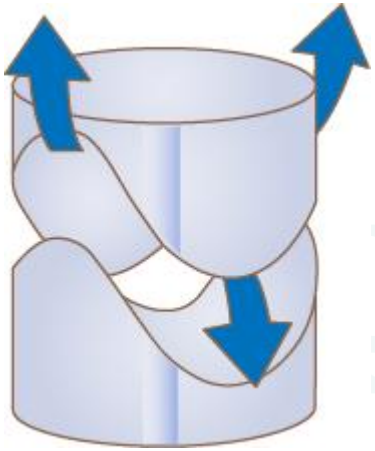
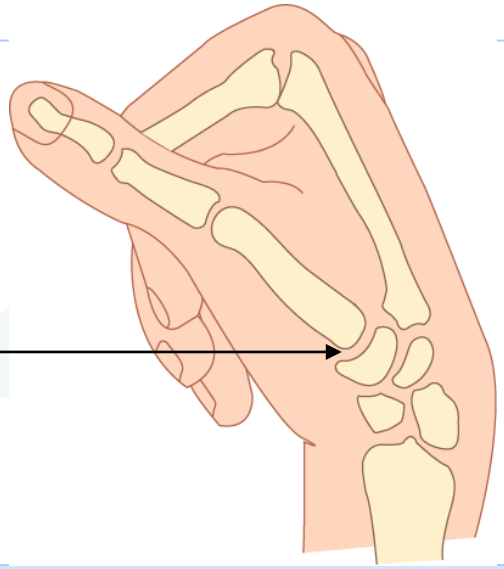
Skeletal Systems.

Type of Synovial Joint

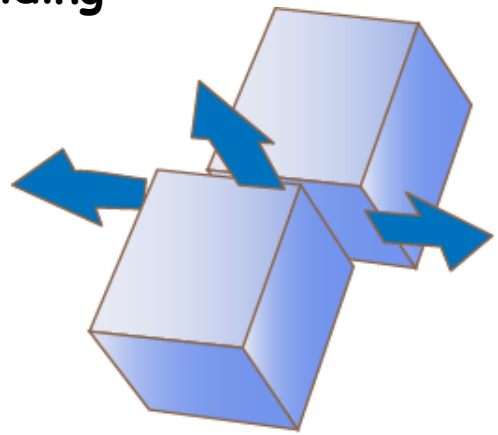
Saddle

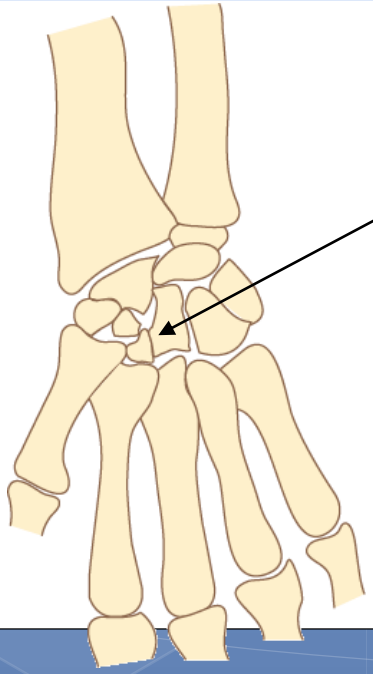


Saddle joint



Gliding





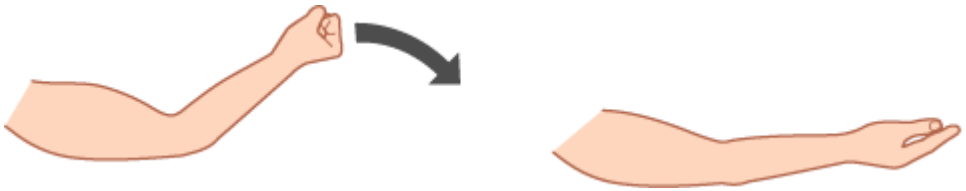
Gliding occurs between the small bones

TYPE OF MOVEMENT

FLEXION – Reducing (closing) the angle at a joint (bending).

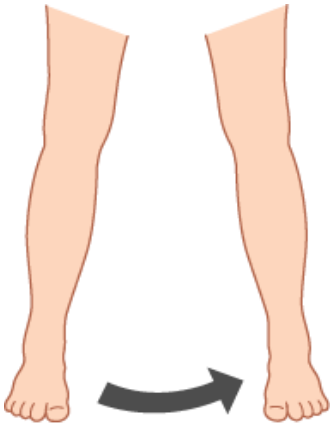
TYPE OF MOVEMENT

EXTENSION – Increasing (opening) the angle at a joint (straightening).



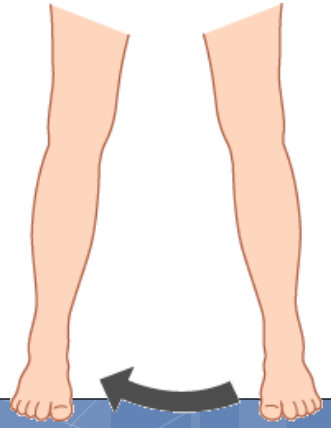
TYPE OF MOVEMENT

ABDUCTION – Is the sideways movement at the hip and shoulder joints away from the body.



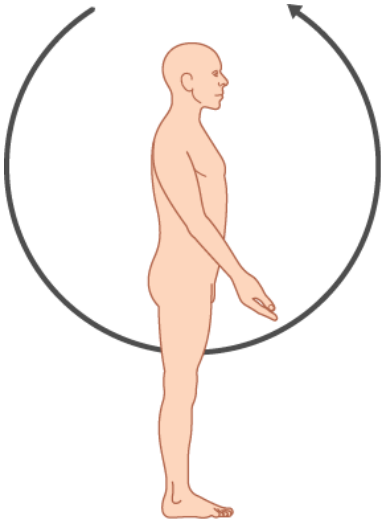
TYPE OF MOVEMENT

ADDUCTION – Is movement at the hip and shoulder joints towards the body.



TYPE OF MOVEMENT

CIRCUMDUCTION – A circular movement, which combines flexion, extension, abduction, and adduction so that the movement of the body-part describes a cone shape.



