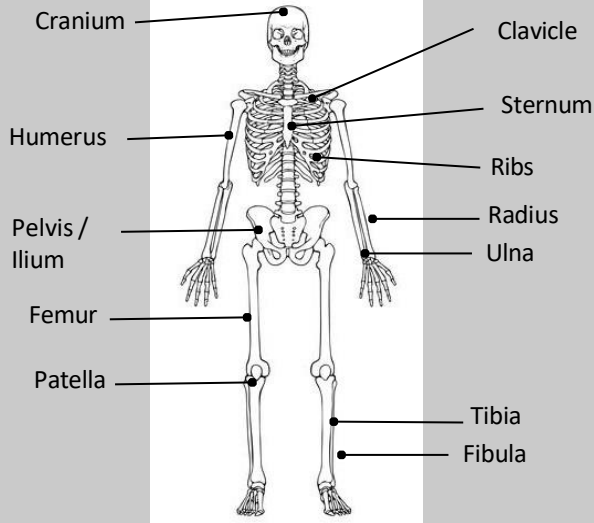
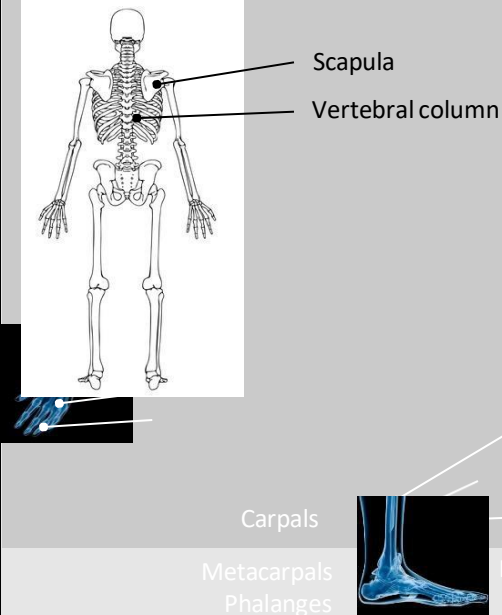


GCSE Physical Education – The structure and functions of the skeletal system

Structure of the skeletal system



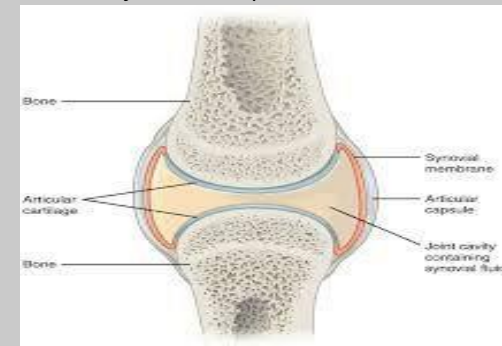
Structure of the skeletal system



Synovial Joints

These are **freely movable** joints where the joint surfaces are covered in **cartilage**, they are connected by a fibrous tissue capsule (joint capsule) and lined with fluid (synovial fluid).

Common joints are hip and shoulder



Function of the skeleton

- **Shape and Support** – posture
- **Movement** - muscle attachment & joint movement
- **Protection** of vital organs
- **Production** – platelets, red and white blood cells
- **Storage** - of minerals (calcium, phosphorus, iron, potassium)

Articulating bones – Hinge joints

- Knee – Femur+Tibia
- Elbow – Humerus, Ulna+Radius
- **Ball and socket joints**
- Hip – Femur+Pelvis
- Shoulder – Humerus+Scapula



Cartilage:

Used to reduce friction at a joint
 Hyaline cartilage (articular) – on the ends of bones at a synovial joint to stop rubbing
 White Fibro-cartilage – between bones as a shock absorber e.g. vertebrae, knee

Joint movements

Extended Knowledge

Decreasing the angle at a joint (bending)	Limbs moving towards the midline of the body.	A twisting/turning action around a joint.	When the toes are turned up to the body.
Extension	Abduction	Circumduction	Plantar-Flexion (ankle joint)
Increasing the angle at a joint (straightening)	Limbs moving away from the midline of the body.	A combination of flexion, extension, adduction & abduction.	When the toes are pointed away from the body.




