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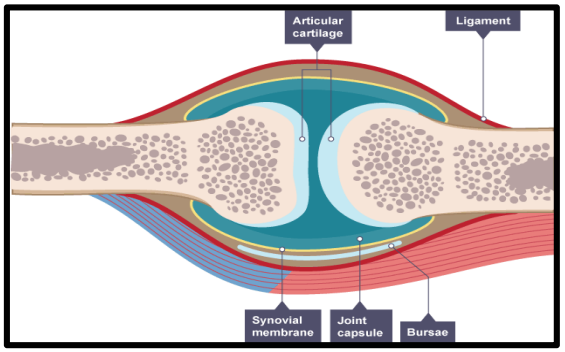
Unit 1.1 Skeletal System

Function of the Skeleton

- **Support:** the bones are solid and rigid. They keep us upright and hold the rest of the body – the muscles and organs – in place.
- **Movement:** the skeleton helps the body move by providing anchor points for the muscles to pull against.
- **Structural shape and points for attachment:** the skeleton gives us our general shape such as height and build. The skeleton also provides anchorage points for the muscles to attach via tendons, so when muscles contract movement occurs.
- **Protection:** certain parts of the skeleton enclose and protect the body's organs from external forces e.g. the brain is inside the cranium. This function is especially important in activities that involve contact. E.g. rugby, boxing.
- **Production of Blood Cells:** the bone marrow in long bones and ribs produce red and white blood cells.
- **Mineral Storage:** bones store several minerals e.g. calcium, which can be released into the blood when needed.

Synovial Joints



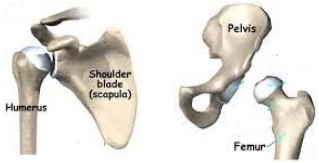
Ligaments
Attaches bone to bone to keep the joint stable eg knee when kicking the ball or restricts movement/prevents movement to stop injury.
Cartilage
Found between bones and prevents friction by stopping the bones from rubbing together.
Synovial Membrane
Secrets synovial fluid.
Synovial Fluid
Is produced by the synovial membrane and helps lubricate the joint.
Joint Capsule
This is lined with synovial membrane. It encloses the joint making sure the cartilage and synovial fluid remain in place.
Bursae
Fluid filled sac providing cushion between bones and tendons. This stops friction at the joint.
Tendons
Attach muscle to bone. When a muscle contracts to move a joint, it is the tendon which pulls on the bone, keeps muscles/bones stable or holds join in place.

Bones Located at Joints

Shoulder = Scapula and Humerus
Elbow = Humerus, Radius, Ulna
Hip = Pelvis, Femur
Knee = Femur, Tibia, Patella

Types of Joint

Ball and Socket Joint



Location in Body: Shoulder and Hip
Type of Movement Allowed by Joint: Flexion, Extension, Adduction, Abduction, Rotation

Hinge Joint

Location in Body: Knee and Elbow
Type of Movement Allowed by Joint: Flexion and Extension

Types of Joints

A place where two bones meet
Fixed- Skull and pelvis
Slightly Moveable- Spine
Synovial Joints

- **Pivot-** Vertebrae
- **Condyloid-** Wrist
- **Saddle-** thumb
- **Gliding-** clavicle
- **Ball and Socket-**Shoulder and hip
- **Hinge-**Knee and Elbow

Types of Bones

FLAT BONES: protect vital organs e.g. cranium protects your brain, ribs protect heart and lungs.
LONG BONES: enable gross (large) movements e.g. femur, tibia and fibula in the leg which allow us to run, humerus, radius and ulna in arm which allows us to throw a ball.
SHORT BONES: enable fine (small) movements e.g. fingers allowing you to spin a cricket ball.
IRREGULAR: vertebrae
SESAMOID- Patella

