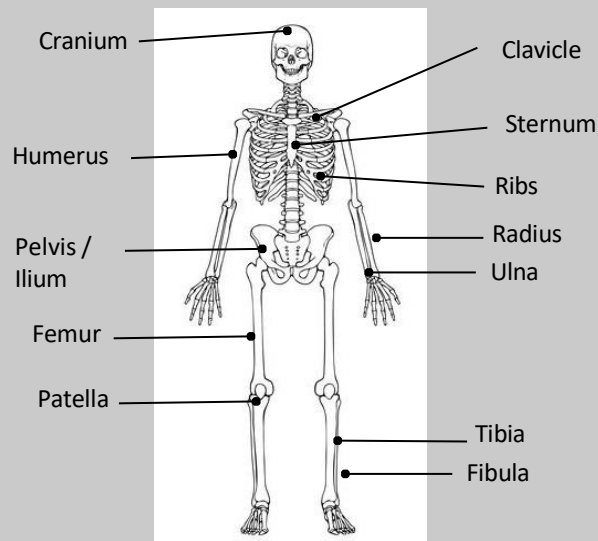
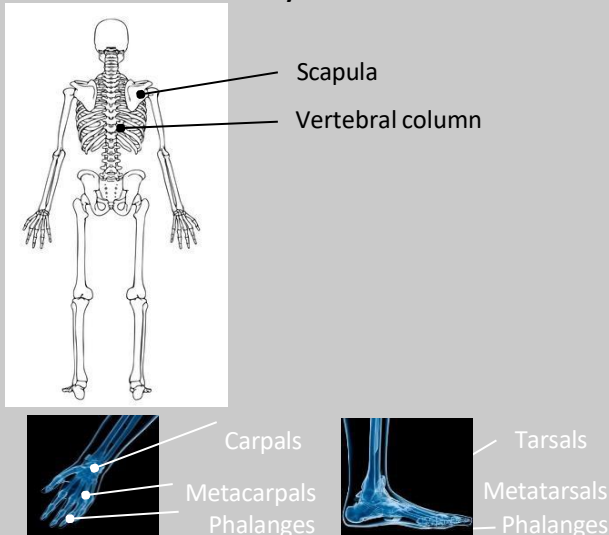


GCSE Physical Education – The structure and functions of the skeletal system

Structure of the skeletal system



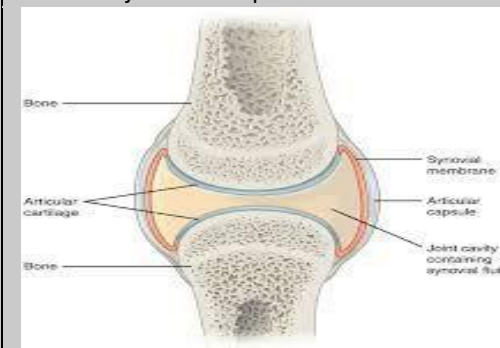
Structure of the skeletal system



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



Connective tissue

Ligaments – attaches bone to bone to add joint stability.

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

Flexion	Adduction	Rotation	Dorsi-Flexion (ankle joint)
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	Planter-Flexion (ankle joint)
Increasing the angle at a joint 	Limbs moving away from the midline of the body. 	A combination of flexion, extension, adduction, and abduction. 	When the toes are pointed away from the body. 

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

(straightening)

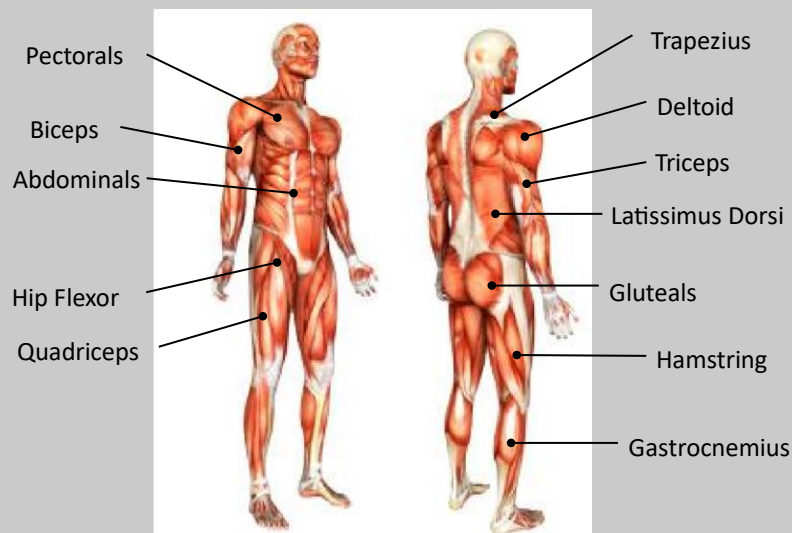
midline of the body.

adduction & abduction.

from the body.

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

Structure of the muscular system

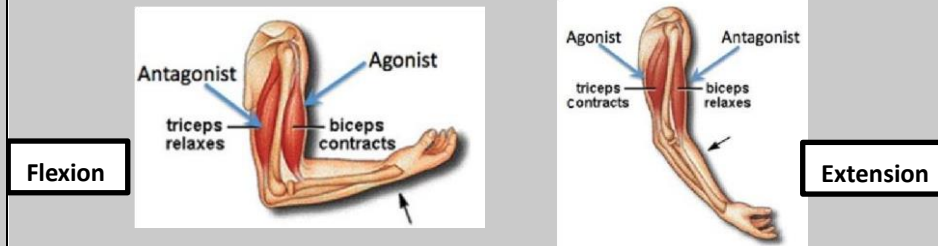


Antagonistic pairs - Muscles are arranged in antagonistic pairs.

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.



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

Term	Definition/notes/concept

Keywords:

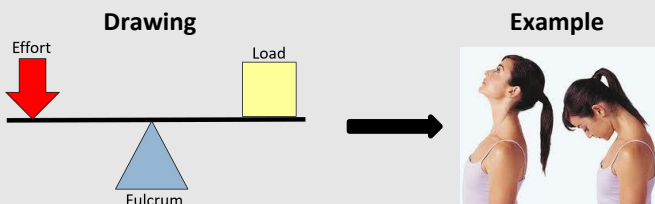
GCSE Physical Education – Movement analysis

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

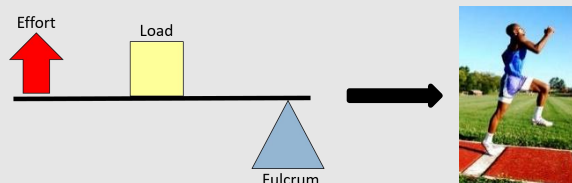
Fulcrum (F)	Effort (E)	Load (L)
A fixed pivot point 	The source of energy that will be applied 	The weight/resistance to be moved 

Classes of lever

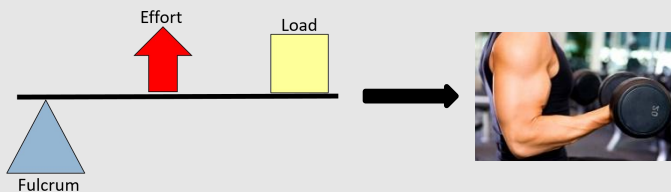
First class lever:



Second class lever:



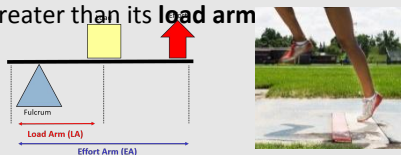
Third class lever:



Mechanical advantage –

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

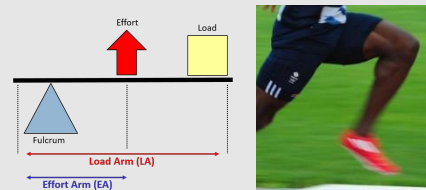
This is where a lever's **effort arm** is greater than its **load arm**



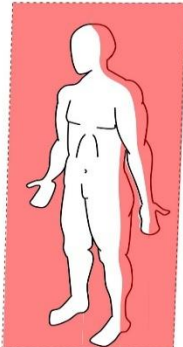
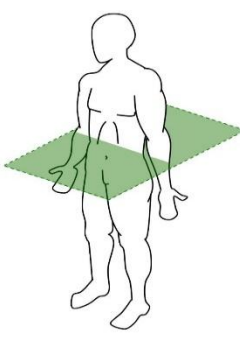
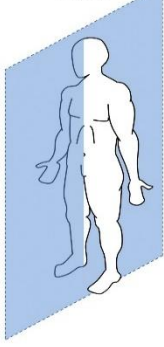
Large loads can be moved with limited effort.

Mechanical disadvantage

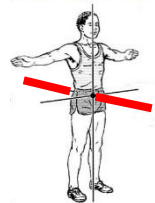

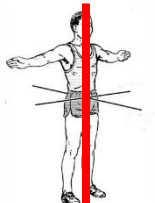

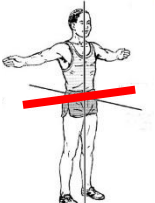

This is where a lever's **load arm** is longer than its **effort arm**.



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 

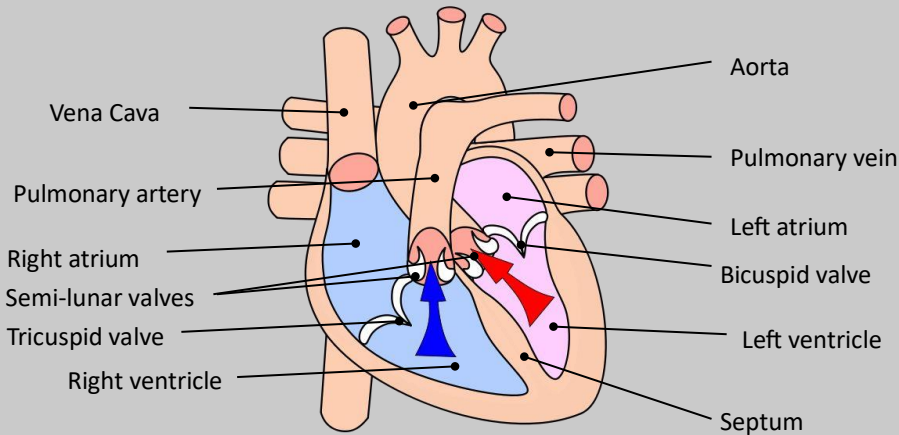
GCSE Physical Education – Movement analysis

Term	Definition/notes/concept

Keywords:

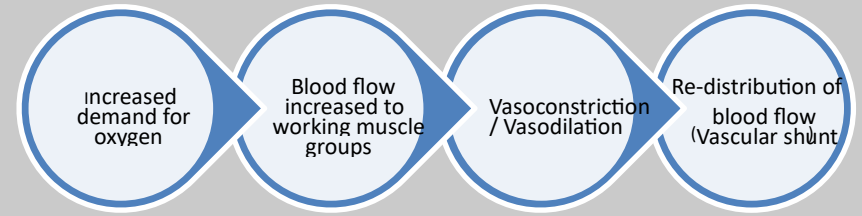
GCSE Physical Education – The structure and functions of the cardiovascular system

Structure of the cardiovascular system

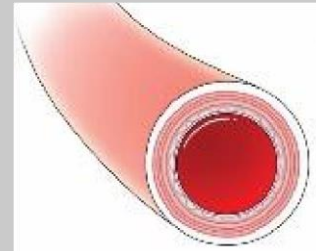


Deoxygenated blood = **BLUE** (Right side)
Oxygenated = **RED** (Left side)

Vascular Shunting



Vasoconstriction – NARROWING

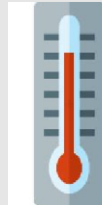


Vasodilation - EXPANDING



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.



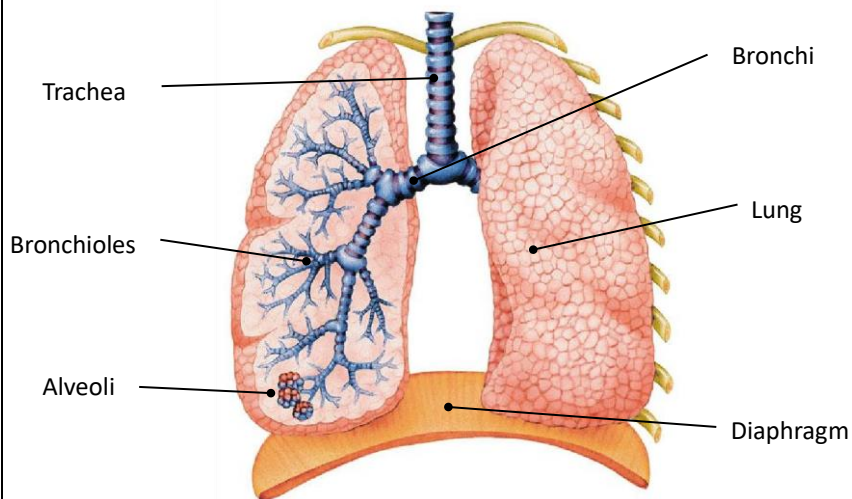
GCSE Physical Education – The structure and functions of the cardiovascular system

Term	Definition/notes/concept

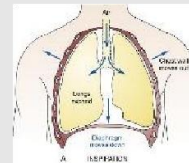
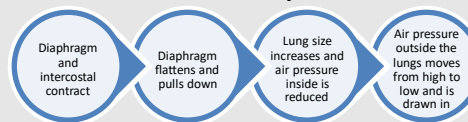
Keywords:

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

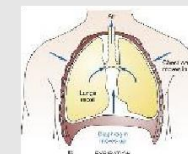
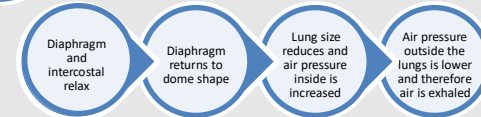
Structure of the respiratory system



Inhalation/Inspiration



Exhalation/Expiration



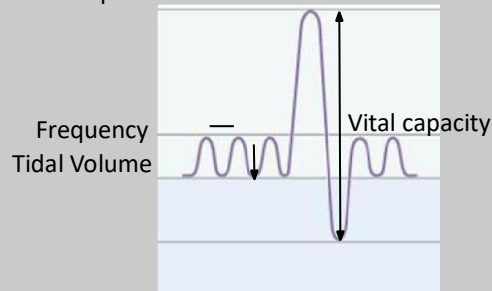
Respiratory values

Tidal Volume – the amount of air inhaled and exhaled per breath. Resting value = 500ml

Vital Capacity – The maximum amount of air exhaled following a maximal breath in.

Frequency – The number of breaths taken per minute. Resting value – 12-20 breaths.

Minute Ventilation – The amount of air inhaled and exhaled per minute. Measured in litres.

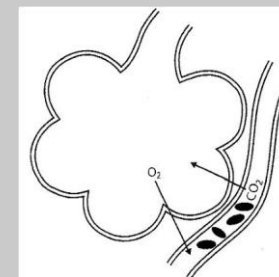


Gaseous exchange at the alveoli

- Diffusion is the movement of molecules from an area of high concentration to a low one.
- The alveoli have thin moist walls to allow diffusion to occur.
- Capillaries are closely wrapped around the alveoli to reduce the distance of diffusion and increase efficiency.

During inhalation:

- The concentration of **oxygen** in the air is higher than the alveoli.
- The concentration of **carbon dioxide** in the blood is higher than that in the air.



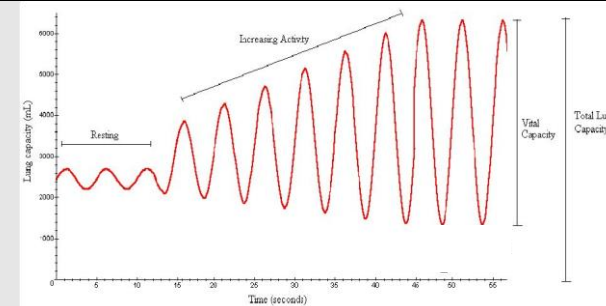
During exercise

Gaseous exchange increases as the intensity of the activity increases to cope with:

An increase demand for oxygen at working muscles

An increase in carbon dioxide production and the need to rid this waste product.

Tidal volume, frequency and minute ventilation all increase during exercise. Training increases total lung capacity and vital capacity readings.



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

[illegible]

Keywords:

GCSE Physical Education – Aerobic/Anaerobic and long term effects of exercise

Aerobic and Anaerobic exercise – two methods of energy production by the body (Energy: the capacity to do work)

Two factors determine which method is used: **Intensity & duration**

Aerobic energy production – takes place in the presence of oxygen



Exercise intensity is moderate/low for a sustained period of time. *i.e. marathon runner/endurance cycling*



By products are released as sweat and CO₂ exhaled.

Anaerobic energy production – takes place in the absence of oxygen



Intensity of anaerobic activity is high as muscle contraction are powerful & quick *i.e. 100m sprinter/long jump*



By product (lactic acid) builds up and causes fatigue.

Cardiovascular system

Cardiac equation – Cardiac output (Q) = Stroke Volume (SV) x Heart Rate (HR)

Long term effects of exercise

1. Cardiac hypertrophy – (left ventricle) this is the increased size of the heart due to training. This impacts on the cardiac equation above.

Lower resting HR - Increased maximum Q - Increased SV

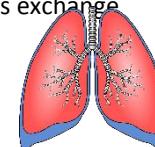
2. Increased elasticity in the walls of arteries and veins – more efficient constriction and dilation.
3. Increased number of red blood cells – has capacity to carry more oxygen to working muscles.
4. More efficient 'vascular shunt'
5. More capillaries
6. Lower blood pressure at rest



Respiratory system

Long term effects of exercise

1. Increased capillarisation – better blood supply around the alveoli.
2. Increased number of alveoli – results in better gaseous exchange (oxygen delivery and waste product removal)
3. Increased strength of diaphragm and intercostal muscles – this increased tidal volume and vital capacity.
4. Increase in vital capacity



Skeletal system

Long term effects of exercise

1. Increased bone density – strong bones reduce the risk of injuries.
2. Increased strength of ligaments and tendons – allows the body to change direction quickly without injury occurring.



Muscular system

Long term effects of exercise

1. Muscular hypertrophy – increase in muscle size and strength/endurance.
2. Increase size and number of mitochondria – produces more energy aerobically.
3. Increased tolerance to lactic acid – reduces muscle fatigue.



GCSE Physical Education – Aerobic/Anaerobic and long term effects of exercise

[illegible]

Keywords:

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)	The ability of the heart and circulatory system to continuously exercise without tiring (for a long period of time).	
VO2 Max O2 intake per minute		

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 outwit 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

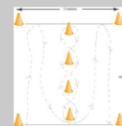
Protocol: Shuttle run continuously for 20 metres. Record the level and point that you cannot continue at that pace for.

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 stationery 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

[illegible]

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

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>

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



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.

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.



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

[illegible]

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:

GCSE Physical Education – Warm up, cool and injury and prevention

MINIMISING THE RISK OF INJURY IN PHYSICAL ACTIVITY AND SPORT

				
Personal Protective Equipment (PPE)	Clothing and Footwear	Balanced competition (gender, age, ability,weight)	Lifting and carrying equipment safely	Warm-up and cool-down

Potential Hazards

HAZARD – SOMETHING WHICH HAS THE POTENTIAL TO CAUSE HARM

RISK – THE CHANCE THAT SOMEONE WILL BE HARMED BY THE HAZARD.

Sports Hall – Slippery Surface, Equipment around the sides, overcrowding

Fitness Centre – Faulty equipment, overcrowding

Playing field – litter, broken glass, dog faeces, damaged goal posts, other participants

Artificial outdoor areas – litter, faulty equipment, surface of pitch, other participants

Swimming pool – slippery surfaces, water and drowning, chemicals in the swimming pool, overcrowding

WARM UP and COOL DOWN

Key Components of a warm up:

Pulse Raiser – Steady Jog

Mobility – (knee raises, side steps, high kicks)

Stretching – Dynamic eg lunges

Dynamic Movements – SAQ (change in speed and direction)

Skill Rehearsal – Skills practice (square passing in football)

Physical Benefits of a warm up:

- Prepare muscles for physical activity
- Increase body temperature
- Increase heart rate
- Increase flexibility
- Pliability of ligaments / tendons
- Increase blood flow /oxygen to muscles
- Increase speed of muscle contraction

• Key Components of a Cool Down:

Low intensity exercise – slow jog

Stretching – (static and dynamic)

Physical Benefits of a cool down:

- Helps body's transition back to rest
- Gradually lowers heart rate
- Gradually lowers temperature
- Circulates oxygen and blood
- Gradually reduces breathing rate
- Increases removal of waste products (lactic acid)
- Reduces risk of DOMS
- Helps recovery by stretching

GCSE Physical Education – Performance-enhancing drugs, injury and prevention

[illegible]
