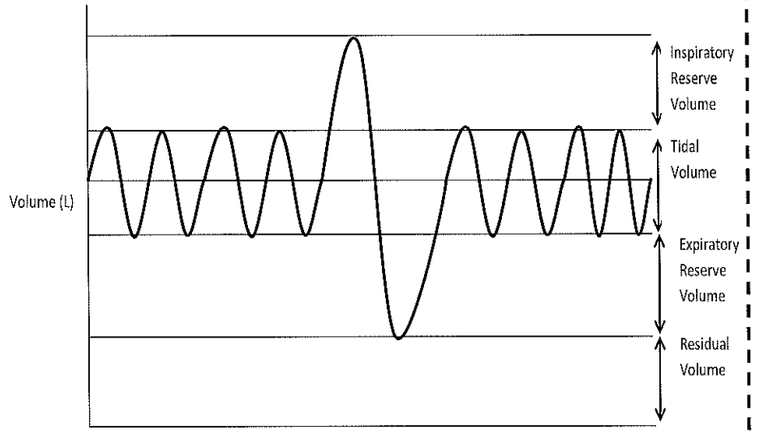
- large number of alveoli
- large number of capillaries
- thin membrane between alveoli and capillary

Lung Volumes

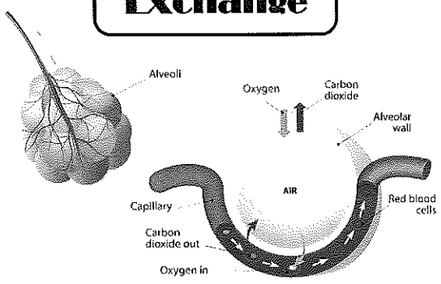
There are a number of different lung volumes which can be measured in order to determine how a person's respiratory system is functioning. These volumes will change depending on the level of physical activity, the training status and the health of the person.

	Tidal volume	Minute ventilation	Residual volume	Expiratory reserve volume	Inspiratory reserve volume
Definition	The amount of air normally breathed in/ out with each breath	The volume of air inspired /expired each minute	The volume of air that remains in the lungs after maximal expiration	The amount of air that can be expired on top of the tidal volume	The amount of air that can be inspired on top of the tidal volume
Typical resting value	500 ml	6.0 L/min	1,200 ml	1,200 ml	3,100 ml
Change during exercise	Increases	Increases	Remains almost the same but may decrease slightly	Decreases	Decreases

Minute ventilation: The volume of air inspired or expired per minute = **Breathing frequency:** The number of breaths per minute (breaths per minute) × **Tidal volume:** The amount of air inhaled/exhaled with each breath (ml)

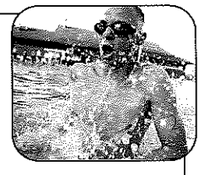


Gas Exchange

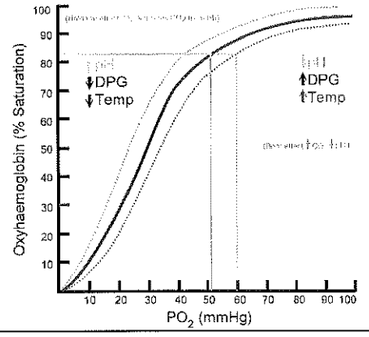


At the muscles:
At rest there is a small arteriovenous difference. When exercising, there is a higher arteriovenous difference, which increases the pressure gradient for gas diffusion.

Gas Exchange during Exercise



Dissociation of oxyhaemoglobin
In a high partial pressure of oxygen (e.g. at the lungs), oxygen binds more readily to haemoglobin. As this partial pressure decreases (e.g. at the exercising muscles) oxygen is more readily released. As exercise intensity increases, the partial pressure of oxygen decreases and so oxygen is easily released from haemoglobin.



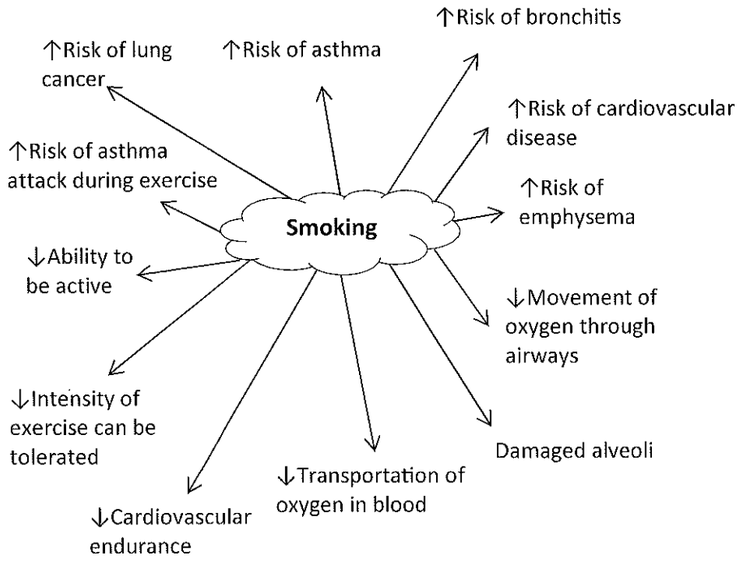
As exercise intensity increases, there is a larger **pressure gradient** between CO_2 and O_2 levels at the sites of gas exchange.

Regulation of Breathing Rate

The respiratory control centre of the brain is made up of the **inspiratory control centre** and the **expiratory control centre**. These two centres work together to regulate breathing at rest and during exercise without conscious thought and, therefore, require different receptors to send them information in order to control breathing rate.

1. **Neural**
   The respiratory centres regulate breathing rate by increasing or decreasing respiratory muscle activation through **sympathetic** or **parasympathetic** stimulation respectively. Neural stimulation is dependent on the following receptors:
   - **Proprioceptors** (detect movement, tension and force)
   - **Baroreceptors** (detect degree of lung inflation)
   - **Thermoreceptors** (detect changes in temperature)
2. **Chemical**
   Chemoreceptors in the aorta and medulla oblongata detect changes in blood pH level. As CO_2 increases, breathing rate increases as a result of stimulation from the inspiratory control centre.
3. **Hormonal**
   Breathing rate can be increased by the release of the hormone adrenaline from the adrenal glands.

Impact of Smoking on Respiration



The Neuromuscular System

Muscle Contraction during Exercise and Recovery

There are two different types of muscle fibres – slow twitch and fast twitch. There are two types of fast-twitch fibres – fast oxidative glycolytic (type IIa) and fast glycolytic (type IIb). The characteristics of each fibre are shown in the table below:

Slow oxidative (I)	Fast oxidative glycolytic (IIa)	Fast glycolytic (IIb)
• Small motor neuron size • Large myoglobin content • High oxidative capacity • Slow contraction time • Suited for aerobic exercise • High resistance to fatigue • Low force production • Low glycolytic capacity • High capillary density	• Large motor neuron size • Intermediate myoglobin content • High oxidative capacity • Fast contraction time • Suited for lengthy anaerobic exercise • Medium resistance to fatigue • High force production • High glycolytic capacity • Medium capillary density	• Large motor neuron size • Small myoglobin content • Low oxidative capacity • Fastest contraction time • Suited for short anaerobic exercise • Low resistance to fatigue • Highest force production • High glycolytic capacity • Low capillary density
Endurance events, e.g. long-distance running	Swimming	100 m sprint

Muscle fibre recruitment
Muscle fibre recruitment is dependent on the intensity of the exercise; higher-intensity exercise requires more force, with lower-intensity exercise requiring less force.

The Size Principle (Henneman et al. 1974)
Smaller motor units are recruited first as they have a smaller firing threshold than larger motor units.

The Recruitment of Muscle Fibres

Structure and role of motor units

Key structures:

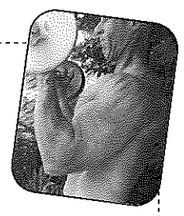
- **Myelin sheath** acts as an electrical insulator around the axons.
- **Axons** are extensions of a nerve cell that carry an impulse.
- **Myofibrils** are contractile structures of the muscle consisting of actin and myosin.
- **Sarcolemma** is the cell membrane.
- **Synaptic vesicle** is where acetylcholine is stored.
- **Synaptic cleft** is the gap between neurons.
- **Motor end plate** is where the action potential from an action travels to stimulate a muscle.

A **motor unit** consists of
- A motor neuron
- The muscle fibres that it stimulates

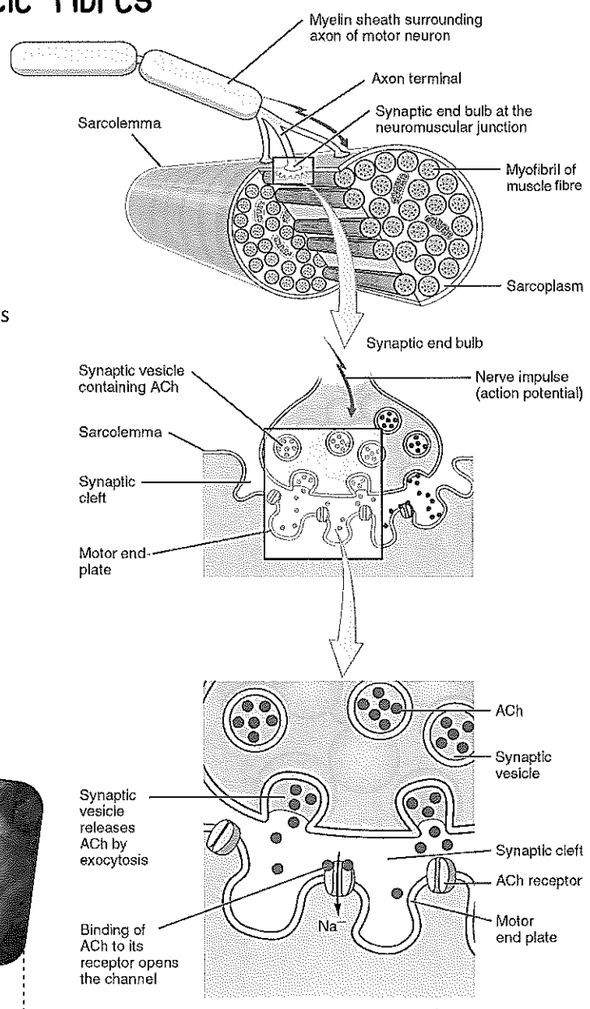
Nervous stimulation of a motor unit

A motor unit needs to be stimulated to enable muscular contraction:

1. A neuron becomes depolarised, firing an action potential (an electrical impulse that acts as a signal).
2. The action potential reaches the neuromuscular junction.
3. This causes the neurotransmitter acetylcholine to move to the motor end plate.
4. The motor end plate becomes depolarised, resulting in muscular contraction.



- Motor units vary in the number of muscle fibres that they stimulate.
- The fibres are made up of only one type.
- The brain recruits smaller motor units before larger motor units.
- Smaller motor units consist of slow-twitch fibres.
- Larger motor units consist of fast-twitch fibres.



The Nervous Systems

The autonomic nervous system is responsible for subconsciously controlling muscular contractions.

There are two systems which make up the autonomic nervous system:

- The **parasympathetic** nervous system is responsible for actions that occur when resting.
- The **sympathetic** nervous system is responsible for actions when active.

Both nervous systems innervate the muscle tissues by sending a nervous impulse to them.

Proprioceptive Neuromuscular Facilitation

Proprioceptive Neuromuscular Facilitation:

- a form of stretching which aims to overcome the stretch reflex
- an isometric contraction is performed when the muscle is stretched to its limit

Role of muscle spindles:

- sensory receptors
- found in the centre of the muscle
- provide information regarding the length of the muscle to the brain
- this information is used to initiate the stretch reflex when the muscle is stretched to its limit

Role of Golgi tendon organ:

- sensory receptor
- found at the connection of the muscle with the bone
- detects changes in tension of the muscle
- initiates the Golgi-tendon reflex which reduces muscle tension when it is high

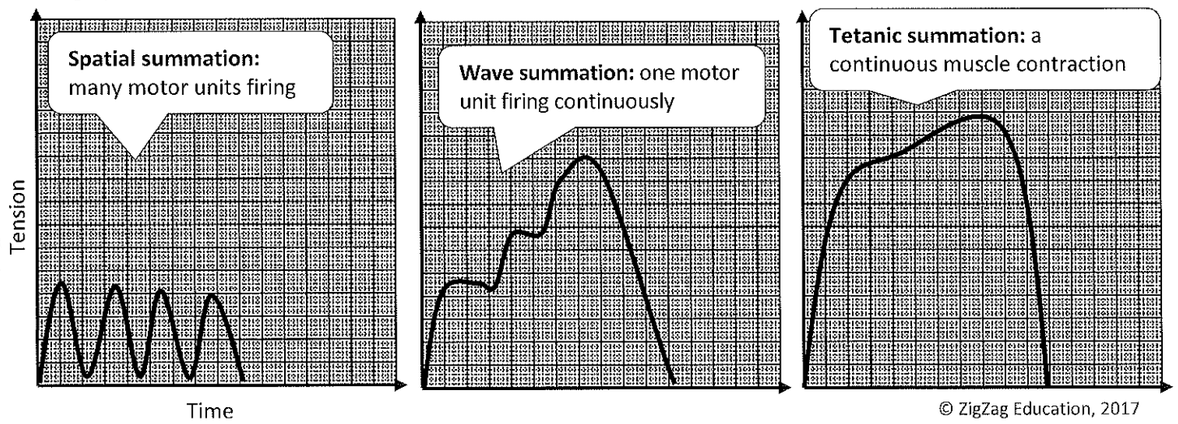
'All or none' law

Each muscle fibre controlled by a motor unit is either fully contracted or not contracted at all.

They can contract in different ways depending on how they are innervated.

Therefore, a muscle fibre cannot partially contract.

The way that individual motor units are recruited determines the amount of force that is produced in a muscle. The graphs below show three different types of motor neuron recruitment.



The Musculoskeletal System and Movement Analysis

Joint	Type	Articulating Bones	Joint Action	Agonist	Antagonist
Shoulder	Ball and Socket	Scapula and humerus	Flexion	Anterior deltoid	Latissimus dorsi
			Extension	Latissimus dorsi	Anterior deltoid
			Adduction	Posterior deltoid and latissimus dorsi	Middle deltoid and supraspinatus
			Abduction	Middle deltoid and supraspinatus	Posterior deltoid and latissimus dorsi
			Horizontal abduction	Latissimus dorsi	Pectorals
			Horizontal adduction	Pectorals	Latissimus dorsi
Elbow	Hinge	Humerus, radius and ulna	Flexion	Biceps	Triceps
			Extension	Triceps	Biceps
Hip	Ball and Socket	Femur and pelvis	Flexion	Iliopsoas and hip flexors	Gluteals
			Extension	Gluteals	Hip flexors
			Adduction	Adductor brevis, longus and magnus	Tensor fascia latae and gluteus medius and minimus
			Abduction	Tensor fascia latae and gluteus medius and minimus	Adductor brevis, longus and magnus
			Horizontal abduction	Hip adductors	Tensor fascia latae and gluteus medius and minimus
			Horizontal adduction	Tensor fascia latae and gluteus medius and minimus	Hip adductors
Knee	Hinge	Femur and tibia	Flexion	Hamstrings	Quadriceps
			Extension	Quadriceps	Hamstrings
Ankle	Hinge	Talus, tibia and fibula	Plantar flexion	Gastrocnemius	Tibialis anterior
			Dorsiflexion	Tibialis anterior	Gastrocnemius

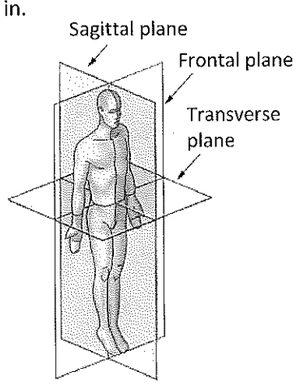
Planes of Movement

There are three planes of movement, each with an associated dimension for your body to move in.

Frontal:
- this plane splits the body into front and back
- any sideways movement in line with this plane occurs here
- movements: adduction and abduction

Transverse:
- this plane splits the body into upper and lower sections
- any rotational motion occurs here
- movements: horizontal abduction and adduction

Sagittal:
- this plane splits the body into a right and left side
- any forward or backward motion occurs here
- movements: Flexion, extension, hyperextension, plantar flexion, dorsiflexion



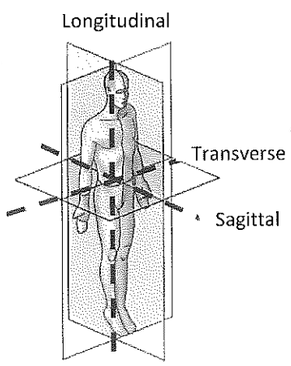
Axes of Rotation

There are three axes of rotation, each with an associated direction for your body to rotate.

Transverse:
- runs from the left side of the body to the right
- rotation in this axis occurs when moving in the sagittal plane

Sagittal:
- runs from the front of the body to the back
- rotation in this axis occurs when moving in the frontal plane

Longitudinal:
- runs from top to bottom
- rotation in this axis occurs when moving in the transverse plane



Movement Examples

Front Somersault
Plane: Sagittal
Axis: Transverse

Discus Throw
Plane: Transverse
Axis: Longitudinal

Cartwheel
Plane: Frontal
Axis: Sagittal

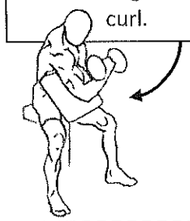
Types of Contraction

Muscles have many different roles within the body, namely **movement**, **heat production**, **digestion** and **maintaining posture**. The capability of the muscles to undergo contraction and relaxation is the key enabler of movement. Muscles can contract in different ways depending on what action they are trying to perform.

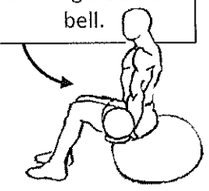
Muscle contractions aren't all the same. Sometimes muscles contract and lengthen, sometimes they contract and shorten and sometimes they contract and don't change length at all.

Isotonic:
The muscle changes length as it undergoes contraction. This contraction can be separated into **Concentric** and **Eccentric**.

Concentric:
The muscle *shortens* as it undergoes contraction, e.g. lifting a dumb-bell during a bicep curl.



Eccentric:
The muscle *lengthens* as it undergoes contraction, e.g. lowering a dumb-bell.



Isometric:
The muscle does not undergo any change in length when it contracts. The muscle contracts to maintain the stability of the position of a body, e.g. a gymnast performing a handstand.

Analysis of Movement

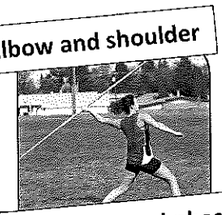
Analysing movement is a key concept of biomechanics, and is completed to help improve sport performance by improving the efficiency of sporting movements, and identifying how technique could be improved.