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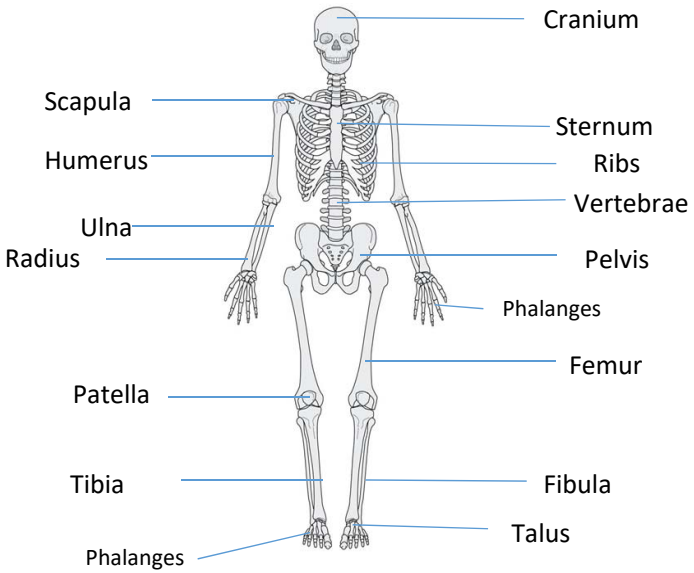
Unit 1.1 Skeletal System



STRUCTURE OF THE SKELETON

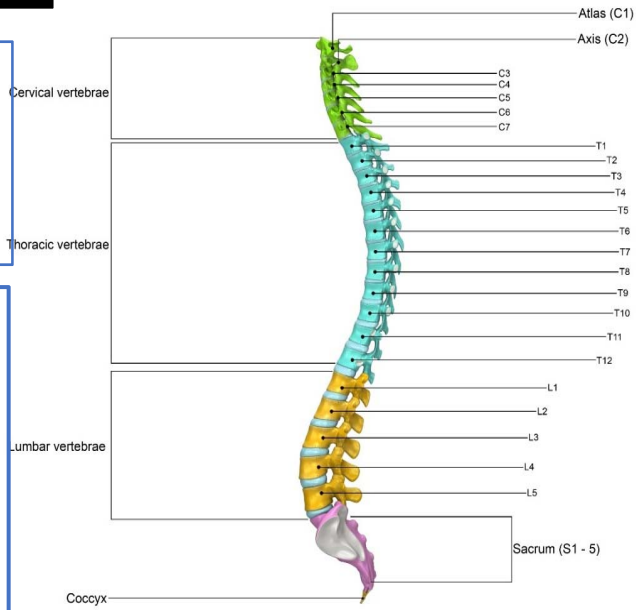
AXIAL-Cranium, sternum, ribs and vertebrae

APPENDICULAR- clavicle, scapula, humerus, radius, ulna, carpals, tarsals, pelvis, femur, tibia, fibula, and phalanges.

Lordosis: Also called swayback, the spine of a person with lordosis curves significantly inward at the lower back.

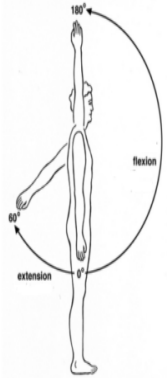
Kyphosis: Kyphosis is characterized by an abnormally rounded upper back (more than 50 degrees of curvature).

Scoliosis: A person with scoliosis has a sideways curve to their spine. The curve is often S-shaped or C-shaped.



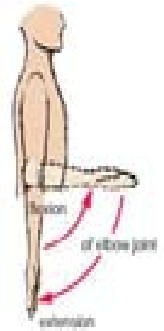
Flexion and extension at the shoulder

- The **Deltoid** causes flexion at the shoulder
- The **Latissimus dorsi** causes extension at the shoulder



Flexion and extension at the elbow

- The **Biceps** cause flexion at the elbow
- The **Triceps** cause extension at the elbow



Flexion and extension at the knee

- The **Hamstrings** cause flexion at the knee
- The **Quadriceps** cause extension at the knee

Flexion and extension at the hip

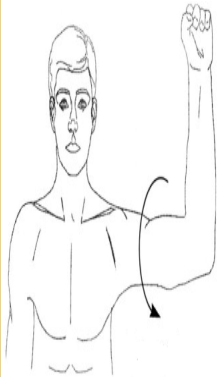
- The **Hip Flexors** cause flexion at the hip
- The **Gluteals** cause extension at the hip

Flexion and extension at the ankle

- The **Tibialis Anterior** causes dorsiflexion at the ankle
- The **Gastrocnemius** cause plantar flexion at the ankle