TYPE OF MOVEMENT

ROTATION – Is a circular movement made by a joint. Part of the body turns whilst the rest remains still

Skeletal Systems.

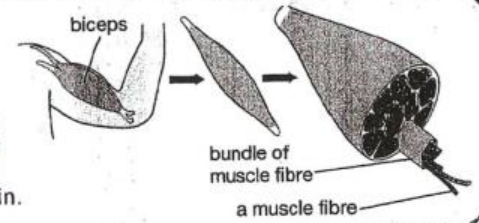
Picture	Type of movement	Type of synovial joint
1	Extension - arms are straightening	Hinge joint
2	Adduction – legs are closing towards the centre line of the body	Ball and socket
3	Flexion – knee is bending	Hinge joint
4	Rotation –body turns at waist to complete the swing	pivot joint
5	Abduction –arms and legs are moving away from the centre line of the body	Ball and socket
6	Circumduction – shoulder rotates	Ball and socket

Muscle Systems.

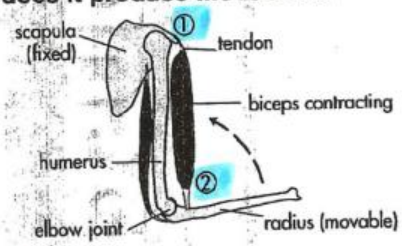
A closer look at voluntary muscle

What is it made of?

- Voluntary muscle contains:
  - bundles of cells called **muscle fibres**.
  - nerves which carry messages to and from your brain.
- A muscle **contracts** when messages from the brain race along the nerves to the fibres, telling them to shorten.
- It **relaxes** when messages tell the fibres to lengthen again.



How does it produce movement?

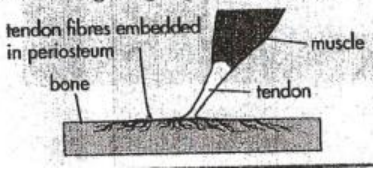


- Muscles usually work across joints.
- One end is usually attached to a fixed bone, the other to a movable bone.
- When the muscle contracts, it pulls on the movable bone.

① the **origin** is where the muscle joins the fixed bone.
② the **insertion** is where it joins the moving bone.
On contraction, the insertion moves towards the origin.

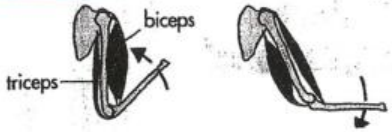
Tendons

- White, flexible cords or straps.
- One end is embedded in the **periosteum** of the bone, giving a good strong grip.



Muscles work in pairs or groups

They have to work in pairs because a muscle can only pull. It can't push. For example the biceps and triceps work together. This is called **antagonistic muscle action.**



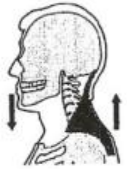
To bend your arm the biceps contracts, the triceps relaxes

To straighten it: the triceps contracts, the biceps relaxes

- The muscle that contracts or shortens is called the **prime mover** or **agonist.**
- The relaxing muscle is the **antagonist.**
- Other muscles called **synergists** contract at the same time as the agonist to help it work smoothly.

Muscle tone

- Even when you are standing still, your muscles are partly contracted.
- This state of partial contraction is called **muscle tone**. Without it you'd collapse in a heap.



- In partial contraction, groups of fibres take turns to contract. So muscles don't get too tired.

Fast and slow twitch fibres

All muscles have a mix of fast and slow twitch fibres.

Fast twitch fibres

- fast powerful contractions
- get tired quickly
- suit activities that need sudden bursts of power (such as sprinting and weightlifting)

Slow-twitch fibres

- contract more slowly and with less power
- do not tire easily
- suit activities that need endurance (such as long-distance running and swimming)

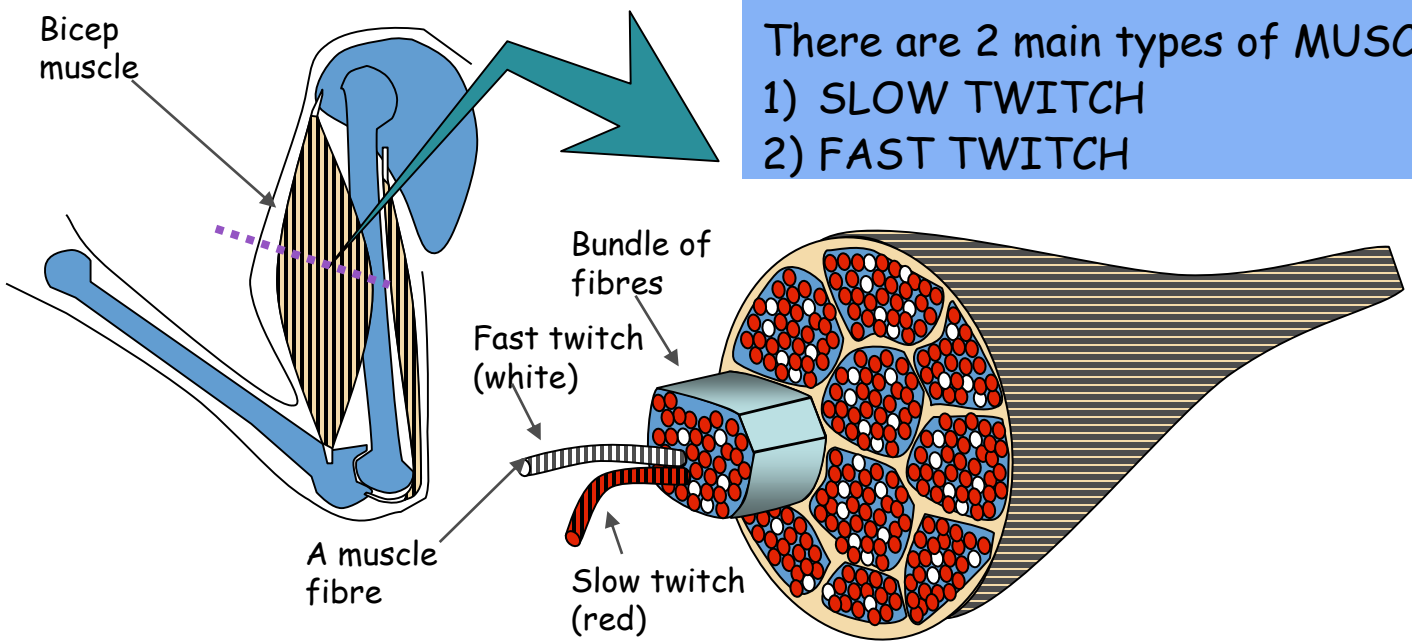
The mixture...