When analysing movement you should refer to:
- the movement produced
- the plane of movement
- the axis of movement
- the type of muscle contraction taking place

Here are some examples of movement analysis in sport:

Elbow and shoulder

Movement produced: Extension (elbow), Hyperextension (shoulder)
Plane of movement: Sagittal
Axis of movement: Transverse
Muscle contraction taking place: Concentric Eccentric



Javelin withdrawal phase

Knee and ankle

Movement produced: Flexion (knee), Plantar Flexion (ankle)
Plane of movement: Sagittal
Axis of movement: Transverse
Muscle contraction taking place: Isotonic Concentric

Kicking backswing

Hip

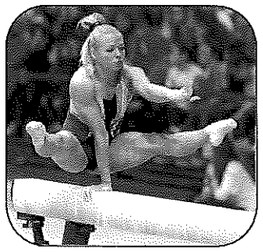
Movement produced: Abduction
Plane of movement: Frontal
Axis of movement: Sagittal
Muscle contraction taking place: Isometric

Holding the leg outstretched

Classification of Skills

Difficulty (simple–complex)

How technically difficult the skill is to perform

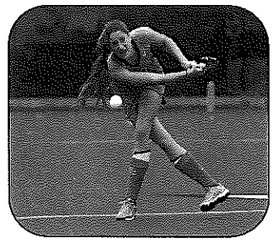


Simple **Complex**

- Cognitive processes are less of a priority
- Few subroutines
- Decision-making and coordination are important
- Multiple subroutines

Environmental influence (open–closed)

How much of an influence the environment has on a skill

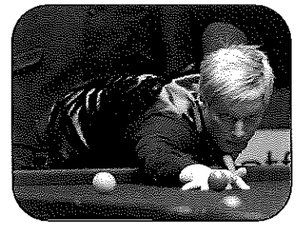


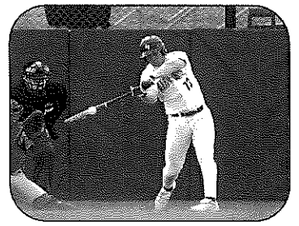
Open **Closed**

- Environment has an impact on the skill
- Performance should be adaptable
- Decision-making is needed
- Environment does not impact on the skill
- Self-paced
- Much less decision-making is needed

Pacing (self-paced–externally-paced)

How much control the performer has over the timing of the skill





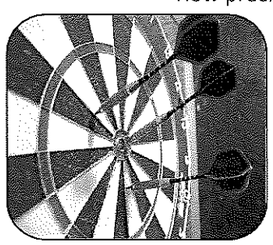
Self-paced **Externally-paced**

- Performer is in control of the timing
- Closed skills
- Performer is not in control of the timing
- Open skills
- Requires decision-making

Remember that when athletes develop one skill, this can have an impact on their ability to learn or perform another skill. This process is called the transfer of learning and you can find more information about this on mind map 7

Muscular involvement (gross–fine)

How precise the movement is



Fine **Gross**

- Requires high levels of control
- Uses small muscle groups
- Requires coordination
- Requires lower levels of control
- Uses large muscle groups
- Involves basic motor skills

Continuity (discrete–serial–continuous)

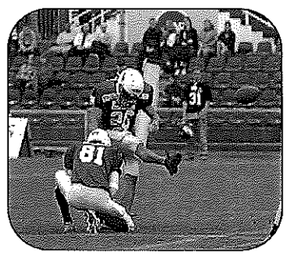
How apparent the start and end of the skill are

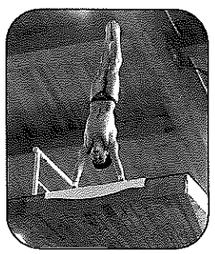
Discrete **Serial** **Continuous**

- Has a clear beginning or end
- Short skill
- Can be easily split into a series of discrete skills
- Particular order of subroutines
- No obvious beginning or end point
- Lengthy skill
- Short skill

Organisation (low–high)

The complexity of the combination of the subroutines

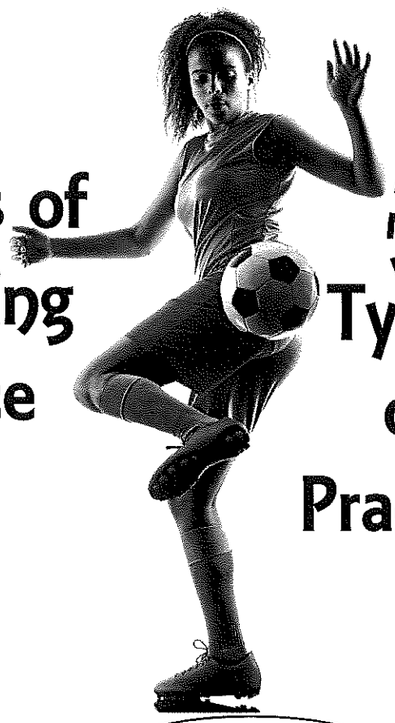




Low **High**

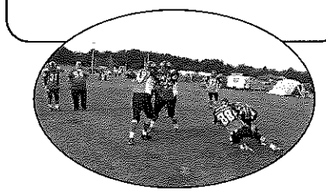
- Simple skills
- Discrete subroutines
- Little cognitive processes needed
- Complex skills
- Hard to separate subroutines
- High level of cognitive processes needed

Methods of Presenting Practice



Whole Practice

Skill is learned in its entirety



Example

Learning the triple jump by performing the three key components (hop, skip and jump) together

Advantages

Useful for simple, continuous skills

Appropriate for low organisation skills

Promotes kinaesthetic awareness

Disadvantages

Can overload novice performers

Difficult to learn complex skills this way

Whole-part-whole Practice

Practising the skill in its entirety and then breaking the skill down into its subroutines, before completing the skill as a whole again

Example

Practising all three stages of the triple jump together and then learning the hop, skip and jump individually before combining them again

Advantages

Useful for complex skills which can be clearly separated into individual subroutines

Useful for serial skills

Enables some kinaesthetic feel

Disadvantages

Time-consuming

Not useful for highly organised skills

Can reduce kinaesthetic understanding of skills

Progressive-part Practice

Learning the individual subroutines in chronological order, and then joining these together in order. Eventually the skill is learned in its entirety.

Example

Learning the triple jump by practising the hop, then the skip, then the hop + skip, then the jump, then the hop + skip + jump

Advantages

Useful for highly organised skills

Useful for serial skills

Aids correct timing of each subroutine

Enables understanding of how the subroutines interact

Disadvantages

Disjointed feel to the skill

Can make the skill flow less effectively

Types of Practice

Massed Practice

Continuous practice of simple skills without breaks

+ Useful for continuous skills
+ Useful for those with high fitness and motivation levels
+ Allows motor programmes to be stored
+ Good for improving fitness
– Can become repetitive and tedious
– Should not be used during dangerous skills
– Can be hard to focus for long periods

E.g. practising dribbling in football by continuously running through cones

Distributed Practice

Practice is interrupted with breaks for discussion and recovery

+ Useful for those with low fitness and motivation
+ Useful for complex skills which would benefit from discussion
+ Useful for discrete skills
+ Provides time for mental rehearsal
– Can be time-consuming
– Breaks can be unnecessary for experienced athletes

E.g. learning a gymnastic routine by stopping to discuss each subroutine

Mental Practice

Creating a mental image of the skill being performed

+ Can allow the performer to build up their confidence by imagining successful performance
+ Useful for controlling arousal
+ A good technique for novices
– Not as useful as physical practice when used alone
– Limited effect for simple skills

E.g. imagining yourself perform successful penalty flicks in hockey before attempting to perform one

Varied Practice

Practising a skill in different situations

+ Environment and situation can be changed by the coach, preparing the performer for various match conditions
+ Improves selective attention
+ Useful for open skills
+ Makes training more interesting
– Often requires learning using a fixed method first
– Time-consuming
– Difficult for novice performers who find it hard to make decisions
– Can't be used for closed skills

E.g. practising an attacking move in rugby against different defensive lines

Transfer of Skills

Skill transfer can occur throughout an athlete's development. The more experience an athlete has of a learned skill, the more of an effect (either positive or negative) it will have on the future skill.

Zero

Proficiency in one skill has no impact on the learning of a new skill

Bi-lateral

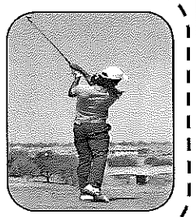
When the learned skill using one limb can be transferred to the opposite limb

Positive

Previously learned skill positively impacts on previously unlearned skill

Negative

Previously learned skill negatively impacts on previously unlearned skill



How to optimise positive transfer and limit the effect of negative transfer:

- Make the performer aware of any similarities and differences between the current and future skill.
- Do not attempt the complex skills too early, make sure that the basic skills are learned first.
- Motor skills should be fully learned, as this will lead to a solid foundation that can form the basis of a new skill.

Principles and Theories of Learning

Operant Conditioning

- Uses **either positive or negative reinforcement**, to encourage the correct response to a stimulus.
- Positive reinforcement is used following a successful performance, through the use of a reward.
- Negative reinforcement is used following an unsuccessful performance, via removing an unpleasant stimulus.
- Punishment is used following an unsuccessful performance and involves adding an unpleasant stimulus or taking away a positive stimulus.

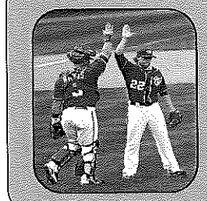
Bandura's Observational Learning

There are four stages of observational learning:

1. **Attention:** the learner must closely attend to the skill being performed accurately. This is more effective if the learner has much in common with the performer of the skill.
2. **Retention:** storing the skill in the memory enables recall.
3. **Motor reproduction:** the learner needs to have the physical skills to be able to complete the skill.
4. **Motivation:** the learner needs to be motivated to learn the skill and reproduce it themselves.

Movement Skills

Stimulus → Stimulus response bond → Response



An example of positive reinforcement: a baseball player congratulating their teammate for good play.

- Strengthened through positive or negative reinforcement
- Weakened through punishment

Cognitive Theories

- The learner needs to develop an understanding of the skill, rather than how to react to a stimulus.
- The learner uses perception to aid their understanding.
- Gestaltists state that skills should be understood in their entirety.
- Insight theory: a sudden understanding, or insight, of the skill leads to a rapid improvement in performance.

Social Development Theory

- Our behaviour is dependent on the behaviours of others.
- We change our behaviour depending on the situation that we are in.
- We adapt so that we display the same behaviour as group norms.
- Different groups will have a different group norm depending on the demands placed upon them.

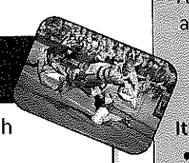
Stages of Learning

Cognitive

- Mental practice
- Inconsistent level of performance, with simple errors occurring
- Guidance is required
- The performer struggles when faced with different situations in which to perform the skill
- Attentional focus is mainly directed to the skill
- Feedback: external, terminal

Associative

- More physical practice
- Large improvement in performance level, with higher consistency and fewer errors
- Errors are made during complex skills
- Improved understanding of the skill
- Balance between conscious and autonomous control
- Feedback: less external and more intrinsic, positive



Autonomous

- Consistent high performance level, with very few errors
- Analysis of physical practice
- Performance is adaptable
- Thorough understanding of the skill
- No conscious thought required
- Feedback: intrinsic, concurrent, negative

A **learning plateau** occurs when an athlete stops making progress and performs to the same level for a period of time.

It can occur due to:

- lack of physical development
- poor learning at an earlier stage
- tiredness
- boredom
- lack of motivation
- bad coaching

Moving past a learning plateau:

- developing physically
- providing adequate rest
- increase motivation
- provide rewards
- set appropriate goals

Guidance and Feedback

Visual Guidance

Visual guidance consists of the coach using visual cues to encourage learning. It is very important that any demonstration given is accurate, as an inaccurate demonstration could result in the incorrect technique being emulated. Combining visual guidance with the use of mental rehearsal enhances its effectiveness, as strategies such as imagery can help the learner retain the key teaching points.

Advantages:
This guidance style allows the learner to concentrate on the key components that determine the success of the whole skill. This is also an effective style of guidance to use when the learner is at the cognitive stage of learning and the skill is simple. It can also be used to show a performer what they are doing wrong.

Disadvantages:
Visual guidance often does not fully explain the reasoning behind the coaching points, whereas verbal guidance does. Therefore, some individuals at the cognitive stage of learning may prefer to have more guidance to allow them to move on from this stage.

Verbal Guidance

Verbal guidance consists of the coach using verbal instructions to clearly explain to the learner how the skill should be correctly performed. When using verbal guidance, the coaching points should be accurate, concise and relevant.

Advantages:
It can provide the additional information that visual guidance does not. It can also be used to improve specific areas of weakness.

Disadvantages:
Providing information in this style can overload the performer with information. It can be hard for the performer to imagine how they can manually perform the skill.

Intrinsic Feedback

Intrinsic feedback comes from within the performer, relating to how the performer thought the performance felt. Information on the performance is gained from kinaesthetic feedback.

Advantages:
Improves the performer's kinaesthetic awareness. Useful for elite athletes to use as they rely on less external feedback.

Disadvantages:
Learners at the cognitive stage of learning may not understand how a correct movement is supposed to feel.

Positive Feedback

Used in response to a successful performance, and is used as a method of positive reinforcement. For example, a coach could praise his athlete when they perform well.

Advantages:
Increases self-efficacy, especially in the early stages of learning. Can lead to reinforcement of the correct responses.

Disadvantages:
Can lead to over-confidence if used repeatedly.

Extrinsic Feedback

Extrinsic feedback comes from outside of the performer, in the form of the information gathered by the performer's senses.

Advantages:
Useful for those in the cognitive and associative stages of learning.
Improves focus and motivation.

Disadvantages:
Disregards any kinaesthetic awareness of the movement.
The performer becomes over-reliant on external gratification.

Negative Feedback

Used in response to an unsuccessful performance, and is used as a form of negative reinforcement. As a performer progresses through the stages of learning, this feedback becomes more intrinsic.

Advantages:
It can prevent future errors being made. It can improve motivation and focus.

Disadvantages:
It can reduce self-efficacy and motivation, particularly for those in the cognitive stage of learning.

Manual Guidance

Manual guidance involves the coach physically altering the learner's body position to ensure that their physical performance of the skill is correct. This style of guidance is primarily used when learning how to perform a dangerous and complex skill.

Advantages:
Increases confidence levels.
Reduces the chance of injury during dangerous skills.
Allows a complex skill to be broken down into simpler parts.

Disadvantages:
The learner can be over-reliant on physical guidance to perform the correct movements. It does not allow for any improvement in kinaesthetic awareness.

Knowledge of Performance

Knowledge of performance involves feedback referring to the quality of the movement. An example may be an athlete using video analysis of a basketball free throw.

Advantages:
Helps to identify the finer details of an action, and explain the effect that they have on performance.

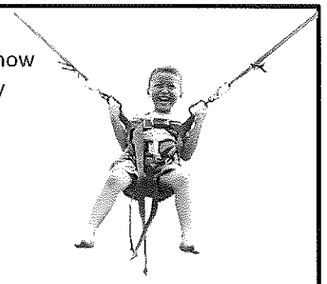
Disadvantages:
Can provide too much information for a learner. It can also not allow the learner to appreciate a whole feel for a movement.

Mechanical Guidance

Mechanical guidance involves the coach using equipment to help the performer learn how to perform specific sections of a movement correctly. This style of guidance is generally used during the learning of a dangerous and complex skill.

Advantages:
This can make the skill safer.
It can help to provide a general feel of the movement required to perform correctly.
It can aid the practice of injured or disabled performers.

Disadvantages:
This can lessen the accuracy of the learner's internal feedback. The learner can be over-reliant on the equipment to perform the movements correctly.

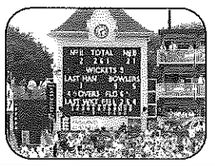


Knowledge of Results

An **extrinsic form of feedback** which enables a benchmark against which the performer can evaluate their present performance compared with past performances.

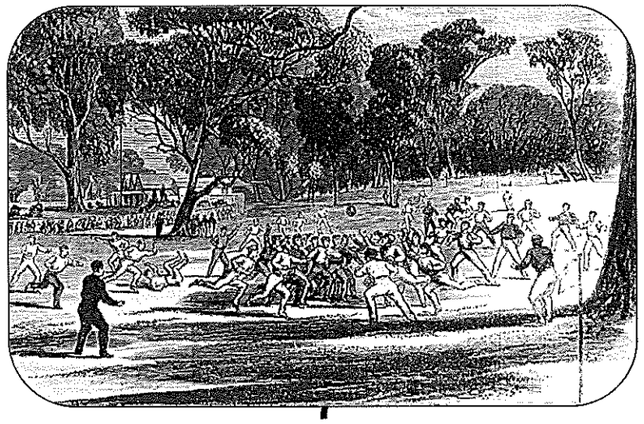
Advantages:
It is easy to identify progression in performance, and if successful can improve task persistence.

Disadvantages:
Overuse can lead to reduced performance enjoyment. It does not explain why a performance was successful or unsuccessful, which may make it harder to replicate a successful performance.



Pre-industrial Britain (pre-1780)

How social and cultural factors shaped the characteristics of, and participation in, sports and pastimes in pre-industrial Britain



Availability of money
Wagering from the upper class enabled the lower class to make money from sports.

Law and order
Cruel and harsh living conditions were replicated in the violent nature of popular recreation.

Influenced by...

Social class

Type and availability of transport
Games were restricted to local areas as the lack of transport meant that those participating could not travel far to play other teams.

Education/literacy
Many of the population were illiterate, meaning that rules needed to be simple to be understood. They were never written down.

Availability of time
- Long working hours meant that sporting events were occasional.
- Sport was played on holidays, festivals and holy days.

Gender
- Men had greater participation rates than women.
- Women played sports such as smock races and bat and ball games.

Upper Class

Upper class signified those with money and who owned large amounts of land, and did not partake in manual labour.

The upper class took part in rational recreation such as real tennis, with those from the lower class not having access to this sport.

Wagering was involved in sport in pre-industrial Britain. Wagering allowed the upper class to bet on lower-class sports and take on the role of spectators.

Those from the lower class were manufacturers with little money, and who lived in poverty in cramped poor conditions. The working conditions of the lower class meant that sport was irregular due to the limited time they had to participate. Lower class participants who took part in popular recreation, such as mob football, were violent due to the lower class enjoying the violent nature of sport.

Lower Class

Case study of real tennis in pre-industrial Britain

- **Real tennis** was a game for the upper class
- It required expensive equipment
- It required access to appropriate facilities
- It was considered sophisticated
- No access for the lower class
- It had a set of written rules
- Participants were expected to compete in a fair manner
- Participants were expected to understand the rules and play within them

Characteristics of **rational recreation:**
- Organised
- Had codes of conduct
- Promoted fair play
- Considered respectable
- Exclusive to the upper class
- Played in urban environments
- Played in specific facilities

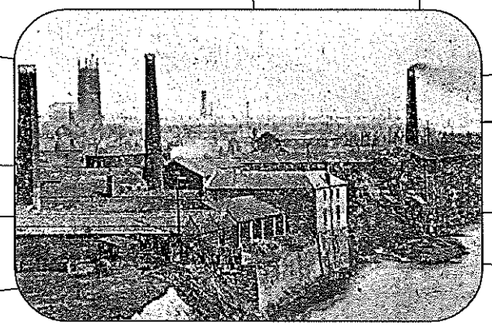
Characteristics of **popular recreation:**
- Violent
- Local
- Rural
- Irregular
- Large teams
- Lower-class participation
- Unwritten and simple rules

Case study of mob football in pre-industrial Britain

- **Mob football** had no skill development, no rules and was brutal in nature
- Only the lower class would take part
- Games were very occasional, usually only being played on religious holidays when the lower class had time off work
- The participants risked injuries and loss of income due to time off work
- They were large-scale games often played by local villages
- Due to the violent nature, property was often damaged

Industrial and Post-industrial Britain (1780–1900)

How social and cultural factors shaped the characteristics of, and participation in, sport between 1780–1900 in Britain



Status of amateur and professional performers

Upper class were amateurs while the **lower class were professionals**.
Professionals were banned from playing in some competitions, while high membership fees kept clubs exclusive to the upper class.

The British Empire

The British Empire **spread the popularity** of sports being played at home to the colonies. This largely occurred as former **public school boys took up leading roles** within the military and spread the games that they had played at school.