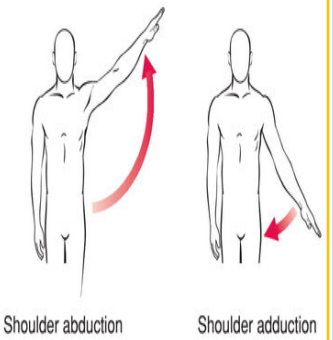
Rotation of the Shoulder

- The **Rotator Cuff** causes rotation at the shoulder



Abduction and Adduction at the shoulder

- The **deltoid** causes abduction at the shoulder
- The **Pectorals / Latissimus Dorsi** cause adduction at the shoulder



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Unit 1.2 Muscular System

Types Of Muscles

CARDIAC- Found in the heart wall
- Oxygen dependent, involuntary
- aids blood flow through the heart

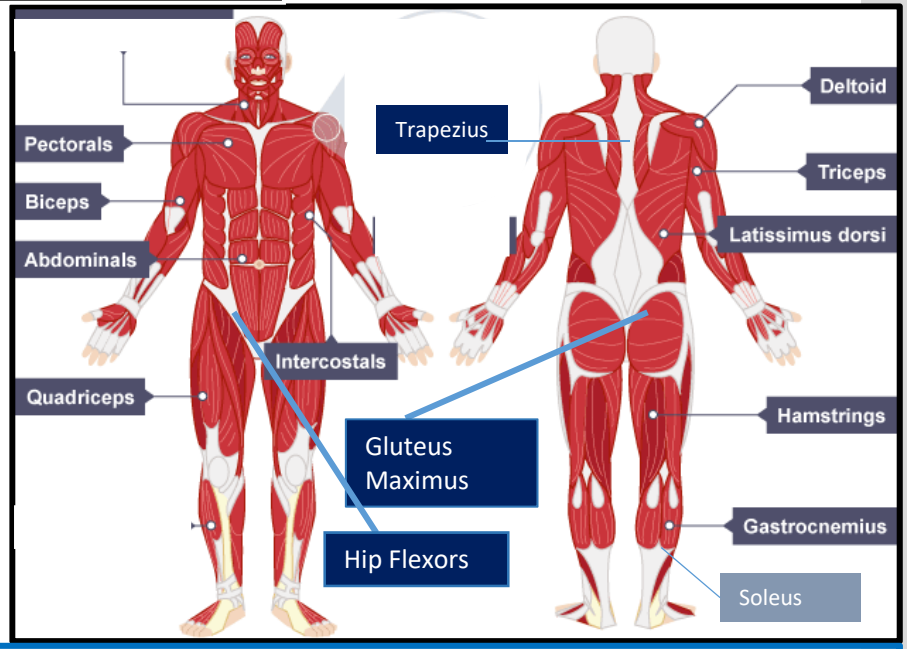
SMOOTH- Found in internal organs, digestive tract, blood vessels and lungs.
- can work without oxygen, involuntary
- aids digestion, helps distribution of blood.

SKELETAL- Found around the body
- can work with or without oxygen, works voluntarily.
- aids with movement.

Muscle fibre types

Type 1- Slow twitch fibres- red in colour, slow contraction speed, low force, fatigue slowly and uses oxygen..

Type 2- fast twitch fibres- white in colour, fast contraction speed, fatigue quickly, contract without oxygen.



Muscular Contractions

Isotonic Contractions

These contractions occur when there is movement of the body. The ends of the muscles move closer together to cause the movement.

Isometric Contractions

This type of contraction takes place when the body is being held in the same position. The length of the muscle during these contractions stays the same length.

Isotonic Concentric Contraction occurs when the muscle shortens e.g. biceps contracting concentrically during the upwards phase of a bicep curl / triceps contracting concentrically during the upwards phase of a press-up

Isotonic Eccentric Contraction occurs when the muscle lengthening (antagonist) is under tension. An eccentric contraction provides the control of a movement on the downward phase and it works to resist the force of gravity e.g biceps contracting eccentically when lowering the weight in a bicep curl / triceps contracting eccentically during the downwards phase of a press-up.