- varies from muscle to muscle and from person to person.
- is inherited, so you can't change it. But you can train both types of fibre to work better. (Aerobic training for slow, anaerobic for fast.)
- can affect performance. Plenty of fast twitch fibre in leg muscles will help a sprinter.

Muscle Fibres

Voluntary muscle contains MUSCLE FIBRES, which, when stimulated by the CENTRAL NERVOUS SYSTEM (CNS) contract or extend.

There are 2 main types of MUSCLE FIBRE
1) SLOW TWITCH
2) FAST TWITCH



Muscle Systems.

All muscles have a mixture of fast and slow twitch fibres. The mix is inherited through your genes, but both types can be trained to function better.

The type of muscle fibre can often determine performance in different physical activities.

Muscle action in all physical activity/ sport requires a contribution from each muscle fibre type.

	Fast twitch	Slow twitch
Size	Large	Small
Colour	White	Red
Speed of contraction	Quick	Slow
Force generated	Large	Small
Fatigue	Quick (Work without O_2 – anaerobically)	Slow (Good O_2 supply)
Physical activity	Power, strength, explosive events	CV endurance activities

Muscle Systems.

Muscles working in pairs

NEVER work alone – they always work in pairs or groups.

As one muscle contracts, another will relax.

These pairs of muscles are called ANTAGONISTIC PAIRS.

The muscles that bring the bones together are the PRIME MOVERS or AGONISTS (they cause the contraction).

The opposite to this are the ANTAGONISTIC muscles – those which relax.

Other muscles called SYNERGISTS contract at the same time as the AGONIST to help it work smoothly – stop unnecessary movement.

FIXATORS are muscles which contract to steady parts of the body to allow the working muscles a firm base.

Muscles have two ends and these are attached to bones by <u>TENDONS</u>.

1) The end that attaches to the <u>FIXED bone</u> is called the <u>ORIGIN</u>.

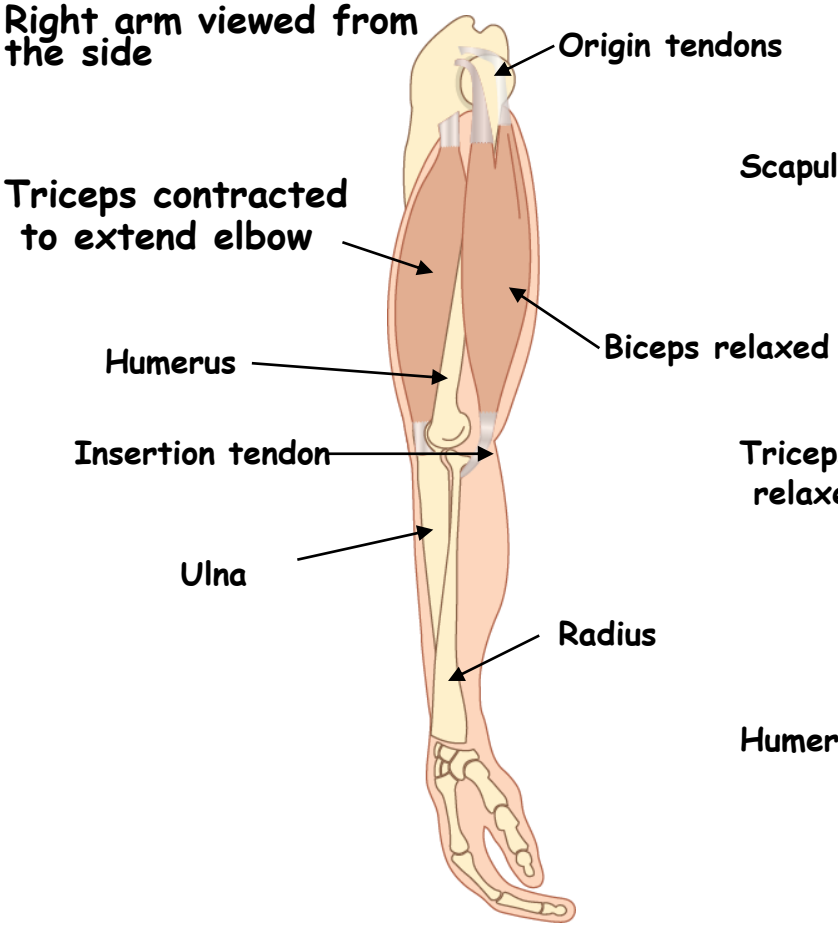
2) The other end is called the INSERTION and is attached to the <u>MOVING bone</u>.

Muscle Systems.

