

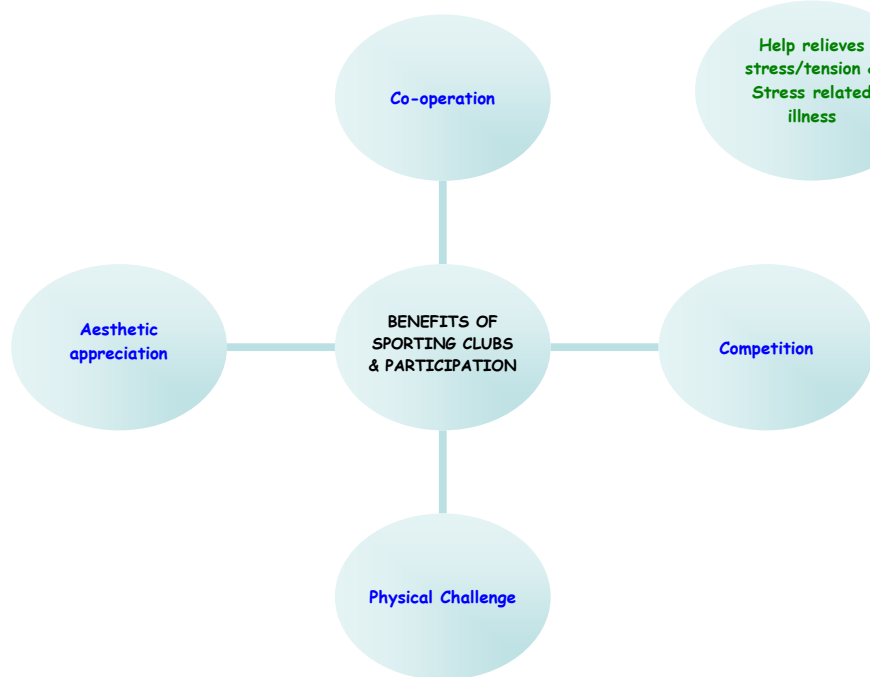
Edexcel GCSE

Physical Education

Revision Booklet

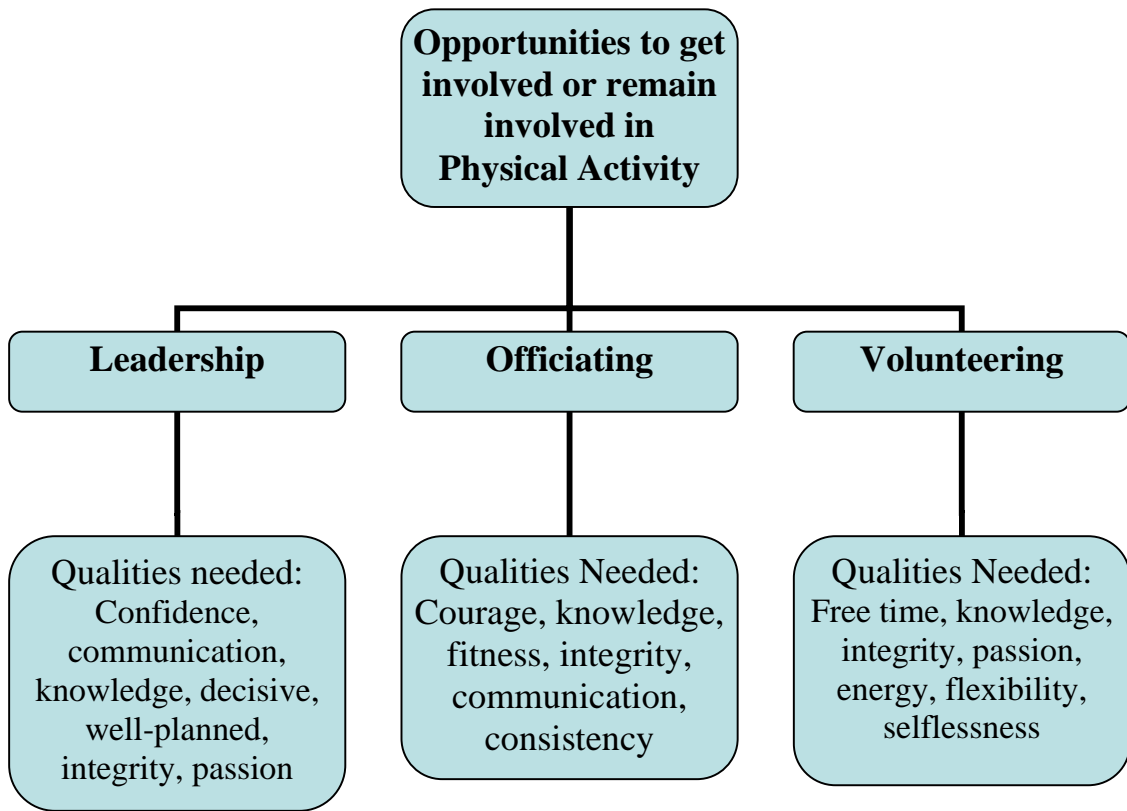
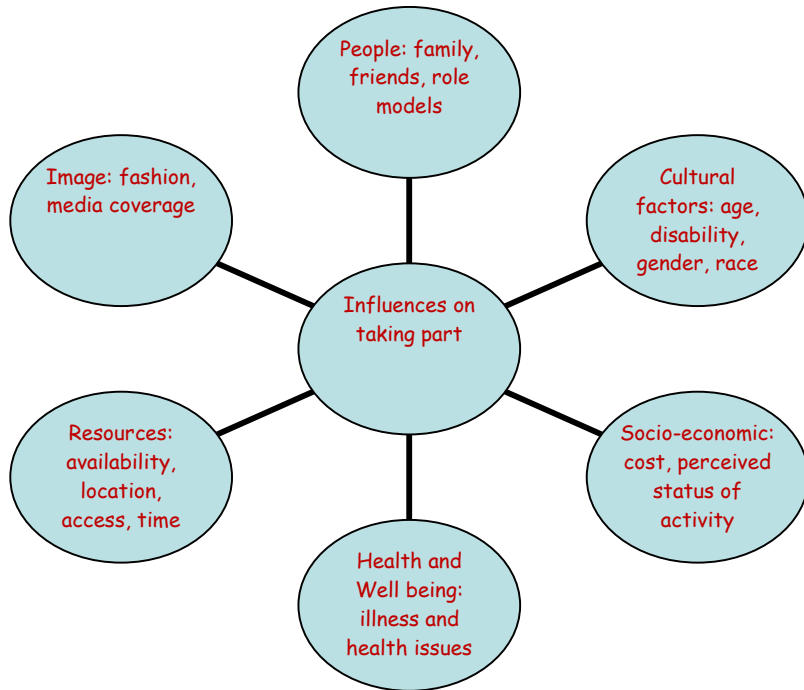
1.1 Healthy, active lifestyles

1.1.1 Reasons for taking part in activity



SOCIAL	MENTAL	PHYSICAL
<ul style="list-style-type: none"> • Make new friends • Social mixing • Meet current friends • Develop teamwork + co-operation 	<ul style="list-style-type: none"> • Helps relieves stress/tension • Help individual feel good • Mental challenge (can I do it?) + competition • Increase self-esteem + confidence • Contribute to life enjoyment • Aesthetic appreciation 	<ul style="list-style-type: none"> • Helps individual to feel and look good • Enhances body shape • Contributes to good health and enjoyment of life • Physical challenge (can I do it) • Competition

Influences on your Healthy Active Lifestyle 1.1.2



1.1.2 SPORTS PARTICIPATION PYRAMID



Foundation:

- Base of the pyramid
- Learning basic skills to provide base for personal development and future participation
- E.g. Primary school PE lessons, TOP Play and multi-skills clubs

Participation:

- Begin to participate regularly in a specific activity for enjoyment
- Sports development helps promote this stage with school festivals and school/club links
- Sports clubs are important at this stage to help make the link to the Performance stage

Performance:





- Focus on a specific sport and technique to develop talent in sport
- Quality coaching is important at this stage to develop sporting skills and the talent
- Organised sports coaching weeks e.g. Youth games help promote this stage

Excellence:

- Peak of the pyramid, where individuals reach sporting excellence
- The pyramid narrows here as fewer people take part at this stage
- Sports Governing Bodies are responsible at this stage (county → regional → national)

1.1.2 Initiatives developed to provide opportunities for becoming, remaining involved in physical activity

Being involved in physical activity, whether as a performer, leader or official can have a positive impact on developing a healthy active lifestyle (physically, mentally + socially)

Initiative	Organiser	Details
PESSCL (used to be PESSYP)	Government Via Sport England + Youth Sports Trust (YST)	<ul style="list-style-type: none"> Physical Education and School Sport & Club Links. National Scheme Increase take-up of sporting opportunities for 5 - 16year olds 8 areas:
TOP programme	YST	<ul style="list-style-type: none"> Chances for those aged 18mths - 18yrs to be involved in physical activity Could be as performers, leaders, officials and also as volunteers
TOP Link Sports Leaders Award	YST 	<ul style="list-style-type: none"> Aimed at 14 - 16yr olds students who want to organise/run sports/dance festivals for partner primary/special school pupils. Aim: to improve links between primary + secondary schools. Aim: to recruit, train, deploy and support young sports leaders.
Sports Leaders Award	YST 	<ul style="list-style-type: none"> Train young people (14 - 16yr olds) as volunteers being leaders or officials for primary children
Start, Stay, Succeed	Sport England (G'ment Sports Council) 	<ul style="list-style-type: none"> <u>Start</u>: increase participation in sport (increase health of nation) <u>Stay</u>: retain people in sport through network of clubs, coaches, facilities + competitive opportunities etc. <u>Succeed</u>: create opportunities for talented performers to achieve success
Active Kids	Sainsbury's 	<ul style="list-style-type: none"> Voucher programme Collect vouchers + exchange for sports equip.



