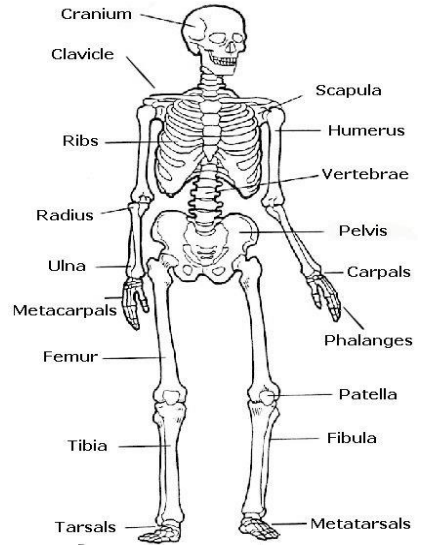
Applied Anatomy & Physiology

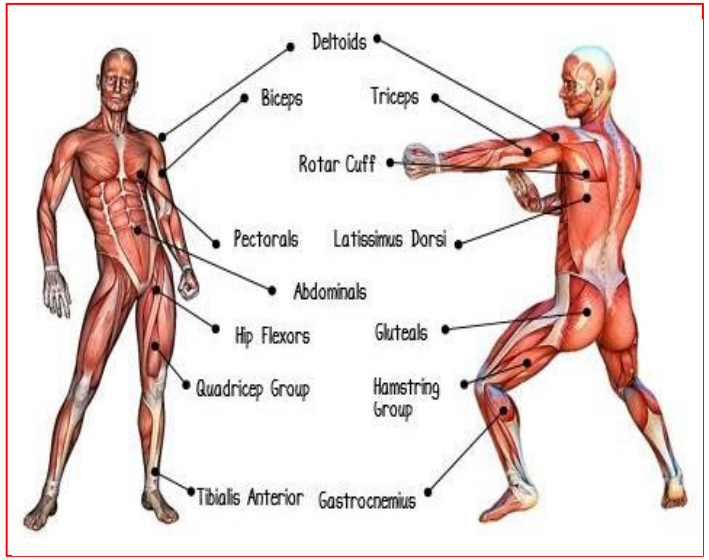
Functions of the skeleton:
- **Support**
- **Protection**
- **Movement**
- **Shape**
- **Mineral storage**
- **Blood cell production**

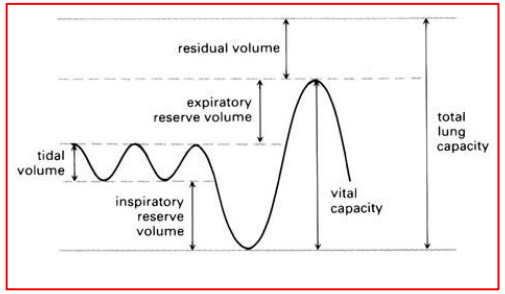
Recovery:
Cool down, manipulate diet, ice bath/ massage

Features of gaseous exchange:
- alveoli have large surface area & moist, thin walls
- Short diffusion pathway
- Lots of capillaries
- Large blood supply
- Steep concentration gradient

Short - Long - Flat - Irregular

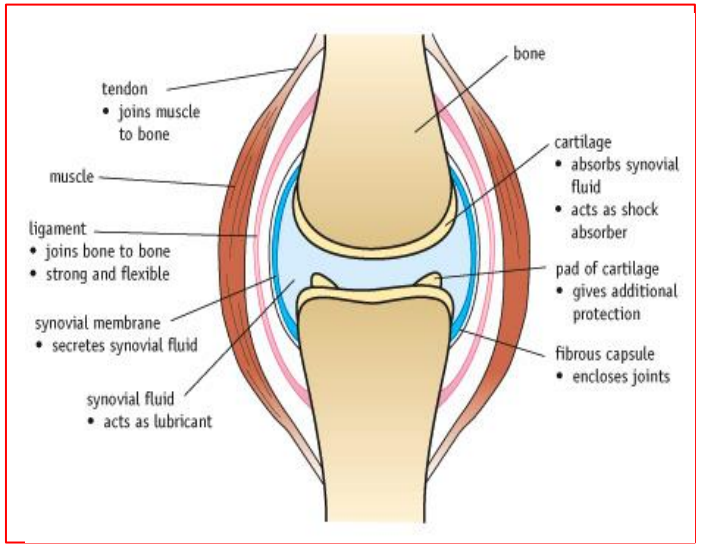






Respiration:
Anaerobic = glucose → energy + lactic acid
Aerobic = glucose + oxygen → carbon dioxide + water + energy