The Major Muscles Used In The Extension And Flexion Of The Arm

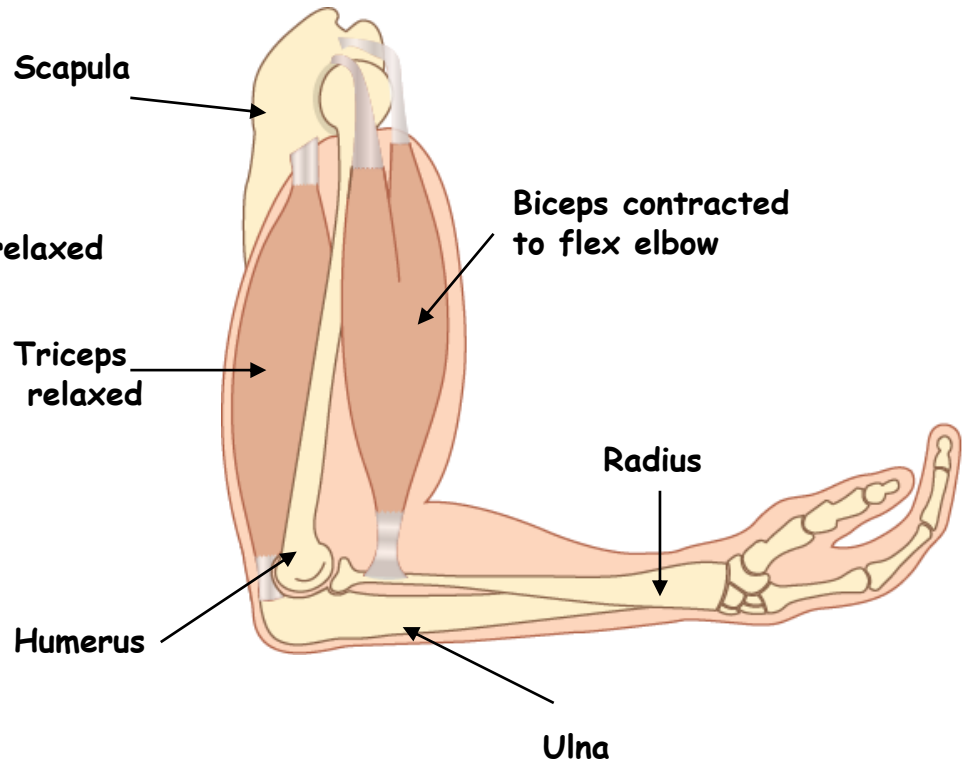
EXTENSION

Right arm viewed from the side



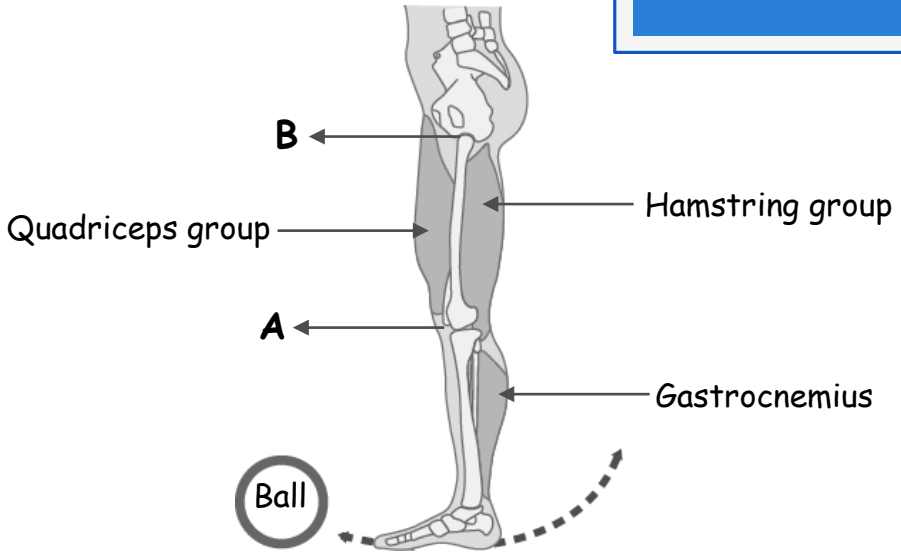
FLEXION

Right arm viewed from the side



Muscle Systems.

Task



Which PRIME MOVER (AGONIST) muscle would need to CONTRACT (FLEX) in order to LIFT the lower leg in readiness to kick the ball?

Which PRIME MOVER (AGONIST) muscle would need to CONTRACT (FLEX) in order to KICK the ball?

Identify the type of joint at the KNEE (A).

Which joint, A or B allows most movement?

What is the term used for muscles which RELAX to allow movement to take place?

What attaches muscle to bone in order for movement at the joint to take place?

What attaches bone to bone to give joints stability?

The movement in the diagram is an example of which type of muscular contraction?

TYPES OF MUSCLE CONTRACTION

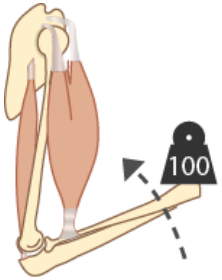
Muscles contract in different ways to produce a range of movements:

ISOTONIC

Concentric contraction

Muscle shortens as it contracts

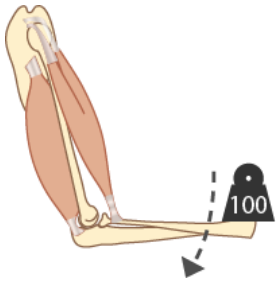
Ends of muscle move closer together



Eccentric contraction

Muscle lengthens but is still under tension

Ends of muscle move further apart

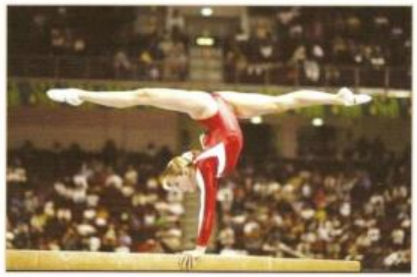


ISOMETRIC

Muscle remains the same length

No movement as a result

Helps to improve posture and strength



Isometric

ISOKINETIC

These contractions occur when the speed of the contraction remains constant

Isokinetic

MUSCLES AND JOINTS AS LEVERS

The LEVER SYSTEM in the body is formed wherever a MUSCLE is attached to a BONE.

The MUSCLES use the BONES as the LEVERS against which they work to cause movement.

FUNCTIONS OF A LEVER		
Generates more force to move larger weights	Produces a greater range of movement	Increases speed at which the body moves

MUSCLES AND JOINTS AS LEVERS

All levers have the same characteristic:

P/F PIVOT or FULCRUM – the point of movement that takes the strain of one moving away from another.

L/R LOAD or RESISTANCE – Body weight or external weight.

E EFFORT – A muscular force to move the load.

In the body, these are the:-

P/F – Joints.