Changing role of women in sport

Women had less opportunity to participate as sport was **perceived as being masculine and physical**, which led many to **believe sport was unsuitable for women**. Women were also affected by their class, with upper and middle classes participating in rational recreation and the lower class restricted by disposable income. Rational recreation characterised by rules and skill was seen as more socially acceptable by females.

Transport

An improvement in transport, particularly in railways, allowed teams and spectators to **travel** across the nation to **play and watch** their sports. This in turn led to a structured approach to sport and allowed spectators to follow their teams.

Industrial revolution / provision through factories

At first **industrialisation meant there was reduced time for sports**, as a result of **increased working hours** in factories. There was also reduced space as many workers moved into **urban** industrial cities for work. However, the middle class began to see the benefits that sport had on their working staff, and **encouraged participation**. **Half-day on Saturdays**, along with **increased leisure time** helped to **increase participation rates**.

Urbanisation

Large numbers of people moved into **urban areas in order to work** in the new factories which were built. This meant that most people now had **less space** to participate in physical activity due to the cramped living conditions.

Churches and local authorities

Churches set up their own teams which took part in respectable forms of recreation in an attempt to improve **moral functioning**. They also **dissuaded participation in popular recreation**.

Development of national governing bodies

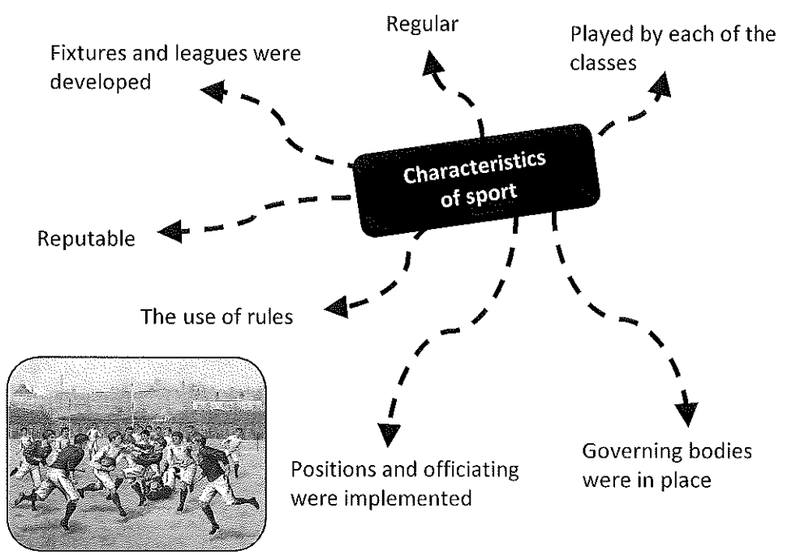
Ex-public school boys developed national governing bodies which provided **structure for the sports** which they played. This led to the development of **codified rules** which were standardised and the development of **national fixtures and leagues.**

Communication

Improved literacy rates and developments in the **printed press (media)** allowed people to follow sporting activity more closely. This encouraged more people to participate both as performers and **spectators**.

Three-tier class system

The **middle class emerged** and created a three-tier class system. It was made up of people such as clergymen and merchants who were given more respect from the upper class. They took part in lots of recreation and helped to develop modern sports through the creation of **public schools** and **national governing bodies**.



Case Studies

Wenlock Olympian Games

These games were the forbearer to the modern Olympic Games. They were organised games which aimed to provide the opportunity for personal development for the working class. They were developed by Dr William Penny Brookes in an attempt to improve the health of the residents of Much Wenlock. The sports were uncomplicated but were more structured than popular recreation and there was a focus on fair play.

Events such as the Much Wenlock Games helped to rationalise the sport of athletics by providing opportunities for athletes to take part in organised track and field events. This was further aided by the creation of the Amateur Athletic Association in 1880. Prior to this, athletics was known as pedestrianism which involved lower-class foot-messengers racing each other to deliver messages while the upper class placed wagers on them.

Lawn Tennis

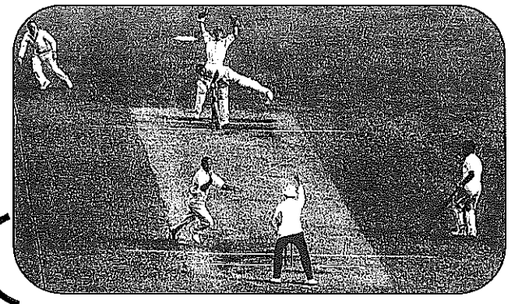
Created by the middle class in 1874 as an alternative version of real tennis and still played today. It was not very popular with schoolboys due to the lack of physical challenge but it provided a greater opportunity for women to take part in sport.

Association Football

A game which evolved from mob football as the rules became standardised. It developed as a result of the lack of space available in inner city areas and became popular with teams, fixtures and competitions being set up. It provided an opportunity for factory workers to compete for money as professionals.

Post-World War II Britain (1950 to present)

How social factors shaped the characteristics of, and participation in, sport in twentieth-century Britain



Gender / changing role and status of women	The notion that women were not suited to physical work was dispelled during the war, as many completed important work in factories. Therefore, more women began to play different sports.
Law and order	Stricter regulations regarding working conditions led to a more disciplined population, with law and order becoming much more maintained.
Education	Military-based education resulted in a stricter teaching approach, aiming to discipline the children.
Availability of time	Greater structure of working hours meant that most of the population had more leisure time, enabling them to spectate and participate in sport.
Availability of money	Wage increases gave more of the population income that they could spend on sporting events.
Transport	Transport and railway developments helped to further increase the spread of sport throughout the nation.

Amateurism and professionalism

In the twentieth century amateurism and professionalism were still similar to the previous century, e.g. upper class were amateurs and lower class were professionals.

This divide has shifted in modern day sport with a class divide not being evident in most sports.

Due to the globalisation of sport, professional sports people are now able to earn vast sums of money

Class

There is not a clear split between amateurism and professionalism in terms of participants' social class. Some sports such as football are still perceived by some as having a lower-class fan base, whereas horse racing is a sport for the upper class. The increased popularity of sport has resulted in the professionals of the major sports being paid extremely well.

Education

Physical Education is a compulsory subject that is taught in every school. This helps educate the population about the benefits of sport and the risks associated with non-participation, leading to higher rates of participation in physical activity. PE also helps to provide every student with a session of physical exercise.

Gender / changing role and status of women

An increase in female sporting models and coverage of women's sport have helped to increase levels of female participation in sport.

Availability of money

An increase in disposable income for many has allowed more money to be spent on spectating and membership fees.

Availability of time

Increased holiday availability and a 40-hour working week for many has allowed for free time to be spent taking part in sports.

Transport

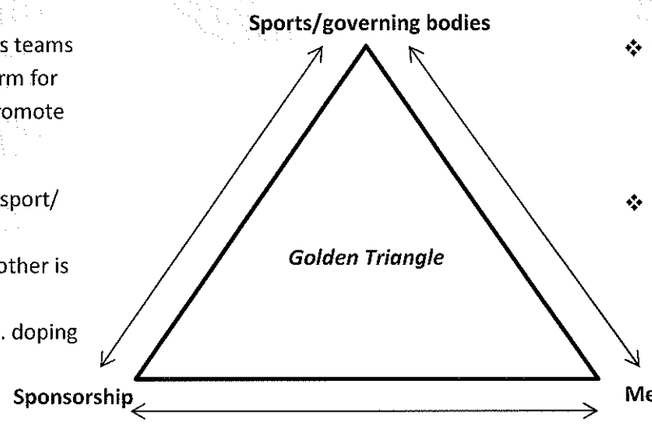
An improvement in modes of transport such as high-speed trains and aeroplanes allows teams to easily travel for international events.

Law and order

Prosecutions for violent behaviour, either by players or spectators, have resulted in less violent behaviour associated with sport.

Globalisation of sport

- Sports teams can receive funding which helps them to become successful
- Successful sports teams provide a platform for companies to promote their products
- Reputation of a sport/ sponsor can be damaged if the other is involved in a controversy, e.g. doping in cycling



- Popular sports have a positive impact on the media by increasing viewership
- The media can increase the popularity of certain sports which are covered in detail
- Other sports may become less popular due to a lack of media coverage

- Media coverage provides a platform for sponsor to promote their product to a large audience
- Sponsors pay high prices to have adverts broadcast during popular sporting events

Twenty-first-century Britain

How social factors shaped the characteristics of, and participation in, sport in twenty-first-century Britain

Case study: Women in football

- More women have been promoted as role models within the media which has increased the number of participants.
- The women's game received more TV coverage and larger crowds at live games due to globalisation, and increased availability of time and money within the general population.
- More and more women have started to become professional football players due to more money being available within the game.

Sociological Theory Applied to Equal Opportunities

Physical activity can have a large effect on the health of an individual and, therefore, have a large impact on society. Below are some key terms relating to society and sociological theory:

Society

The organised combination of individuals that live together. Sport can aid society by providing a feel-good feeling and a sense of pride.

Social Processes

How a society has progressed via their social interaction. This is impacted by **social control** and **social change** which regulate society's views. These processes can have a positive or negative impact on physical activity participation depending on the attitudes of society.

Socialisation

The learning of, and conformation to, a social group's values and habits to fit in with the society. **Primary socialisation** occurs in childhood and involves the learning of norms primarily from family members. Whereas **secondary socialisation** occurs from teenage years when individuals are influenced more by their friendship groups.

Social Issues

A dispute which affects a large proportion of the society and which can lead to **social inequality.** An example of social inequality is the lack of physical activity facilities in lower socio-economic areas.

Social Structures / Stratification

The hierarchical organisation of members of the society based on social status. This can have a negative impact on physical activity participation for those at the lower levels of the social hierarchy due to reduced access to opportunities. This reduced access can be thought of as **discrimination**.

Social Action Theory

The formation and maintenance of a society is dependent upon social interaction (**interactionist approach**). Society can have a positive impact on sport participation and sport participation can lead to the formation of societies.

The following terms can have an impact on society and affect the level of sports participation:

- **Discrimination:** *the use of a negative perception to make a distinction between individuals or a group*
- **Stereotyping:** *a preconceived, oversimplified perception of an individual or a group*
- **Prejudice:** *a previously formed biased opinion which has no evidence to back it up*

These can be overcome by:

- **Equal opportunities:** *an individual being treated fairly without any form of discrimination preventing them from participation*

The table below outlines the barriers to participation for certain social groups and the possible solutions to raise participation:

Underrepresented group	Barrier	Solution
Disability	• Poor access and facilities • Negative attitudes towards disability sport • A lack of media coverage for disabled sports • Lack of confidence • Lower income • Poor disability sport programmes/coaching	• Providing the facilities and equipment for disability • Educating members of staff and the public • Increasing the media reporting of adapted sports, such as the Paralympic Games • Subsidising fees for disability sport • Providing training for disability sport coaches • Setting up national bodies who can plan programmes
Ethnicity	• Negative attitudes, stereotypical and racist views • Placing athletes into positions/sports that coaches stereotypically believe they are best suited to • A lack of positive role models in underrepresented sports • Physical activity may not be culturally important • Communication issues due to language barrier	• Campaigns such as Kick It Out can increase awareness • The education of members of staff would help to dispel any stereotypical views • Increasing media coverage of those of an ethnic minority in sports which feature a low percentage of that minority • Increasing the number of ethnic minority coaches and managers • Banning/fining/arresting those found guilty of racial discrimination • Programmes which are sensitive to the needs of participants, e.g. adjustments made during times of fasting
Gender	• Negative attitudes and sexist views towards female roles in sport • Females can be pushed towards sports typically seen as more suitable for females • Lack of media coverage • Lack of role models • Disinterest in physical education lessons at school • Lack of funding for female sport	• Increased media coverage of female sport would help to increase the amount of positive female role models • The enforcement of laws which help to prevent sexist behaviour • Increasing opportunities in a wider range of sports • Increasing leisure opportunities by supporting mothers with childcare duties • Sourcing greater sponsorship for female sport • More female-only sports programmes • Tailoring physical education lessons to suit the preferences of female students
Disadvantaged	• They are said to be at a disadvantage in a sport due to not being able to afford the associated costs	• Community-run sporting projects reduce the cost involved • Reducing membership fees

There are a number of reasons why attempts should be made to increase the sport and physical activity participation rates:

Health	Fitness	Social
• Reduced risk of illness • Reduced strain on the heart • Reduced blood pressure • Reduced risk of type II diabetes • Increased confidence • Reduction in obesity levels • Reduced health costs	• Improved cardiovascular fitness • Improved strength • Improved reaction times • Improved body composition • Improved flexibility • Improved agility • Improved speed • Improved muscular endurance • Improved coordination	• Reduced crime rates • Improved self-esteem and confidence • Improved social skills • Increased opportunity for social interactions • Develops a sense of pride • Improved mood

In order to raise participation rates and benefit society, a number of organisations work together

Sport England

Sport England works with the following partners:

Local Partners	National Partners	National Governing Bodies
e.g. local authorities	e.g. Women in Sport	e.g. the Football Association (FA)

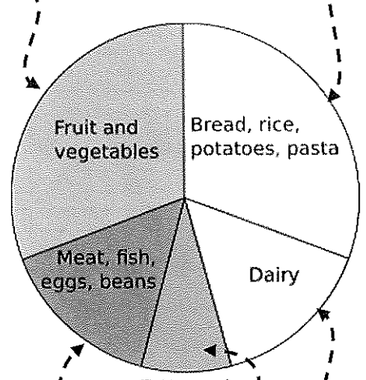
These organisations work together to:

- increase provision of sport
- increase and improve facilities
- increase funding
- provide talent pathways to elite sport
- increase participation at grass roots
- increase participation of underrepresented groups, e.g. disabled individuals and women

Diet and Nutrition and Their Effect on Physical Activity and Performance

Diet and nutrition

A healthy balanced diet consists of seven components, which when eaten in an optimal proportion can help improve sporting performance.



Vitamins

Vitamins are also micronutrients that are required in small amounts. There are four main vitamins that have exercise-related functions:

Vitamin C

- Improves immune function which allows athletes to avoid infections and illnesses and maintains and repairs the health of bones and connective tissues
- Found in green vegetables and citrus fruits

Vitamin D

- Improves bone health by assisting the absorption of calcium which is required for bone remodelling
- Supports protein synthesis and increases ATP stores – providing more energy
- Found in fatty fish and dairy products such as milk and cheese

Vitamin B-12

- Aids the production of red blood cells which improves oxygen transport
- Can increase metabolism and, therefore, maintain lean body mass
- Increases energy production
- Found in fish, meat and eggs

Vitamin B-complex

- Used in the production of energy by assisting the breakdown of food
- Found in multivitamin tablets, fortified breads, tuna, berries and vegetables

Minerals

Minerals are micronutrients, required in small amounts. There are three main minerals that have an exercise-related function:

1. **Calcium:** required for bone regeneration and for muscular contractions and can be found in dairy products such as *yoghurt* and *milk*
2. **Iron:** required for effective transportation of oxygen through the production of haemoglobin and found in *red meat, brown rice* and *fish*
3. **Sodium:** required for maintaining electrolyte balance and found in *olives, eggs, table salt,* and *sports drinks*

Carbohydrates

- Main energy source
- Broken down into glucose and absorbed into the blood stream
- Stored as glycogen in the body which can be released into the blood stream when required
- Fuels aerobic exercise such as long-distance running and anaerobic exercise such as sprinting
- There are simple and complex carbohydrates
- Simple carbohydrates release energy quickly but cannot sustain exercise for long periods – they are found in processed sugary foods such as chocolate bars as well as fruit
- Complex carbohydrates release energy slowly and, therefore, sustain endurance-type activities – they are found in foods such as bread, pasta and rice

Fibre

- Foods containing carbohydrates are also good sources of dietary fibre
- Fibre aids the process of digestion and also reduces the rate at which glucose is released into the blood which makes energy release more sustainable and avoids spikes in blood glucose levels

Fats

- Main source of energy during low-intensity exercise
- Stored in adipose tissue within the body
- There are two main types of fats:
  1. **Saturated fats** which provide the body with cholesterol and are associated with increase in weight and cardiovascular disease
     - **Trans-fats** are natural or man-made saturated fats which are combined with food products to increase their life span. They provide energy but can increase levels of low-density lipoproteins.

Saturated sources: *butter, cream, pork / trans-fats, margarine, ice cream, crisps*

2. **Unsaturated fats** contain less cholesterol and are, therefore, considered better for cardiovascular health

Unsaturated sources: *olive oil, salmon, avocados*

There are two types of cholesterol.

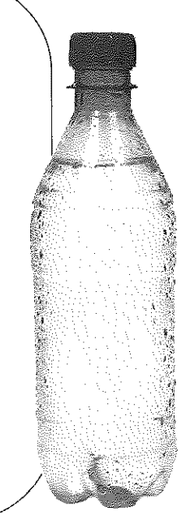
1. **Low-density lipoproteins** transfer cholesterol to the tissues of the body but some can build up on the walls of the arteries and increase the risk of cardiovascular disease
2. **High-density lipoproteins** transfer cholesterol in the blood to the liver to be broken down and removed from the body. They reduce the risk of cardiovascular disease

Proteins

- Minor source of energy
- Role in tissue repair, muscle protein synthesis and recovery
- Allow muscle to repair and adapt to training loads
- Should be consumed immediately after a training session in order to aid recovery of muscle cells
- ***Sources:*** **meat, eggs, milk**

Water

- Hydrates the athlete, preventing dehydration, and replaces fluids lost by sweating
- Required in order to avoid dizziness, increased body temperature, increased heart rate and headaches
- Therefore, water should be consumed as we exercise to maintain hydration:
  - **Pre-exercise:** 0.5L 3 hours before exercise and 0.25L 30 mins before exercise
  - **During exercise:** water should be consumed during breaks in play
  - **Post-exercise:** 0.5L gradually over 30 mins
- Water can be obtained from all sources of fluid, including tap water, bottled water and sports drinks. Drinks such as tea and coffee are diuretics so don't have as strong a hydrating effect, as they cause the need to urinate. Additionally, sugary fizzy drinks also have their negative health effects.



Nutritional aids

Caffeine

Reduces perceived effort, encourages glycogen sparing, improves muscular contraction and increases awareness and alertness. It is useful for endurance athletes who benefit from the increased fat metabolism during exercise that occurs after consuming caffeine.

Risks: Irritability, irregular heart rate

Bicarbonate

Helps to buffer lactic acid in the blood and, therefore, reduces the fatiguing effect of lactic acid during anaerobic exercise.

Risks: Nausea, unsettled stomach

Glycogen loading

Athletes can deplete their glycogen stores by consuming a diet high in protein and performing high levels of exercise a week before a competition. They can then consume a diet high in carbohydrates for three days as this leads to super-compensation of glycogen and increases the glycogen stores available during an endurance event.

Risks: Feeling bloated, nausea, issues with digestion

Creatine

Increases power and strength by providing creatine to fuel the ATP-PC system which allows athletes to exercise anaerobically for longer using this system. It also aids recovery by restoring the creatine stores of the body.

Risks: Kidney damage, excess water retention

Preparation and Training Methods in Relation to Improving and Maintaining Physical Activity and Performance

Data terms

There are four types of data that can be collected from fitness testing. These are qualitative, quantitative, objective and subjective and they are explained below:

Qualitative data is a measurement based on observational data.

Quantitative data is a measurement that involves numerical data.

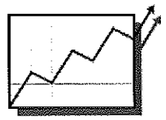
Subjective data is any data which is taken from observations and involves some form of personal opinion.

Objective data is any data which can be measured directly without personal opinion.

Data integrity can be maintained by ensuring the following are met and also by calibrating equipment regularly:

Validity – the degree to which a test measures what it is intended to

Reliability – the degree to which the results of a test can be repeated



Warming up and cooling down!