Joints:
- **Ball & socket** – shoulder/ hip
- **Hinge** – elbow/ knee



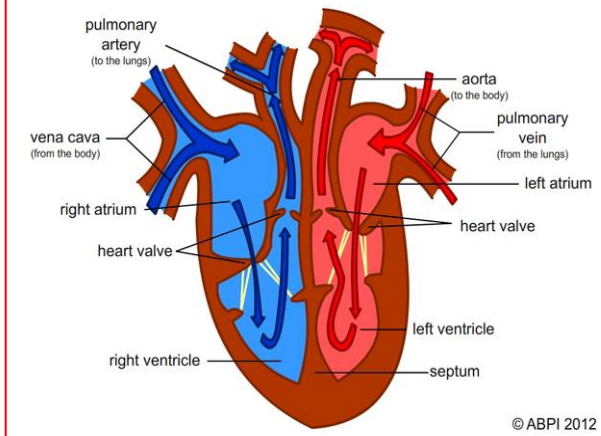
Agonist = muscle that contracts to start the movement
Antagonist = muscle that relaxes to allow movement

Isotonic contractions = muscle changes length to move limb (concentric – shortens, eccentric – lengthens)
Isometric contractions = length doesn't change – no limb movement

EPOC (Excess Post-exercise Oxygen Consumption) – amount of oxygen needed to recover after anaerobic respiration.

Inhalation:
1. Diaphragm contracts
2. Intercostal muscles contract
3. Rib cage moves out
4. Chest cavity expands
5. Pressure decreases – air rushes out

Exhalation:
1. Diaphragm relaxes
2. Intercostal muscles relax
3. Rib cage moves down
4. Chest cavity decreases#
5. Pressure increases – air rushes in



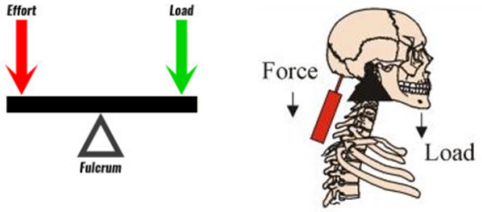
Immediate effects – temp/ HR/ breathing rate increase, sweat
Short-term effects – fatigue, nausea, light-headedness, DOMS
Long-term effects – body shape, improved CoF, built muscle strength, hypertrophy, decreased resting HR

Gaseous exchange – O2 diffused through alveoli into capillaries. O2 turns haemoglobin into oxyhaemoglobin. CO2 diffuses out of capillaries into alveoli.

Diastole = the phase of the heartbeat when chambers relax & fill with blood
Systole = the phase of the heartbeat when chambers empty of blood

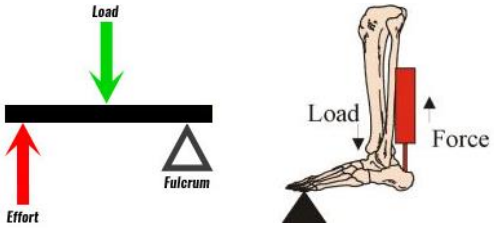
Movement Analysis

1st class lever: LFE/ EFL



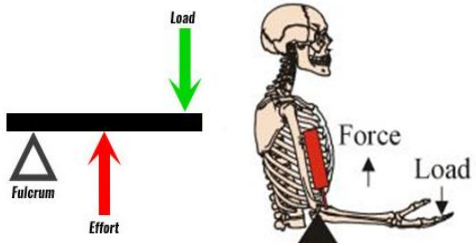
e.g. header in football

2nd class lever: FLE/ ELF



e.g. pushing against the block in a sprint start

3rd class lever: LEF/ FEL



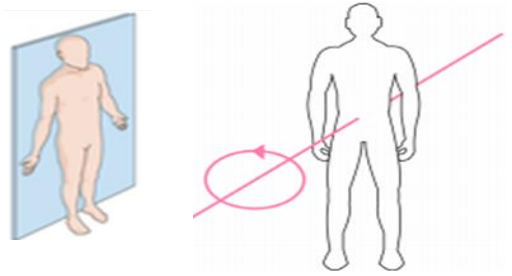
e.g. bicep curl

Fulcrum or 'axis' = the fixed point where the lever turns/ is supported
Load or 'resistance' = the weight that the lever must move
Effort or 'force' = the force required to move the load