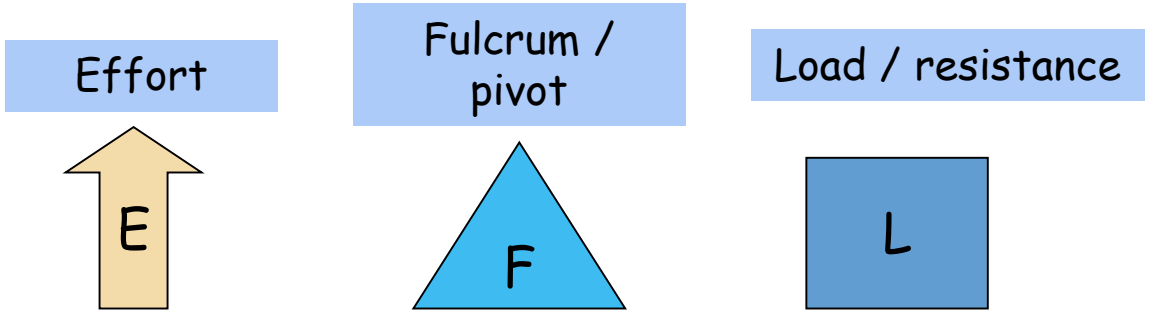
L/R – Body weight or external weight.

E – Muscles and Bones.

MUSCLES AND JOINTS AS LEVERS

There are 3 types of lever in the body, each of which is capable of producing different types and ranges of movements and forces.

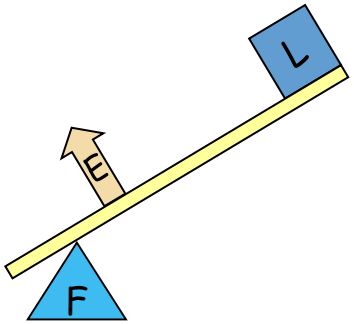
Levers are classified according to the positions of:

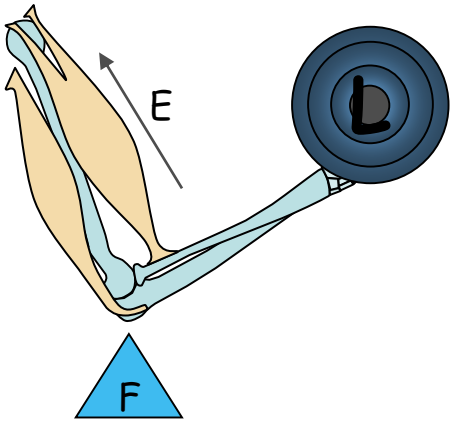


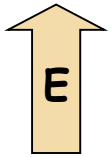
MUSCLES AND JOINTS AS LEVERS

The third-order lever is the most common type of lever found in the human body.

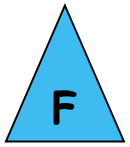
Using the diagrams to help you, describe how a 3rd class/order lever works in the human body.



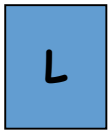




Effort



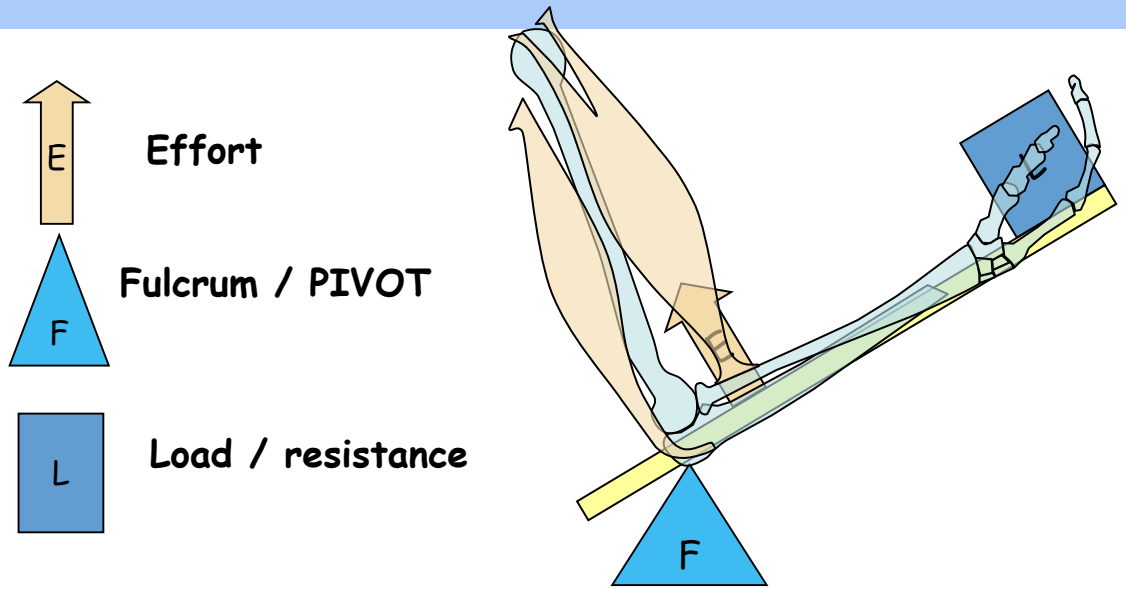
Fulcrum / pivot



Load / resistance

Muscles and joints as levers

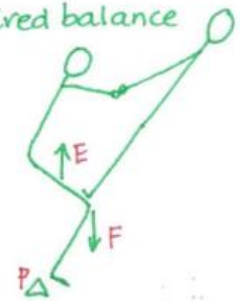
In the 3rd class/order lever, the effort **E** is between the fulcrum **F** and the load **L**.



In this type of lever the muscle is attached close to the joint allowing a long lever movement from a small muscular contraction.

Joints, Muscles, Levers and Sporting Movement

Paired balance



E/F/P (Levers)

shoulder Pass

E/F/P

Chest Pass

Type of movement?

Flexion / Extension

Handstand

Type of contraction?

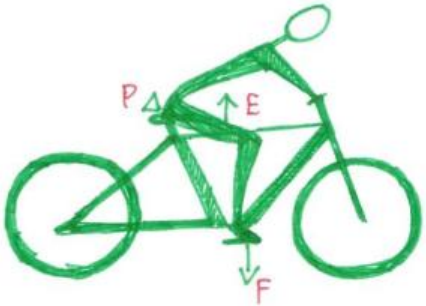
Isometric

Hitting a rounders ball

Type of movement?
Joint name?