Connective tissue

Ligaments – attaches bone to bone to add joint stability.

Tendons – attaches muscles to bone and contributes to joint movement as a result of muscle contraction.

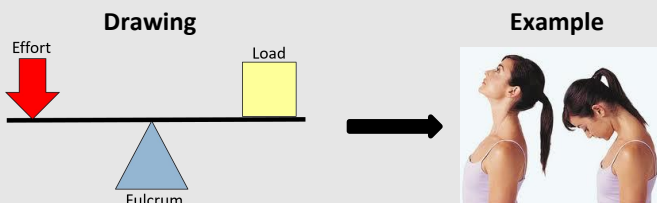
GCSE Physical Education – Movement analysis

Levers – a rigid bar that moves around a pivot point with force applied to it.

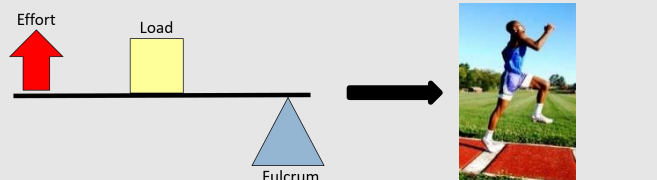
Fulcrum (F)	Effort (E)	Load (L)
A fixed pivot point 	The source of energy that will be applied 	The weight/resistance to be moved 

Classes of lever

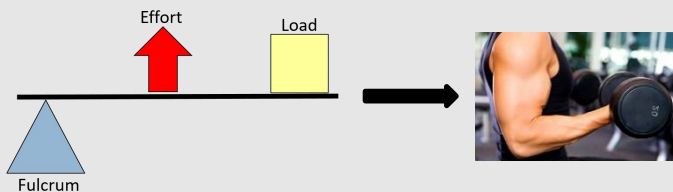
First class lever:



Second class lever:



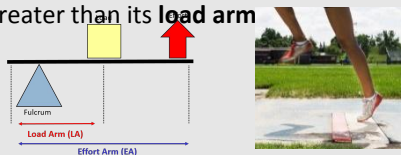
Third class lever:



Mechanical advantage –

$$MA = \text{Load} / \text{Effort}$$

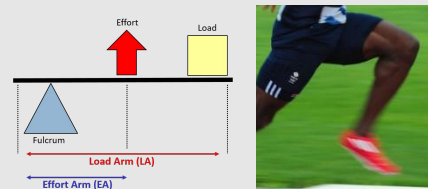
This is where a lever's **effort arm** is greater than its **load arm**



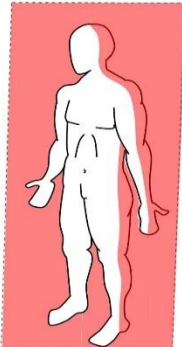
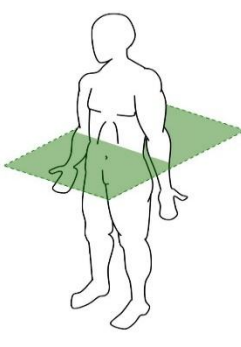
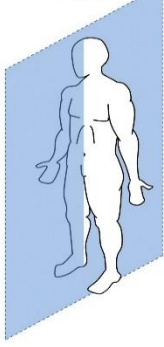
Large loads can be moved with limited effort.

Mechanical disadvantage

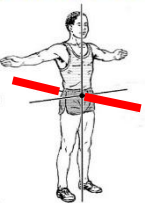

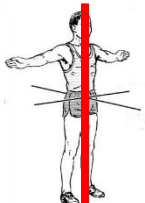

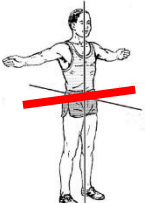

This is where a lever's **load arm** is longer than its **effort arm**.