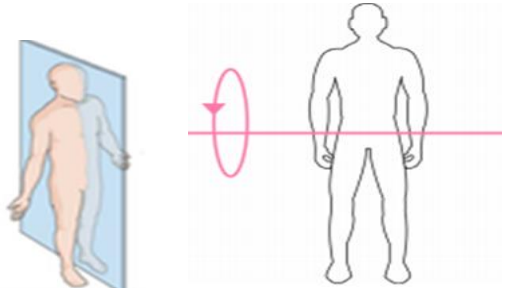
Mechanical advantage measures the efficiency of a lever. It can be calculated by doing **effort arm ÷ load arm**
Effort arm = distance from effort to fulcrum
Load arm = distance from load to fulcrum

Planes of movement & axis of rotation:

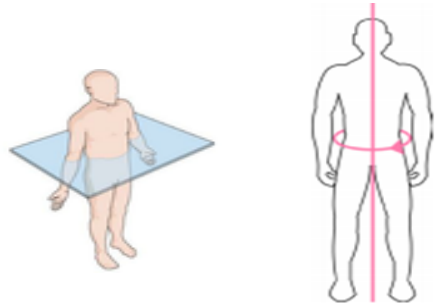
1) **Frontal plane & Sagittal axis** – adduction/ abduction occur e.g. cartwheel



2) **Sagittal plane & Transverse axis**– flexion/ extension occur e.g. walking



3) **Transverse plane & Longitudinal axis** – rotation occurs e.g. spinning in skating



Flexion: decrease in angle of bones at a joint e.g. knee before kicking a ball
Extension: increase in angle of bones at a joint e.g. knee after kicking a ball

Abduction: movement of a bone or limb away from the midline of the body e.g. arms & legs - outward star jump
Adduction: movement of a bone or limb towards the midline of the body e.g. arms & legs – inward star jump

Dorsiflexion: movement at the ankle joint that flexes the foot upwards and decreases the angle e.g. squat
Plantar flexion: movement at the ankle joint that points the toes and increases the angle e.g. vertical jump

Circumduction: a circular movement around a joint/axis e.g. shoulder – bowling in cricket

Rotation:

Physical Training

Principles of training

S.PO.R.T

Specificity – making it specific to the sport/ movements/ muscles/ energy

Progressive Overload – gradual increase of overload so that fitness gains occur

Reversibility – losing fitness levels when exercise is stopped or reduced

Tedium – boredom that can occur from training the same way constantly

F.I.T.T (used to achieve overload)

Frequency – how often

Intensity – how hard

Time - duration

Type – method

Preventing injury

- Make goals achievable
- Don't over train
- Wear appropriate clothing/ footwear
- Don't stretch cold muscles or bounce stretches
- Use taping/ bracing where appropriate
- Use correct techniques
- Keep hydrated
- Make time for rest & recovery
- Always warm up & cool down

Qualitative data – involves opinions e.g. judges scoring gymnastics routine

Quantitative data – based on facts e.g. time in seconds or goals achieved

Fitness testing

- Identify strengths/ weaknesses
- Monitor improvement
- Motivation/ set realistic targets

Limitations:

- Too general/ not sport specific
- May not replicate movements of actual activity
- Don't replicate competitive conditions
- Don't use direct measuring – inaccurate
- Need to be carried out with correct conditions

Aerobic training zone = 60-80% of MHR

Anaerobic training zone = 80-90% of MHR

Training seasons

1. **Pre-season**

General aerobic fitness

Train essential components of fitness

practice skills & techniques

2. **Competitive/ peak**

Maintain fitness levels

Avoid overtraining

Optimise skills

Take on strength + weaknesses from each match

3. **Post-season**

Rest & recovery

Light aerobic exercise to maintain general fitness

Types of training

- **Circuit** – series of different exercises (stations), brief rest between, longer rest after each circuit
- **Continuous** – sustained exercise at a constant rate
- **Interval/ HIIT** – periods of work with periods of rest/ periods of high-intensity work with periods of low-intensity exercise (active recovery)
- **Fartlek** – periods of fast and slow work
- Static stretching – hold an isometric contraction for up to 30s
- **Weight** – free weights: core has to work to keep them stable, resistance machines: promote good technique, provide stability
- **Plyometric** – high impact exercise to increase power, eccentric contraction followed by concentric contraction
- **High altitude** – aerobic training at 2000m above sea level to increase red blood cell count