Adduction / Ball & Socket

Label each Lever task with E - effort, F - force and F - fulcrum.



Levers E/F/P

Type of contraction in legs?

Isotonic

Skeletal/Muscle Systems.

In diagram 1 the knee is bending ready for take-off. Which muscle is contracting to cause the bending? Is it A or B?	Hamstring B
In diagram 2 the leg has straightened. Which muscle is contracting to cause this? Is it A or B?	Quads A
If the contracting muscle is the agonist or prime mover, what is the relaxing muscle called?	Antagonist
What type of muscular contraction occurs in both diagrams in order to cause the movement?	Isotonic
What type of joint is the knee joint?	Hinge
What type of movement does the knee joint allow?	Flexion/extension
What attaches a muscle to a bone to enable movement to take place?	Tendon
What attaches a bone to another bone in order to ensure stability of movement?	Ligament

IDENTIFYING RISK – TAKING STEPS TO MINIMISE RISK

e.g. SKIING

IDENTIFYING RISK

1. Falling down
2. Crashing – Other skiers / trees
3. Environment – Snow / winds / White-out
4. Snow conditions – Hard packed snow / ice / soft heavy snow / avalanche risk

STEPS TO MINIMISE RISK

1. Learn correct techniques
2. Understand and abide by 'Skiers Code'
3. Wear appropriate protective clothing – helmet, gloves, goggles, anorak - layers
4. Be aware of weather conditions and snow conditions
5. Warm up appropriately
6. Know and ski to your limits

Fuel for Sport

People exercise to

- Foster a healthy lifestyle
- Improve fitness and/or sporting performance

A BALANCED DIET is essential for this to take place.

However, individuals will choose a diet which is SPECIFIC to their needs.

Any physical activity requires:

ENERGY EXPENDITURE

The amount of energy needed depends on:

- The type of sport exercise
- Duration of the activity
- Intensity of the activity

Fuel for Sport

Three other factors which contribute to Energy Needs are:

AGE

As you age your metabolism slows down –

You need to eat less or you will gain weight

SEX

Males usually need more energy than females

BODY TYPE

LIFESTYLE

The more active you are, the more energy you need

BASAL METABOLIC RATE (BMR)

The amount of energy needed just to keep you alive.
BMR varies from one person to the next.

PHYSICAL ACTIVITY LEVEL (PAL) OR WORKING ENERGY

The amount of energy needed for physical activity/ sport

TOTAL ENERGY NEEDS = BMR + PAL

(measured in kilojoules/ kilocalories)

1. Energy balance

Energy in = Energy out

Taking in (eating) = using up (physical activity)

Calories calories

Weight stays constant

2.

Energy in > Energy used

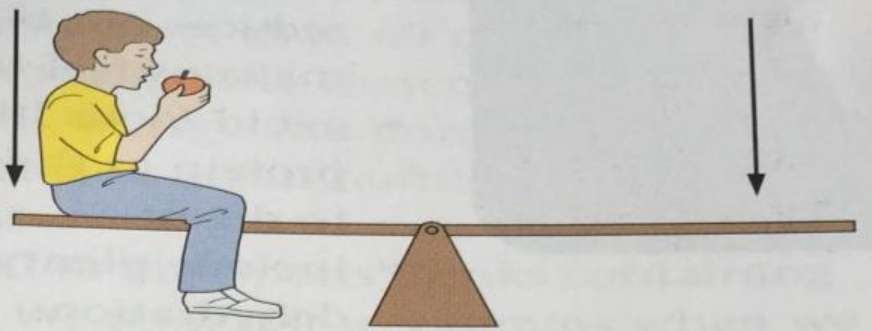
WEIGHT GAINED

3.

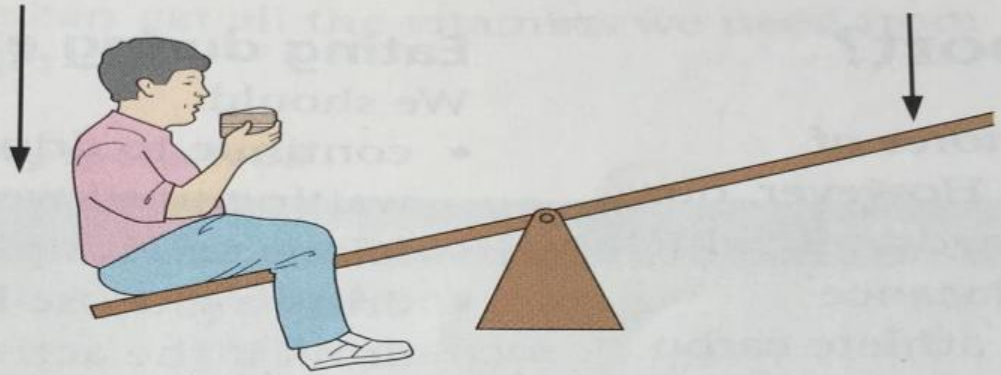
Energy in < Energy used

WEIGHT LOST

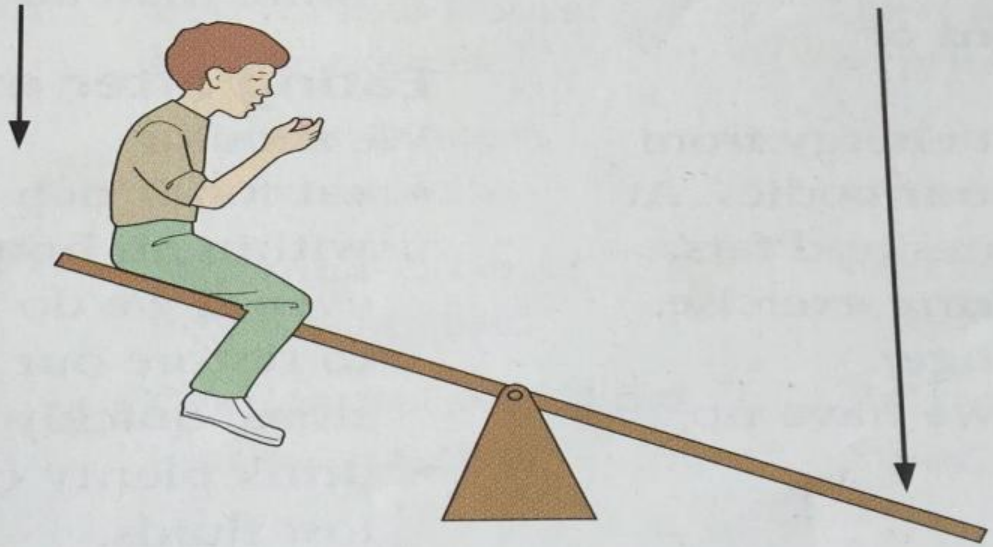
Weight stays constant
Kilojoules taken in each day equals kilojoules burned up each day