1.1.3 - Exercise and fitness as part of your healthy, active lifestyle

KEY DEFINITIONS

- **Health** - State of complete mental, physical and social well-being.
- **Fitness** - The ability to meet demands of the environment
- **Exercise** - Form of physical activity done primarily to improve one's health and physical fitness
- **Performance** - How well a task is completed
- **Healthy, Active lifestyle**- A lifestyle that contributes positively towards social, mental and physical well being and that includes regular physical exercise.

CARDIOVASCULAR FITNESS - The ability to exercise the entire body for long periods of time. Describes the efficient of the heart, lungs + blood vessels to deliver oxygen to working muscles so physical work can be maintained.

Examples

- Playing 90 minutes in football matches
- Playing Cricket matches that could last for 3-5 days
- Running in a marathon

MUSCULAR ENDURANCE - The ability to use voluntary muscles many times (over a long period) without tiring

Examples

- Long distance walking
- Long distance running
- Long distance swimming

FLEXIBILITY - The range of movement possible at a joint

Examples

- Hurdling in athletics
- Gymnastics - performing complex sequences
- Swimming -

HEALTH RELATED COMPONENTS

STRENGTH - the ability to lift a maximum weight in one attempt
Muscular strength - The amount of force a muscle can exert against a resistance

Examples

- **DYNAMIC** - required to start and maintain movement of the body *e.g. cycling or doing loads of press-ups*
- **EXPLOSIVE** - required when a high amount of force has to be applied quickly *e.g. shot putting*
- **STATIC** - required when applying strength to a fixed static object *e.g. pushing in a rugby scrum*

Body Composition is defined as the percentage of body weight which is fat, muscle and bone.

Extra information Our body composition can have a significant bearing on the sports we are most able to play. Taking part in physical activities will change our body composition by decreasing the percentage of fat and increasing the percentage of muscle.

1.1.3 SKILL RELATED FITNESS

SKILL COMPONENTS

REACTION TIME - The time it takes to respond to a stimulus (*simple*) or a variety of stimuli (*choice*)

Examples

- **SIMPLE** - responding to a signal *e.g. sprint start to a gun*
- **CHOICE** - responding to a variety of signals *e.g. playing a shot in cricket depending on length of the ball pitched*

POWER - Ability to perform strength performances quickly (power = strength x speed)

Examples

- Football - Goal keeper taking a goal kick
- Badminton - playing an overhead smash

AGILITY - Ability to change the position of the body quickly and still control the movement of the whole body

Examples

- Football - dribbling past an opponent at speed
- Rugby - Running, avoiding opponents whilst in possession

CO-ORDINATION - Ability to use two or more parts of the body at the same time

Examples

- Pole vaulting
- Basketball - lay up shot
- Tennis - player taking a serve

BALANCE - Ability to keep the body's centre of mass (gravity) above the base of support with reference to still (*static*), changing (*dynamic*) conditions of movement, shape and orientation

Examples

- **STATIC** - holding a position without movement *e.g. a handstand in gymnastics*
- **DYNAMIC** - maintaining a position whilst moving *e.g. cycling or surfing*

SPEED - Fastest rate at which a person can complete a task or cover a distance

Examples

- Running fast - 100m sprint
- Throwing a cricket ball at the stumps to get a run out

1.1.4 PRINCIPLES OF TRAINING

Assessing personal readiness

Use a PARQ (Personal Activity Readiness Questionnaire) to assess you are ready to start an exercise programme.

It will ask you several standard questions including:

- Do you have any medical conditions?
- Are you taking any medication?
- Are you pregnant?

Assessing your fitness levels

Test	Aspect of fitness tested
Cooper's 12 minute run	Cardiovascular fitness
Hand grip test	Muscular strength
Sit and reach test	Flexibility
Harvard step test	Cardiovascular endurance
Illinois agility run	Agility
Standing stork test	Balance
Sergeant Jump	Power
Standing broad jump	Power
Ruler drop test	Reaction time
30 Metre sprint	Speed
3 ball juggle	Co-ordination

BLUE = HRE

GREEN = SRF

Principles of Training:

Good training takes into account all of the principles and their effects on the body.

RIPS R Principles

- **REST AND RECOVERY** - Rest is the period of time set aside for your body to recover. Recovery is the time required for the body to repair damaged caused during competition
- **INDIVIDUAL NEEDS** - Whether training to compete or training for health, everyone has **different personal needs**. People vary in height, size, shape, fitness and preference. Therefore, even though they have the same goals they may not reach them by the same means.
- **PROGRESSIVE OVERLOAD** - Putting greater demands on the body by exercising This will improve fitness as long as the sessions are made more difficult each time by using the FIT principles. The point where exercise is demanding enough to have an effect on the body is called the *'threshold of training'*.
- There 3 ways;
 - *Frequency - number of sessions e.g. up to 3 per week*
 - *Intensity - increasing distances run, repetitions or weight*
 - *Time - length of training sessions*
- **SPECIFICITY** - Understanding the **needs of the game or event**, e.g. a goalkeeper will include reaction work in their training. The pace of training should be consistent to the pace of the game. Also the actions should be the same in training as it is in match situations *e.g. a swimmer needs to spend most of their time in the water.*
- **REVERSIBILITY** - The body will increase in strength, tone and skill with exercise; however it also loses them without it. After injury or illness, an athlete can lose their strength and skill, up to 3x as fast as they gain it - *'If you don't use it, You lose it!'*

F.I.T.T PRINCIPLES

FREQUENCY - How **often** the exercise is done (be it an individual set or the whole session) - *e.g. Training 3 times a week or 2 per day*. Elite performers train more frequently to achieve results good enough. Remember, the body needs time to recover so training very, very hard, every day can be harmful even to an elite performer.

INTENSITY - The **difficulty** of the exercise - could be the amount of weight or the speed you move. Consider cardiovascular fitness, your pulse rate can show you how intensely you're working. Fitness will increase by working in 60-80% target zone of the maximum heart rate, *e.g. Training with heart rate of 120bpm - 160bpm*. Strength training is similar, by calculating 60-80% of their maximum weight they can lift and working to it.

TIME - The **duration** of the Exercise. Keeping your pulse at 60-80% of its maximum for 2minutes is the target. The time begins once the pulse rate hits 60%. The warm up is not included. Also you can vary the duration of each session *e.g. 30mins, 45mins or 60mins*

TYPE - What **kind** of exercise you do - For general fitness then personal preference to suit the individual is usually done *e.g. swimming, cycling or running*, But if its for a specific activity then choice becomes limited as it should reflect the activity. However remember to vary to keep interesting and work all different muscle groups

1.1.4 - Goal Setting

Gives people something to aim for - acts as a motivator.

Using **SMART** goal setting makes people's aims/goals easier to achieve and they're more likely to stick with them

SPECIFIC - Knowing exactly what the goal is *e.g. I want to run 100m further in my Cooper's Run test.*

MEASURABLE - will be easy to know when the goal is achieved *e.g. improving you Illinois Agility Run score by 1.2 seconds*

ACHIEVABLE - running an extra 100m after 6 weeks training is achievable, running a marathon would not be

REALISTIC - goal is ok to achieve in reality not just in theory *i.e. you have the right amount of time and resources to achieve the goal*

TIME-BOUND - The goal needs to have an end point *e.g. your PEP lasted for 6 weeks*

1.1.4 - METHODS OF TRAINING

Method	Description	Benefit/ element of fitness to be trained
CIRCUIT	Has between 8 - 15 stations in it. Each station has a specific <i>exercise</i> to do. A short rest is allowed between each station. Work:rest ratio Repeat whole circuit after approx. 2mins rest	Can combine muscular strength, endurance, agility, coordination, power, cardiovascular fitness within one session. Can tailor exercises to individuals. Range of exercises makes it interesting. Includes both aerobic + anaerobic. Can have skills focus. Useful for variety of sports , depending on focus.
WEIGHT	Done in a gym using free weights to use progressive resistance. High reps + low weight = muscular endurance Low reps + high weight = muscular strength	Useful for strength events : athletics, speed + jumping events. Increase muscle strength, muscular endurance, increase speed, increase muscle size, rehabilitate after illness.
INTERVAL	Mixing periods of hard exercise and rest periods (these could be walking, jogging or stopping). Set distances or set time to work. Rest time should be at least 30secs. 1 rep = 1 work + 1 rest cycle 1 set = repeating the reps 4, 5 or 6 times for eg.	Similarity to games activities e.g. Rugby and Football Can be done in variety of activities Repeated sprints = anaerobic Reps of pulse at near max and then recover will improve CV Fitness.
CONTINUOUS	Exercising aerobically at a constant rate doing activities like running or cycling, with no rests . Session usually lasts 15 - 20mins .	Cheap. Can be done individually or in a group. Can be done in a wide range of activities swim/cycle/run as well as inside on machines. Useful for endurance events e.g. marathon
FARTLEK	Swedish for ' <i>speed play</i> '. Changing speed, distances + times of exercise in same session. Difference between Fartlek & Interval training is takes place on VARYING TERRAIN, CAN INCLUDE HILLS . Also VARYING Sprint LENGTHS	Suited to most games . Rest periods can be included Can include repetitions e.g. up same hill several times Can take place anywhere safe to do so.
CROSS	Uses a combination of different training methods	Variety of training = prevents boredom. Weather is not a factor - very versatile. Can rest certain muscle groups Can train individually or with different groups of people - adds interest + increases social circles. Useful for variety of sports, depending on MoT chosen but certainly games players will benefit