Prior to any level of sporting participation it is very important to complete an effective warm-up as this will:

- increase the temperature of the muscles and tendons, which increases flexibility
- increase the speed and strength of muscular contractions
- raise the heart rate, which helps to increase the speed of blood flow to the exercising muscles
- raise the breathing rate which helps to increase the transport of oxygen to the exercising muscles

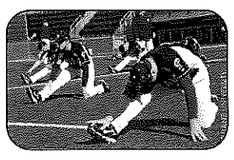
After physical activity it is important to complete an effective cool-down as this can result in the following physiological benefits:

- improves the removal of lactic acid and other waste products of exercise
- helps to reduce the likelihood of the delayed onset of muscle soreness (DOMS)
- aids the prevention of blood pooling
- enables the gentle lowering of heart rate and breathing rate to pre-exercise levels

There are three types of stretching which can be performed during warm-ups and cool-downs:

1. **Ballistic stretching** which involves sudden bouncing movements to stretch a muscle, and is not recommended due to this type of stretching putting the performer at risk of injury.
2. **Dynamic stretching** which involves stretches being performed when moving which is important for sports such as rugby where athletes must stretch when moving, e.g. during a scrum.
3. **Static stretching** which involves a stretch being held in a stationary position which is important for sports such as gymnastics.

Dynamic stretching



Static stretching

Principles of training

Coaches and athletes should use the following principles of training to guide their training plans. These principles will ensure that training is effective and adequate changes can be made when required.

- **S** – **Specificity** – training should be relevant to the athlete, e.g. a runner's training should mostly involve running
- **PO** – **Progressive overload** – as an athlete adapts to their training load, the load should be increased in order to stress the body
- **R** – **Reversibility** – if an athlete has a period without training, they will begin to lose their adaptations to training
- **R** – **Recovery** – it is important to rest and recover in order for adaptations to occur
- **F** – **Frequency** – the number of times you train each week
- **I** – **Intensity** – the amount of work that is performed in each training session
- **T** – **Time** – the amount of time spent training in each session
- **T** – **Type** – the form of exercise that is performed in each session

Periodisation of training

Periodisation cycles:

Specific training areas	Microcycle	Microcycle	Microcycle	~a week
Consists of a number of microcycles	Mesocycle			~a month
The training year/goal	Macrocycle			

Phases of training:

1. Preparatory phase: prior to competition, includes fitness training and being ready for competition
2. Competitive phase: maintaining physiological and psychological readiness to compete
3. Transition phase: in-between the end of the competition and preparatory phase, allowing the athlete to recover

Factors to consider when planning a personal health and fitness programme:

- the client's characteristics
- the client's goals
- the fitness components to target
- FITT
- how to monitor progress
- when to taper
- phases of training

Tapering

Tapering involves reducing the amount of training (but maintaining intensity) 1–3 weeks prior to the competition.

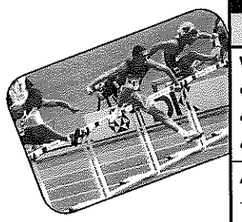
Benefits:

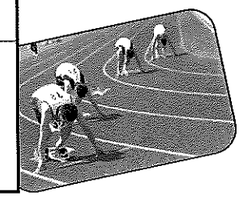
- increases muscle glycogen concentration
- increases muscular endurance and power
- increases VO_2 max

Peaking

When the adaptations from tapering enable the optimal level of performance. The performer normally aims to peak during the most important competition period of their season.

Training Methods to Improve Physical Activity and Performance



Interval Training

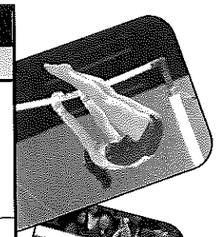
Anaerobic Power

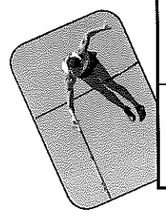
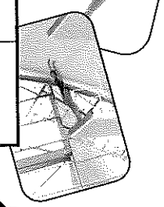
What?
- High-intensity work performed
- Short duration
- Many rest periods

Advantages
+ Can be performed with very little equipment
+ Little time requirements

Disadvantages
– Not an appropriate method for all individuals
– Requires high levels of motivation
– Can be physically demanding

Useful for
Appropriate for those who are required to perform periods of high-intensity anaerobic work with limited rest or recovery in between, e.g. games players such as rugby and football players.

Proprioceptive Neuromuscular Facilitation

Flexibility

What?
The muscle is passively stretched, before isometrically contracted. This then stimulates the Golgi tendon organ to inhibit the stretch reflex, allowing for a greater range of motion for the passive stretch that follows.

Advantages
+ Reduces the risk of injury
+ Increases range of motion

Disadvantages
– Can require an assistant to perform it
– Can lead to injury if performed incorrectly
– Can be painful

Useful for
Appropriate for any athlete who is required to move their limbs to the full range of motion, e.g. gymnasts and divers.

Weight Training

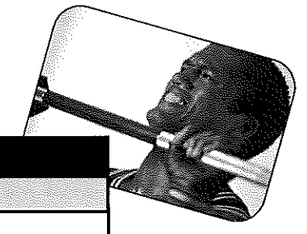
Strength

What?
- Loads are repeatedly lifted
- Can be performed using free weights, resistance machines and body weight
- The number of sets and repetitions determines the type of strength being trained
- Usually performed with a load of 80-100% of 1 rep max and around 4 sets with a low number of repetitions

Advantages
+ Requires little assistance
+ Can be performed using free weights, resistance machines and body weight
+ Can be altered to train different muscles
+ Can be altered to train different components of strength (dynamic, static, explosive, etc.)

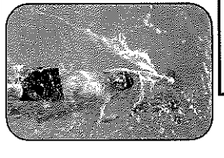
Disadvantages
– Correct technique is very important to avoid injury
– There are a lot of different techniques to learn
– Requires specialist equipment
– Usually requires access to a gym

Useful for
Appropriate for any athletes who are required to move loads or exert large forces onto another object, e.g. weight lifters and boxers.



Training methods



Continuous Training

Aerobic Endurance

What?
- Low intensity
- Long duration
- No rest periods

Advantages
+ Requires little equipment
+ Easy to perform
+ Requires little assistance

Disadvantages
– Can become boring
– Takes up a lot of time
– Doesn't improve anaerobic performance

Useful for
Appropriate for those who perform prolonged exercise and require cardiovascular endurance, e.g. triatheletes.

Fartlek Training

Aerobic Endurance

What?
- Continuous exercise
- Performed over different terrains

Advantages
+ Can be made appropriate for different sports
+ Can prevent boredom due to changing terrain
+ Requires little assistance

Disadvantages
– Can become boring
– Hard to track progress
– Easy to not put effort in

Useful for
Appropriate for those who perform prolonged exercise and require cardiovascular endurance, e.g. triathletes

Circuit Training

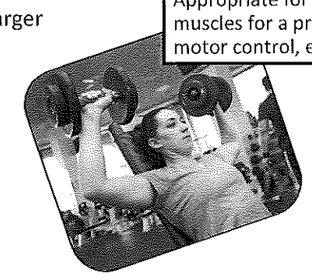
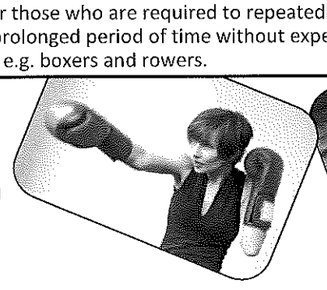
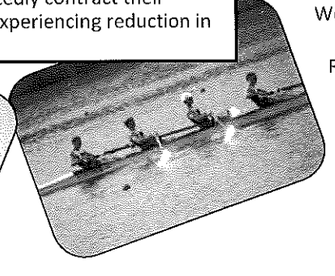
Muscular Endurance

What?
- A series of exercises are performed at different stations
- Little or no rest between each station
- Usually performed with a load of 50% of 1 rep max and 3 sets with a high number of repetitions

Advantages
+ It can be made appropriate for all sports by adjusting the exercises performed at each station
+ The rest:work ratio can easily be adjusted
+ It is easy to monitor progress
+ It can incorporate fun exercise which keep the exercisers interested and motivated

Disadvantages
– Time consuming to set up
– Requires adequate space, e.g. a sports hall
– Requires a lot of equipment

Useful for
Appropriate for those who are required to repeatedly contract their muscles for a prolonged period of time without experiencing reduction in motor control, e.g. boxers and rowers.

VO_2 max

The maximal volume of O_2 that can be consumed and utilised by the body

Age
As age increases, VO_2 max decreases

Gender
Males have a larger VO_2 max

Training
Aerobic training is the best way to increase VO_2 max

Individual physiological make-up
Factors such as body composition and muscle fibre types affect VO_2 max

Strength

Different components of strength can be trained using weight training

Maximum Strength
Weight: 70–85% 1RM
Sets: 1–3 Repetitions: 6
Rest between sets: 2–3 minutes

Strength Endurance
Weight: <70% 1RM Sets: 2–4
Repetitions: 10–25
Rest between sets: 30–60 seconds

Static Strength
Isometric exercises held for 5–10 seconds

Dynamic Strength
Weight: 100% 1RM Sets: 1
Repetitions: 1

Explosive Strength
Weight: 60–75% 1RM
Sets: 1–3 Repetitions: 3–6
Rest between sets: 1–3 minutes

Biomechanical Principles and Levers

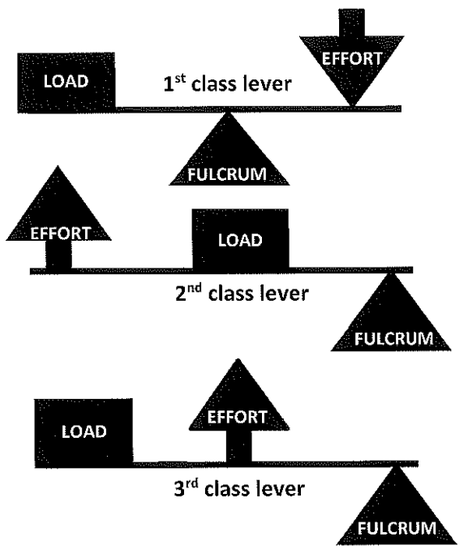
Newton's Laws of Motion

First Law: Inertia	An object's state of motion will not change unless acted upon by an external force.
Second Law: Acceleration	An object will accelerate in the same direction as the force exerted on it, and the amount of acceleration is directly proportional to this force.
Third Law: Reaction	For every action there is an equal and opposite reaction.

Biomechanical Calculations

Speed (m/s) *The time it takes to move a certain distance*	=	Distance (m)	/	Time (s)
Distance (m) *The length of the path travelled*	=	Speed (m/s)	×	Time (s)
Force (N) *The 'push' or 'pull' exerted onto an object*	=	Mass (kg)	×	Acceleration (m/s^2)

Levers



E.g. rowing

E.g. a press up

E.g. bicep curl (upwards phase)

Load: the weight that needs to be moved (the weight of the moving body part)

Effort: the force needed to move the load (the muscle)

Fulcrum: the location of the movement (the joint)

Effort arm: the distance from the fulcrum to the effort

Load arm: the distance from the fulcrum to the load

Mechanical Advantage/Disadvantage

*If a load is close to the fulcrum and the effort is further away from the fulcrum (1st & 2nd class lever systems), it is said to have a **mechanical advantage** and you can move large loads.*

*If the effort is larger than the load (3rd class lever system), it is said to have a **mechanical disadvantage** and large loads cannot be moved but smaller loads can be moved at greater speeds.*

Force

Weight:
The effect of gravity on an object
Weight = mass × 9.81m/s²

Net force:
The total force exerted on an object

Balanced forces:
Opposing forces in opposing directions are equal

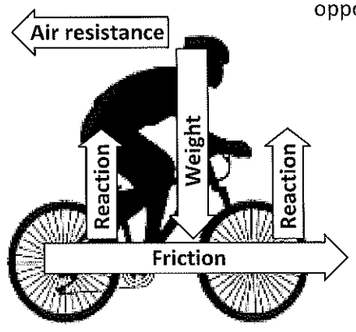
Unbalanced forces:
Opposing forces in opposing directions are unequal

Affected by:
- The mass and velocity of an object
- Streamlining and shape
- Front cross-sectional area

Reaction:
Provides an opposite force to the force being exerted

Air resistance:
A form of friction acting between an object and the air

Free body diagrams:
These show the vertical and horizontal forces being exerted on a body, and how these affect the motion of the body



Friction:
Occurs when two surfaces interact, opposing movement

Affected by:
- The velocity and mass of an object
- Smoothness of the interacting surfaces

Stability

The object's resistance to changing position

Centre of mass:
The point at which the total body mass is concentrated

Raising the centre of mass will reduce the stability

Body mass:
A measure of the body's resistance to change

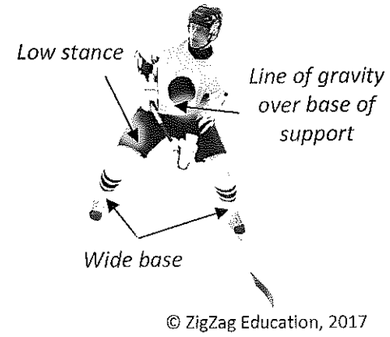
The greater the mass of a body, the greater the stability

Position of line of gravity:
The line through which gravity acts is altered by the shape of the body

A line of gravity which is closer to the centre of mass will result in greater stability

Area of base of support:
The width of the base of support

Having a wide base of support will increase stability



Psychological factors that influence performance: Personality, Attitudes, Motivation and Social Facilitation

Personality: The collection of distinctive characteristics of an individual which are specific to them.

Type A:
- Competitive
- Likely to be stressed
- Unstable emotionally
- Works quickly
- High need to achieve
- Controlling

Type B:
- Non-competitive
- Calm
- Stable emotionally
- Takes time when working
- Low need to achieve
- Prefers to be controlled

Trait theory (Cattell)

An enduring quality that characterises an individual

Behaviour = function of personality

Introverts: Energy is lost during social situations

Extroverts: Become energised in social situations

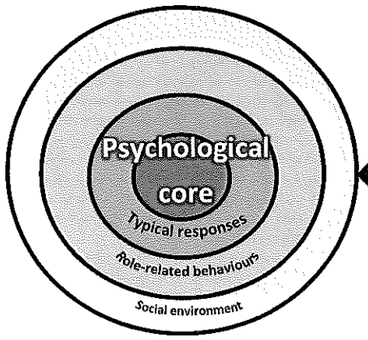
Unstable: Emotions which can fluctuate wildly

Stable: Emotions which stay steady

Theories

Social Learning theory (Bandura)

Personality formed from previous observations.
Personality type is strengthened if observed behaviour is reinforced.
Behaviour = function of environment



Hollander's model of psychological core

Interactionist theory (Lewin)

Lewin suggests traits govern how an individual is predisposed to react; however, this may change in response to their environment. This is linked to *Hollander's model of the psychological core.*

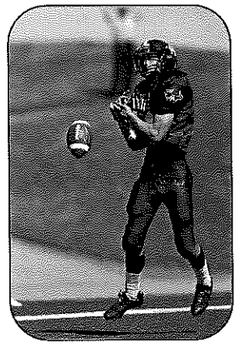
Behaviour = function of (personality × environment)

This perspective can aid sports performance as athletes with different traits may need to act differently in changing environments, e.g. a rugby player who is normally relaxed when playing, may need to calm themselves down when playing against a rival.

Social Facilitation:

Zajonc suggested that high levels of arousal when performing in front of others will lead to the dominant response being displayed. This will either lead to social facilitation or inhibition.

Presence of others → Arousal → Dominant response



Correct dominant response

Incorrect dominant response

Social facilitation (✓):

The beneficial impact on sporting performance caused by performing in front of an audience

Social inhibition (✗):

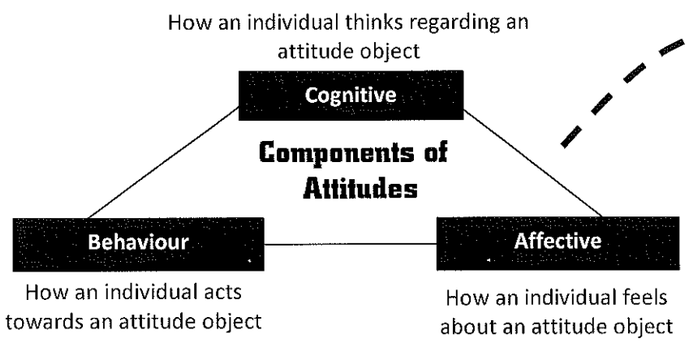
The negative impact on sporting performance caused by performing in front of an audience

Strategies to minimise social inhibition: mental rehearsal, self-talk, practising in front of an audience, selective attention, positive reinforcement, relaxation techniques

Evaluation apprehension: the perceived judging of others that negatively affects performance

Attitude: An enduring emotional feeling that alters the response given towards a specific situation.

Attitude formation:
- **Personality types:** e.g. stable and unstable personality types are likely to form different attitudes
- **Personal experiences:** positive experiences make an attitude more likely to be formed
- **Conditioning:** reinforcement helps to form an attitude
- **Social influences:** likely to adopt the same attitude as close friends or family



Creating an imbalance between these components makes an individual feel uncomfortable. This is known as **cognitive dissonance**. An individual is moved to reduce this dissonance.

Persuasive communication:
Verbally making relevant points, to change another person's attitude towards an object.

Effectiveness dependent on:
- the persuader's and receiver's characteristics
- the quality of the message
- the situation

Motivation: The reason a person acts in the way that they do.

Intrinsic Motivation
A type of motivation that stems from within an individual

Sources: feelings of satisfaction and enjoyment that accompany a successful performance

Effects: improved task persistence, enjoyment and satisfaction

Extrinsic Motivation
A type of motivation that stems from outside of an individual

Sources: reinforcement (positive or negative), trophies (tangible) or praise (intangible)

Effects: reinforcement of the correct behaviour, less satisfaction and enjoyment

Psychological factors that influence performance: Arousal, Anxiety and Aggression

Aggression: The behaviour which has the goal of harming others by breaking the rules of the game. This shouldn't be confused with **assertive behaviour** which is acting in a forceful way within the rules.

Instinct theory: every person has innate aggression, which they need to act upon to release this feeling. Sports which are thought of as being 'aggressive' provide an opportunity for an individual to let off steam and release their built-up aggressive energy.

Critique:
- aggression is not always spontaneous
- sport does not have a calming effect
- aggressive sports people have also been found to be aggressive in everyday life

Social learning theory: aggression is learned through observation. Observing reinforcement of aggressive behaviour increases the likelihood of an individual displaying aggressive behaviour.

Critique:
- it ignores a person's biological state
- can't be concluded if the aggressive state observed in the studies performed would have a long-term effect

Frustration–aggression hypothesis: feeling frustrated is the reason why aggressive behaviour occurs.

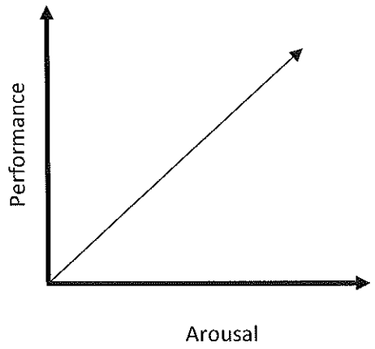
Critique:
- ignores other emotions that are present during frustration, e.g. dejection
- aggression is displayed even when people are not frustrated

Aggressive cue hypothesis: an increase in arousal coupled with an aggressive cue leads to aggressive behaviour.