Planes – imagery lines that divide the body into two.

Frontal plane	Transverse plane	Sagittal plane
A vertical plane but this divides the body into front and back e.g. jumping jacks 	A horizontal plane that divides the body into upper and lower halves e.g. bowling in cricket 	A vertical plane that divides the body into right and left sides e.g. kicking, running 

Axes – imagery lines that the whole body turns around.

Frontal axis	Longitudinal axis	Transverse axis
Runs through the body horizontally from the back to front.  Example: Cartwheel 	Runs through the body vertically from the top to bottom.  Example: Full twist 	Runs through the body horizontally from the left to right.  Example: Somersault 

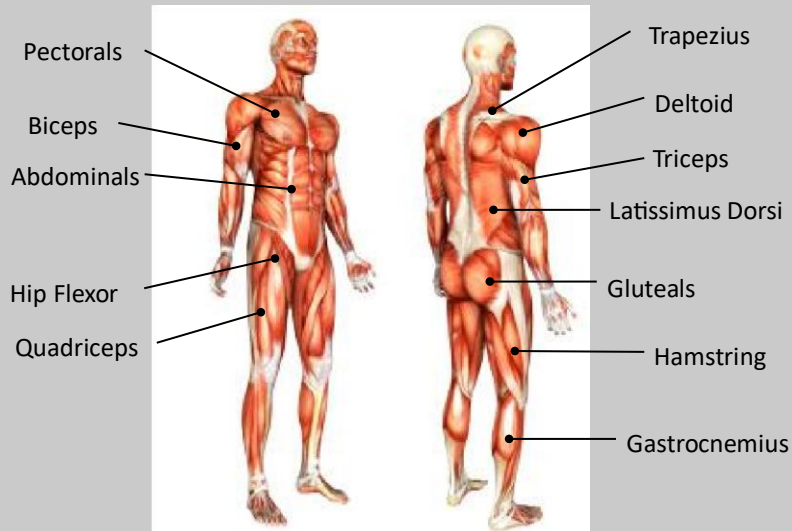
GCSE Physical Education – Movement analysis

Term	Definition/notes/concept

Keywords:

GCSE Physical Education – The structure and functions of the muscular system

Structure of the muscular system

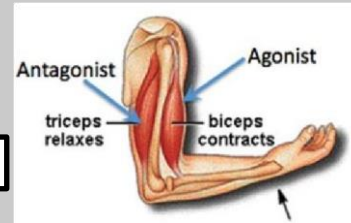


Antagonistic pairs - Muscles are arranged in antagonistic pairs.

FOR EXAMPLE THE ELBOW JOINT

As one muscle contracts (shortens) its partner relaxes (lengthens) *i.e. Biceps and Triceps.*

Agonist = the muscle that contracts to produce movement.



Flexion



Extension

Antagonist = the muscle that relaxes to allow the movement to occur.

Fixator = the muscle that works to stabilise the origin of the prime mover (agonist)

ROLE OF MUSCLES IN MOVEMENT

MUSCLE	JOINT MOVED	EXAMPLE
DELTOID	SHOULDER	Diving to save a goal
TRAPEZIUS	NECK	Binding in a scrum
LATISSIMUS DORSI	SHOULDER	Preparing to serve in tennis
PECTORALS	SHOULDER	Tackling in rugby
BICEPS	ELBOW	Upward phase of a biceps curl
TRICEPS	ELBOW	Throwing in cricket
ABDOMINALS	SPINE	Sit up
QUADRICEPS	KNEE	Jumping in basketball
HAMSTRINGS	KNEE	Tackling in hockey
GLUTEALS	HIP	Pushing off the blocks in sprinting
GASTROCNEMIUS	ANKLE	Gymnast pointing their toes