Warm up – gradual pulse raiser then stretch

- Raise temperature
- Increase flexibility
- Mental prep
- Increase blood flow to working muscles
- Reduces chance of injury

Cool down – gradual reduce intensity then stretch

- Removes waste products in blood
- Prevents DOMS

Agility	**Ability to change direction quickly whilst maintaining control**	**Illinois agility test**
Balance	**Maintaining the centre of mass over the base of support**	**Stork test**
Cardiovascular endurance (aerobic power)	**ability of the heart & lungs to supply oxygen to the working muscles**	**Multi-stage fitness test**
Co-ordination	**Ability to use two or more body parts together**	**Wall toss test**
Flexibility	**Range of movements possible at a joint**	**Sit and reach test**
Muscular endurance (dynamic strength)	**Ability of the muscles/ muscle group to undergo repeated contractions, avoiding fatigue**	**Sit up bleep test**
Power (explosive strength/ aerobic power)	**Product of strength and speed**	**Vertical jump test**
Reaction time	**Time taken to react to a stimulus**	**Ruler drop test**
Speed	**Maximum rate an individual is able to perform a movement or cover a distance in a period of time, putting body parts into action as quickly as possible**	**30m sprint**
Strength	**Maximal – maximum force that a muscle can exert in a single voluntary contraction**	**One rep max**
	Explosive – muscular strength used in one short sharp movement	**Vertical jump test**
	Static – ability to hold a body part in a static position, isometric contraction	**Handgrip dynamometer**
	Dynamic – ability of the muscles/ muscle group to undergo repeated contractions, avoiding fatigue	**Sit up bleep test**

Sports Psychology

Information processing:

Input: senses tell you what's happening

↓

Decision making: brain decides what to do

↓

Output: body carries out the action

↓

Feedback: find out if you've been successful

Skill = a learned action or behaviour
Ability = an inherited trait that determines someone's potential to learn a skill

Aggression = a deliberate intent to physically or mentally harm someone

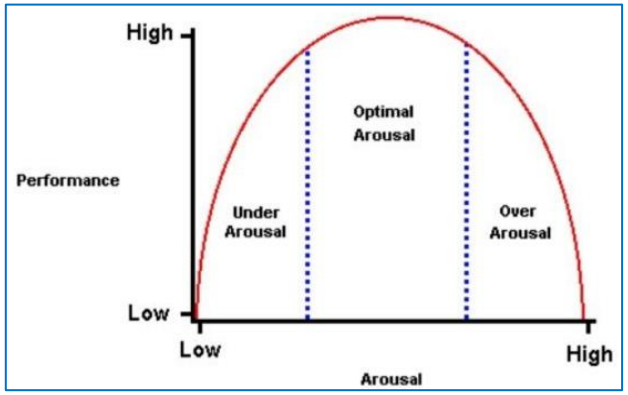
- **Direct** – involves physical contact e.g. contact in netball
- **Indirect** – taken out on an object to gain advantage e.g. hitting a tennis ball harder

Guidance:

- **Visual** – performer can see it e.g. demonstration/ video
- **Verbal** – performer can hear it e.g. listening to instructions
- **Manual** – performer assisted in physical movement e.g. support doing a gymnastics vault
- **Mechanical** – using objects or aids e.g. a harness for beginner divers removes the risk of injury

Types of feedback:

- **Positive/ negative**
- **Knowledge of results**
- **Knowledge of performance**
- **Intrinsic**– from themselves
- **Extrinsic** – from others



SMART targets:

- **Specific** to the demands of the sport, muscles & movements
- **Measurable**
- **Accepted** by the performer & others involved such as coach
- **Realistic** – possible to complete or achieve
- **Time-bound** – over a set period of time so its clear if it's been achieved