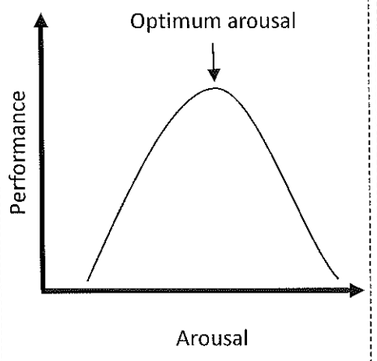
Critique:
- aggressive reactions can be displayed when the target is considered a genuine threat

Ways to control aggression:
- fining aggressive behaviour
- rewarding non-aggressive behaviour
- controlling arousal
- removing aggressive players from arousing situations
- educating players

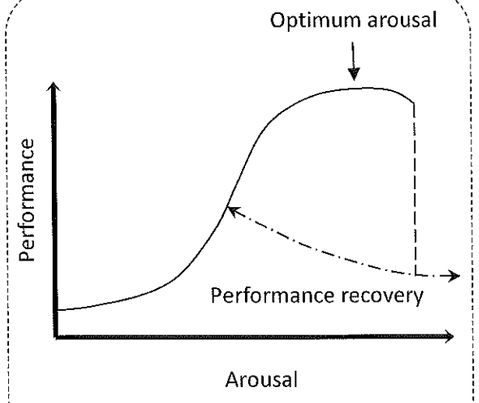
Arousal: A raised state of physiological readiness.



Drive theory:
- performance increases linearly with arousal levels
- at higher levels of arousal, the dominant response is prominent

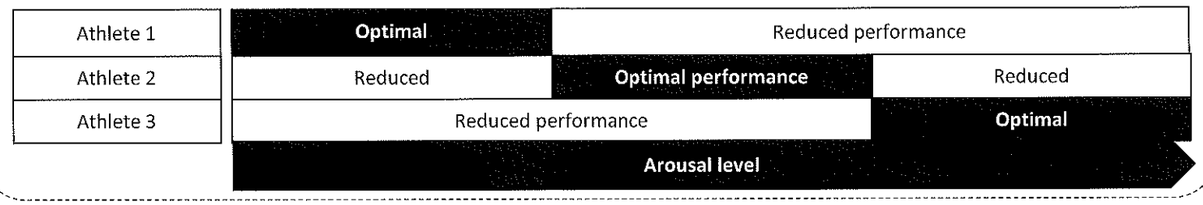


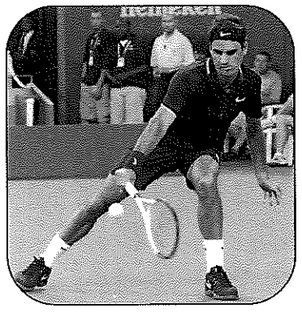
Inverted-U theory:
- as arousal increases, so does performance
- optimal arousal is the level of arousal where optimal performance occurs
- increasing arousal thereafter reduces performance

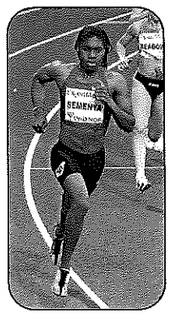


Catastrophe theory:
- performance increases along with cognitive anxiety
- as somatic anxiety increases alongside this, performance can rapidly deteriorate
- reducing arousal levels can help a performer regain their performance

Zone of Optimal Functioning: the performance of different types of individuals is affected differently along the arousal continuum.







Peak Flow
All three theories of arousal contain a point of peak flow. This is when the athlete is performing at their maximum. Peak flow is characterised by the following: *feeling effortless, high level of performance, being focused, time slowing down, feeling relaxed* and *high levels of control.*

Anxiety: A feeling of apprehension when faced with a stimulus that is perceived as threatening.

Competitive state anxiety:
How an individual reacts to a specific stressful situation

Competitive trait anxiety:
An individual's tendency to react to stress in a specific way

Somatic anxiety:
Physiological responses to anxiety

Cognitive anxiety:
Mental responses to anxiety

Methods of measuring:

Method	Advantages	Disadvantages
Questionnaires	• Can be validated • Reliable • Easy to distribute • Can be completed quickly	• Subject to social influence • Require a clear understanding of the question – some individuals may interpret the same question differently
Observations	• Can be recorded during competition • Require little input from the performers	• Rely on subjective data • Can make the performer more anxious • Can only observe the outcomes of anxiety – can't easily observe the causes
Physiological measures	• Can provide real-time information • Can be validated • Reliable	• Wearing monitoring systems can cause a spike in anxiety

Group and Team Dynamics in Sport

Defining a Group and Group Cohesion

Group definition: A collection of individuals that work together to achieve a common goal

There is a close link between a group and a team, and the two terms are often seen as interchangeable.

Team definition: A group of people using their particular skills to work together

Cohesion:
Cohesion is determined by how close a team is, both socially and in pursuit of common goals. A cohesive group can achieve a performance goal with maximum efficiency, whereas a dysfunctional group could experience breakdowns in performances.

Two types of cohesion:

- **Task** – how united a group or team is in the pursuit of a common goal
- **Social** – how close group or team members feel to each other based on their social interactions

To be successful as a group, the members need:

- to be highly motivated
- to have strong communication skills
- the ability to work well in a team
- to have a shared goal

Steiner's Model of Group Effectiveness

About the model:
The model is concerned with the relationship between the individual contribution of group members to group productivity. A successful group performance requires a high level of team productivity, which in turn consists of the combination of the productivity of each of the individual team members.

This model is best summarised by the equation below:

Actual productivity =
best potential productivity – losses due to faulty processes

Coordination losses:
Resulting from being incohesive, which affects the ability of a group to work together to reach a goal

Motivational losses:
Individual members lack the required motivation to help the group succeed

The collective term for these types of losses is **faulty processes**.

Cohesion, group productivity and social loafing can be improved by:
improving communication, producing shared goals, outlining roles, ensuring team performance is more important than individual performance and allowing everyone to be involved in decision-making and goal-setting.

Goal-setting in Sports Performance

There are four types of goal-setting which can be used by athletes and coaches:

Outcome	This is concerned with objective success, e.g. winning a tournament.
Task-orientated	This is concerned with performing a skill well, e.g. improving shot accuracy.
Performance	This is concerned with personal improvement, e.g. improving your own 100m personal best.
Process	This is concerned with technique improvements which are required for successful performance, e.g. improving sprint start in order to improve 100m time.

How goal-setting can improve performance...

Attentional focus

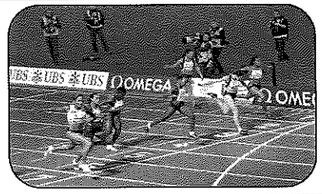
- Goals provide something for the performer to focus on.
- It improves the performer's selective attention, as factors irrelevant to achieving the goal become disregarded.

Task persistence

- Having something to aim for improves motivation and, therefore, task persistence.
- Goals help identify the high level of performance that is needed, which can make the performer persist at a task to ensure they reach this level.

Raising confidence and self-efficacy

- Achieving a goal helps to improve self-efficacy as it gives the performer the belief they can be successful.
- Using goals to improve a weak area of performance can give a performer confidence when faced with this area again.

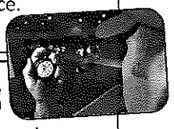


Controlling arousal and anxiety

- Helps to improve the feelings of control the performer has over a performance.
- Having achievable goals helps to reduce the stress of not knowing if a successful performance is possible.

Monitoring performance

- Recording weaknesses and strengths can help to identify how to improve performance.
- Noticing improvements through monitoring can help increase motivation and confidence. Allows for goals to be adjusted.



The SMART principles

Following this principle ensures that effective goal-setting can take place.

- **S** – **Specific:** Having a clear aim to improve competency in a particular area helps to improve attentional focus
- **M** – **Measurable:** Helps to ensure that progress can be measured, allowing the performer to be aware of their level of performance
- **A** – **Achievable:** The goal must be within the athlete's potential as repeated failure can lead to the performer being demotivated
- **R** – **Realistic:** The goal should be based on previous achievements that the athlete has made to ensure that it can be reached
- **T** – **Time-bound:** Needing to complete a goal by a specified time helps to increase motivation
- **E** – **Evaluate:** Determining how well the athlete is progressing
- **R** – **Re-do:** If something needs to be revisited in order to enhance learning, the athlete should learn it again

Group Formation

Group dynamics:
The social processes and relationships that exist between the members in a group

Performing

- Final stage of group formation – the group perform successfully to achieve their team goals, by each member performing successfully in their own role.

Norming

- Problem-solving stage – members work together to discover solutions.
- Members become aware of their individual roles within the group.

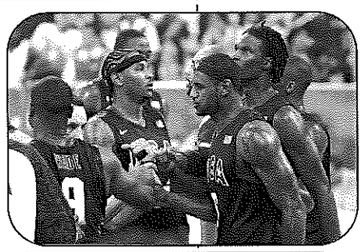
Storming

- Most problems arise here – members can clash due to differences in opinions.
- Subgroups are formed consisting of those sharing similar opinions.

Forming

- First stage of group formation – team members meet, forming initial relationships and discussing opinions.

Tuckman's Model of Group Formation



Factors affecting group formation:

- group size
- time available
- the communication between group members
- the motivation levels of members
- the experience of members
- the behaviour of the leader
- the group goals

Ringelmann Effect and Social Loafing

Both the Ringelmann effect and social loafing describe the negative impact that individuals can have on the productivity of a team.

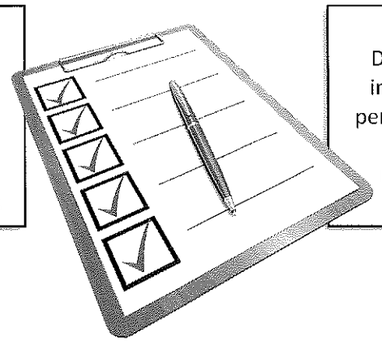
Ringelmann effect
Refers to the negative effect that increasing the number of group members has on the group

Social loafing
Refers to the perceived loss of individual role importance resulting in an individual exerting less effort in a larger group

A good example of this, discovered by Ringelmann in 1913, concerns the contribution of the individuals during a tug of war. As the team adds extra members, each individual feels as though they have to put less effort into pulling the rope. This is because they feel as though their significance to team success is diminished. This results in a less productive team performance, and an increased likelihood of a failure in team performance.

The role of technology in physical activity and sport

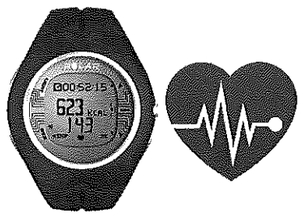
Qualitative
Data which is descriptive in nature, e.g. questionnaires regarding motivation levels



Subjective
Data which is influenced by perceptions, e.g. number of mistakes in technique

Data collection

Quantitative
Data which can be measured and assigned a numerical value, e.g. blood lactate levels



Objective
Factual data with no personal bias, e.g. number of goals scored

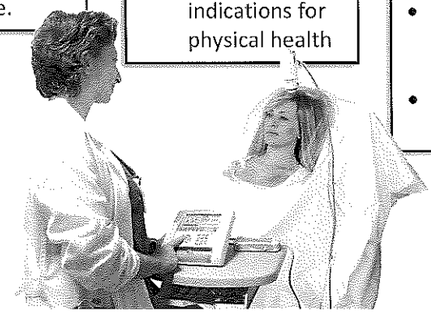
Technology

Testing and recording equipment

What is it?
Technical equipment can be used to measure the physiological functioning of the body and it's response to exercise.

Why is it used?
- To determine fitness levels
- To measure the success of training programmes
- To provide indications for physical health

Example of use: indirect calorimetry
- Measured using a metabolic cart which measures heat production of the body
- Heat production at rest provides a measure of resting metabolism
- This can be used to determine a person's energy expenditure and calorie requirements
- Also provides an indication of physical health



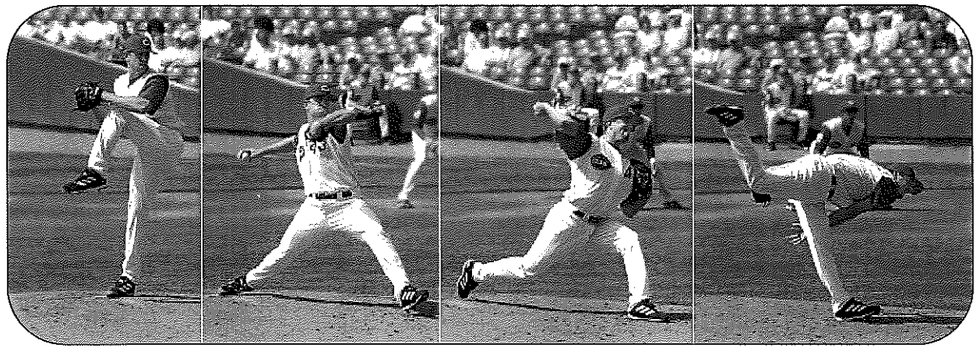
Video analysis

What is it?
Software can be used to determine how successfully a team or athlete performed during training or competition.

It can be used to guide training programmes by determining areas of weakness and displaying the correct model of performance.

Why is it used?
- To improve technique
- To increase performance levels
- To guide training
- To scout weaknesses/ strengths of opponents

Examples of use:
- Biomechanical analysis of serve technique
- Match analysis
- Scouting of opposing teams/ players



Data integrity

Maintaining data integrity during collection and storage is important in order to ensure that the performance data collected is reliable and valid.

Reliability
The repeatability of results when testing the same thing

Validity
Whether the method of data collection is measuring what it is intended to measure

Methods to maintain data integrity
- Storing data on separate hardware
- Ensuring data is password-protected
- Carefully selecting the correct data collection method
- Checking data entry for mistakes
- Backing-up your data

GPS and motion tracking software/ hardware

What is it?
GPS (global positioning system) is a method of measuring the distance covered, path of movement, speed of movement and positioning of an athlete during training sessions or competition. This information is measured via a small chip which is carried by the athlete (usually in their clothing or using smartphones/watches).

Why is it used?
- To provide information about performance levels
- To provide technical information such as their average position which can inform tactics
- To inform training, e.g. help maintain an average speed

Examples of use:
- Placed in the clothing of rugby players during matches
- Wearing a watch while jogging

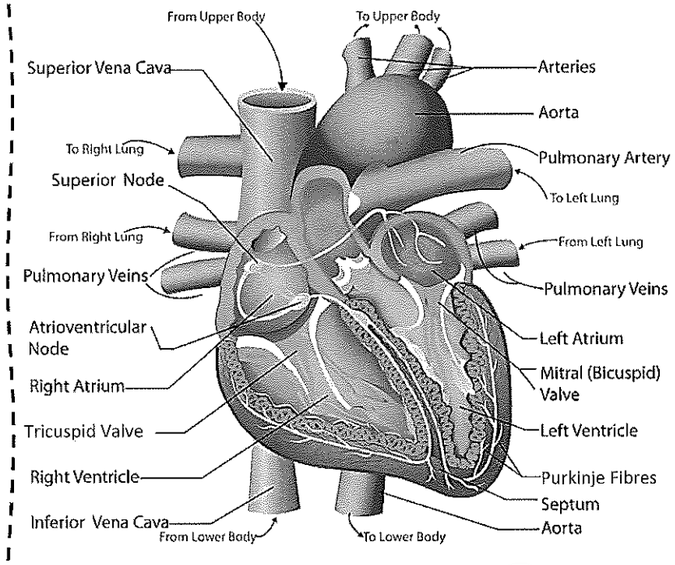
THE CARDIOVASCULAR SYSTEM...

Impact on Health and Fitness

A

Fill in the table with as many effects of physical activity on health and fitness as you can think of.

Health	Fitness



Cardiac Conduction System

C

The conduction system involves the electrical impulses that cause the cardiac cycle of the heart. **The cardiac muscle is myogenic**, meaning it generates its own impulses. **Outline the order of the cardiac conduction system on the diagram below.**

1. 2. 3. 4.

Atrial depolarisation:
Stimulus from the SA node travels across the atria, causing atrial contraction.

Ventricular depolarisation:
The effect that the AV node has on the ventricles by causing them to contract by providing an electrical stimulus.

Atrial and ventricular repolarisation:
Occurs during a brief time period following depolarisation and describes the electrical impulse returning to a baseline value.

The Relationship between Heart Values...

B

Complete the equation for cardiac output and explain how training status and exercise intensity can affect each heart value.

Research:
What is a pacemaker?

Cardiovascular Drift and A-VO_2 Difference

- **Cardiovascular drift** – the increase in heart rate which occurs despite no change in the intensity of exercise.
- **Arteriovenous oxygen difference (A-VO_2 diff)** – the difference in oxygen concentration between the arteries and veins.
- High-intensity exercise will result in a greater A-VO_2 diff as more oxygen is taken out of the arteries to fuel muscular contractions. However, a plateau will be reached when more oxygen cannot be removed from the arteries.
- Trained athletes will have higher starting A-VO_2 diffs and will experience a bigger change during exercise.
- Regular training can increase the A-VO_2 diff due to: *greater capillary density, greater alveoli density* and *greater myoglobin in the muscles.*

Factors Regulating Heart Rate

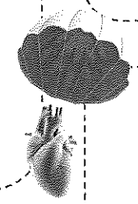
D

How do these three factors regulate heart rate?

1. Neural

2. Hormonal

3. Intrinsic



Transportation of Oxygen

Oxygen is transported within the body in association with:

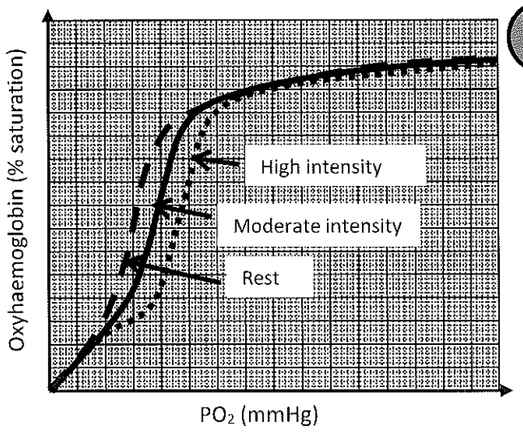
- **Haemoglobin** – the oxygen-carrying component of red blood cells
- **Myoglobin** – the oxygen-carrying component of the muscle tissue

The graph shows an oxyhaemoglobin dissociation curve which displays the **Bohr shift** during exercise of different intensities.

The Bohr shift is demonstrated by the line shifting to the right as the conditions within the blood become more acidic (reduced pH due to increased levels of CO_2) during higher-intensity exercise.

Factors influencing Bohr shift include:

1. Increase in CO_2
2. Decrease in pH – due to increase in CO_2
3. Increase in temperature



Redistribution of Cardiac Output

E

During exercise our blood needs to redistribute to working muscles. Describe the methods given below:

Vascular shunt

Arterioles

Pre-capillary sphincters

Venous return:
The rate at which blood returns to the heart.

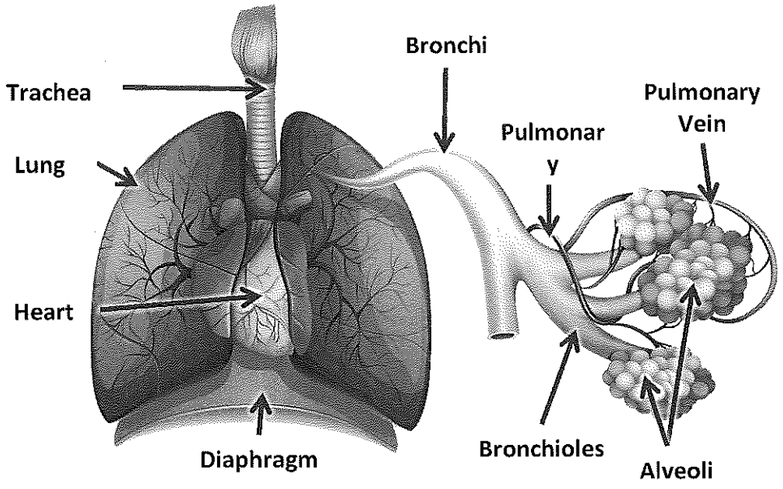
As intensity increases:
Blood redistribution needs to be quicker otherwise cardiac output decreases. Exercise increases it through the **muscle pump** and **respiratory pump** which force blood back to the heart. This process is also aided by **pocket valves** in the veins, **smooth muscle** in the walls of the blood vessels and **gravity**. Venous return is quickest in the arteries and during **systole** as systolic blood pressure is larger than diastolic.