Antagonistic pairs

FOR EXAMPLE THE KNEE JOINT

FLEXION



AGONIST – HAMSTRINGS

ANTAGONIST – QUADRICEPS

EXTENSION

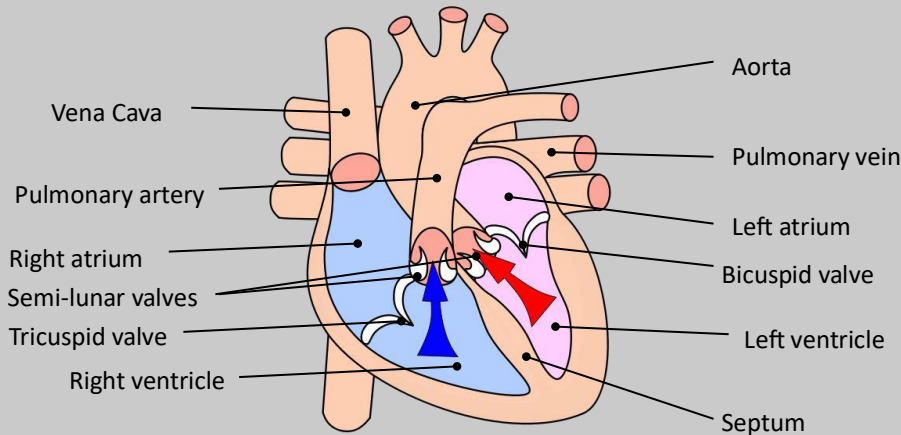


AGONIST - QUADRICEPS

ANTAGONIST - HAMSTRINGS

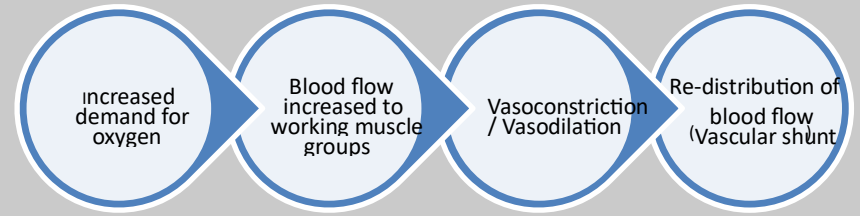
GCSE Physical Education – The structure and functions of the cardiovascular system

Structure of the cardiovascular system

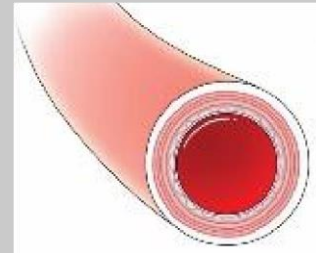


Deoxygenated blood = **BLUE** (Right side)
Oxygenated = **RED** (Left side)

Vascular Shunting



Vasoconstriction – **NARROWING**

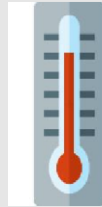


Vasodilation – **EXPANDING**



Function of the cardiovascular system




- Transport of oxygen, carbon dioxide and nutrients
- Clotting of open wounds
- Regulation of body temperature



Cardiac Output (Q) = Heart Rate x Stroke Volume
(l/min) (bpm) (mL per beat)

- Heart rate (HR) – Number of beats per minute
- Stroke Volume (SV) – Amount of blood pumped out of the heart per beat
- Cardiac Output (Q) – Amount of blood pumped out of the heart per minute






Blood vessels

Arteries	Veins	Capillaries
<ol style="list-style-type: none"> 1. Away from the heart 2. Oxygenated blood (except pulmonary artery) 3. Thick/elastic walls 4. High pressure 5. Small lumen 	<ol style="list-style-type: none"> 1. Back to the heart 2. Deoxygenated blood (except pulmonary vein) 3. Thin walls + larger lumen 4. Lower pressure 5. Valves 	<ol style="list-style-type: none"> 1. In the tissue 2. Site of gaseous exchange 3. Very thin walls 

- **Red blood cells** Carry oxygen from the lungs to the working muscles + removes CO₂.
- **Haemoglobin** binds with oxygen to transport Oxygen around the body.