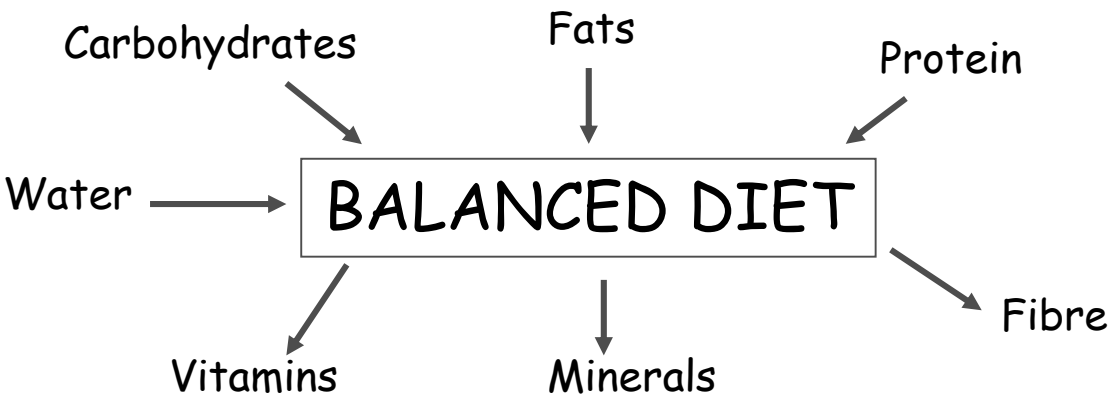
Weight gained
Kilojoules taken in each day is greater than kilojoules burned up each day

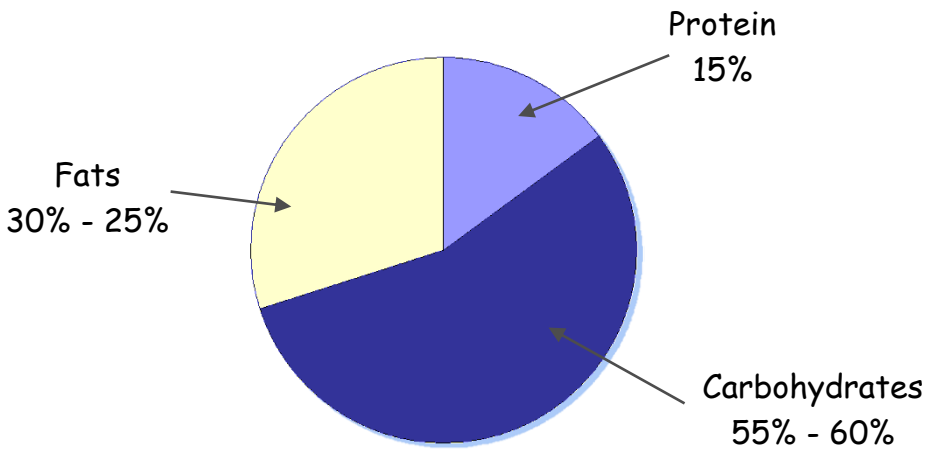


Weight lost
Kilojoules taken in each day is less than kilojoules burned up each day



Fuel for Sport





Fuel for Sport

Carbohydrates

Main source of ENERGY for working muscles
Broken down into GLUCOSE and stored as GLYCOGEN in the liver and muscles
Carbohydrates are an IMMEDIATE energy source
SIMPLE carbohydrates : SUGAR – biscuits, cakes, sugar
COMPLEX carbohydrates : STARCH – pasta, potatoes, bread
It is important to stock up on carbohydrate after exercise to replace that which has been used
Excess carbohydrate is stored in the body as FAT

Fats

Fats are a form of STORED ENERGY, released SLOWLY when there is a lack of carbohydrates (glycogen)
Extra fat is stored just under the skin
Extra fat can lead to:

OBESITY

HIGH CHOLESTROL LEVELS
(HEART / CIRCULATORY PROBLEMS)

Fats are used during AEROBIC work (O_2 is present)
SATURATED fats: milk, meat, biscuits
POLY UNSATURATED fats: fish, nuts

Fuel for Sport

Energy and physical activity

Carbohydrates provide QUICK ENERGY. They supply energy for both AEROBIC and ANAEROBIC physical activity

Used for physical activity of a comparatively SHORT length of time and HIGH INTENSITY

Fats provide SLOW ENERGY

- The provision is too slow to be used when used when working hard
- Used for walking and low-impact exercise
- Used for exercise of a longer duration, and MODERATE INTENSITY
- Energy used will come from fats and carbohydrates in equal measures
- Physical activity of LONG DURATION and HIGHER INTENSITY is fuelled more from fat stores in the body because the glycogen store becomes depleted

Fuel for Sport

Different sports performers need different types of energy so they will vary (change) the type of diet they have.
Examples:

Carbohydrate Loading 	Sports persons needing slow energy release will do something called: carbohydrate loading – this is when the night before a race or big match that could last a long time they will eat lots of carbohydrates eg pasta. This will be digested and stored in muscles and the liver to give extra energy the next day. It is good for marathon runners and games players taking part in continuous activities or events.
High Protein Diet 	Weightlifters and other performers (eg sprinters, shot putters) who need a lot of strength for their event will eat lots of PROTEIN when training. This will help them to build up muscles so muscles get bigger and stronger.