Arousal = physical & mental state of alertness

Stress management

- **Deep breathing** – returns breathing to normal & increases oxygen supply to brain
- **Mental rehearsal, visualisation & imagery** – controlling thoughts & imagining positive outcomes
- **Positive self talk** – replacing negative thoughts with positive

Basic – simple, not much concentration needed (e.g. walking)
Complex – requires a lot of concentration & coordination (e.g. pole vault)

Open – has to be performed in a certain way to deal with affect of the environment (e.g. rugby drop kick)
Closed – not affected by the environment (e.g. diving)

Self-paced – performer controls how it starts (e.g. serving in tennis)
Externally-paced – started by an external factor (e.g. receiving a ball)

Gross movement – uses large muscle groups to do big strong movements (e.g. jumping)
Fine movement – involves small muscle groups (e.g. archery)

Motivation = desire to succeed

- **Intrinsic**: comes from within
- **Extrinsic**: to gain external rewards (can be tangible/ physical e.g. medal or intangible e.g. praise

Personality types:

- **Introverts** – shy, quiet, prefer individual sports e.g. darts
- **Extroverts** – sociable, enthusiastic, prefer team sports e.g. rugby

Performance goals = personal standards to be achieved, comparing with previous achievements
Outcome goals = focus on end result (e.g. winning)

Socio-Cultural Influences

Etiquette = unwritten rule
Sportsmanship = conforming to rules, spirit & etiquette
Gamesmanship =stretching the rules to gain an advantage e.g. time wasting
Contract to compete = unwritten agreement between players to abide by all rules

Preventing **hooliganism**:
- Early kick-offs
- Improved security
- All-seater stadiums
- Segregation of fans
- Alcohol restrictions
- Travel restrictions

Effects of **spectator behaviour**:
- ✓ Atmosphere
- ✓ Revenue
- ✓ Home-field advantage
- ✓ Support
- × Pressure
- × Hooliganism
- × Costly to manage

PED	Effect on performance	Side effects
Anabolic agents	Muscle & bone growth Reduces recovery time	Liver/ kidney damage & heart disease
Beta blockers	Reduced heart rate Steady nerves Improves fine motor control	Heart problems, nausea, tiredness/ weakness
Blood doping	Improves aerobic capacity Increases performance time Reduces recovery time	Kidney/ heart failure, viscous blood
Diuretics	Reduce weight quickly Reduce concentration of other substances	Severe dehydration, muscle cramps
Narcotic analgesics	Reduces pain Performer can over train	Addictive
Peptide hormones	EPO - Increase red blood cell count HGH – Muscle growth	EPO – stroke, heart problems HGH – heart disease, diabetes, arthritis
Stimulants	Increase arousal Reduce fatigue	Addictive, anxiety, heart failure

Impact of technology:
- On **performers** – improves performance, can question decisions / expensive, disrupt play
- On **officials** – help, communication/ undermines poor decisions, too reliant
- On **sport** - fair competitions, correct decisions/ disrupts play
- On **spectators** – see how decisions are made/ unrest
- On **sponsor** – good image/ not available at all levels of sport

Technology
- **Hawkeye**
- **Performance analysis aids/ dartfish**
- **TV match officials (VAR)**

Impact or sponsorship/ media:
- ✓ Money
- ✓ Creates role models
- ✓ Develops careers
- ✓ Increases participation
- ✓ Fixtures/ ranking info
- ✓ Links to sponsors
- × Pressure – less enjoyment
- × Mistakes made public
- × Over-exposure
- × Overtraining
- × Spectators watch at home
- × Changed event timings
- × Distraction
- × Scandal damage reputations

Sponsor = an individual/ group (usually a company) that provides support
Sponsorship = provision of funds/ support in return for advertisement (e.g. financial, clothing/ equipment/ footwear, facilities)

Commercialisation = management or exploitation of a person or activity in a way designed to make profit

Factors affecting participation:
- Attitudes
- Role models
- Accessibility
- Media coverage
- Sexism/ stereotyping
- Family commitments
- Available leisure time
- Familiarity
- Education
- Socio-economic factors/ disposable income

Media:
- Broadcast – TV, Radio
- Internet – social media, search engines, websites
- Print/ press – newspapers, magazines, books
- Outdoor – billboards