STRUCTURE AND FUNCTION OF THE RESPIRATORY SYSTEM

Pathway of air through the respiratory system	<p>1. Mouth  2. Nose  3. Trachea  4. Bronchi  5. Bronchioles  6. Alveoli</p>					
Role of respiratory muscles in breathing	1. Inspiration (breathing in)	Role: Intercostal muscles and diaphragm contract. Ribs move upwards and out. Diaphragm moves downwards meaning the area of the thoracic cavity increases. Pressure in the lungs decreases drawing air in.			2. Expiration (breathing out)	Role: Intercostal muscles and diaphragm relax. The ribs lower and the diaphragm moves upwards meaning the pressure in the lungs increases forcing air out.
Key terms	1. Breathing rate	Definition: The frequency of breathing measured in breaths per minute.	2. Tidal volume	Definition: The amount of air breathed in OR out PER BREATH.	3. Minute volume	Definition: The volume of gas inhaled OR exhaled from the lungs PER MINUTE.
Gaseous exchange	The movement of gases taking place at the alveoli and capillaries. Gases diffuse through the walls of the capillaries surrounding the alveoli.			Key term	1. Oxyhaemoglobin	Haemoglobin combines with oxygen to form this bright red chemical
Aerobic and anaerobic exercise	1. Aerobic exercise	Definition: Use of oxygen for the duration of exercise	Intensity: When exercise is not too fast and is steady, the heart can supply all the oxygen that the working muscles need.		Summarised as: glucose + oxygen → energy + carbon dioxide + water.	
Aerobic and anaerobic exercise	2. Anaerobic exercise	Definition: Exercise which does not allow for the use of oxygen	Intensity: When exercise duration is short and at high intensity, the heart and lungs cannot supply blood and oxygen to muscles as fast as the respiring cells need them.		Summarised as: glucose → energy + lactic acid.	
Key term	1. Lactic acid	With the absence of oxygen, lactic acid is formed in the working muscles. Lactic acid causes muscle pain and fatigue				

SHORT TERM EFFECTS OF EXERCISE ON THE BODY SYSTEMS

Key terms	1. Exercise	Activity that requires physical effort. Usually carried out to sustain or bring about improvements to health or fitness.	2. Short term	These are TEMPORARY CHANGES. Your body will return back to normal following a period of recovery (rest).			
Short term effects	Muscular system		1. Increase in muscle temperature	2. Increase in metabolic activity		3. Increase in the production of lactic acid (depending on the type of exercise)	
	Cardiovascular system		1. Heart rate increases	2. Increase in Stroke Volume and Cardiac Output.		3. Vascular shunt occurs.	
	Key terms	1. Anticipatory rise	This is the raising of the heart rate before exercise begins. Adrenaline causes this.	2. Adrenaline	This is a hormone released from the adrenal glands and its major action is to prepare the body for 'fight or flight'	3. Vascular shunt	Occur when more blood is distributed to the working muscles and less to the non-essential organs
Respiratory system		1. Rise in the respiratory rate (breathing rate)	2. Tidal volume increases		3. Minute volume increases		