During recovery the lower venous return results in a lower stroke volume. This is due to reduced stretching of the ventricles with a low venous return (**Frank-Starling law**).

THE RESPIRATORY SYSTEM...

Research:
What differences would we see in how the respiratory system works with individuals who have respiratory conditions such as asthma?

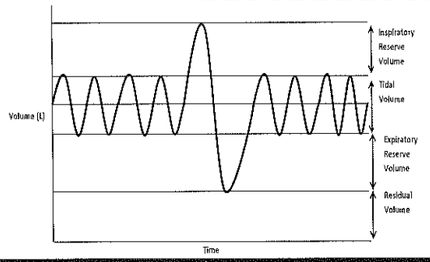
The respiratory system consists of a number of structures (outlined in the diagram below) which allow gasses to be transferred between the body and the external environment. This is an important process during exercise when large volumes of oxygen are required by the muscles and large volumes of carbon dioxide need to be removed from the body.



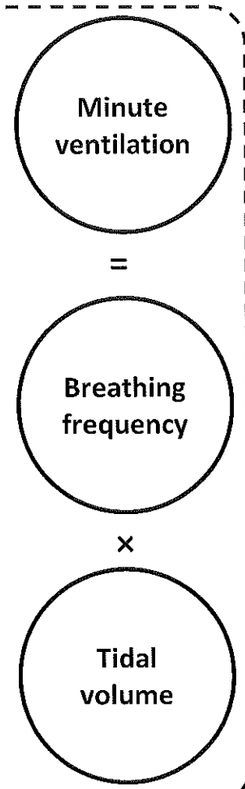
Lung Volumes

There are a number of different lung volumes which can be measured in order to determine how a person's respiratory system is functioning. These volumes will change depending on the level of physical activity, the training status and the health of the person.

Complete the table below by defining each of the lung volumes, identifying a typical resting value and indicating how this volume would change during exercise. **A**

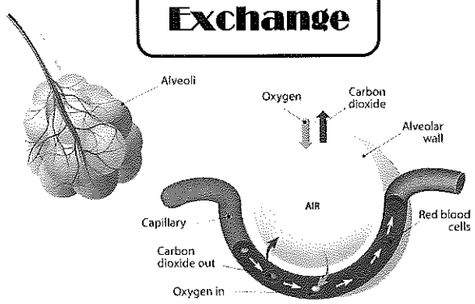


	Tidal volume	Minute ventilation	Residual volume	Expiratory reserve volume	Inspiratory reserve volume
Definition					
Typical resting value					
Change during exercise					



At the alveoli:

Gas Exchange



Explain how gas exchange occurs at the alveoli and the muscles. **B**

At the muscles:

Regulation of Breathing Rate

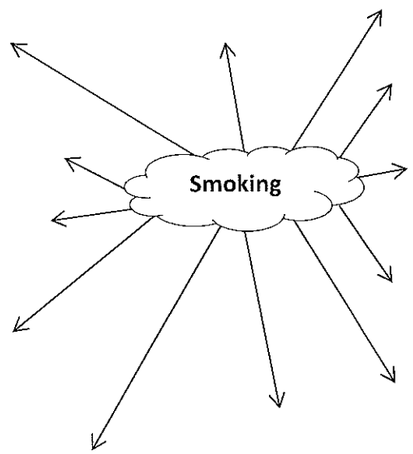
The respiratory control centre of the brain is made up of the **inspiratory control centre** and the **expiratory control centre**. These two centres work together to regulate breathing at rest and during exercise without conscious thought and, therefore, require different receptors to send them information in order to control breathing rate.

Explain how neural, chemical and hormonal factors control breathing rate. **C**

1. **Neural**
2. **Chemical**
3. **Hormonal**

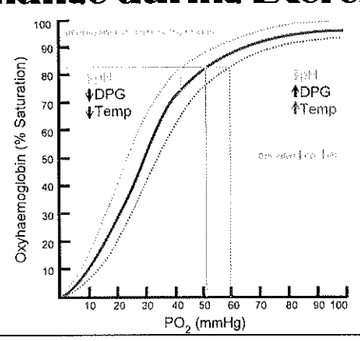
Impact of Smoking on Respiration

D **Complete the spider diagram by identifying the risks associated with smoking.**



Gas Exchange during Exercise

Dissociation of oxyhaemoglobin
In a high partial pressure of oxygen (e.g. at the lungs), oxygen binds more readily to haemoglobin. As this partial pressure decreases (e.g. at the exercising muscles) oxygen is more readily released. As exercise intensity increases, the partial pressure of oxygen decreases and so oxygen is easily released from haemoglobin.



As exercise intensity increases, there is a larger **pressure gradient** between CO_2 and O_2 levels at the sites of gas exchange.

The Neuromuscular System

Muscle Contraction during Exercise and Recovery

There are two different types of muscle fibres – slow twitch and fast twitch. There are two types of fast-twitch fibres – fast oxidative glycolytic (type IIa) and fast glycolytic (type IIb).

Identify the characteristics of each muscle fibre type in the table below and give one sport each fibre type would be beneficial in.

A

Slow oxidative (I)	Fast oxidative (IIa)	Fast glycolytic (IIb)
Sport:	**Sport:**	**Sport:**

Muscle fibre recruitment
Muscle fibre recruitment is dependent on the intensity of the exercise; higher-intensity exercise requires more force, with lower-intensity exercise requiring less force.

The Size Principle (Henneman et al. 1974)
Smaller motor units are recruited first as they have a smaller firing threshold than larger motor units.

The Recruitment of Muscle Fibres

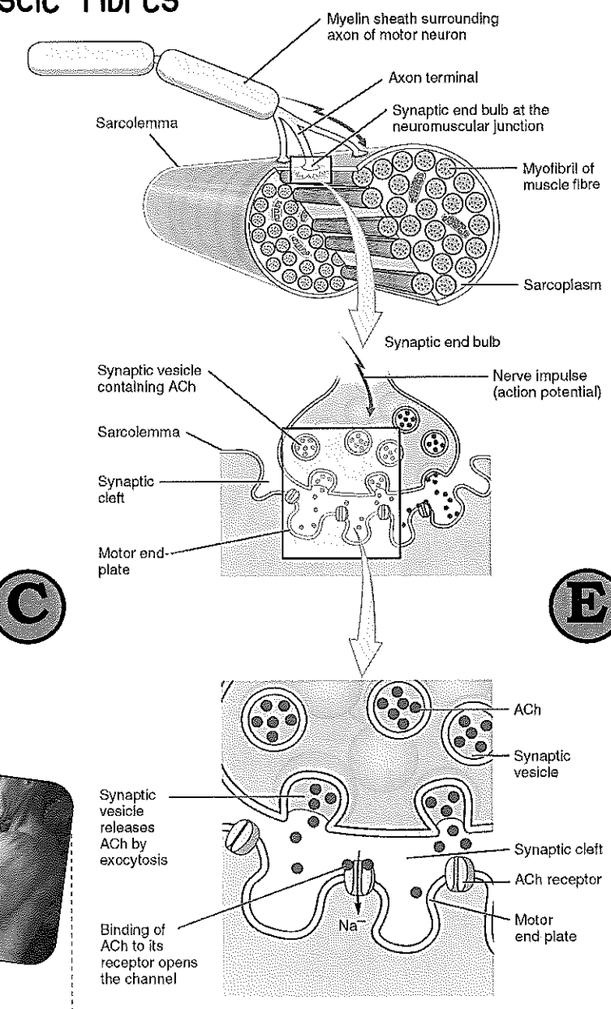
Structure and role of motor units

B

Describe the functions of each component that makes up a motor unit.

Key structures:

- **Myelin sheath:**
- **Axons:**
- **Myofibrils:**
- **Sarcolemma:**
- **Synaptic vesicle:**
- **Synaptic cleft:**
- **Motor end plate:**



Nervous stimulation of a motor unit

A motor unit needs to be stimulated to enable muscular contraction.

Outline the four stages of nervous stimulation of a motor unit:

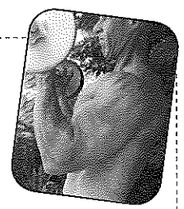
C

1.

2.

3.

4.



- Motor units vary in the number of muscle fibres that they stimulate.
- The fibres are made up of only one type.
- The brain recruits smaller motor units before larger motor units.
- Smaller motor units consist of slow-twitch fibres.
- Larger motor units consist of fast-twitch fibres.

The Nervous Systems

The autonomic nervous system is responsible for subconsciously controlling muscular contractions.

There are two systems which make up the autonomic nervous system:

- The **parasympathetic** nervous system is responsible for actions that occur when resting.
- The **sympathetic** nervous system is responsible for actions when active.

Both nervous systems innervate the muscle tissues by sending a nervous impulse to them.

Proprioceptive Neuromuscular

D

Describe what proprioceptive neuromuscular facilitation is and the role that muscle spindles and the Golgi tendon organ play.

Research:
How does nervous stimulation of a muscle change when a performer is fatigued?

'All or none' law

Each muscle fibre controlled by a motor unit is either fully contracted or not contracted at all.

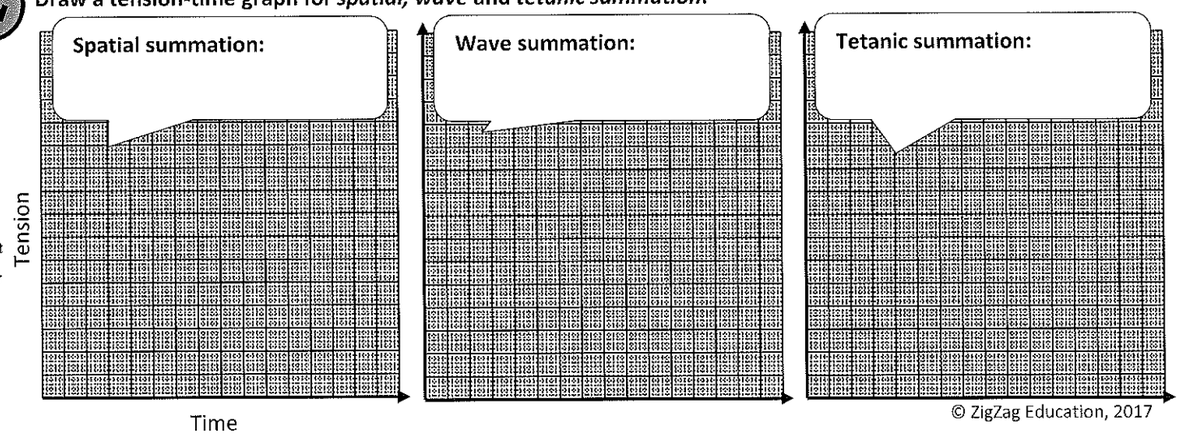
They can contract in different ways depending on how they are innervated.

Therefore, a muscle fibre cannot partially contract.

E

The way that individual motor units are recruited determines the amount of force that is produced in a muscle.

Draw a tension-time graph for *spatial, wave* and *tetanic summation*.



The Musculoskeletal System and Movement Analysis

A Identify the agonist and antagonist muscles used in each of the following movements.

Joint	Type	Articulating Bones	Joint Action	Agonist	Antagonist
Shoulder	Ball and Socket	Scapula and humerus	Flexion		
			Extension		
			Adduction		
			Abduction		
			Horizontal abduction		
			Horizontal adduction		
Elbow	Hinge	Humerus, radius and ulna	Flexion		
			Extension		
Hip	Ball and Socket	Femur and pelvis	Flexion		
			Extension		
			Adduction		
			Abduction		
			Horizontal abduction		
			Horizontal adduction		
Knee	Hinge	Femur and tibia	Flexion		
			Extension		
Ankle	Hinge	Talus, tibia and fibula	Plantar flexion		
			Dorsiflexion		

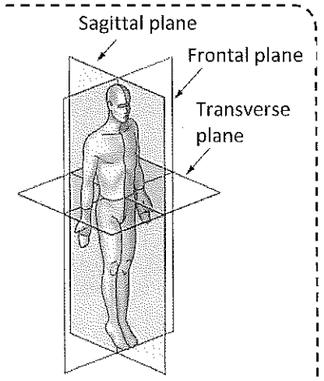
Planes of Movement

There are three planes of movement, each with an associated dimension for your body to move in. **Give as many sporting movements which occur in each plane as you can think of.** **B**

Frontal:

Transverse:

Sagittal:



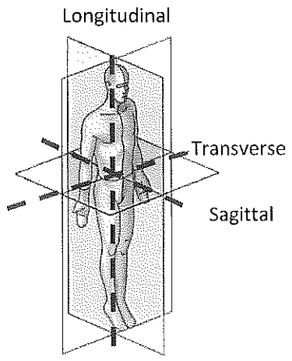
Axes of Rotation

There are three axes of rotation, each with an associated direction for your body to rotate. **Give as many sporting movements which occur around each axis.** **C**

Transverse:

Sagittal:

Longitudinal:



Types of Contraction

Muscles have many different roles within the body, namely **movement**, **heat production**, **digestion** and **maintaining posture**. The capability of the muscles to undergo contraction and relaxation is the key enabler of movement. Muscles can contract in different ways depending on what action they are trying to perform.

D **Provide a definition for the following types of contraction.**

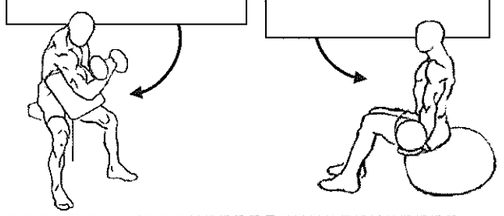
Muscle contractions aren't all the same. Sometimes muscles contract and lengthen, sometimes they contract and shorten and sometimes they contract and don't change length at all.

Isotonic:

Concentric:

Eccentric:

Isometric:



Analysis of Movement

Analysing movement is a key concept of biomechanics, and is completed to help improve sport performance by improving the efficiency of sporting movements, and identifying how technique could be improved.

When analysing movement you should refer to:

- the movement produced
- the plane of movement
- the axis of movement
- the type of muscle contraction taking place

Research: ***How is movement analysis data and analysis used in sport today?***

Analyse the movements in the images below: **E**

Elbow and shoulder

Javelin withdrawal phase

Knee and ankle

Kicking backswing

Hip

Holding the leg outstretched

Bullet point the characteristics of each skill type on the continuums below and then provide as many examples as you can in sport for each of the skill types

A

Classification of Skills

Difficulty (simple–complex)

How technically difficult the skill is to perform

Simple ⟷ Complex

Environmental influence (open–closed)

How much of an influence the environment has on a skill

Open ⟷ Closed

Pacing (self-paced–externally-paced)

How much control the performer has over the timing of the skill

Self-paced ⟷ Externally-paced

Research:
How do the different types of skills influence the approaches a coach may take when helping someone to learn them?

Muscular involvement (gross–fine)

How precise the movement is

Fine ⟷ Gross

Continuity (discrete–serial–continuous)

How apparent the start and end of the skill are

Discrete ⟷ Serial ⟷ Continuous

Organisation (low–high)

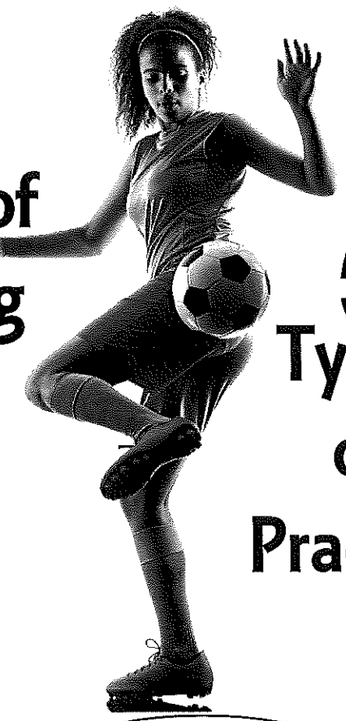
The complexity of the combination of the subroutines

Low ⟷ High

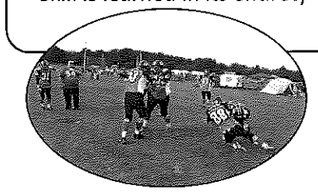
A Complete the spider diagram below to provide a sporting example of each method of practice and evaluate the advantages and disadvantages of each method.

B Describe and evaluate the different types of practices

Methods of Presenting Practice



Whole Practice
Skill is learned in its entirety



- Example
- Advantages
- Disadvantages

Whole-part-whole Practice
Practising the skill in its entirety and then breaking the skill down into its subroutines, before completing the skill as a whole again

- Example
- Advantages
- Disadvantages

Progressive-part Practice
Learning the individual subroutines in chronological order, and then joining these together in order. Eventually the skill is learned in its entirety.

- Example
- Advantages
- Disadvantages

Types of Practice

Massed Practice

Distributed Practice

Mental Practice

Varied Practice

Transfer of Skills

Skill transfer can occur throughout an athlete's development. The more experience an athlete has of a learned skill, the more of an effect (either positive or negative) it will have on the future skill.

A **Using the images to help, describe each type of skill transfer listed below and provide another example of each.**

zero


bi-lateral


positive


negative


How to optimise positive transfer and limit the effect of negative transfer:

- Make the performer aware of any similarities and differences between the current and future skill.
- Do not attempt the complex skills too early, make sure that the basic skills are learned first.
- Motor skills should be fully learned, as this will lead to a solid foundation that can form the basis of a new skill.

Principles and Theories of Learning movement Skills

Operant conditioning

- Uses **either positive or negative reinforcement**, to encourage the correct response to a stimulus.
- Positive reinforcement is used following a successful performance, through the use of a reward.
- Negative reinforcement is used following an unsuccessful performance, via removing an unpleasant stimulus.
- Punishment is used following an unsuccessful performance and involves adding an unpleasant stimulus or taking away a positive stimulus.

Stimulus → Stimulus response bond → **Response**

An example of positive reinforcement: a baseball player congratulating their teammate for good play.

- Strengthened through positive or negative reinforcement
- Weakened through punishment

Bandura's Observational learning

B **Identify and explain the four stages of observational learning outlined by Bandura's social learning theory.**

1.

2.

3.

4.

Cognitive theories

- The learner needs to develop an understanding of the skill, rather than how to react to a stimulus.
- The learner uses perception to aid their understanding.
- Gestaltists state that skills should be understood in their entirety.
- Insight theory: a sudden understanding, or insight, of the skill leads to a rapid improvement in performance.

Social development theory

- Our behaviour is dependent on the behaviours of others.
- We change our behaviour depending on the situation that we are in.
- We adapt so that we display the same behaviour as group norms.
- Different groups will have a different group norm depending on the demands placed upon them.

Research:
Why are there so many learning theories?

Stages of Learning

C **Describe the characteristics of each stage of learning**

Cognitive	Associative	Autonomous
		

A **learning plateau** occurs when an athlete stops making progress and performs to the same level for a period of time.

Provide some reasons why a learning plateau occurs and how it can be overcome. **D**

It can occur due to:

-
-
-
-
-
-

Moving past a learning plateau:

-
-
-
-
-

Guidance and Feedback

A Evaluate the advantages and disadvantages of each type of guidance.