- **How do MUSCLES WORK?**

- Muscles can only PULL they cannot push. This means that they must work in pairs to allow parts of the body to move back and forth. THESE PAIRS ARE CALLED **ANTAGONISTIC PAIRS.**
- **Antagonistic Pairs**
- A muscle must work in partnership with another muscle to allow movement to occur.
- The muscle that causes the movement (the pulling muscle) is called the **AGONIST** or **PRIME MOVER**. When this muscle contracts in becomes shorter.
- During this time the other muscle within this partnership is relaxing. This muscle is called the **ANTAGONIST** and is lengthening while it relaxes.

EXAMPLES:

- When we flex our elbow the bicep is the **agonist** and the tricep is the **antagonist**. However these roles are reversed when the elbow extends ,with the tricep becoming the **agonist** and the bicep becoming the **antagonist**.
- When dorsiflexion occurs in our ankle the tibialis anterior is the **agonist** and the gastrocnemius is the **antagonist**. However these roles are reversed when plantar flexion occurs at the ankle, with the gastrocnemius becoming the **agonist** and the tibialis anterior becoming the **antagonist.**

Antagonistic Muscle pairs

HAMSTRINGS	QUADRICEPS
Bicep	Tricep
HIP FLEXORS	GLUTEALS
DELTOID	LATISSIMUS DORSI

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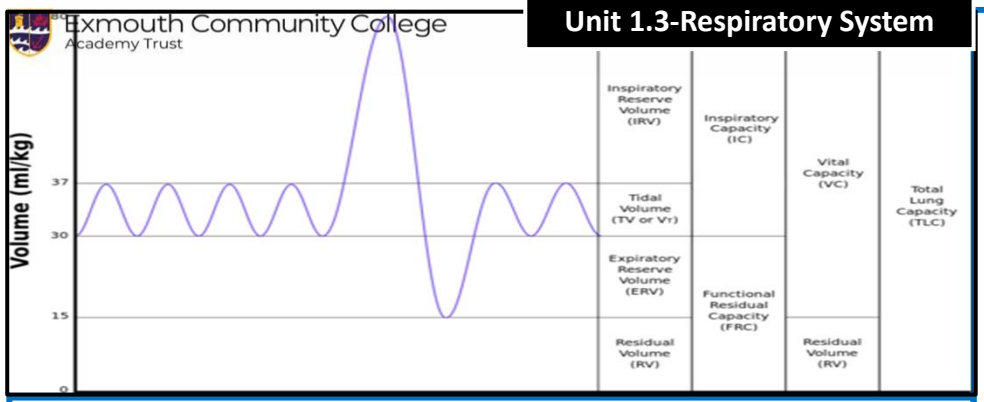
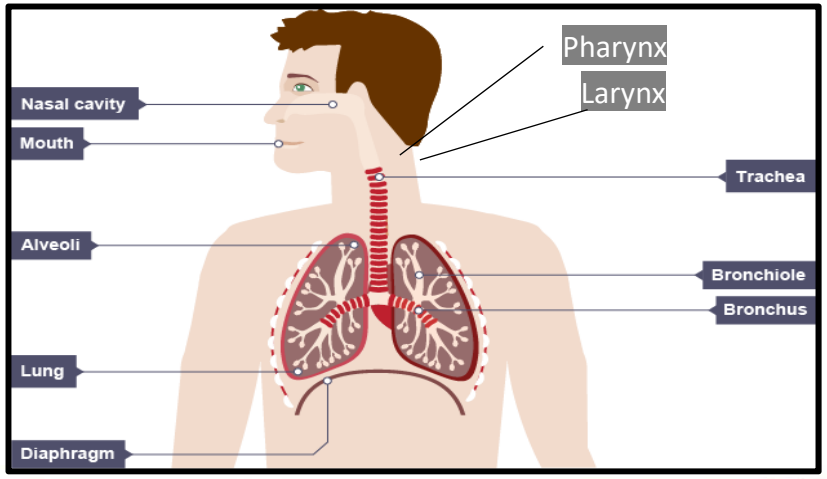
Unit 1.3-Respiratory System



The Pathway of Air into the Body

- When we breathe in, air moves through the **mouth and nose**.
- It then travels down the **trachea**.
- Near the lungs the trachea divides into two tubes called **bronchi** (one enters left lung and the other the right).
- Once in the lungs the bronchi split into smaller bronchi before dividing into even smaller tubes called **bronchioles.**
- At the end of each bronchiole are openings to the **alveoli.** There are usually several alveoli coming from one bronchiole, forming a little clump that resembles a cluster of grapes.
- At the alveoli gaseous exchange occurs. Capillaries carrying blood surround each alveoli resulting in oxygen being passed into the bloodstream from the alveoli in exchange for carbon dioxide which passes from the blood stream into the alveoli.