AEROBIC and ANAEROBIC ACTIVITY

Aerobic - with oxygen

- Lower intensity
- Endurance activities - Marathon
- MoT: Continuous, circuit, fartlek, cross

Anaerobic - without oxygen

- Higher intensity
- Short distance activities - Sprinting
- MoT: interval, fartlek, circuit, cross, weight

1.1.4
THE EXERCISE
SESSION

1. Warm-Up:

Cardiovascular pulse raiser (5 – 15mins)
Dynamic stretching
Specific skills practice (batting, shooting, catching)

Benefits:

Prevents injury;
improves performance;
practise skills before performance; prepare psychologically for the event

2. Main Activity:

Usually a training session (one of MoT) e.g. skill circuit for hockey player
Could be a match, weight loss or rehab session

Benefits:

Always raises HR above normal.
Improve element of fitness
Allow performer to work at peak performance level

3. Cool Down:

CV pulse reducer (5 – 10mins)
Static stretching (5 – 15mins)
Relaxation exercises (10 – 15mins)

Benefits:

Gradually returns body to normal resting HR + temp.
Disperses lactic acid which prevents stiffness and muscle soreness
Helps relieve stress

1.1.4 TRAINING TERMINOLOGY

Measuring Heart Rate - Radial or carotid pulse or heart rate monitor

Resting Heart Rate - HR at rest! best taken first thing in the morning.

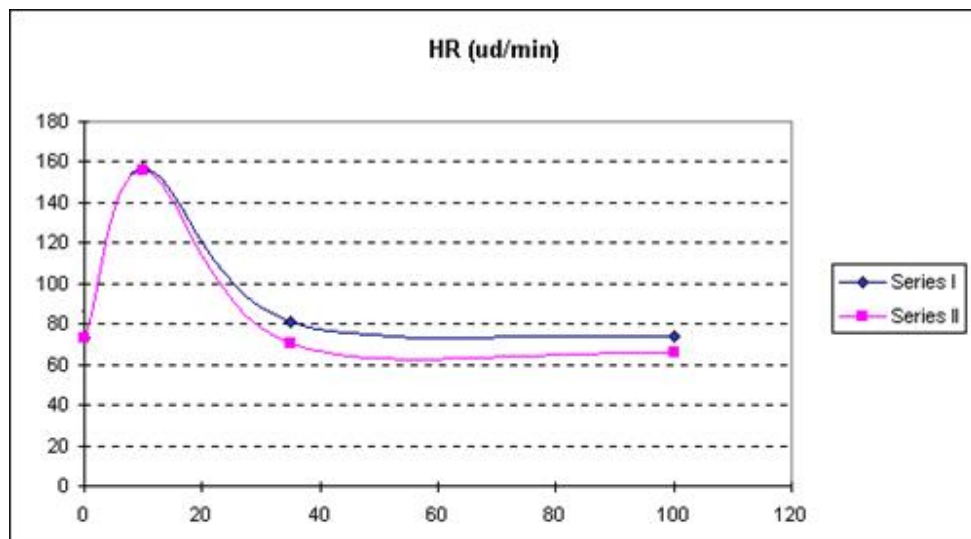
Working Heart Rate - measurement of HR during or immediately after exercise (accurate guide to how hard you work i.e. intensity of the session)

Recovery Rate - time taken to return HR to resting after training

Recovery Rate Graph

The faster your HR returns to its pre-exercise state, the fitter you are

Series I = Recovery rate before 6-week PEP; Series II = Recovery Rate after 6-week PEP.



www.life-enthusiast.com

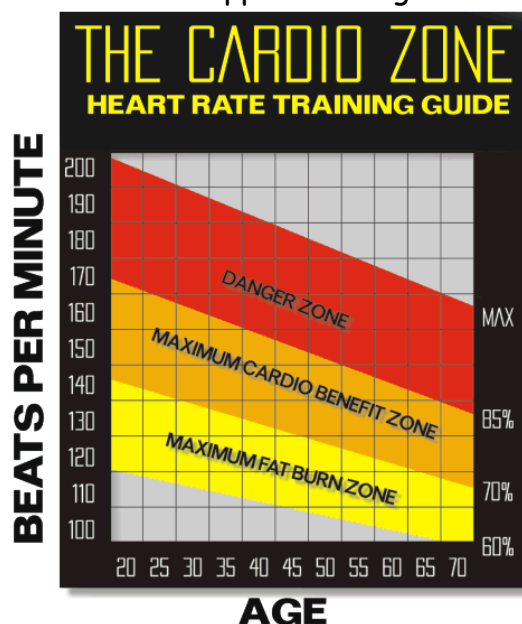
Maximum Heart Rate - $220 - \text{your age}$

Lower Training Threshold - 60% of your maximum heart rate (MHR)

Upper Training Threshold - 80% of your MHR

Target Zone - Working between the lower and upper training thresholds i.e. between 60-80% of your MHR

www.thehealthyteacher.com





1.1.5 - YOUR PERSONAL HEALTH & WELLBEING



BALANCED DIET - Daily intake of food containing right amounts and types of nutrients

	Element	Function	Foods found in	Aid to Sportsperson
Macro nutrients	Carbohydrates	Ready source of energy Store of energy as <i>Glycogen</i>	Fruit, cakes, beer, sweets, granulated sugar and bread, pasta rice, potatoes.	Ready source of energy when muscles need it. Athletes training hard use carbohydrates quickly so diet should be high in this food type.
	Proteins	Growth and Repair of tissues, enzymes and hormones	Meat, fish, pulses (chick peas, lentils and beans), nuts, eggs and poultry	Builds muscle and repairs tissue within body. Essential after injury to heal quickly. Sportspeople who have large muscles need extra protein.
	Fats	Source of energy (slow release) Can be stored in body	Milk, cheese, butter, oils, chocolate, fatty meats, soya beans and corn.	Increase size and weight of body beneficial to performers with extra bulk e.g. Shot putter. Excess weight can inhibit performance though.
Micro nutrients	Vitamins	Helps general health - vision, skin condition, forming of red blood cells and clotting, good condition of bones and teeth	Fruit - vitamin C Liver, carrots - Vitamin A Whole grain, nuts - Vit B1 Vegetable oil - Vitamin E	General health is important to perform well. When training hard vitamins from B group are used up more so need replenishing.
	Minerals	Calcium helps growth of bones, Iron helps making red blood cells and the way blood is carried by haemoglobin.	Milk and salt water fish (iodine), red meat, liver and green vegetables (iron), cheese and cereal.	Increase oxygen carrying capacity to working muscles. Iodine aids growth, essential for athlete's energy production. Iron helps produce red blood cells so carry more oxygen around body preventing fatigue. Calcium helps blood to clot, aiding recovery and strengthens bones and muscles.
	Fibre	Helps Digestion. There are 2 types. <ul style="list-style-type: none"> Insoluble - adds bulk to food so moves through digestive system Soluble - helps reduce cholesterol, keeping heart healthy 	Leaves, seed cases, cereals and whole grains.	Less Cholesterol in the body makes the heart more efficient By keeping digestive system functioning regularly the body retains less waste
	Water	Two-thirds of the body is water Need to replenish water which is lost in urine, sweat and condensation when we breathe	Fluids and foods	Water allows blood to flow more easily - important when exercising as the body demands more oxygen, nutrients, heat control and waste removal.

1.1.5 Link between diet, exercise, work and rest

DIET - essential part of providing energy needed to work, exercise + also repair tissues. Must consider **Energy balance** (calories in vs calories out)

EXERCISE - can provide fitness necessary to enjoy life + work

WORK - can provide finance, motivation + opportunity

REST - maintains balance between work and exercise ("all work and no play makes jack a dull boy!") + provides chance for tissue repair to occur

1.1.5 Timing of Dietary Intake

Carbo-loading - system used mostly by **marathon runners** to make max use of energy resources.