LONG TERM EFFECTS OF EXERCISE ON THE BODY

Long term effects	Skeletal and Muscular system (bones, joints, muscles, tendons).	1. Muscular strength and size increases (hypertrophy)	2. Tendons become stronger	3. Increase in the range of movement around a joint	4. Muscular endurance, Strength and Power increases.	5. Fatigue and tiredness will be delayed. Increased resistance to Lactic acid.	6. Increase in bone density.
	Key term	1. Hypertrophy	The increase in size of skeletal or cardiac muscle. Often as a result of training or exercise				
	Cardiovascular system (Heart, Blood and Blood Vessels).	1. Heart becomes stronger and increases in size (cardiac hypertrophy)	2. More blood is delivered to the working muscles	3. Stroke volume increases	4. Cardiac output increases	5. Resting heart rate lowers (Bradycardia RHR is below 60bpm).	
		6. More capillaries develop increasing blood flow	7. Blood vessels become more efficient	8. Blood pressure decreases at rest	9. Increase in red blood cells	10. Decrease in blood viscosity	
	Key terms	1. Capillarisation	Definition: Increase in the number of capillaries.	2. Rate of recovery	Definition: The speed at which the body returns back to normal after exercise.	3. Blood viscosity	Definition: The thickness of the blood and how resistant the blood is to flow freely.
	Respiratory system (Lungs, Respiratory muscles and breathing).	1. Increase in capillary density – greater uptake of oxygen	2. Slight increase in Tidal Volume, Minute Volume and Vital Capacity.		3. Increase in the strength of the Respiratory muscles (intercostals and diaphragm).		4. Surface area of the alveoli increases – which increases gaseous exchange

GCSE Physical Education – Components of Fitness

Health – A state of complete mental, physical and social well-being (not merely the absence of disease or infirmity).

Fitness - The capacity to carry out life’s activities without getting too tired.

Well-being – a feeling or mental state of being contented, happy, prosperous and healthy.

Sedentary – a lifestyle that is inactive and involves much sitting down


Relationship between these:

- Regular **exercise** increases general **health, fitness and well-being**.
- High levels of **fitness** can in turn have a positive impact on **well-being and sedentary** lifestyles.

Health Related Components of Fitness

How to remember this?
 B – Bob
 M – Munches
 M – More
 F – Fried
 C – Chicken



Component	Definition	Sporting Example
Muscular Strength	The ability of a muscle to exert force for a short period of time.	
Muscular Endurance	The ability to use voluntary muscles, over long periods of time without getting tired.	
Flexibility	The range of movement at a joint.	
Cardiovascular Endurance (stamina) VO2 Max O2 intake per minute	The ability of the heart and circulatory system to continuously exercise without tiring (for a long period of time).	

Skill Related Components of Fitness

How to remember this?
 C
 R
 A
 B
 S
 P



Component	Definition	Sporting Example
Coordination	The ability to move different limbs at different times or to do more than one task at a time effectively.	
Reaction Time	The ability to react quickly in sport situations to out wit your opponent or outspurt another athlete	
Agility	The ability to change direction under control, whilst maintaining speed, balance and power.	
Balance	The ability to keep your body mass or centre of mass over a base of support.	
Speed	The ability to move the body quickly.	
Power	The ability to combine speed and strength.	

GCSE Physical Education – Components of Fitness

Term	Definition/notes/concept

Keywords:

GCSE Physical Education – Fitness Testing

Muscular Strength

Test: Hand Grip Dynamometer Test

Protocol: Grip the dynamometer in one hand. Start with your hand up and bring down to side while pulling in handle. No swinging your hand.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Simple and easy to complete 	<ul style="list-style-type: none"> • Only one size of dynamometer which may affect reading. • Focuses solely on forearm strength.

Muscular Endurance

Test: sit up test (metronome)

Protocol: Complete full sit ups in time to the beat on the recording



Test: Maximal press up test

Protocol: complete as many press-ups as possible resting in the “up” position



Advantages	Disadvantages
<ul style="list-style-type: none"> • Simple test to complete • Minimal equipment needed. 	<ul style="list-style-type: none"> • Difficult to assess whether each repetition is performed correctly. Difficult to accurately measure large groups.

Flexibility

Test: Sit and Reach Test

Protocol: Sit with legs straight out in front and soles of feet against box/table. Reach forward without bending knees. No jerking movements.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Quick and easy to perform. • Data table readily available for comparison 	<ul style="list-style-type: none"> • Can cause injury if not fully warmed up appropriately. • Only measures flexibility of lower back and hamstrings.