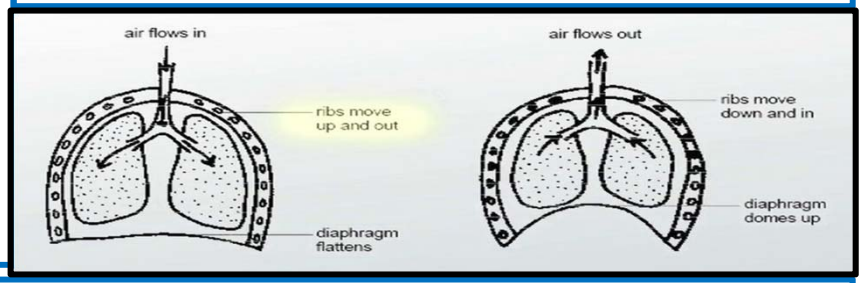


Inspiration (How we breathe in):

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

Expiration (How we breathe out):

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



Gaseous Exchange

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

Key features of the Alveoli (help diffusion):

- Alveoli walls are only **one cell thick** and are **moist** – easy to exchange gases
- They are **very small**, however their are **millions** within the lungs – large surface area
- Covered with **huge network of capillaries** – constant blood supply

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1.4 Cardiovascular System

Structure and Function of the blood vessels.

Arteries- Carry blood away, thick muscular walls, small lumen and elastic
Veins- Have valves, Thin walls, carries blood to the heart, large lumen
Capillaries- Tiny, thin walled, they join arteries and veins.

Vascular Shunt

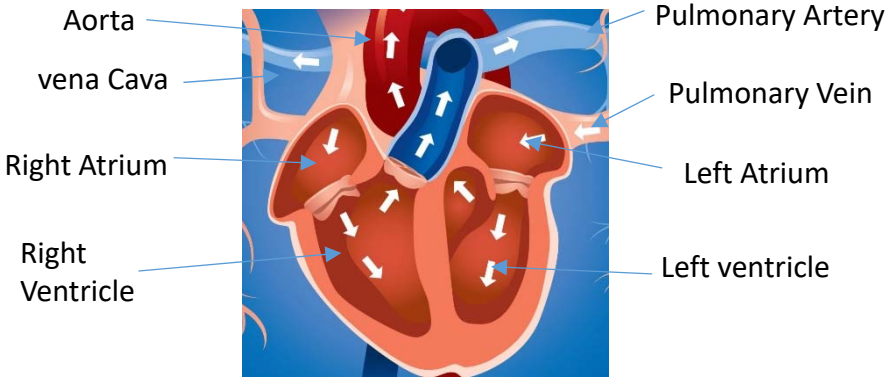
The body uses two mechanisms to control this redistribution. **Vasoconstriction (narrowing)** and **Vasodilation (expanding)** is used to redistribute blood to essential areas of the body while decreasing blood flow to others.

Blood Pressure is described as the **force of blood pushing against the walls of your arteries as the heart pumps blood**.

1) Systole (Ejection)
2) Diastole (Filling)

Low Blood Pressure Range	Below 90/60 mmHg	Causes Dizziness, fainting, and poor blood circulation
Ideal Blood pressure range	Between 120/ 80 and 90/60 mmHg	
High Blood pressure range	140/90mmHg	Kidney damage, burst blood vessels, damage to the brain, including strokes.

Structure of the Heart



Maximum heart rate (MHR)= 220-age

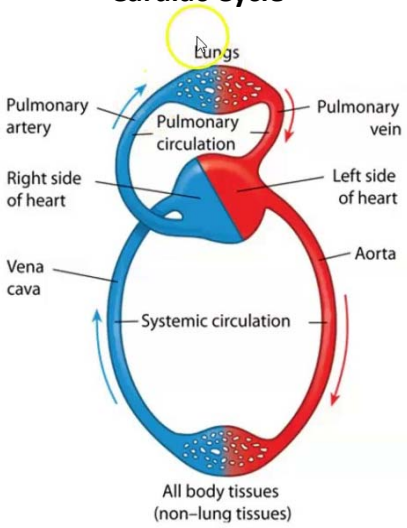
cardiac output = stroke volume × heart rate

Cardiac output is the amount of blood pumped out of the left ventricle of the heart per minute.