Age & participation:
- Skills improve with age & experience
- Older people have longer recovery time & are more prone to injury & disease
- Tidal volume & stroke volume decrease (harder to get oxygen to working muscles)
- Flexibility & reaction time decrease with age
- Strength increases with age

Gender & participation:
- Women have more body fat
- Women are more flexible
- Men tend to be taller, heavier and stronger

Race/ religion/ culture & participation:
- Dress codes e.g. Sikh men wear turbans
- Ramadan fasting – low energy levels
- Cultural attitudes e.g. against women boxing

Disability & participation:
- Adapted activities e.g. wheelchair basketball
- Adapted equipment
- Disability classifications
- Provision for disabled people e.g. parking

Family/ friends & participation:
- Positive – encouragement from peers. Equipment, training & transport costs covered by family
- Negative – peers/ family don't encourage e.g. peer pressure

Health, Fitness & Well-Being

Health = a state of physical, mental & social well-being, and not merely the absence of disease or infirmity
Fitness = the ability to meet or cope with the demands of the environment

Health/ well-being
Physical: all body systems working well, free of illness/ injury & able to carry out everyday tasks (benefits – improves efficiency of body systems, avoiding obesity etc…)
Mental: realising potential, coping with normal stresses of life & being productive (benefits – reducing stress, releasing hormones like serotonin, controlling emotions)
Social: basic human needs are being met (food, clothing, shelter), socially active, have support of others & little stress (benefits – opportunity to make knew friends, be involved in teamwork etc…)

Factors affecting energy required:
- **Age** – young need more to grow & more muscle replaced with fat as you age (burning fewer calories)
- **Height** – taller have bigger skeletons so need more
- **Gender** – men 2500Kcal/day, women 2000Kcal/day
- **Energy expenditure** – more exercise, more energy needed

Fitness
General – suitable for a beginner
Specific – required for elite performer
Benefits:
- Improved fitness levels & helps maintain health
- Reduced chances of injury
- Ensures that you're physically able to work

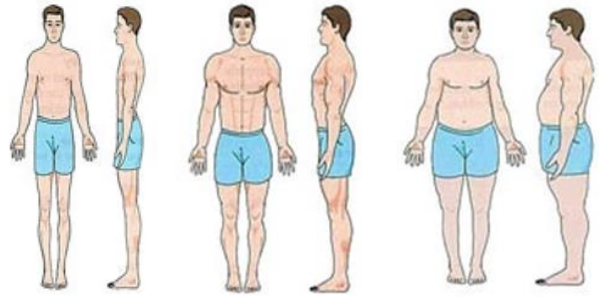
Balanced diet consists of:
- **Carbohydrates** (55-60%) – main energy source, simple provide immediate energy e.g. sugar, complex releases slowly e.g. pasta
- **Proteins** (15-20%) – repair & grow muscle e.g. chicken
- **Fats** (25-30%) – energy source, insulate body, saturated are bad e.g. butter, unsaturated are good e.g. nuts
- **Vitamins** – maintain good health e.g. vitamin A from oily fish for healthy skin
- **Minerals** – essential for health & for bone & tissue formation e.g. calcium from milk for strong bones

Sedentary lifestyle = a routine with irregular or no physical activity
Consequences:
- Weight gain/ obesity
- Risk of heart disease
- Hypertension (high blood pressure)
- Risk of diabetes
- Poor sleep patterns
- Poor self-esteem
- Lethargy (laziness)

Water balance:
Hydration = having enough water for the body to function normally
Dehydration = excessive water loss, interrupting normal bodily functions (can be quickened by exercise intensity, duration & temperature)
Rehydration = consuming water to restore hydration

Effects of dehydration:
- Viscous blood, slowing flow
- Increased HR
- Increased body temperature
- Increased reaction time
- Muscle cramps/ fatigue
- Dizziness, nausea, blurred vision & headaches

Somatotypes



Ectomorph - endurance events | Mesomorph – speed/ strength/ power events | Endomorph – low speed/ mobility events

Obesity – BMI over 30, caused by imbalance of calories consumed to energy expenditure
Effects:
- Components of fitness – limits cardiovascular endurance, flexibility, agility, speed, power
- Physical factors – risk of cancer, heart disease, heart attacks, diabetes, high cholesterol
- Mental factors – risk of depression, loss of confidence, poor self-esteem, laziness
- Social factors – inability to socialise or leave home