- Early part of week before event → high protein (muscle repair after high intensity sessions)
- Later in week → high levels of carbohydrates (turn into glycogen stores). Happens 'easily' in the body because of the 'starving' state the body was in during early part of the week
- Immediately after race → take on carbs (isotonic drinks) to restock

BLOOD FLOW DURING EXERCISE - blood shunts to working muscles

- Less blood available to digest food in gut
- Causes cramps/discomfort
- Exercise session should wait until 2-3 hrs after eating

1.2 Your Healthy, active body

1.2.1 Physical activity and your healthy mind and body

DEFINITIONS

OVERWEIGHT - having weight excess than normal, harmless unless accompanied with over fatness

OVER FAT - person having more fat than recommended for gender and age

OBESE - term used to describe people who are very over fat

UNDERWEIGHT - weighing less than normal, healthy or required

ANOREXIC - describes someone who has anorexia, which is a prolonged eating disorder due to loss of appetite.

WEIGHT'S IMPACT ON PERFORMANCE

- Different weights are desirable for different activities
- Some athletes can be deliberately overweight due to the extra muscle mass they need to be successful in their activity e.g. weight lifters
- Each sport will dictate a different optimum weight for success (e.g. basketballer vs shot putter)
- Within each sport, different positions will require different optimum weights (e.g. prop vs kicker in rugby)

FACTORS AFFECTING OPTIMUM WEIGHT

- **Height:** taller people are usually, though not always, heavier
 - **Gender:** men tend to have more muscle and larger bones
 - **Bone structure:** 'frame size' can vary from person to person
 - **Muscle girth:** muscle girth increases with training so will vary from person to person
 - **Genetics:** body weight and shape are largely passed on through genes
- NB. **Body composition** = % of body weight that is fat, muscle and bone (so all 3 will affect a person's weight)

WHAT ARE THE DIFFERENT SOMATOTYPES?

ECTOMORPH

- Slightly built, delicate body
- Narrow shoulders and hips
- Lean, fragile
- Excel in long distances
- *E.G. Marathon Runner*

MESOMORPH

- 'Athletic Build'
- Muscular, large trunk
- Broad shoulders, narrow hips
- Strength/sudden burst events
- *E.G. 100m Sprinter*

ENDOMORPH

- Round/ 'pear drop' shape
- Narrow shoulders and broad hips
- Carry weight around waist and on hips and upper thighs
- Power events
- *E.G. Sumo wrestler*



RISK ASSESSMENT & PREVENTING INJURIES

Method of minimising risk	Why it helps
Warm Up	<ul style="list-style-type: none"> • Warming up muscles gradually helps prevent injury - increases blood flow to working muscles to prepared for action, focuses mind on activity
Cool Down	<ul style="list-style-type: none"> • Prevents injury by increasing flexibility for next performance • Disperses lactic acid - prevent soreness and aches and also stiffness which limits movement which can lead to injury
Checking equipment + facilities	<ul style="list-style-type: none"> • Facilities need to be safe and secure • E.g. pitch clean + lines visible • Equipment needs to be in a good condition • E.g. trampoline bed, springs, pads etc all ok.
Protective equipment + clothing	<ul style="list-style-type: none"> • Some sports have protective equip, built into rules e.g. horse riding and sailing • Clothing must be safe and may vary depending on position • Jewellery should be removed - can get caught or injures others • Footwear - grip better (sprinter), extra protection/support for feet (hockey)
Balanced competition	<ul style="list-style-type: none"> • Weight (boxing), gender (rugby), age (netball), handicap (golf)
Playing to the rules of competition	<ul style="list-style-type: none"> • Help ensure safety and allow game to flow → fair play • E.g. professional fouls
Physical readiness	<ul style="list-style-type: none"> • Physical Activity Readiness Questionnaire (PARQ) completed before exercise commences • Should highlight any problems + help guide person to appropriate sport + how often to take part



DRUGS



ALCOHOL

- Impairs co-ordination, speech + judgement → **dangerous**
- Slows your reactions → **dangerous**
- Makes your **muscles tire quickly**
- Eventually damages heart, liver (cirrhosis), kidneys, brain, muscles + digestive + immune systems
- Increases urination (diuretic) → **dehydration** (thickens the blood)

RECREATIONAL DRUGS 'LEGAL BUT HARMFUL'

SMOKING

- Causes nose, throat + chest irritations
- Makes you short of breath
- Increases risk of developing heart disease, lung cancer, bronchitis and other diseases
- **NICOTINE** = addictive drug within cigarettes
- Negative effect on aerobic fitness → **poor performance**

PERFORMANCE ENHANCING DRUGS (socially unacceptable)

These drugs are banned by the International Olympic Committee (IOC)

B.A.D.S.N.A.P	Advantages	Disadvantages
Beta Blockers (Snooker)	<ul style="list-style-type: none"> • Drugs designed to control heart rate • Lower heart rate, steady shaking hands and reduce anxiety • Banned in sports where it may be an advantage - <i>Snooker, shooting</i> 	<ul style="list-style-type: none"> • Can reduce HR to a dangerous level... • Can lead to cardiac arrest!
Alcohol (shooting, archery)	<ul style="list-style-type: none"> • Calms nerves 	<ul style="list-style-type: none"> • Impairs judgments • Reactions affected - delay in reacting cause an accident (skiing)
Diuretics (jockey, boxer)	<ul style="list-style-type: none"> • Elevate rate of urine production • Weight loss - important if competing in a certain weight division • Can mask traces of other drugs in body 	<ul style="list-style-type: none"> • Cause cramp and dehydration • Dehydration → dizziness, headaches, nausea • Long-term dehydration → Kidney problems
Stimulants (boxer)	<ul style="list-style-type: none"> • Effect on Central Nervous System so... • Speeds up reactions and increases aggression • Make you feel less pain 	<ul style="list-style-type: none"> • They're addictive + Feeling less pain can make athlete train too hard • Lead to high blood pressure, increased HR, irregular heart beat • Insomnia, irritability
Narcotic Analgesics (dancer)	<ul style="list-style-type: none"> • Reduce pain - so injuries and fatigue doesn't affect performance • Marijuana (archery) - Calms nerves • Local Anesthetics Reduce pain but maybe allowed for medical purposes • 	<ul style="list-style-type: none"> • Loss of concentration, balance, coordination • Feeling less pain can make athlete train too hard → damage body further • Lead to constipation and low blood pressure • Emotional effects e.g. hallucinations (morphine) •
Anabolic Steroids (shot putter)	<ul style="list-style-type: none"> • Mimic testosterone (male hormone) + promote bone + muscle growth • Increase Muscle size • Allow athletes to train harder 	<ul style="list-style-type: none"> • High blood pressure, heart disease, infertility, cancer, liver disease...death • Women may facial and body hair, and their voices may deepen • Increase risk of muscle injury
Peptide Hormones (marathon runner)	<ul style="list-style-type: none"> • Drugs that cause other hormones to be produced • Increase muscle growth • Increase number of Red Blood Cells... • Assist recovery from training (improves lactic acid removal and decreases O₂ debt quicker) • EPO - allows more oxygen carrying capacity due increase of red blood cells 	<ul style="list-style-type: none"> • Cause strokes and abnormal growth • EPO thickens the blood → harder for blood to pass through capillaries → increase risk of heart attack/stroke

SO WHY ATHLETES CHOOSE TO USE THEM, IN SPITE OF THE RISKS?

- Enhance or improve performance e.g. last chance to get Olympic gold medal
- Encouraged to do so by their coaches or fellow athletes
- Level the playing field
- Financial reward (during relatively short professional career)

1.2.2 - THE CARDIOVASCULAR SYSTEM DURING EXERCISE

KEY TERMS

- **Heart Rate (HR)** - the amount of beats per minute
- **Stroke Volume (SV)** - the amount of blood pumped by heart in one beat
- **Cardiac Output (CO)** - the amount of blood pumped by the heart per minute

$$CO = SV \times HR$$

WHAT ARE ARTERIES, VEINS & CAPILLARIES?

Arteries:

- Thick, flexible vessel walls
- Has a pulse. No valves
- Work under high pressure
- Transports blood away from heart (**OXYGENATED**)
- Narrow lumen

Veins:

- Thin walls
- Valves present; prevents backflow. No pulse
- Pulsating muscles close to veins prevent backflow- '*skeletal pump*'
- Work under low pressure
- Transports blood towards the heart (**DEOXYGENATED**)
- Wide lumen

Capillaries:

- Smallest of all vessels - walls one cell thick
- They are 'semi-permeable' - substances pass through
- At one end - they feed muscles, organs and body tissue with oxygen and nutrients
- At other end - carbon dioxide and waste products pass into veins to be removed
- They bring blood within reach of every cell

The 3 parts of the circulatory system are blood, heart and blood vessels

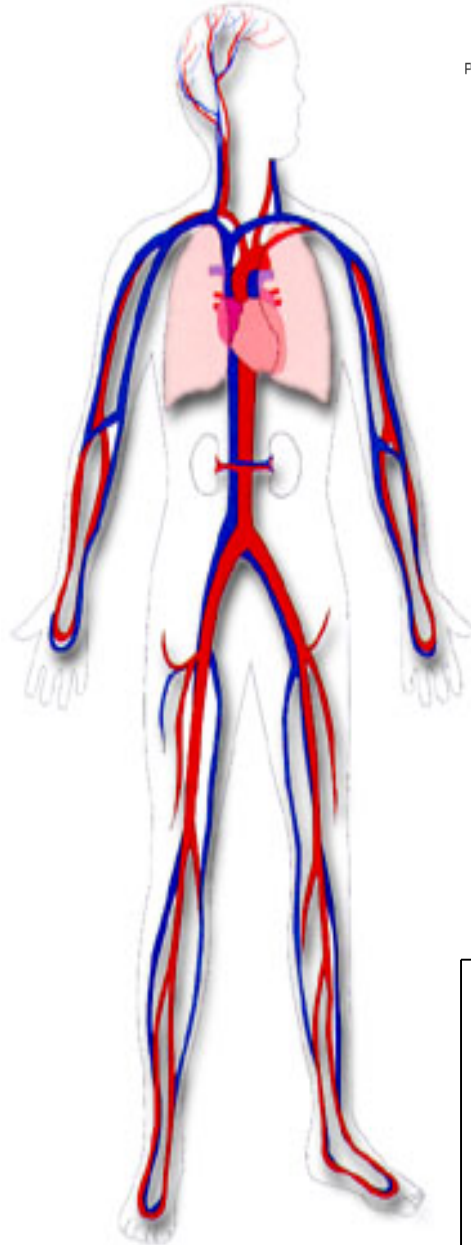
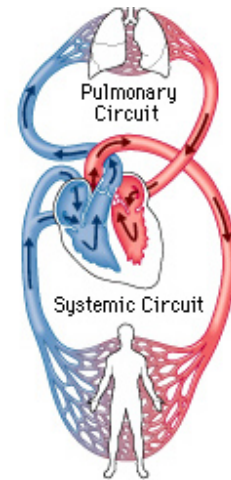
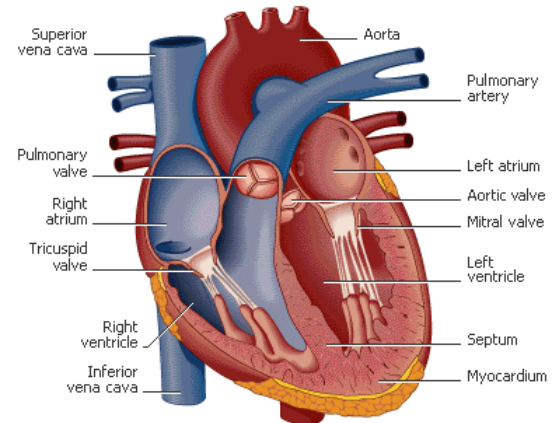


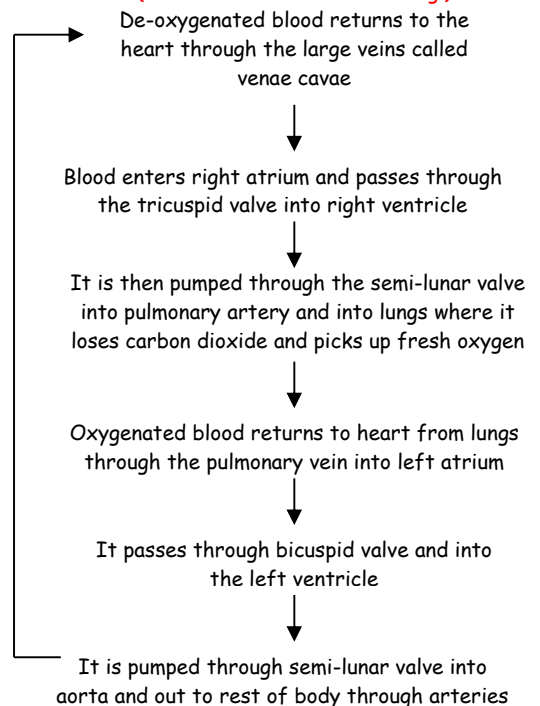
Diagram of the heart
Labels for extra info!



Key:
■ = Oxygen rich, CO₂- poor blood
■ = Oxygen poor, CO₂- rich blood

THE FLOW OF BLOOD

(for info + extra understanding!)



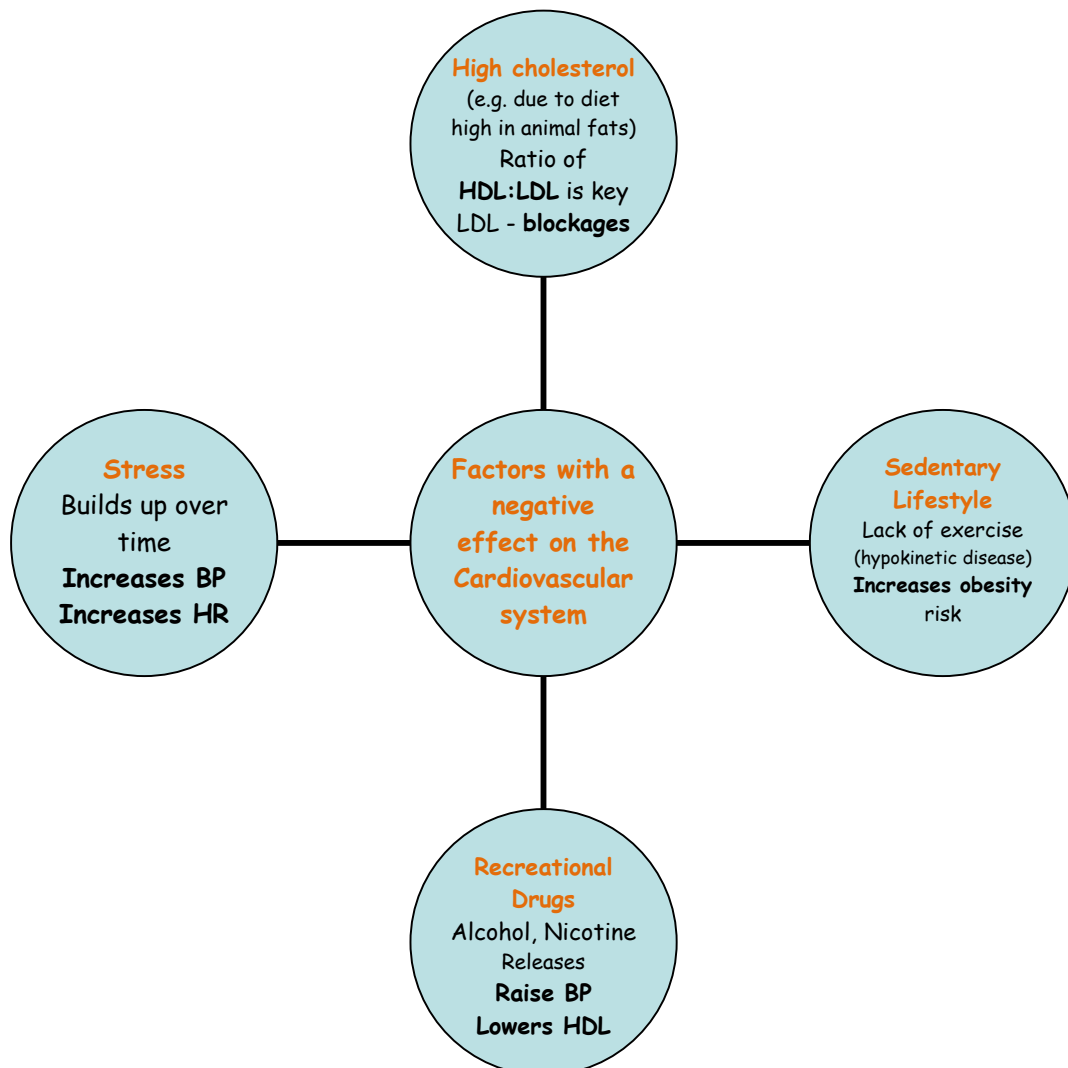
Immediate Effects of Exercise	Effects of Regular Training	Long Term Benefits
<ul style="list-style-type: none"> ✓ Heart Rate increases ✓ Cardiac Output & Stroke Volume increases ✓ Blood Pressure increases ✓ Increase of Blood to working muscles - blood shunting ✓ Vasodilation ✓ Lactic acid builds up + muscles ache ✓ Body temp increases 	<ul style="list-style-type: none"> ✓ Bigger & Stronger heart ✓ Lower Resting Heart Rate ✓ Increased Cardiac Output & Stroke Volume ✓ Lower systolic + diastolic Blood Pressures ✓ More Blood Vessels - Capillarisation ✓ Faster recovery rate 	<ul style="list-style-type: none"> ✓ Helps prevent coronary heart disease ✓ Helps prevent Type 2 diabetes ✓ Helps prevent Cardiovascular Disease ✓ Helps prevent Obesity ✓ Healthy veins & arteries - more elastic ✓ Increases ratio of HDL: LDL

The Effect of lifestyle on the cardiovascular system

REST

= the period of time allotted for recovery

- Essential to recovery
- Allows body to adapt: heart grow in size + thickness, capillarisation
- E.g. 2 days training + 1 day rest + 3 days training



1.2.3 - THE RESPIRATORY SYSTEM

KEY TERMS

- **Oxygen debt** - Shortfall of oxygen to the body after maximal effort/anaerobic exercise, resulting in deep and shallow breathing e.g. at end of 400m race
- **Vital Capacity** - The maximum amount of air that can be forcibly exhaled after breathing in as much as possible
- **Tidal Volume** - Amount of air breathed in or out at rest

The 3 parts of the respiratory system are the diaphragm, lungs and air passages

THE RESPIRATORY SYSTEM

The function of the respiratory system is:

- To get oxygen into the body
- To remove carbon dioxide out of the body

Oxygen is used by the body to release energy and carbon dioxide is released so it doesn't build up and poison the body

MECHANISM OF BREATHING (For info/extra understanding!)

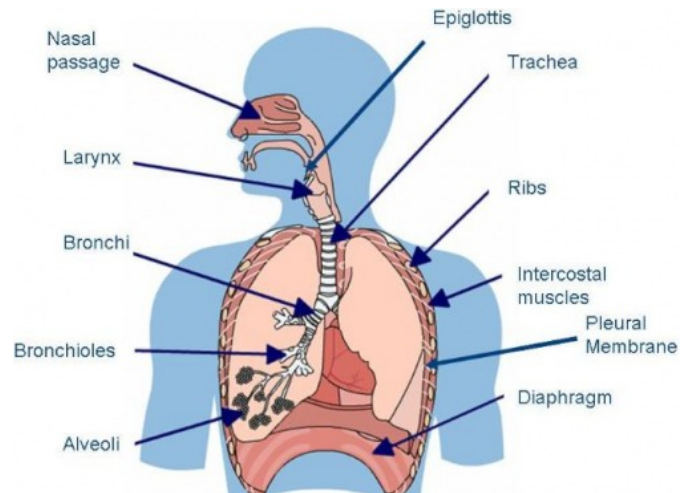
Lungs are not muscles therefore can't move on their own accord. They are helped by the **diaphragm** and **intercostal muscles** between the ribs.

When we breathe in -
Inspiration - the following happens...

- Our diaphragm pulls down
- Our intercostal muscles contract
- Air pressure is reduced
- Air is sucked through the tubes into lungs
- Our chest expands

When we breathe in -
Expiration - the following happens...

- Our diaphragm relaxes
- Our intercostal muscles relax
- Our chest becomes smaller
- Pressure increases on the lungs
- Air is forced out



WHAT IS LACTIC ACID?

- Lactic acid is a bi-product of exercise. A build up of this can inhibit performance and cause pain, discomfort and fatigue.
- Lactic acid occurs in the anaerobic system because without the presence of oxygen, pyruvic acid turns to lactic acid.
- Cooling down properly with stretching helps the lactic acid be removed and prevents aching muscles after the exercise.

AEROBIC and ANAEROBIC ACTIVITY

AEROBIC - with oxygen

- Lower intensity
- Endurance activities - Marathon

ANAEROBIC - without oxygen

- Higher intensity
- Short distance activities - Sprinting

DAMAGE BY SMOKING/NICOTINE

IMPAIRS GASEOUS EXCHANGE

- × Damages lungs
- × Makes alveoli less stretchy i.e. less efficient
- × More difficult to O₂ in and CO₂ out
- × Hearts have to work harder → athlete feels more tired

Immediate Effects of Exercise	Effects of Regular Training
<ul style="list-style-type: none"> ✓ Breathing deepens ✓ Breathing quickens ✓ Oxygen Debt (result from anaerobic exercise) ✓ Increase in tidal volume 	<ul style="list-style-type: none"> ✓ Improved efficiency of lungs → more efficient delivery of O₂ and removal of CO₂ ✓ More alveoli ✓ Improved VO_{2max} ✓ Increased vital capacity ✓ Increased tidal volume ✓ Faster recovery rate



1.2.4 - MUSCLES AND MUSCLE ACTION



HOW ARE MUSCLES CLASSIFIED?

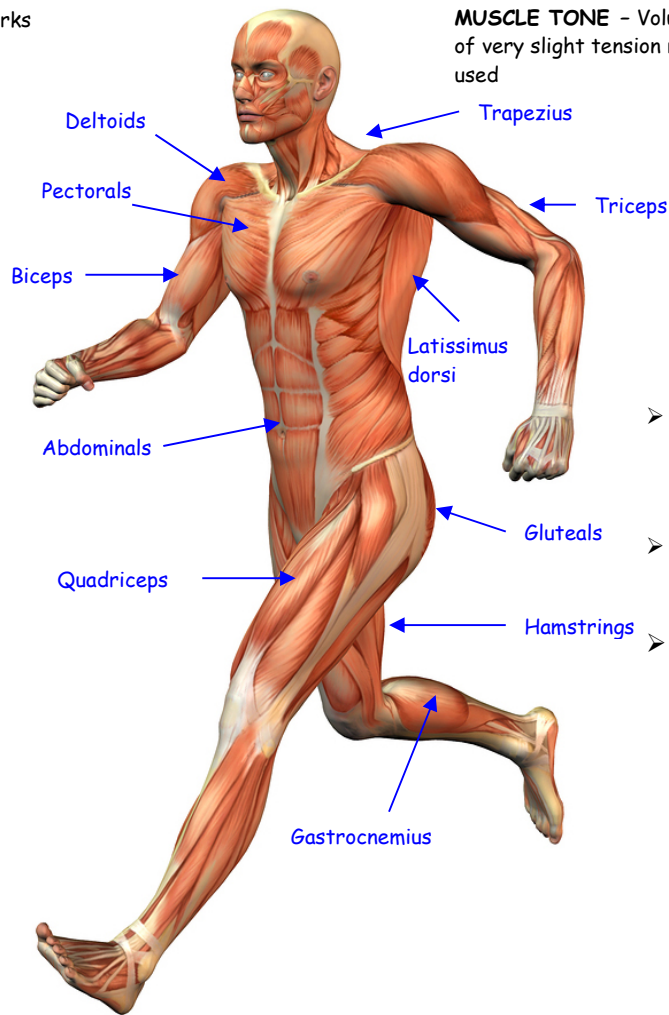
- **Skeletal (Voluntary)** - most common. They attach to the skeleton, give a person's shape - *Biceps/Triceps*
- **Smooth (Involuntary)** - work automatically and are not controlled - found in *intestines, blood vessels and urinary organs.*
- **Cardiac (Involuntary)** - *Heart Muscle* works automatically and beats rhythmically

WHAT IS MUSCLE TONE?

Some muscle fibres contract whilst others relax. These contractions tighten the muscles but aren't strong to cause movement. Different fibres contract at different times to prevent fatigue. This called **Muscle tone** and is very important for good posture.

MUSCLE TONE - Voluntary muscles in a state of very slight tension ready and waiting to be used

Muscle	Movement	E.g.
Deltoid	Moves arms in all directions at shoulder	Tennis serve, cricket bowl
Trapezius	Rotates shoulder backwards	Rowing
Latissimus Dorsi	Rotates arm @ shoulder	Butterfly
Pectorals	Adduct arm @ shoulder	Forehand in tennis
Abdominals	Flex trunk	Pull body down in hurdles
Biceps	Flex arm @ elbow	Chin-up
Triceps	Extend arm @ elbow	Press-up, javelin release
Gluteals	Extend leg @ hips	Pulling back leg before kicking ball
Quadriceps	Extend leg @ knee	Take off on LJ, kick ball
Hamstrings	Flex leg @ knee	Bending on landing from vault
Gastrocnemius	Pointing toes	Front crawl, pushing onto toes in run



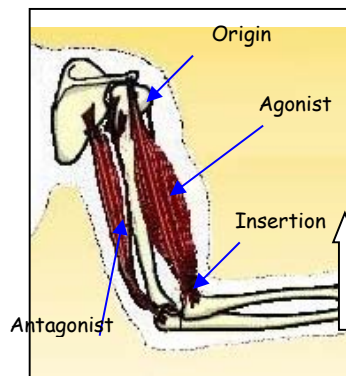
ROLE OF MUSCULAR SYSTEM DURING EXERCISE

- Muscles are connected to bone to be the driving force behind your movement
- Due to contraction + relaxation (lengthening) of muscles
- Happens voluntarily to bring about movement. These are the ones we can train so they can work harder for longer or to improve their flexibility so performing with them becomes easier and more effective

HOW DO MUSCLES WORK TOGETHER?

Antagonistic Pairs: Muscles working together to provide movement. E.g. Flexion of the arm, **biceps** contracts and **triceps** relax. To extend the arm, the **triceps** contract and the **biceps** relax.

- **Agonist (Prime mover)** - contracting muscle causing movement
- **Antagonist** - relaxing muscle that assists prime mover
- **Origin** - the end of muscle that is attached to a fixed bone
- **Insertion** - point where a tendon attaches muscle to bone where there is movement
- **Flexibility** - a joint's ability to move through its full range
- bone where there is movement



Another example is the hamstrings & quadriceps

1.2.4 - MUSCLES AND MUSCLE ACTION

continued...

TYPES OF CONTRACTION

- **Isotonic Contraction** - In this contraction, the muscle changes length and so something moves. *E.g. Bicep Curl*
- **Isometric Contraction** - In this contraction, the muscle stays the same length and so nothing moves. *E.g. the Wall Sit*
Used less frequently in sports



FAST TWITCH OR SLOW TWITCH?