Stroke volume is the amount of blood pumped out of the left ventricle per beat.

Heart rate is beats per minute

Cardiac Cycle



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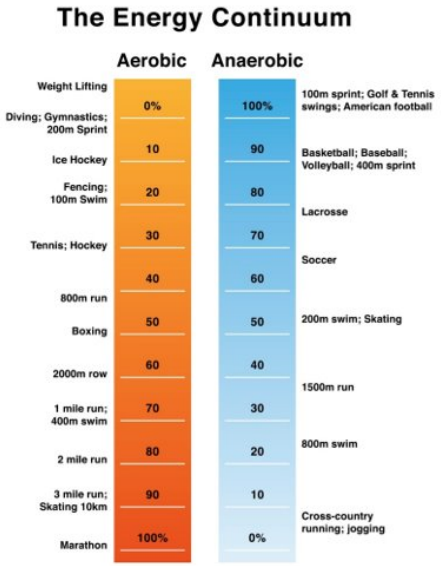
1.5 Energy Systems

Aerobic Energy System- Uses/is dependent on oxygen; used for long duration, low intensity activities.
Anaerobic Energy System- Not dependent on oxygen used for short duration; used for high intensity activities.
Lactic Acid- Fatiguing waste product of the anaerobic energy system.

Glucose + oxygen ⟶ energy + Carbon dioxide (co2) + water

Glucose ⟶ energy + Lactic Acid

Training Zones:
- Aerobic Training Zone = 60 – 80% of maximum heart rate
- Anaerobic training Zone – 80 – 90% of maximum heart rate
- Maximum heart rate = 220 – age



2.1 Short and long term effects of exercise

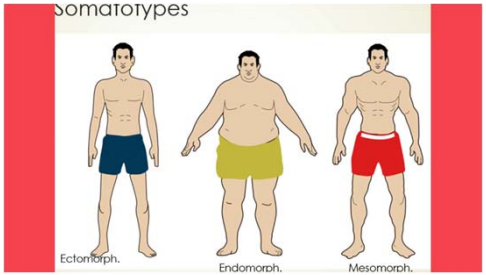
Short term effects AO1
Breathing rate increases
Heart rate increases- beats per minute Stroke volume increases- amount of blood pumped per beat Cardiac output Cardiac output increases- amount of blood pumped per minute
Blood pressure increases
Body temperature Increases
Hydration levels decreases as we lose water through sweat
Muscles begin to fatigue
Delayed onset of muscle soreness

Long term effects AO1
Cardiovascular endurance increases
Body uses oxygen more efficiently
Blood pressure is reduced
Resting heart rate decreases
Muscular endurance increases
Muscular strength and size increases
Number of red blood cells increases
Flexibility increases
Body shape changes

1.ENDOMORPH (Fat/DUMPY)
Wide hips and Narrow shoulders, has a tendency to store fat
Shot putters, sumo wrestlers.

2.MESOMORPH (Muscular)
Narrow hips, broad shoulders, Low level of fat and solid build
Tennis, rugby, sprinters & swimmers

3.ECTOMORPH (Thin)
Narrow hips and shoulders, long, thin frame, slim build, generally does not build muscle easily, generally does not store fat easily
High jumper, marathon runner



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3.1 Health and Fitness

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

Fitness:
Ability to meet the demands of the environment

Relationship between health and fitness:

- Ill health can negatively affect fitness as the individual may be too unwell to train.
- Increases in fitness can positively affect health and well-being e.g. you may be less likely to get ill, you may feel better about yourself; **HOWEVER**, an increase in fitness cannot prevent illness.