Cardiovascular Fitness (Aerobic Endurance)

Test: 12 min Cooper Run

Protocol: Continuously run/swim for 12 minutes. Distance recorded.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Minimal equipment needed • Test can be self administered. 	<ul style="list-style-type: none"> • Inaccuracy of heart rate measurements • Motivation dependant

Test: Multi-Stage Fitness Test

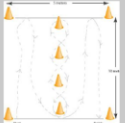
Protocol: Shuttle run continuously for 20 metres. Record the level and point that you cannot continue at that pace for.

Advantages	Disadvantages
<ul style="list-style-type: none"> • Simple test to complete 	<ul style="list-style-type: none"> • Motivation dependant

Agility

Test: Illinois Agility Test

Protocol: Start lying down at the start line. Complete course as quick as possible (10m x 5m – 4 central cones)



Advantages	Disadvantages
<ul style="list-style-type: none"> • Simple and easy to complete 	<ul style="list-style-type: none"> • Motivation dependant / Timing errors.

Speed

Test: 30m Sprint Test

Protocol: Start from stationary position. Complete distance in the quickest possible time. Time is stopped when chest crosses the line.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Quick test to complete. • Minimal equipment needed and can be performed anywhere with a flat 50m run. 	<ul style="list-style-type: none"> • Running surfaces/weather conditions can affect the results. • Inaccuracies with stopwatch usage.

Power

Test: Vertical jump Test

Protocol: Stand next to wall and mark an initial reach while feet are flat on the ground. Standing jump to reach as high as possible. Measure distance from first mark to second.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Quick and easy to perform. • Easy to complete with large groups. 	<ul style="list-style-type: none"> • Technique plays a large role in successful completion.

Reliability /Validity

Validity relates to whether the test actually measures what it sets out to measure.

Reliability is a question of whether the test is accurate. It is important to ensure that the procedure is correctly maintained for ALL individuals.



Results can be improved:

- By using experienced testers & calibrating equipment
- Ensuring performers have the same level of motivation to complete each test
- Repeatedly test to avoid human error (x3)

GCSE Physical Education – Fitness Testing

Term	Definition/notes/concept

Keywords:

GCSE Physical Education – Principles of Training

Principles of training - **Guidelines** that ensure **training is effective** and results in **positive adaptations**. These principles are used when planning an Exercise Programmes

PAR-Q – Physical Activity Readiness Questionnaire

Conducted before fitness testing or an activity programme to examine the performer's readiness for training or any health conditions/lifestyle choices that may affect the successful completion.

FITT Principle

Frequency	How often training takes place.	<i>Increase training from once a week to two</i>
Intensity	How hard the exercise is.	<i>Increase resistance from 10kg to 15kg or increase incline on the treadmill.</i>
Time	The length of the session.	<i>Increase training session from 45 minutes to 55 minutes.</i>
Type	The method of training used.	<i>Change to from interval training to Fartlek training.</i>

Progression

Using overload in a progressive way over the course of a programme. Once adaptations have happened overload needs to be applied to make gains again, e.g. lifting more in week 12 than in week 2 of the programme.



Overload

Working the body harder than normal/gradually increasing the amount of exercise you do. *i.e. bench press 50kg x 10 repetitions and increase to 55kg x 5 repetitions.*

Reversibility

If training is not regular, adaptations will be reversed. This can happen when:

- Suffering from illness and cannot train
- Injury
- After an off-season.



Specificity

Training should be **matched** to the requirements of the sport or position the performer is involved in.

Training must be specifically designed to develop the right:

- Muscles
- Type of fitness
- Skills



Individual needs

All athletes programmes would differ depending on:

- Performer's goals/targets
- Strength and weaknesses
- Age/gender
- Current health/fitness levels



Overtraining

Occurs when you **train too hard** and do not allow the body enough **rest/recovery time**. Signs/symptoms include: extended muscle soreness, frequent illness & increase injuries.