FAST TWITCH

Used in explosive activities
Contract quickly
Produce powerful action
Limited Oxygen supply
White in colour
e.g. speed events, throwing & jumping

SLOW TWITCH

Used in endurance activities
Contract slowly
Long Lasting
Good oxygen supply
Red in colour
e.g. long distance running, cycling & swimming

Immediate Effects of Exercise	Effects of Regular Training
<ul style="list-style-type: none"> ✓ Requirement for extra fuel (glucose + O₂) ✓ Lactic acid produced if not enough O₂ → ✓ Muscle stiffness/soreness/cramp ✓ Muscle start to fatigue...eventually can no longer perform the movement 	<ul style="list-style-type: none"> ✓ Can cope better with lactic acid - takes longer to build up ✓ Hypertrophy (increased size of muscles) ✓ Increased strength ✓ Increased power (power = strength x speed) ✓ Increased muscle endurance ✓ More toned muscles in appearance ✓ Better posture ✓ Reduce risk of injury

NB. Must cool down after exercise to prevent negative effects of lactic acid build up

POTENTIAL FOR INJURIES

Includes:

- Sprains (muscle)
- Strains (joints)
- Muscle atrophy (muscle wastage due to inactivity)
- Minor injuries - cuts, grazes and bruises



TREATMENT FOR MUSCULAR INJURIES - R.I.C.E

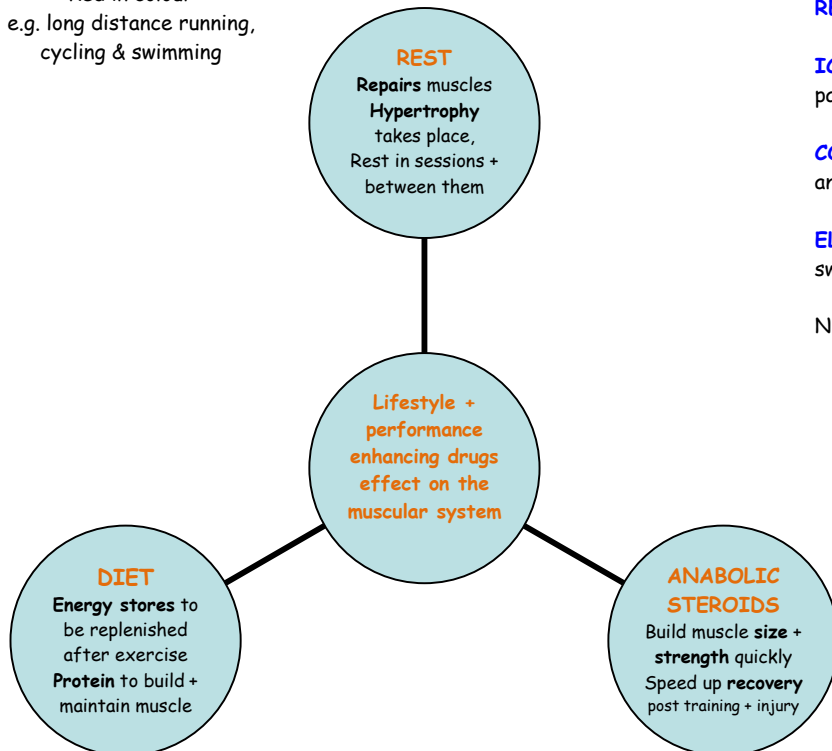
REST - Rest the injured part to prevent further injury

ICE - Apply ice or a cold compress to reduce blood flow, pain and swelling

COMPRESSION - Compress the injury to reduce bleeding and swelling

ELEVATION - Elevate the injured part to reduce bleeding, swelling and throbbing

NB: Cuts/grazes - treat with antiseptic wipe then bandage





1.2.5 - THE SKELETAL SYSTEM

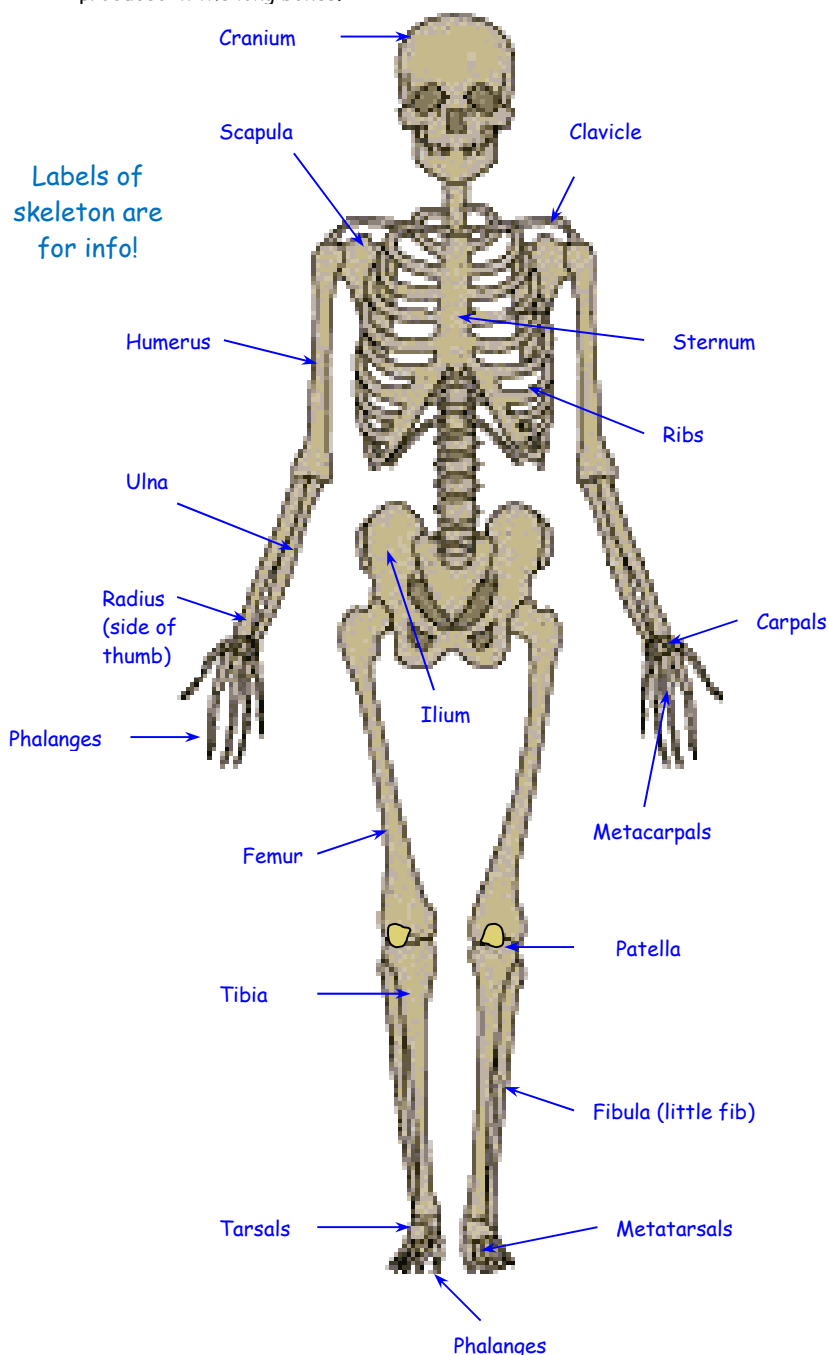
WHAT ARE THE FUNCTIONS OF THE SKELETON?

During movement:

1. **Protection** - Ribs protect heart and lungs, Cranium protects brain, vertebral column protects spinal cord
2. **Support** - firm, rigid and keep us upright
3. **Movement** - Skeleton has 'anchor points' to which muscles attach and act as levers. *Long bones* help create the leverage to apply the force.

At other times:

4. **Shape** - gives framework - basketball player long, thin skeleton - jockeys small, thin skeleton
5. **Blood Production** - red and white blood cells are produced in the long bones.



HOW ARE BONES CLASSIFIED? For info!

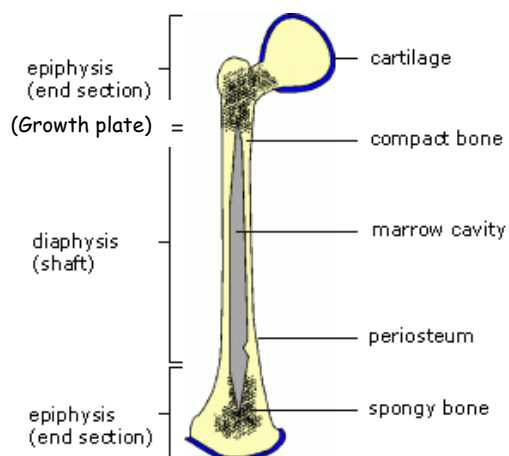
1. **Long bones** - Humerous, Femur
2. **Short bones** - Carpals and Tarsals.
3. **Flat bones** - Cranium, Scapula and Sternum
4. **Irregular bones** - Patella and Vertebrae. (odd shaped bones)

THE DEVELOPMENT OF BONES - For info!

Bones start off as cartilage and then become bone by the process of **Ossification**.

Bones have a tough outer layer called the **Periosteum**. As development continues there are 3 centres of ossification: in the *diaphysis* (middle) and *epiphyses* (end).