3.2Health and Skill components of fitness

1) **Cardiovascular endurance:** the ability of the heart and lungs to supply oxygen to the working muscles.
2) **Agility:** The ability to move and change direction quickly (at speed) whilst maintaining control.
3) **Balance:** maintaining the centre of mass over the base of support.
4) **Co-ordination:** the ability to use different (two or more) parts of the body together smoothly and efficiently.
5) **Flexibility:** the range of movement possible at a joint.
6) **Muscular endurance:** Ability of a muscle or muscle group to undergo repeated contractions avoiding fatigue.
7) **Power / Explosive strength:** the product of strength and speed (strength x speed).
8) **Reaction Time:** the time taken to initiate a response to a stimulus.
9) **Speed:** the maximum rate at which an individual is able to perform a movement or cover a distance in a period of time (speed = distance divided by time)
10) **Strength:** the ability to overcome a resistance
    a) **Maximal** – the largest force possible in a single maximal contraction
    b) **Dynamic** – repeated contractions
    c) **Explosive** – (see POWER)
    d) **Static** – the ability to hold a body part in a static position.

When asked to explain remember to give specific sporting examples:

- Power is needed in football to kick the ball harder when shooting so it is more difficult for the goalkeeper to save.
- A gymnast uses power gain height when jumping. This will give them more time to complete the move.
- Cardiovascular fitness is important in hockey as each game lasts a long time therefore they need to be able to transport oxygen around the body effectively for the duration of the match. This will help them maintain the quality of performance throughout game.

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4.1 Principles of Training

Types of Training:

1) **Interval** = Training that involves set periods of work followed by set periods of rest. It usually involves periods of intense exercise followed by periods of rest so that the performer can recover. The intensity of interval training can be altered to suit the individual by altering the time working and / or the time resting.

2) **High Intensity Interval Training(HIIT)** = Short bursts of extreme effort with even shorter rest periods. A 2 : 1 work ratio is often used e.g. 30 seconds work, 15 seconds rest. During HIIT training the performer will be working anaerobically so it will develop their ability to withstand the build up of lactic acid.

3) **Continuous** = Exercising for a sustained period of time without rest. It improves cardiovascular fitness. Sometimes referred to as 'steady state' training. The performer normally trains at a low to moderate intensity but for an extended period of time 20 minutes +. During continuous training the performer will be working aerobically so it will develop their ability to get oxygen into the body and create energy.

4) **Fartlek** = Also known as 'speed play', this type of training involves performers varying their speed / intensity. It can involve different speeds (walk, jog, sprint) or running at different terrains (uphill, down hill, on sand). Altering the intensity allows the performer to use both their aerobic and anaerobic energy systems.

5) **Circuit** = A series of exercises performed one after the other with a rest in between. Each circuit involves different activities called 'stations'. Stations are often set out to work all of a performers body (arms, core, legs). In circuit training performers often work for a set amount of time and then have a set rest period e.g. work 30 seconds, rest 30 seconds. Progressing these sessions is easy as the performer can increase the work time or decrease the rest time.

6) **Weight** = Involves the lifting of weights / resistance to develop muscular strength or endurance. The beauty of weight training is that it can focus on specific muscles / muscles groups so that sessions can be designed to suit an individual's needs. This type of training involves REPS (completing one lift of a weight) and SETS (the completion of a number of reps). To develop strength / power performers must lift heavy weights but for a low number of reps. To develop strength / power performers should lift above 70% of their one rep max for 4 – 8 reps. To develop muscular endurance performers must lift lighter weights but for a higher number of reps. To develop muscular endurance performers should lift below 70% of their one rep max for 12 – 15 reps.

7) **Plyometric** = Is a type of training that is used to increase power (strength x speed). It typically takes the form of bounding, hopping or jumping. The aim of plyometrics is to use your body weight and gravity to stress the muscles involved. This type of training involves the muscles working eccentrically (lengthening) when landing (often quadriceps) which helps them store elastic energy. This energy is released when the performer pushes up , working their muscles concentrically (shortening) e.g. jumping (hamstrings).

8) **Static Stretching** = Stretching to the limit and holding the stretch isometrically.

SPORT-The principles of training are a guide and should be considered for all prolonged periods of training

Specificity- Training should be specific to the individual and sport

Progression- The overload should be **gradually** increased as the body adapts and gets better

Overload- Working harder than usual

Reversibility- If you stop or reduce your training your level of fitness or skill will drop.

Tedium- Refers to boredom, training should be altered or varied.

FITT This principle will help you overload

Frequency- Refers to often you train

Intensity- How hard you train

Time- How long you train

Type- The type of training, eg continuous, circuit, or weight training