Calculating Training Zones/Thresholds of Training

Maximum Heart Rate (MHR) = 220 – age	Aerobic target zone: 60–80% of MHR (60% = x 0.6 / 80% = x 0.8)	Anaerobic target zone: > 85% MHR (85% = x 0.85)
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GCSE Physical Education – Principles of Training

Term	Definition/notes/concept

Keywords:

GCSE Physical Education – Types of Training

Continuous training - Involves a steady but regular pace at a moderate intensity (aerobic) which should last for at least 20 minutes. i.e. running, walking, swimming, rowing or cycling. Used by a **marathon runner**.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Ideal for beginners • Highly effective for long distance athletes 	<ul style="list-style-type: none"> • Can be extremely boring as repetitive

Interval training - Involves periods of work followed by periods of rest. i.e. *Sprint for 20 metre + walk back to start.* Used by a **200m sprinter**



Advantages	Disadvantages
<ul style="list-style-type: none"> • Quick and easy to set up. • Can mix aerobic and anaerobic exercise which replicates team games. 	<ul style="list-style-type: none"> • It can be hard to keep going when you start to fatigue (high motivation and self discipline needed) • Over training can occur if sufficient rest is not allowed between sessions (48 hours)

Fartlek training – Referred to as ‘speed play’

This is a form interval training but without rest. Involves a variety of changing intensities over different distances and terrains.



i.e. *1 lap at 50% max, 1 lap walking, 1 lap at 80% (aerobic and anaerobic used)*

Used by **games players – Hockey players**

Advantages	Disadvantages
<ul style="list-style-type: none"> • More enjoyable than interval and continuous training • Good for sports which require changes in speed • Easily adapted to suit the individuals level of fitness and sport. 	<ul style="list-style-type: none"> • Performer must be well motivated particularly when intensity is high • Difficult to assess whether performer is performing at the correct intensity

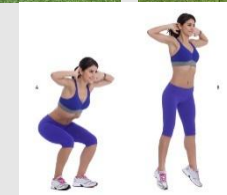
Plyometrics training

Involves high-impact exercises that develop **power**. i.e. *bounding/hopping, squat jumps.* Used by **long jumpers, 100 m sprinters or basketball players.**

Advantages
<ul style="list-style-type: none"> • Easy to set up requiring little or no equipment • Hugely effective in developing power



Disadvantages
<ul style="list-style-type: none"> • Can result in injury if not fully warmed up. • Can place a great stress on joints and muscles.



Weight/Resistance training – A form of training that uses progressive resistance against a muscle group. Used by **cyclists**.

Muscular strength: **High weight x low repetitions**

Muscular endurance: **Low weight x high repetitions**



Advantages	Disadvantages
<ul style="list-style-type: none"> • Variety of equipment to prevent boredom • Strengthens the whole body or the muscle groups targeted. • Can be adapted easily to suit different sports 	<ul style="list-style-type: none"> • Requires expensive equipment • If exercises are not completed with the correct technique it can cause injury to the performer

Circuit training - A series of exercises completed one after another. Each exercise is called a station. Each station should work a different area of the body to avoid fatigue.

i.e. *press ups, sit ups, squats, shuttle runs.*



Advantages	Disadvantages
<ul style="list-style-type: none"> • Quick and easy to set up • Easy to complete with large groups • Can be adjusted to be made specific for certain sports. i.e. <i>netball specific circuit</i> 	<ul style="list-style-type: none"> • Technique can be affected by fatigue and can increase risk of injury • Must have motivation and drive to complete the set amount of repetitions and sets.

HIIT Training

These are High Intensity Interval Training activities where speed and recovery are used throughout the session. Exertion levels are high (7/10) for between 30 secs and 3 mins. Work output is much shorter than recovery time. Examples might be Body pump, High Impact Aerobics, Spinning.



Advantages	Disadvantages
<ul style="list-style-type: none"> • Variety avoids boredom • Instructor will challenge & motivate • Great way to meet new people 	<ul style="list-style-type: none"> • Gym membership can be expensive. • Group classes are not tailored to individual needs.

GCSE Physical Education – Methods of Training

Term	Definition/notes/concept

Keywords: