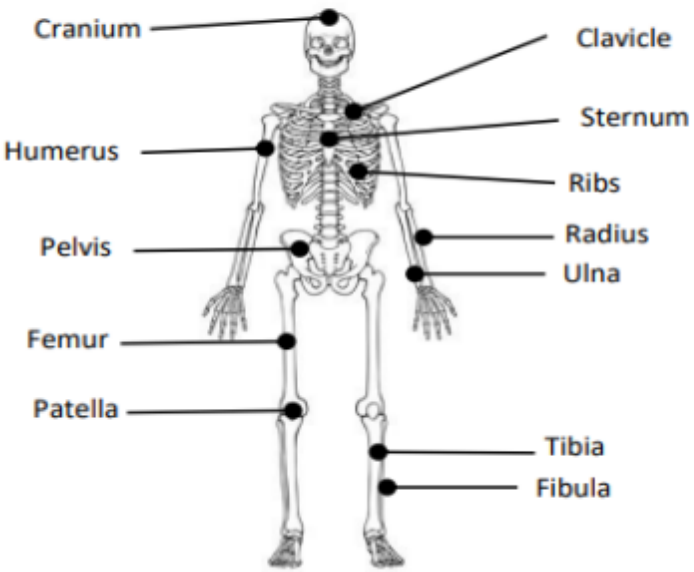
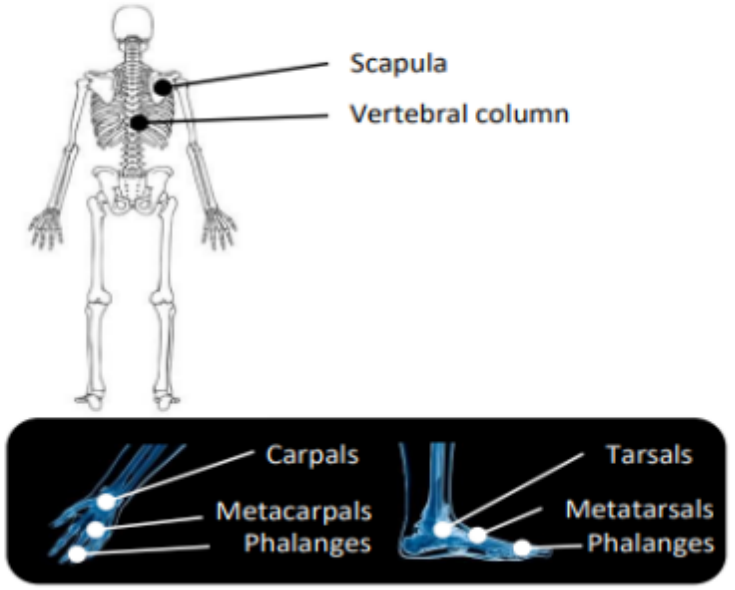
NCFE Knowledge Organiser - Skeletal System

Structure of the skeletal system



Structure of the skeletal system



Vertebral Column

The vertebral column is divided into 5 sections. It is made up of irregularly shaped bones called vertebrae.

Each vertebra is protected with cartilage to prevent friction.

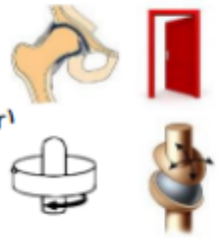
The vertebrae protects the spinal cord.

Function of the skeleton

- Protection of vital organs
- Muscle attachment
- Joints for movement
- Blood cell production (platelets, red and white)
- Storage of calcium and phosphorus

Classification of joint

- Pivot (neck – atlas and axis)
- Hinge (elbow and knee)
- Ball and socket (hip and shoulder)
- Condyloid (wrist)



Connective tissue

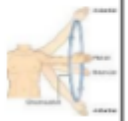
Ligaments – attaches bone to bone to add joint stability.

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

Classification of bones

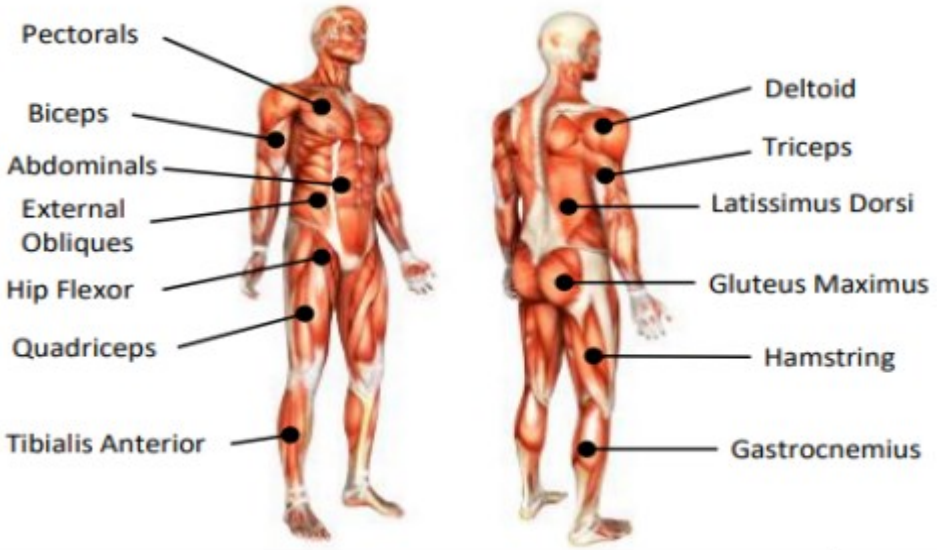
Long (leverage)	Short (weight bearing)	Flat (protection + muscle attachment)	Irregular (protection and muscle attachment)
Clear shaft region to the bone. *i.e. femur, humerus & phalanges* 	Light, small and very strong. *i.e. carpals tarsals* 	Broad surface area for muscle attachment. *i.e. cranium* 	Assist the functioning of certain joints. *i.e. Patella/vertebrae* 

Joint movements

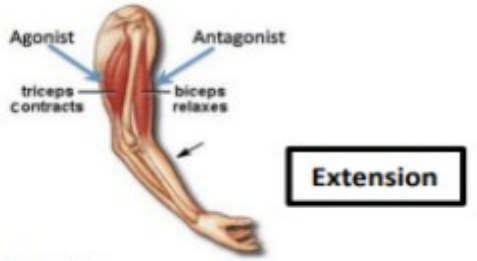
Flexion	Adduction	Rotation	Dorsi-Flexion (ankle joint)
Decreasing the angle at a joint (bending) 	Limbs moving towards the midline of the body. 	A twisting/turning action around a joint. 	When the toes are turned up to the body. 
Extension	**Abduction**	**Circumduction**	**Planter-Flexion (ankle joint)**
Increasing the angle at a joint (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. 

NCFE Knowledge Organiser - Muscular System

Structure of the muscular system



Antagonistic pairs - Muscles are arranged in antagonistic pairs.
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.

Examples in the body:

- Biceps & Triceps
- Quadriceps & Hamstring
- Hip Flexor & Gluteus Maximus
- Tibialis Anterior & Gastrocnemius

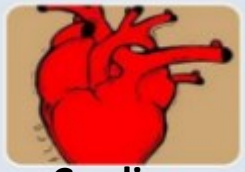
Types of muscle

Skeletal

Voluntary muscles enable movement throughout the body.

Smooth

Involuntary muscles are essential in maintaining healthy body systems.



Cardiac

Cardiac muscle is vital in sport because it makes the heart pump. Fitness training will strengthen cardiac muscle making the heart more efficient at pumping blood around the body.

The **short term effects** of exercise on the muscles:

1. Working muscles produce heat
2. Increased muscle fatigue due to lactate accumulation
3. Blood is re-distributed to working muscles (Shunting)

Muscle fibre types

Slow twitch muscle fibres (Type I)	Fast twitch muscle fibres (Type II
1. Smaller in size. 2. Work aerobically with high fatigue resistance. 3. Have a good oxygen supply = deep red in colour. 4. They contract slowly, but can work for long periods. **Marathon runner**	1. Larger in size 2. Work anaerobically & linked to high intensity activities. 3. Are paler in colour and have limited oxygen supply. 4. They contract quickly and powerfully, but tire easily. **Sprinter 100m / 200m**

Muscle Contractions

Isotonic Contractions
Eccentric -The origins and insertions move further away from one another.
Concentric - origins and insertions move closer together. The movement must occur against gravity
Isometric contractions
Static contraction - A muscle provides tension but stays the same length.

Origin:
Closer to the midline.
Proximal attachment.
Fixed during muscular contraction.
Insertion:
Further away from the midline.
Distal attachment.

Training muscle fibres

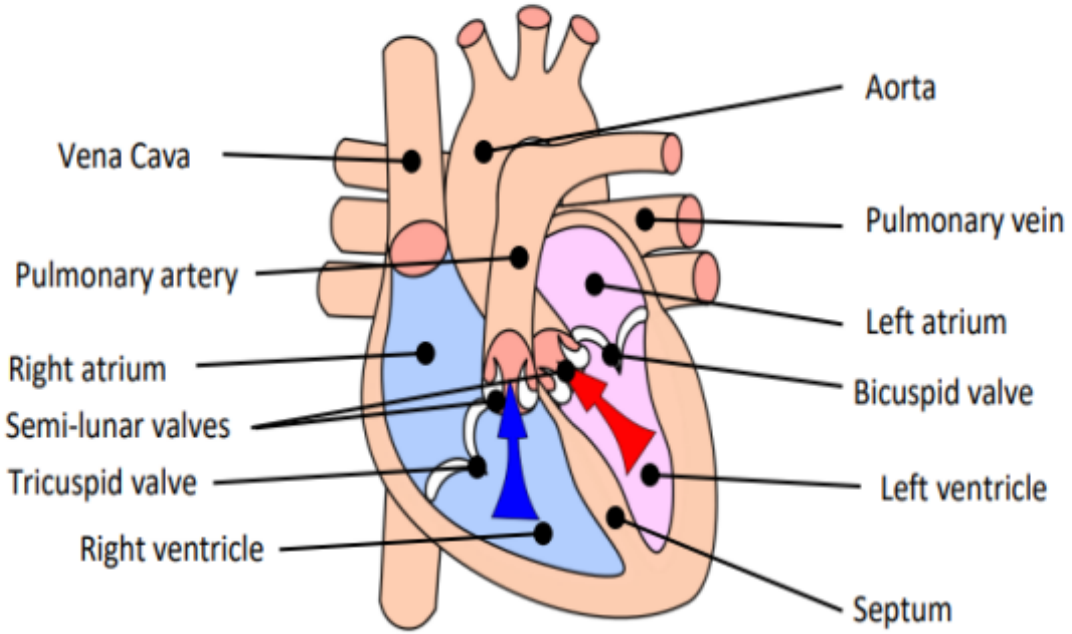
Type 1: slow twitch
Low intensity but higher repetitions.

Type 2:
Higher intensity / weight but lower repetitions

Link of the muscular and skeletal system – both systems work together to produce movement. *i.e. a contracting muscle pulls on a bone which changes the angle at a joint.*

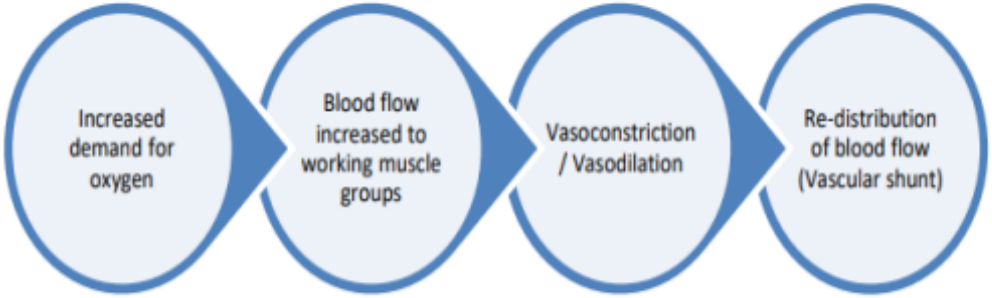
NCFE Knowledge Organiser - Cardiovascular System

Structure of the cardiovascular system



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

Vascular Shunting

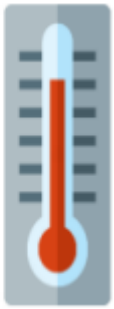


Vasoconstriction – NARROWING

Vasodilation - EXPANDING

Function of the cardiovascular system

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

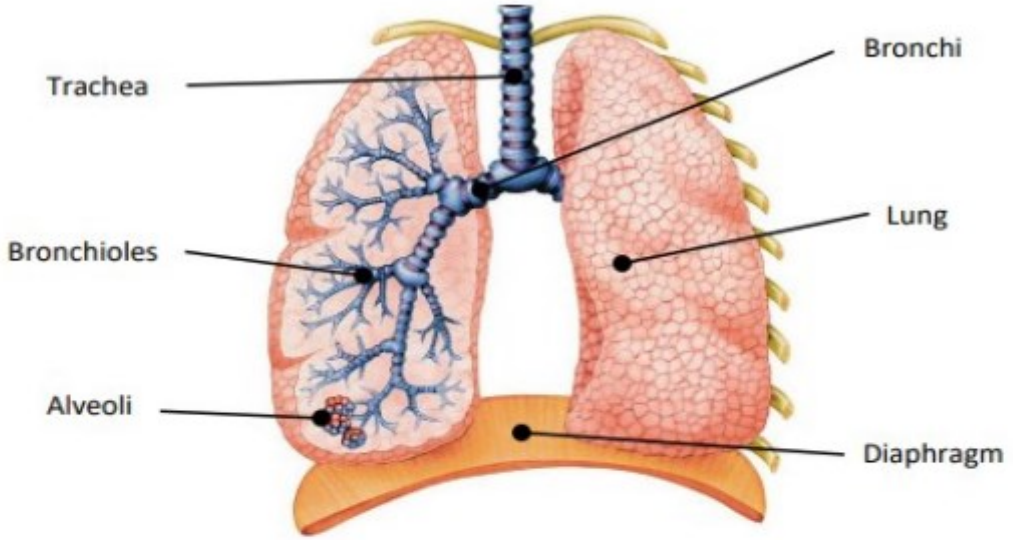


Blood vessels

Arteries	Veins	Capillaries
1. Away from the heart 2. Oxygenated blood (except pulmonary artery) 3. Thick/elastic walls 4. High pressure 5. Small lumen	1. Back to the heart 2. Deoxygenated blood (except pulmonary vein) 3. Thin walls + larger lumen 4. Lower pressure 5. Valves	1. In the tissue 2. Site of gaseous exchange 3. Very thin walls

NCFE Knowledge Organiser - Respiratory System

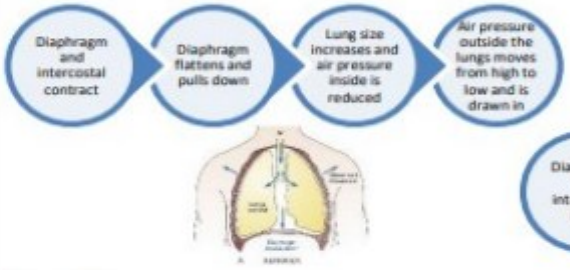
Structure of the respiratory system



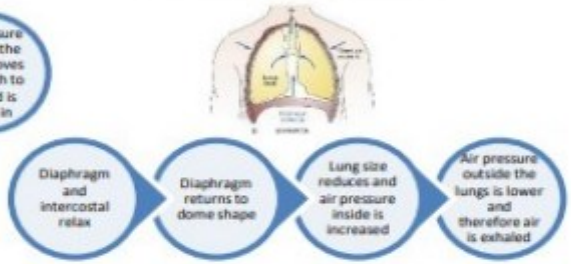
Composition of inhaled and exhaled air

Gas	Inhaled air	Exhaled air
Oxygen	21%	16%
Carbon dioxide	0.04%	4%
Nitrogen	78%	78%

Inhalation/Inspiration



Exhalation/Expiration



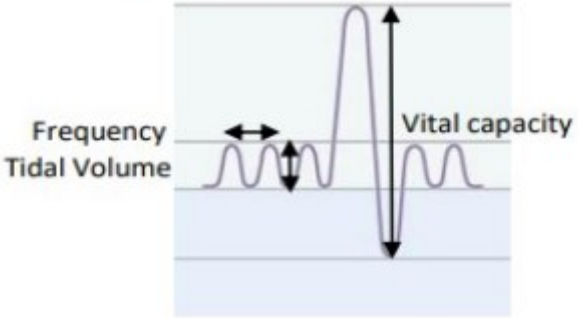
Respiratory values

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.

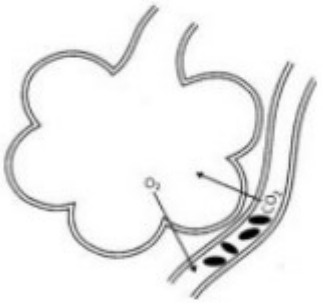


Gaseous exchange at the alveoli

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

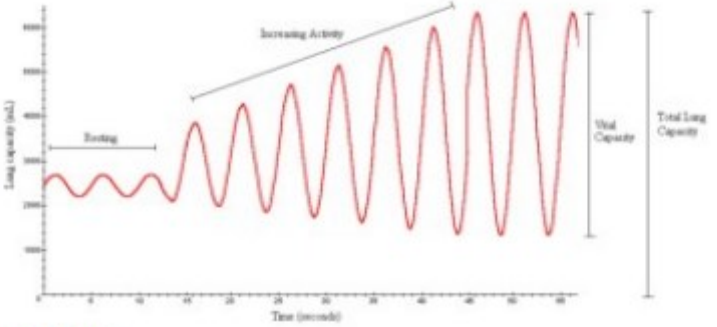


During exercise

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.

Frequency ↑ + Tidal Volume ↑



Training increases total lung capacity and vital capacity readings.

NCFE Knowledge Organiser - Effects of exercise

Short term effects of exercise:

Body system		
Muscular System	**Respiratory System**	**Cardiovascular System**
• Increase in oxygen to the working muscles • Increase in muscle temperature • Lactic acid production	• Increase in respiratory rate • Increase in tidal volume • Increase in minute ventilation	• Increase in heart rate • Increase in stroke volume • Increase in cardiac output • Redistribution of blood flow

Long term effects of exercise:

Body system			
Muscular System	**Skeletal System**	**Respiratory System**	**Cardiovascular System**
• Hypertrophy of muscle • Muscular strength • Muscular endurance • Resistance to fatigue	• Bone density	• Increase aerobic capacity • Increased strength of Respiratory muscles • Increase in tidal volume and minute volume during exercise	• Hypertrophy of the heart • Decrease in resting heart rate and resting stroke volume • Increased cardiac output • Capillarisation • Improved rate of recovery

Sporting example:

Muscular System

When we start to exercise, we work anaerobically Lactic acid is a waste product of anaerobic exercise.

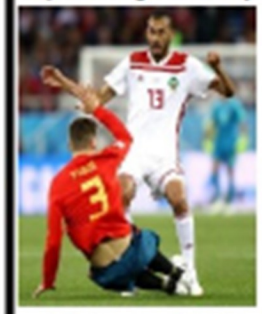
There is an increase in oxygen to the working muscles, when this oxygen is converted into energy it releases heat therefore there is an increase in muscle temperature

Cardiovascular and respiratory systems work together

When you exercise there is an increase in demand for oxygen to the working muscles and the removal of carbon dioxide. Tidal volume and minute ventilation all increase. Blood carries oxygen. To get the oxygen to the working muscles heart rate, stroke volume and cardiac output all increase.

The cardiovascular system will redistribute blood around the body through vasoconstriction and vasodilation. It will increase blood flow to the working muscles (vasodilate) and decrease blood flow to inactive (vasoconstrict)

Sporting examples:

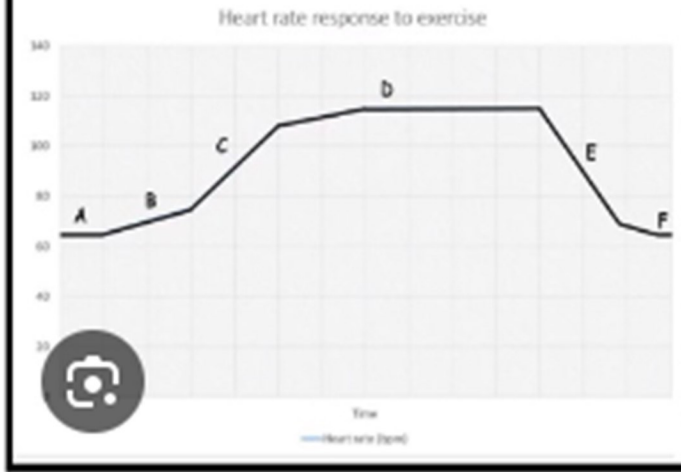


An increase in bone density will decrease the chance of a fracture from a bad tackle in football

Muscular hypertrophy and strength. This will allow rugby players to bust through tackles more effectively

An increase in the size of the diaphragm and intercostal muscles will allow a long distance runner to get more oxygen to the working muscle so they will not tire as easily

Muscular endurance will allow a rower to keep going for longer without getting tired. This will give him more chance of winning



A = Heart rate is at rest

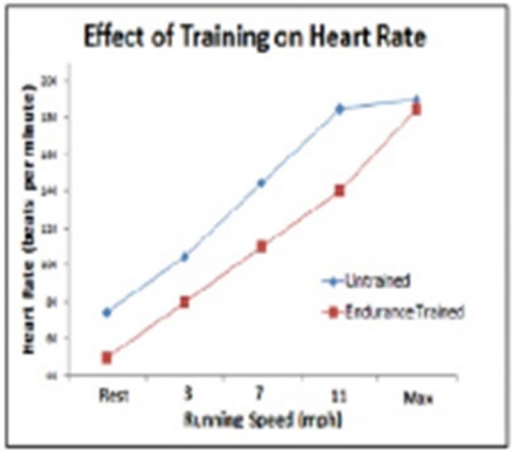
B = Immediately before exercise resting heartrate will increase. This is called an anticipatory rise;

C = When you start to exercise the heart rate increases sharply. This is due to the demand of oxygen. Cardiac output and stroke volume also increase

D = During continuous exercise heart rate levels off this is because the heart rate is sustaining the amount of oxygen needed.

E = Immediately after exercise heart rate decreases sharply, this is because exercise has stopped and the demand for oxygen has reduced.

F = Heart rate slowly returns to its resting rate



The untrained athlete has a higher heart rate when running at the same speed as the endurance athlete.

This is due to the long term adaptations the cardiovascular system. The endurance athlete will have a larger heart due to hypertrophy. This will allow them to pump more blood per beat (stroke volume) and per minute (cardiac output). More oxygen is delivered to the working muscles

NCFE Knowledge Organiser - Components of Fitness

Health Related Components of Fitness

CARDIOVASCULAR FITNESS
The ability of the heart and lungs to continuously exercise without tiring.

Test: 12 minute cooper run

MUSCULAR STRENGTH
The amount of force a muscle can produce during one repetition.

Test: One repetition max (bench press / squat)

MUSCULAR ENDURANCE
The ability of the muscle to perform repetitive work for a long time without tiring.

Test: 60 seconds push up test

FLEXIBILITY
The full range of movement possible at a joint. It helps us to stretch and reach further.

Test: Sit and reach test

BODY COMPOSITION
The amount of fat mass compared to lean muscle mass, bone and organs.

Test: Body fat test (skinfold callipers)

Curry Makes Me Feel Better

Skill Related Components of Fitness (PC BARS)

POWER
The ability to perform strength based movements quickly. Speed x strength.

Test: Sergeant jump / Vertical jump test

COORDINATION
The ability to use two or more body parts together, or at the same time.

Test: Alternate tennis ball wall toss

BALANCE
The ability to maintain your line of gravity within your Base of support.

Test: Standing stork test

AGILITY
Changing direction at speed whilst maintaining control of the body.

Test: Illinois agility test

REACTION TIME
The time between the onset of a stimulus and the initiation of the response.

Test: Ruler drop test

SPEED
The rate at which someone can move when performing a movement or covering a distance.

Test: 30 metre sprint test

NCFE Knowledge Organiser - Principles of Training (SPORT & FITT)

SPECIFICITY

Specificity means making training specific to the sport or activity being played or performed, to the movements, muscles and energy systems which are used in that sport or activity.

PROGRESSION

Progression means gradually increasing the amount of overload so that fitness gains occur, without the potential for injury.

OVERLOAD

Overload involves gradually increasing the stress placed on the body during training. This gradual increase in stress makes the body work harder than normal so that adaptations take place.

REVERSIBILITY - (If you don't use it, you lose it)

Reversibility means that fitness levels are lost when you stop exercising. Gains made through training are lost more quickly than they are achieved, it can much longer to return to the same level of fitness achieved before a break.