B Describe each type of feedback.

Visual Guidance

Visual guidance consists of the coach using visual cues to encourage learning. It is very important that any demonstration given is accurate, as an inaccurate demonstration could result in the incorrect technique being emulated. Combining visual guidance with the use of mental rehearsal enhances its effectiveness, as strategies such as imagery can help the learner retain the key teaching points.

Advantages:

Disadvantages:

Verbal Guidance

Verbal guidance consists of the coach using verbal instructions to clearly explain to the learner how the skill should be correctly performed. When using verbal guidance, the coaching points should be accurate, concise and relevant.

Advantages:

Disadvantages:

Manual Guidance

Manual guidance involves the coach physically altering the learner's body position to ensure that their physical performance of the skill is correct. This style of guidance is primarily used when learning how to perform a dangerous and complex skill.

Advantages:

Disadvantages:

Mechanical Guidance

Mechanical guidance involves the coach using equipment to help the performer learn how to perform specific sections of a movement correctly. This style of guidance is generally used during the learning of a dangerous and complex skill.

Advantages:

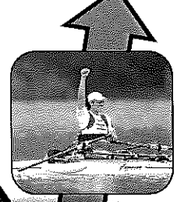
Disadvantages:

Research:
How can an individual's past experiences impact on how they perceive and use the guidance and feedback given to them?

Intrinsic Feedback

Advantages:
Improves the performer's kinaesthetic awareness. Useful for elite athletes to use as they rely on less external feedback.

Disadvantages:
Learners at the cognitive stage of learning may not understand how a correct movement is supposed to feel.



Positive Feedback

Advantages:
Increases self-efficacy, especially in the early stages of learning. Can lead to reinforcement of the correct responses.

Disadvantages:
Can lead to over-confidence if used repeatedly.

Extrinsic Feedback

Advantages:
Useful for those in the cognitive and associative stages of learning.
Improves focus and motivation.

Disadvantages:
Disregards any kinaesthetic awareness of the movement.
The performer becomes over-reliant on external gratification.

Negative Feedback

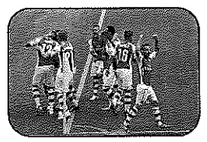
Advantages:
It can prevent future errors being made. It can improve motivation and focus.

Disadvantages:
It can reduce self-efficacy and motivation, particularly for those in the cognitive stage of learning.

Knowledge of Performance

Advantages:
Helps to identify the finer details of an action, and explain the effect that they have on performance.

Disadvantages:
Can provide too much information for a learner. It can also not allow the learner to appreciate a whole feel for a movement.



Knowledge of Results

Advantages:
It is easy to identify progression in performance, and if successful can improve task persistence.

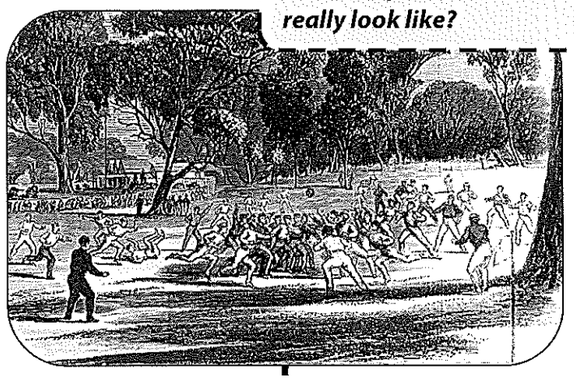
Disadvantages:
Overuse can lead to reduced performance enjoyment. It does not explain why a performance was successful or unsuccessful, which may make it harder to replicate a successful performance.

Pre-industrial Britain (pre-1780)

How social and cultural factors shaped the characteristics of, and participation in, sports and pastimes in pre-industrial Britain

A Fill in the spider diagram below by explaining how each factor influenced the characteristics of sport during pre-industrial Britain.

Research:
What did pre-industrial Britain really look like?



Influenced by...

- **Availability of money**
- **Law and order**
- **Type and availability of transport**
- **Education/literacy**
- **Availability of time**
- **Gender**
- **Social class**

Upper Class

Upper class signified those with money and who owned large amounts of land, and did not partake in manual labour.

The upper class took part in rational recreation such as real tennis, with those from the lower class not having access to this sport.

Wagering was involved in sport in pre-industrial Britain. Wagering allowed the upper class to bet on lower-class sports and take on the role of spectators.

Those from the lower class were manufacturers with little money, and who lived in poverty in cramped poor conditions. The working conditions of the lower class meant that sport was irregular due to the limited time they had to participate. Lower class participants who took part in popular recreation, such as mob football, were violent due to the lower class enjoying the violent nature of sport.

Lower Class

B **Provide as much information about real tennis in pre-industrial Britain as you can:**

Characteristics of **rational recreation:**

C **List the characteristics associated with rational and popular recreation during pre-industrial Britain.**

Characteristics of **popular recreation:**

Case study of mob football in pre-industrial Britain

- **Mob football** had no skill development, no rules and was brutal in nature
- Only the lower class would take part
- Games were very occasional, usually only being played on religious holidays when the lower class had time off work
- The participants risked injuries and loss of income due to time off work
- They were large-scale games often played by local villages
- Due to the violent nature, property was often damaged

Status of amateur and professional performers

The British Empire

Changing role of women in sport

Transport

Industrial revolution / provision through factories

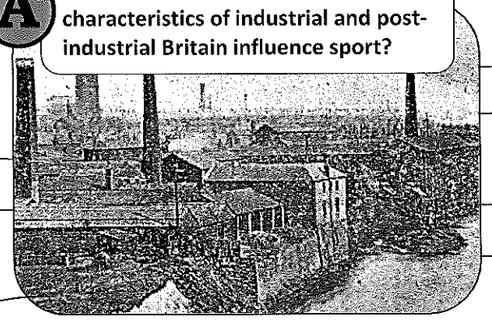
Urbanisation

Development of national governing bodies

Churches and local authorities

Three-tier class system

Communication



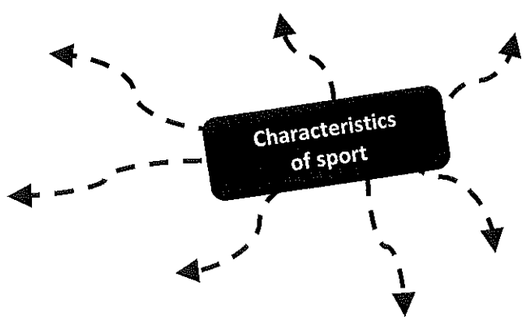
A How did the social and cultural characteristics of industrial and post-industrial Britain influence sport?

Industrial and Post-industrial Britain (1780–1900)

How social and cultural factors shaped the characteristics of, and participation in, sport between 1780–1850 in Britain

Research:
What sporting competitions were taking place during this period of time?

B List the characteristics of sport at this time.



Case Studies

C Describe how the characteristics of sport during this era brought about the Wenlock Olympian Games.

Wenlock Olympian Games

Lawn Tennis

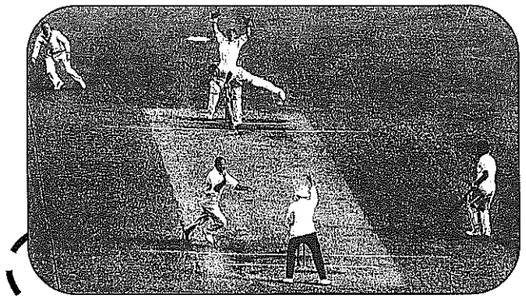
Created by the middle class in 1874 as an alternative version of real tennis and still played today. It was not very popular with schoolboys due to the lack of physical challenge but it provided a greater opportunity for women to take part in sport.

Association Football

A game which evolved from mob football as the rules became standardised. It developed as a result of the lack of space available in inner city areas and became popular with teams, fixtures and competitions being set up. It provided an opportunity for factory workers to compete for money as professionals.

Post-World War II Britain (1950 to present)

How social factors shaped the characteristics of, and participation in, sport in twentieth-century Britain



A Explain the effect that each of the factors in the table below had in shaping modern sport in twentieth-century Britain.

Gender / changing role and status of women	
Law and order	
Education	
Availability of time	
Availability of money	
Transport	

Amateurism and professionalism

In the twentieth century amateurism and professionalism were still similar to the previous century, e.g. upper class were amateurs and lower class were professionals.

This divide has shifted in modern day sport with a class divide not being evident in most sports.

Due to the globalisation of sport, professional sports people are now able to earn vast sums of money

Class	Gender / changing role and status of women
Education	Availability of money

Transport	
Law and order	
Availability of time	

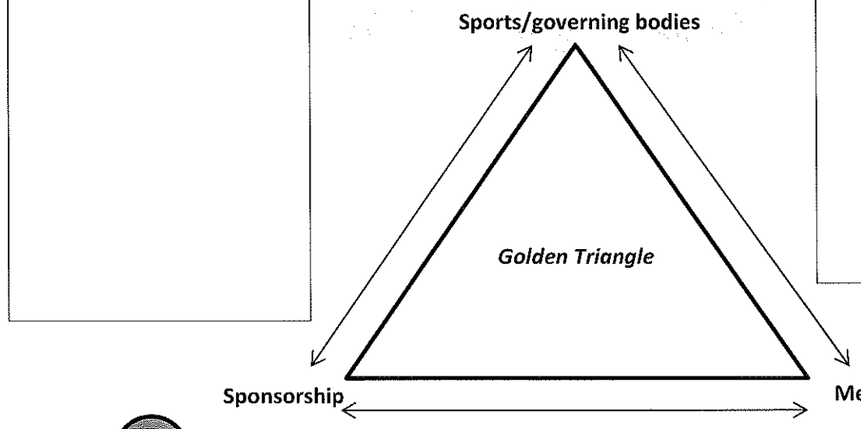
B Using the headings on the diagram below, assess how each of the factors given has shaped participation in sport in the twenty-first century.

Twenty-first-century Britain

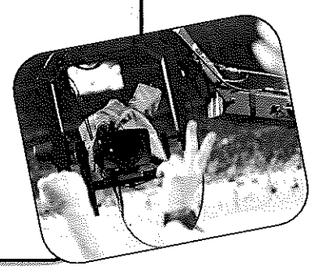
How social factors shaped the characteristics of, and participation in, sport in twenty-first-century Britain

Research:
What defining historical events happened in the twentieth century and how did these impact on sport?

Globalisation of sport



D Annotate the 'golden triangle' of sport to show how each factor impacts upon the others.



Case study: Women in football

C Women's football has developed a lot in the twenty-first century. Identify three possible reasons why the women's game has become more popular.

Research:
What other sports have seen a considerable increase in participation and success in the twenty-first century?

Sociological Theory Applied to Equal Opportunities

Physical activity can have a large effect on the health of an individual and, therefore, have a large impact on society.

A **Describe the six key terms relating to society and sociological theory.**

Society

Social Processes

Socialisation

Social Issues

Social Structures / Stratification

Social Action Theory

The following terms can have an impact on society and affect the level of sports participation:

- **Discrimination:** *the use of a negative perception to make a distinction between individuals or a group*
- **Stereotyping:** *a preconceived, oversimplified perception of an individual or a group*
- **Prejudice:** *a previously formed biased opinion which has no evidence to back it up*

These can be overcome by:

- **Equal opportunities:** *an individual being treated fairly without any form of discrimination preventing them from participation*

Research:
Identify policies and schemes that organisations like Sport England have developed to reduce the barriers to participation in the underrepresented groups.

B **Identify as many barriers to physical activity participation as you can for each of the four underrepresented groups. Then try to identify any solutions which could reduce the impact of these barriers.**

Underrepresented group	Barrier	Solution
Disability		
Ethnicity		
Gender		
Disadvantaged		

There are a number of reasons why attempts should be made to increase the sport and physical activity participation rates:

In order to raise participation rates and benefit society, a number of organisations work together

C **Identify the health, fitness and social benefits of being physically active.**

Health	Fitness	Social

Sport England

Sport England works with the following partners:

Local Partners	National Partners	National Governing Bodies
e.g. local authorities	e.g. Women in Sport	e.g. the Football Association (FA)

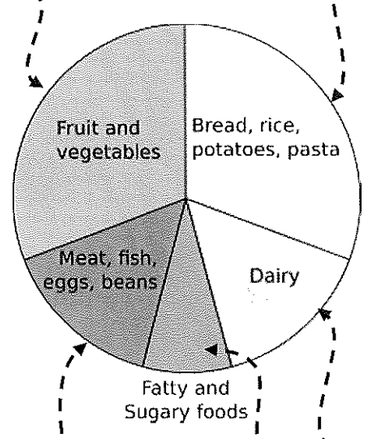
These organisations work together to:

- increase provision of sport
- increase and improve facilities
- increase funding
- provide talent pathways to elite sport
- increase participation at grass roots
- increase participation of underrepresented groups, e.g. disabled individuals and women

Diet and Nutrition and Their Effect on Physical Activity and Performance

Diet and nutrition

A healthy balanced diet consists of seven components, which when eaten in an optimal proportion can help improve sporting performance.



Vitamins

Vitamins are also micronutrients that are required in small amounts. There are four main vitamins that have exercise-related functions:

Vitamin C

- Improves immune function which allows athletes to avoid infections and illnesses and maintains and repairs the health of bones and connective tissues
- Found in green vegetables and citrus fruits

Vitamin D

- Improves bone health by assisting the absorption of calcium which is required for bone remodelling
- Supports protein synthesis and increases ATP stores – providing more energy
- Found in fatty fish and dairy products such as milk and cheese

Vitamin B-12

- Aids the production of red blood cells which improves oxygen transport
- Can increase metabolism and, therefore, maintain lean body mass
- Increases energy production
- Found in fish, meat and eggs

Vitamin B-complex

- Used in the production of energy by assisting the breakdown of food
- Found in multivitamin tablets, fortified breads, tuna, berries and vegetables

Minerals

Carbohydrates

Fibre

- Foods containing carbohydrates are also good sources of dietary fibre
- Fibre aids the process of digestion and also reduces the rate at which glucose is released into the blood which makes energy release more sustainable and avoids spikes in blood glucose levels

Fats

There are two types of cholesterol.

1. **Low-density lipoproteins** – transfer cholesterol to the tissues of the body but some can build up on the walls of the arteries and increase the risk of cardiovascular disease
2. **High-density lipoproteins** – transfer cholesterol in the blood to the liver to be broken down and removed from the body. They reduce the risk of cardiovascular disease

Explain the main exercise-related roles of *Minerals, Carbohydrates, Proteins* and *Fats* in the diet, giving examples of food sources in your answer. A

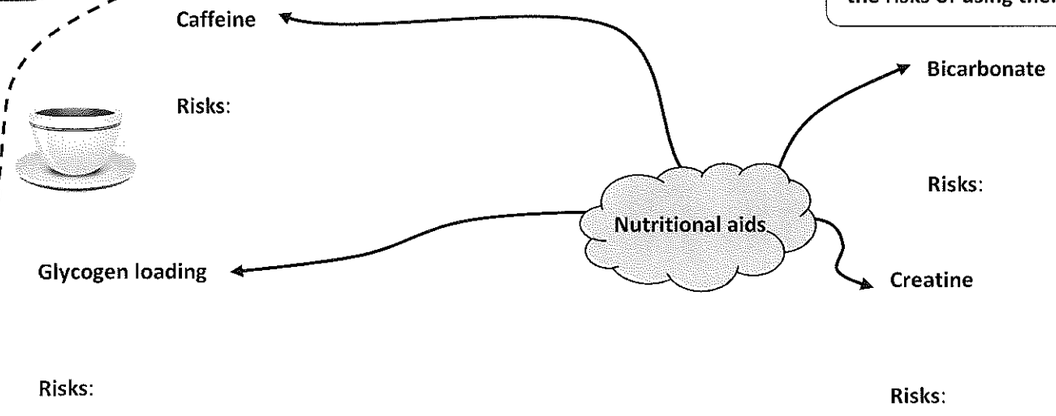
Proteins

Research:
What other nutritional aids do elite performers use?

Water

Explain the importance of consuming water and identify different times it can be consumed. B

Describe the nutritional aids given below and identify the risks of using them. C



Preparation and Training Methods in Relation to Improving and Maintaining Physical Activity and Performance

Data terms

There are four types of data that can be collected from fitness testing. These are qualitative, quantitative, objective and subjective and they are explained below:

Qualitative data is a measurement based on observational data.

Quantitative data is a measurement that involves numerical data.

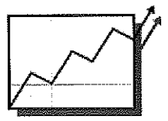
Subjective data is any data which is taken from observations and involves some form of personal opinion.

Objective data is any data which can be measured directly without personal opinion.

Data integrity can be maintained by ensuring the following are met and also by calibrating equipment regularly:

Validity – the degree to which a test measures what it is intended to

Reliability – the degree to which the results of a test can be repeated

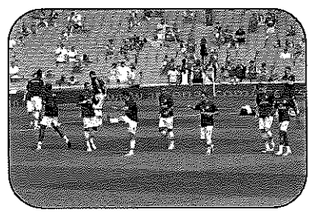


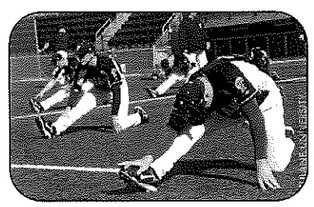
Warming up and cooling down!

A **List the benefits of completing a warm-up and cool-down.**

B **Identify the three types of stretching from the descriptions provided.**

1. _____ which involves sudden bouncing movements to stretch a muscle, and is not recommended due to this type of stretching putting the performer at risk of injury.
2. _____ which involves stretches being performed when moving which is important for sports such as rugby where athletes must stretch when moving, e.g. during a scrum.
3. _____ which involves a stretch being held in a stationary position which is important for sports such as gymnastics.





Principles of training

C

Coaches and athletes should use the following principles of training to guide their training plans. These principles will ensure that training is effective and adequate changes can be made when required.

Identify (using the letters to help you) and describe the principles of training below.

S F

PO I

R T

R T

Research: ***How does periodisation of training regimes differ with age and gender?***

Periodisation of training

Periodisation cycles:

Specific training areas	Microcycle	Microcycle	Microcycle	~a week
Consists of a number of microcycles	Mesocycle			~a month
The training year/goal	Macrocycle			

D **Describe the three phases of training.**

1.
2.
3.

Factors to consider when planning a personal health and fitness programme:

- the client's characteristics
- the client's goals
- the fitness components to target
- FITT
- how to monitor progress
- when to taper
- phases of training

E

Tapering

Tapering involves reducing the amount of training (but maintaining intensity) 1–3 weeks prior to the competition.

Identify three benefits of tapering:

1.
2.
3.

Peaking

When the adaptations from tapering enable the optimal level of performance. The performer normally aims to peak during the most important competition period of their season.

Training Methods to Improve Physical Activity and Performance

A Identify the component of fitness that each training method can be used to improve.

B What are the advantages and disadvantages of each type of training?

C Identify a sporting example where each training method would be useful to improve performance and explain why it would be an appropriate method.

Interval Training

Component of fitness:

.....

What?
- High-intensity work performed
- Short duration
- Many rest periods

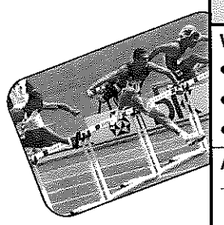
Advantages
+

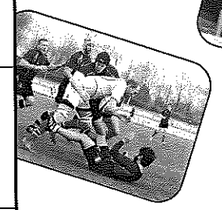
+

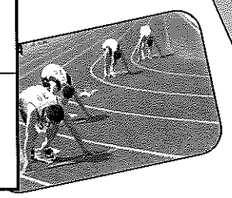
Disadvantages
–

–

Useful for







Proprioceptive Neuromuscular Facilitation

Component of fitness: .....