Ossification - The development of bone from cartilage. It occurs throughout childhood until adulthood.

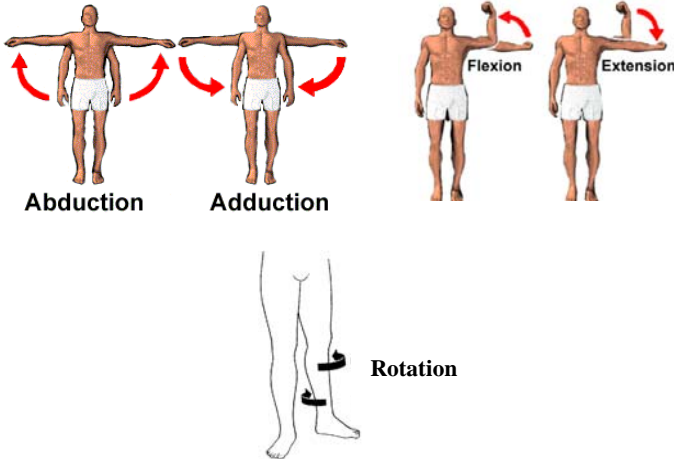


Effects of Regular Training On the Skeletal System
✓ Increased bone density
✓ Thus increased bone strength
✓ Ligaments become stronger
✓ Tendons become stronger
✓ Increase joint flexibility
✓ Helps prevent osteoporosis (where bone density weakens and bones become weak and thus break easily)
✓ Weight bearing exercises have positive effect in preventing osteoporosis (e.g. skipping, brisk walking, running, yoga) NB too much while still growing can hinder development

1.2.5 - JOINTS, TENDONS, LIGAMENTS & MOVEMENT

IN WHAT WAYS DO JOINTS MOVE?

1. **Flexion:** decreasing the angle at a joint.
2. **Extension:** increasing the angle at a joint.
3. **Adduction:** movement of a limb towards the body
4. **Abduction:** movement of a limb away from the body.
5. **Rotation:** movement of a limb in a circular or part circular direction.



THE STRUCTURE OF JOINTS

JOINT = place where 2 bones meet
 CARTILAGE = prevents rubbing/friction between bones
 SYNOVIAL FLUID - lubricates joint
 LIGAMENTS - keep joint together
 TENDONS - help create movement by connecting to muscles

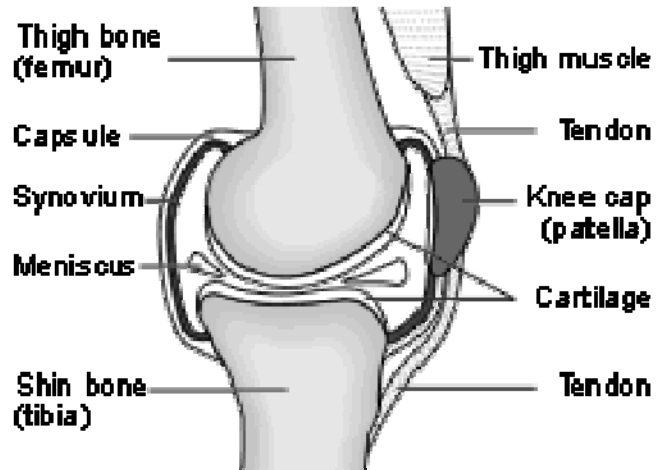
WHAT TYPES OF JOINTS ARE THERE?

1. **Synovial joints** or Freely Moveable - e.g. *Knee/hip*
For info only:
2. Fixed (fibrous) joints - *Skull*
3. Slightly moveable (cartilaginous) joints - *Vertebrae*

SYNOVIAL JOINT

Example - The Knee (HINGE)

Labels are just for info!



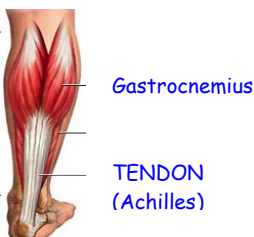
WHAT TYPES OF SYNOVIAL JOINTS ARE THERE?

1. **Ball and Socket** - movement in all directions and rotation - Hip, Shoulder (*hurdling*)
 2. **Hinge** - movement Flexion and Extension only - Knee or Elbow (*javelin throw, kick ball*)
- For info only:*
3. **Pivot** - only rotation at Atlas and Axis at top of the spine
 4. **Gliding** - Little bit of movement in all directions tarsals and carpals
 5. **Condylloid** - movement forwards and backwards, left to right - in the wrists

WHAT ARE TENDONS, LIGAMENTS & CARTILAGE?

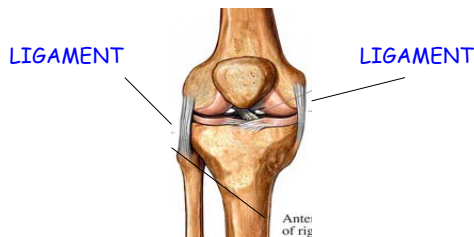
TENDONS

- Attach muscle to bone
- Strong, non-elastic connective tissue
- Joint stability



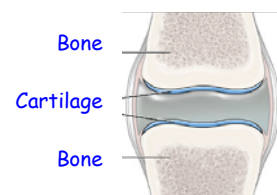
LIGAMENTS

- Attach bone to bone
- Very strong elastic fibres
- Joint stability



CARTILAGE

- Covers joints to allow bones to rub smoothly
- Acts as shock absorber
- Produces synovial fluid



LIGAMENT



SKELETAL SYSTEM INJURIES & IMPORTANCE OF DIET



HARD TISSUE INJURIES

These are injuries to the bone and include;

- Fractures
- Dislocations

FRACTURES - break in the bone. There are two types;

1. **Simple (closed) fracture** - bone stays under the skin
2. **Compound (open) fracture** - Bone breaks through the skin
3. **Greenstick fracture** - like a simple fracture but bone is only partly broken
4. **Stress fracture** - Small cracks in the bone. 'Overuse' injury often caused by running too much in a hard surface

All fractures are serious and need URGENT medical attention

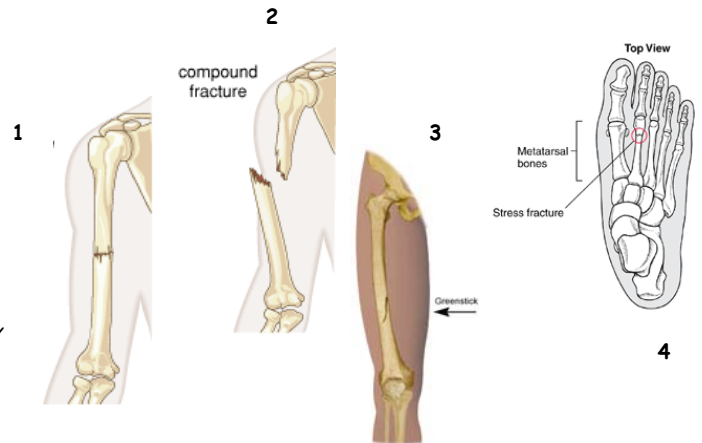
STRESS FRACTURES - We need to;

- Get immediate rest
- Keep fit doing over activities
- Check running and footwear for problems

DISLOCATIONS - Bone at a joint is forced out of its normal position.

Also could be possible ligament damage around the joint. Could be caused by strong force wrenching the bone e.g. rugby tackle.

All dislocations should be treated as a fracture.



TENNIS + GOLFER'S ELBOW

- Due to overuse of TENDONS at elbow

TENNIS ELBOW RECOGNITION

- Pain on outside of elbow
- Using wrong-sized grip of racket

GOLFER'S ELBOW RECOGNITION

- Pain on inside of elbow

SPRAINS

- Sprain = damaged ligament e.g. twisted ankle

CAUSES

- Tearing of ligaments holding bones of joint together
- E.g. Joint was inverted (turned inwards), falling awkwardly, colliding with another player.

TORN CARTILAGE

- Tearing connective elastic substance joining muscle to bone

RECOGNITION

- E.g. knee: pain on inside of knee
- Athlete falls to the ground
- Joint is likely to be bent

BONE & JOINT INJURIES

RECOGNITION

- Recent blow or fall
- Snapping sound
- Difficulty moving limb
- Pain worse when moving
- Deformity - limb unusual shape
- Swelling, bruising
- Signs of shock

ACTION

- Keep him/her still & comfortable
- Support injured part
- Bandage injured part to their body/limb
- Reassure him/her
- Send for medical help

TREATMENT FOR INJURIES

REST

- Stop playing/training

ICE

- Limits swelling
- Allows healing to take place faster
- Provides pain relief

COMPRESSION

- Restricts swelling

ELEVATION

- Raising injury - reduces swelling

DIET & THE SKELETAL SYSTEM

Effect of Calcium

- Helps bones grow
- Increases their density
- E.g. milk, cheese, yogurt (choose low-fat!)

Effect of Vitamin D

- Helps with absorption of calcium
- Essential to growth + maintenance of healthy bones
- Made when skin is exposed to sunlight

This revision guide should NOT be your only resource if you want to achieve MAXIMUM MARKS...use your class notes, your textbook and course outline too. Good Luck!