TEDIUM

Tedium is the boredom that can occur from training the same way every time. Variety is needed in a training programme to keep motivation levels high.

FREQUENCY - How often you train

You can ensure overload by gradually increasing the number of training sessions you complete each week. For example, you could increase your training sessions from two to three each week.

INTENSITY - How hard you train

You can ensure overload by gradually increasing how hard you train. For example, you could increase the size of the weights lifted or increase the incline on the running machine.

The FITT principles

The FITT principle is used to increase the amount of work the body does, in order to achieve overload:

TIME - How long you train for

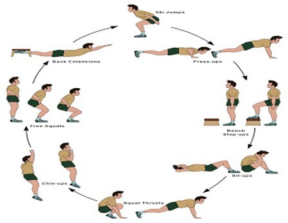
You can ensure overload by increasing the time you spend exercising in each training session or the length of time spent completing a specific exercise. For example, you could increase the number of reps or sets you complete .

TYPE - The specific method of training

You can ensure overload by taking part in different methods of training. For example, you could switch between continuous training, interval training and Fartlek training.

NCFE Knowledge Organiser - Training Methods

CIRCUIT TRAINING



A form of interval training

Targets strength building

Targets muscular endurance

Can be tailored to meet the different components of fitness

Disadvantages

- need lots of space
- poor technique could lead to injury

INTERVAL TRAINING

Periods of intense work with timed rest

Cardiovascular benefits

Strengthens heart

Improves anaerobic fitness.

Disadvantages

- can be too challenging for some
- Requires time to recover after the training

CONTINOUS TRAINING

Improves cardiovascular fitness

Improves aerobic and anaerobic fitness

Target heart rate range between 60% - 80% maximum heart rate (maxHR)

Disadvantages

can be boring and tiring.

PLYOMETRIC TRAINING

Fast, powerful movements

Increases speed

Increases endurance

Disadvantages

- does not improve aerobic fitness
- risk of injury

WEIGHT / BODY WEIGHT TRAINING

Increases muscle mass and strength

Increases muscular endurance

Reduces body fat

Disadvantages

- many performers use poor technique
- May need special equipment
- can cause muscle soreness

FLEXIBILITY TRAINING

Improves range of motion

Improves posture

Improves muscle co-ordination

Disadvantages

- Underused by many athletes
- A muscle may be stretched beyond its normal range

FARTLEK TRAINING (Swedish for speed play)

Improves speed

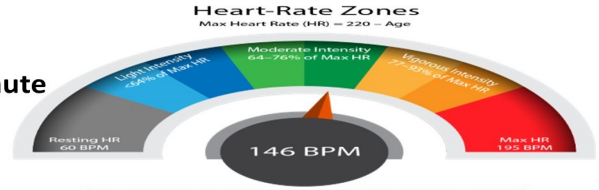
Improves endurance

Changes in speed, incline and terrain are used to provide changes in exercise intensity

Disadvantages

- some urban areas have little variety of in-cline and terrain.
- Can be too easy to skip the difficult parts

KEY TERMS



Heart Rate = number of beat per minute

BPM = Beats per minute

Maximum HR = 220 - AGE

Resting HR = HR before exercise

Working HR = HR during exercise

Recovery HR = How quickly HR returns to normal after exercise

AEROBIC TRAGET ZONE

60 - 80% OF Maximum heart rate

ANAEROBIC TRAGET ZONE

80 - 90% of Maximum heart rate

Data type	Definition	Example
Quantitative data	Measurement that can be quantified as a number	Timing a runner using a stopwatch
Qualitative data	The expression or opinion in quality of words	"I enjoy pe".

NCFE Knowledge Organiser - Impact on lifestyle	
Health	A complete state of **physical, mental and social** wellbeing.
Fitness	The ability to meet the demands of the **environment or sport.**
Lifestyle	The way which people live.
Active Lifestyle	A lifestyle that include **regular** physical activity
Sedentary Lifestyle	A lifestyle that has **very little** or **no physical** activity and an **excessive amount of sitting.**
Moderate Activity	Your breathing rate will quicken but not enough to make you out of breath. **Example - walking.**
Vigorous Activity	More intense and difficult exercise that will result in a higher heart rate and faster breathing rate. **Example - sprinting.**