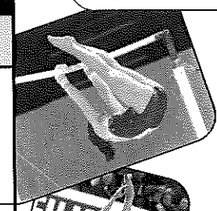
What?
The muscle is passively stretched, before isometrically contracted. This then stimulates the Golgi tendon organ to inhibit the stretch reflex, allowing for a greater range of motion for the passive stretch that follows.

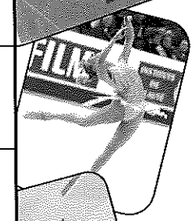
Advantages
+

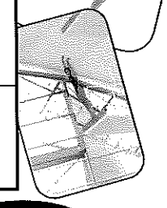
+

Disadvantages
–
–
–

Useful for







Weight Training

Component of fitness:

.....

What?
- Loads are repeatedly lifted
- Can be performed using free weights, resistance machines and body weight
- The number of sets and repetitions determines the type of strength being trained
- Usually performed with a load of 80-100% of 1 rep max and around 4 sets with a low number of repetitions

Advantages
+

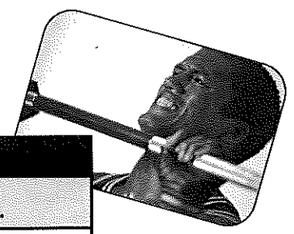
+

+

+

Disadvantages
–
–
–
–

Useful for



Continuous Training

Component of fitness:

.....

What?
- Low intensity
- Long duration
- No rest periods

Advantages
+

+

+

Disadvantages
–

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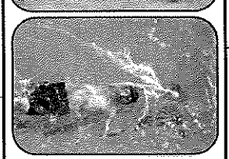
Useful for



Fartlek Training

Component of fitness:

.....

What?
- Continuous exercise
- Performed over different terrains

Advantages
+

+

+

Disadvantages
–
–
–

Useful for

Training methods

Circuit Training

Component of fitness: .....

What?
- A series of exercises are performed at different stations
- Little or no rest between each station
- Usually performed with a load of 50% of 1 rep max and 3 sets with a high number of repetitions

Advantages
+

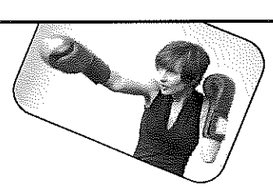
+

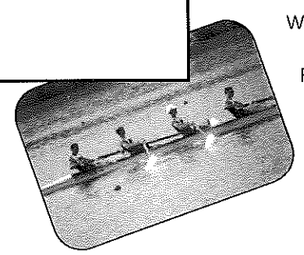
+

+

Disadvantages
–
–
–

Useful for





VO_2 max

The maximal volume of O_2 that can be consumed and utilised by the body

Age
As age increases, VO_2 max decreases

Gender
Males have a larger VO_2 max

Training
Aerobic training is the best way to increase VO_2 max

Individual physiological make-up
Factors such as body composition and muscle fibre types affect VO_2 max

Strength

Different components of strength can be trained using weight training

Maximum Strength
Weight: 70–85% 1RM
Sets: 1–3 Repetitions: 6
Rest between sets: 2–3 minutes

Strength Endurance
Weight: <70% 1RM Sets: 2–4
Repetitions: 10–25
Rest between sets: 30–60 seconds

Static Strength
Isometric exercises held for 5–10 seconds

Dynamic Strength
Weight: 100% 1RM Sets: 1
Repetitions: 1

Explosive Strength
Weight: 60–75% 1RM
Sets: 1–3 Repetitions: 3–6
Rest between sets: 1–3 minutes

Biomechanical Principles and Levers

Newton's Laws of Motion

A Describe Newton's three laws of motion.

First Law: Inertia	
Second Law: Acceleration	
Third Law: Reaction	

Biomechanical Calculations

B Complete the equations below and provide units for all parts of the equation.

Speed (m/s) *The time it takes to move a certain distance*	=		/
Distance (m) *The length of the path travelled*	=		×
Force (N) *The 'push' or 'pull' exerted onto an object*	=		×

Research:
How can the biomechanical principles on this page provide elite performers with an advantage in their sport?

Levers

C Draw and label the three lever systems in the space below and explain what is meant by mechanical advantage/disadvantage.

E.g. rowing

E.g. a press up

E.g. bicep curl (upwards phase)

Load: the weight that needs to be moved (the weight of the moving body part)

Effort: the force needed to move the load (the muscle)

Fulcrum: the location of the movement (the joint)

Effort arm: the distance from the fulcrum to the effort

Load arm: the distance from the fulcrum to the load

Mechanical Advantage/Disadvantage:

Weight:
The effect of gravity on an object
Weight = mass × 9.81m/s²

Net force:
The total force exerted on an object

Balanced forces:
Opposing forces in opposing directions are equal

Unbalanced forces:
Opposing forces in opposing directions are unequal

Affected by:
- The mass and velocity of an object
- Streamlining and shape
- Front cross-sectional area

Reaction:
Provides an opposite force to the force being exerted

Force

Air resistance:
A form of friction acting between an object and the air

Friction:
Occurs when two surfaces interact, opposing movement

Free body diagrams:
These show the vertical and horizontal forces being exerted on a body, and how these affect the motion of the body

Affected by:
- The velocity and mass of an object
- Smoothness of the interacting surfaces

D Draw and label arrows on the free body diagram of a cyclist to show the forces acting upon them as they perform.

Stability

The object's resistance to changing position

E Identify and describe four factors which affect stability in the boxes below. And under each box explain how a rugby player could use this information to improve their stability.

Psychological factors that influence performance: Personality, Attitudes, Motivation and Social Facilitation

Personality: The collection of distinctive characteristics of an individual which are specific to them.

A **Identify the characteristics of 'Type A' and 'Type B' personalities.**

Type A:

Type B:

Trait theory (Cattell)

An enduring quality that characterises an individual

Behaviour = function of personality

Introverts: Energy is lost during social situations

Extroverts: Become energised in social situations

Unstable: Emotions which can fluctuate wildly

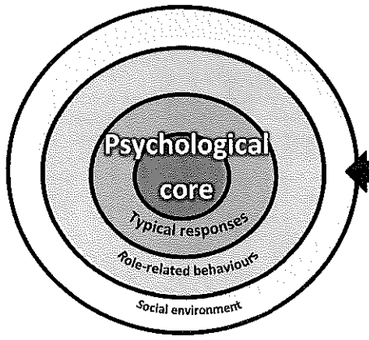
Stable: Emotions which stay steady

Theories

Social Learning theory (Bandura)

Personality formed from previous observations. Personality type is strengthened if observed behaviour is reinforced.

Behaviour = function of environment



Hollander's model of psychological core

Interactionist theory (Lewin)

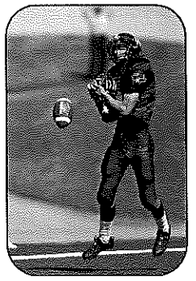
Lewin suggests traits govern how an individual is predisposed to react; however, this may change in response to their environment. This is linked to *Hollander's model of the psychological core.*

Behaviour = function of (personality × environment)

This perspective can aid sports performance as athletes with different traits may need to act differently in changing environments, e.g. a rugby player who is normally relaxed when playing, may need to calm themselves down when playing against a rival.

Social Facilitation:

C Zajonc suggested that high levels of arousal when performing in front of others will lead to the dominant response being displayed. This will either lead to social facilitation or inhibition.
Complete the diagram of social facilitation and explain what social facilitation and inhibition mean.



Social facilitation (✓):

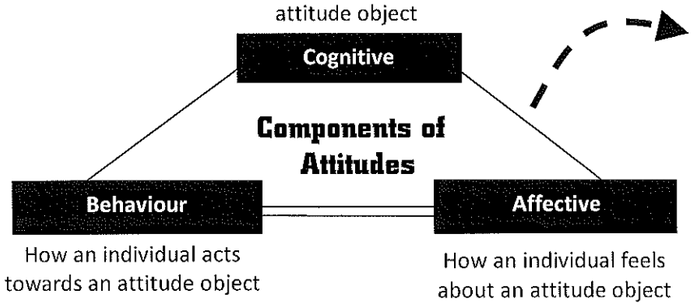
Social inhibition (✗):

Research:
Can you think of real-life sporting examples of someone experiencing social facilitation or inhibition?

Attitude: An enduring emotional feeling that alters the response given towards a specific situation.

B **Explain how attitudes towards physical activity and sport can be formed:**

How an individual thinks regarding an attitude object



How an individual acts towards an attitude object

How an individual feels about an attitude object

Creating an imbalance between these components makes an individual feel uncomfortable. This is known as **cognitive dissonance**. An individual is moved to reduce this dissonance.

Persuasive communication:
Verbally making relevant points, to change another person's attitude towards an object.

Effectiveness dependent on:

- the persuader's and receiver's characteristics
- the quality of the message
- the situation

Motivation:

The reason a person acts in the way that they do.

D **Identify the sources and effects of the two types of motivation.**

Intrinsic Motivation
A type of motivation that stems from within an individual

Sources:

Effects:

Extrinsic Motivation
A type of motivation that stems from outside of an individual

Sources:

Effects:

Psychological factors that influence performance: Arousal, Anxiety and Aggression

Aggression: The behaviour which has the goal of harming others by breaking the rules of the game. This shouldn't be confused with **assertive behaviour** which is acting in a forceful way within the rules.

A **Provide a critique for each theory of aggression.**

Instinct theory: every person has innate aggression, which they need to act upon to release this feeling. Sports which are thought of as being 'aggressive' provide an opportunity for an individual to let off steam and release their built-up aggressive energy.

Critique:

Social learning theory: aggression is learned through observation. Observing reinforcement of aggressive behaviour increases the likelihood of an individual displaying aggressive behaviour.

Critique:

Frustration–aggression hypothesis: feeling frustrated is the reason why aggressive behaviour occurs.

Critique:

Aggressive cue hypothesis: an increase in arousal coupled with an aggressive cue leads to aggressive behaviour.

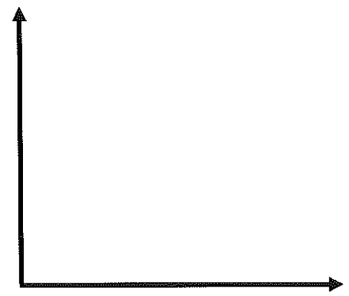
Critique:

B **Suggest three methods that could be used to control aggression.**

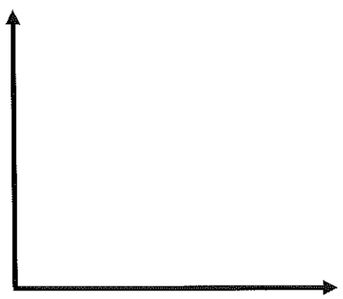
Arousal: A raised state of physiological readiness.

C **Draw a diagram to represent the three theories of arousal.**

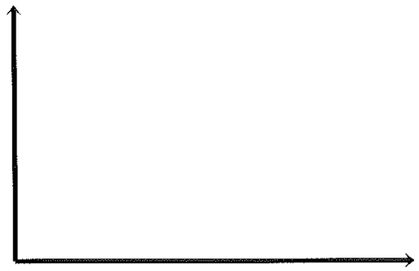
Research:
Can you form a link between each of the topics on this page? Can arousal lead to aggression and subsequently a negative attitude?



Drive theory:
- performance increases linearly with arousal levels
- at higher levels of arousal, the dominant response is prominent

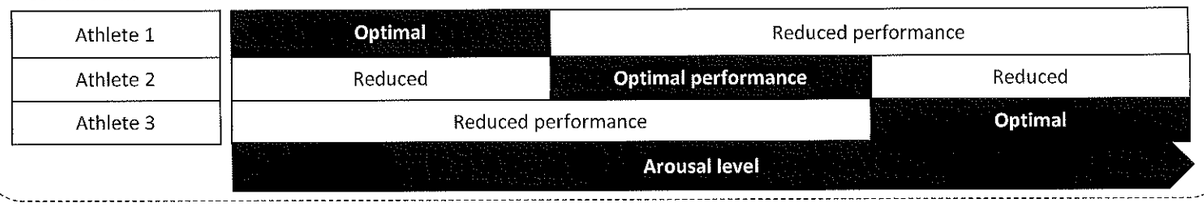


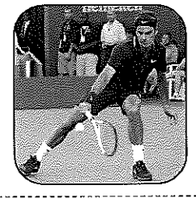
Inverted-U theory:
- as arousal increases, so does performance
- optimal arousal is the level of arousal where optimal performance occurs
- increasing arousal thereafter reduces performance



Catastrophe theory:
- performance increases along with cognitive anxiety
- as somatic anxiety increases alongside this, performance can rapidly deteriorate
- reducing arousal levels can help a performer regain their performance

Zone of Optimal Functioning: the performance of different types of individuals is affected differently along the arousal continuum.





D **Describe what is meant by 'peak flow'.**

Anxiety: A feeling of apprehension when faced with a stimulus that is perceived as threatening.

Competitive state anxiety:
How an individual reacts to a specific stressful situation

Competitive trait anxiety:
An individual's tendency to react to stress in a specific way

Somatic anxiety:
Physiological responses to anxiety

Cognitive anxiety:
Mental responses to anxiety

E **Identify the advantages and disadvantages of the three methods of measuring anxiety.**

Method	Advantages	Disadvantages
Questionnaires		
Observations		
Physiological measures		

Group and Team Dynamics in Sport

Defining a group and group cohesion

Group definition: A collection of individuals that work together to achieve a common goal

There is a close link between a group and a team, and the two terms are often seen as interchangeable.

Team definition: A group of people using their particular skills to work together

Cohesion:
Cohesion is determined by how close a team is, both socially and in pursuit of common goals. A cohesive group can achieve a performance goal with maximum efficiency, whereas a dysfunctional group could experience breakdowns in performances.

Two types of cohesion:

- **Task** – how united a group or team is in the pursuit of a common goal
- **Social** – how close group or team members feel to each other based on their social interactions

A **What characteristics do members of a group need in order to be successful?**

Research:
Find an example in sport where someone's 'individual differences' resulted in poor group dynamics.

Steiner's model of group effectiveness

About the model:
The model is concerned with the relationship between the individual contribution of group members to group productivity. A successful group performance requires a high level of team productivity, which in turn consists of the combination of the productivity of each of the individual team members.

This model is best summarised by the equation below:

Actual productivity =
best potential productivity – losses due to faulty processes

Coordination losses: Resulting from being incohesive, which affects the ability of a group to work together to reach a goal

Motivational losses: Individual members lack the required motivation to help the group succeed

The collective term for these types of losses is **faulty processes**.

Cohesion, group productivity and social loafing can be improved by: *improving communication, producing shared goals, outlining roles, ensuring team performance is more important than individual performance and allowing everyone to be involved in decision-making and goal-setting.*

Goal-setting in Sports Performance

There are four types of goal-setting which can be used by athletes and coaches:

Outcome	This is concerned with objective success, e.g. winning a tournament.
Task-orientated	This is concerned with performing a skill well, e.g. improving shot accuracy.
Performance	This is concerned with personal improvement, e.g. improving your own 100m personal best.
Process	This is concerned with technique improvements which are required for successful performance, e.g. improving sprint start in order to improve 100m time.

How goal-setting can improve performance...

Attentional focus

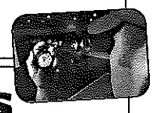
Task persistence

Raising confidence and self-efficacy

D **Explain how goal-setting can improve performance in relation to the following factors.**

Controlling arousal and anxiety

Monitoring performance



B Group formation

Identify and describe the four stages of group formation.

1.

2.

3.

4.

Tuckman's Model of Group Formation

Group dynamics: The social processes and relationships that exist between the members in a group

Factors affecting group formation:

- group size
- time available
- the communication between group members
- the motivation levels of members
- the experience of members
- the behaviour of the leader
- the group goals

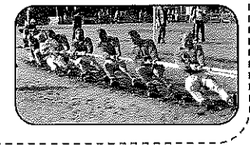
Ringelmann effect and social loafing

C **Explain what is meat by the Ringelmann effect and social loafing.**

Ringelmann effect

Social loafing

A good example of this, discovered by Ringelmann in 1913, concerns the contribution of the individuals during a tug of war. As the team adds extra members, each individual feels as though they have to put less effort into pulling the rope. This is because they feel as though their significance to team success is diminished. This results in a less productive team performance, and an increased likelihood of a failure in team performance.



E The SMART principles

Identify and describe the SMARTER principles of goal-setting.

S

M

A

R

T

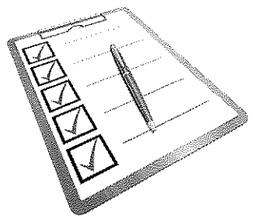
E

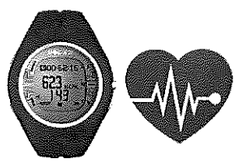
R

The role of technology in physical activity and sport

A Describe the four different types of data that can be collected.

Qualitative	Subjective
Quantitative	Objective





Research:
Find specific examples of professional sports teams / athletes using technology to improve their performance group dynamics.

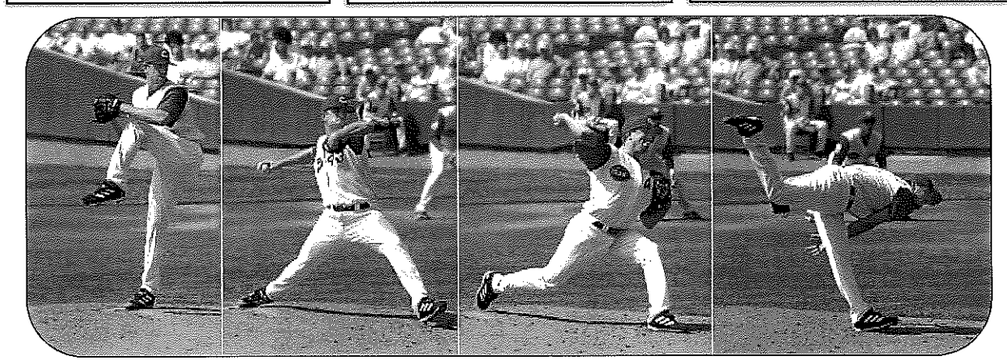
Data collection

Technology

Video analysis

B Identify the reasons why video analysis is used and any examples of its use that you can think of.

What is it?	Why is it used?	Examples of use:
Software can be used to determine how successfully a team or athlete performed during training or competition. It can be used to guide training programmes by determining areas of weakness and displaying the correct model of performance.		



Data integrity

Maintaining data integrity during collection and storage is important in order to ensure that the performance data collected is reliable and valid.

Reliability	Validity
The repeatability of results when testing the same thing	Whether the method of data collection is measuring what it is intended to measure

D How can data integrity be upheld?

Methods to maintain data integrity:

Testing and recording equipment

C Why is testing and recording equipment used in sport?

What is it?	Why is it used?	Example of use: indirect calorimetry
Technical equipment can be used to measure the physiological functioning of the body and it's response to exercise.		• Measured using a metabolic cart which measures heat production of the body • Heat production at rest provides a measure of resting metabolism • This can be used to determine a person's energy expenditure and calorie requirements • Also provides an indication of physical health

GPS and motion tracking software/ hardware

What is it?	Why is it used?	Examples of use:
GPS (global positioning system) is a method of measuring the distance covered, path of movement, speed of movement and positioning of an athlete during training sessions or competition. This information is measured via a small chip which is carried by the athlete (usually in their clothing or using smartphones/watches).	• To provide information about performance levels • To provide technical information such as their average position which can inform tactics • To inform training, e.g. help maintain an average speed	• Placed in the clothing of rugby players during matches • Wearing a watch while jogging