Fuel for Sport

General rules for diet before, during and after exercise.

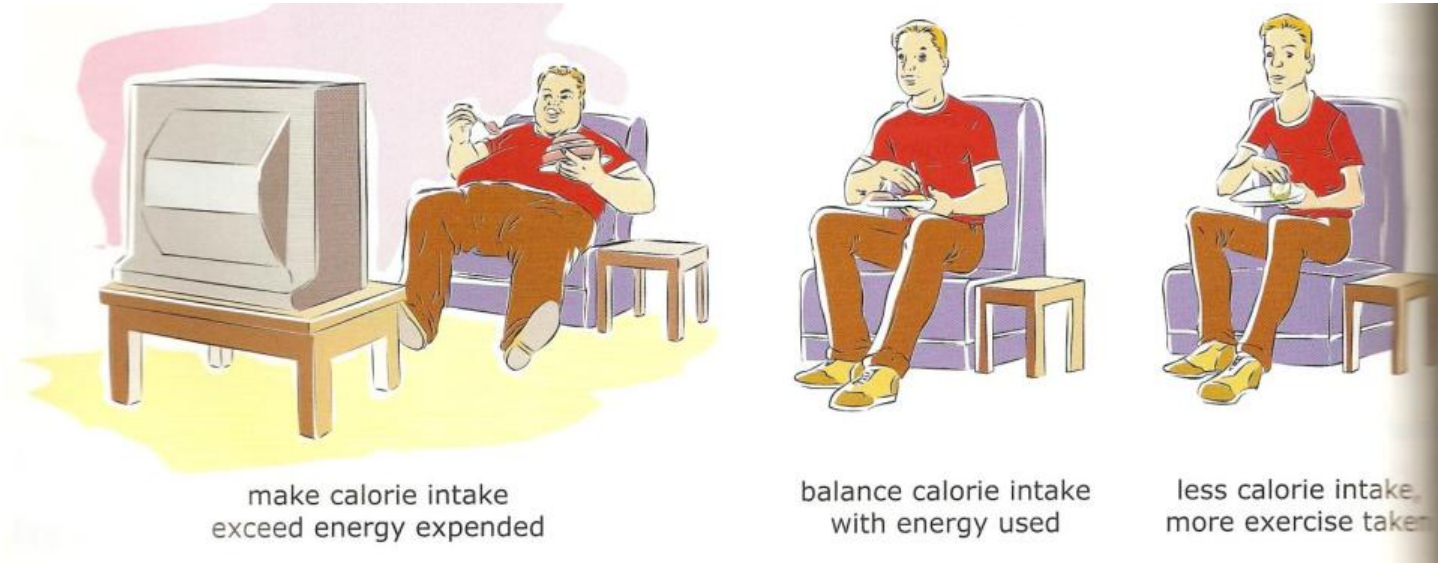
BEFORE ACTIVITY	DURING ACTIVITY	AFTER ACTIVITY
Eat carbohydrates 1-2 hours before the activity to give energy slowly. Avoid sweets and fats and lots of meat 4 hours before the activity. Drink fluid to avoid dehydration	Do not eat food for HIGH INTENSITY ACTIVITY For activities with natural breaks eg tennis or half time in games a small amount of food containing simple carbohydrates such as energy bar/banana. Take plenty of fluid in small sips to replace water lost through sweat.	Immediately after activity eat carbohydrate filled foods to replace the stored energy used in the activity. Drink fluid to prevent de- hydration.

Fuel for Sport

OBESE – normally 20% over the Food Standards Agency guide of weight for height. Health risks – Heart disease, cancer, diabetes, osteoarthritis and other problems are likely if obese.

UNDER WEIGHT – ANOREXIA NERVOSA – where people do not eat as the see themselves as fat – leads to excessive weight loss.

Athletes quite often are concerned about their weight for the physical activity they take part in. This can lead to eating disorders.



Motivation

- Learning will not take place unless the sportsperson is motivated:

Motivation

1. What makes a person act
2. The amount of enthusiasm and determination a person has for physical activity
3. A combination of the drive within us to achieve goals and the outside factors which affect it

Motivation

- **Motivation** is responsible for:
  1) The selection and preference for activity
  2) The persistence at the activity
  3) The intensity and effort put into performance
  4) How well or how badly a person will perform.

- The more motivated a sportsperson is the harder he/she will work at it, and the more likely they are to succeed.
- There are two types of motivation: Intrinsic and Extrinsic

- **Intrinsic Motivation**

  - This is the inner drive to achieve success and a pride and satisfaction in completing a task. It can also be a determination to achieve personal goals.
  - This inner drive is enough to enthuse sportspersons to practice, train and compete.
  - Taking part in physical activity for fun, enjoyment, joy and satisfaction.
  - The challenges, satisfaction, sense of achievement and a desire to maintain a healthy, active lifestyle are intrinsic reasons motivating many people to take part in physical activities and sport.

Motivation

- **Extrinsic Motivation**

Extrinsic motivation comes from a source outside of the performer – it can encourage the performer to perform:

Trophies/Money/Certificates/Awards **Praise/Recognition/Achievements**

- **Extrinsic Motivation**

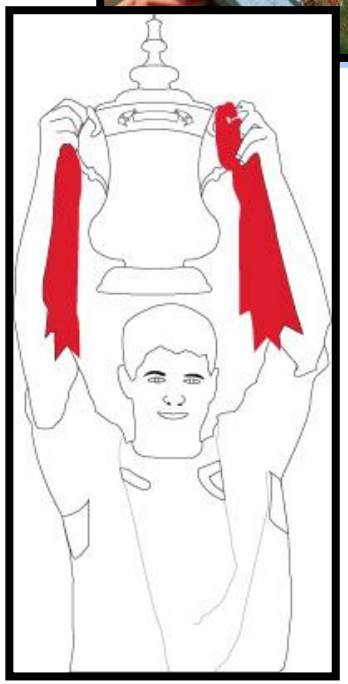
Extrinsic motivation should be used carefully:
as a means of informing a person how well they are doing rather than the reason for performing.

It is Intrinsic Motivation that will keep sportspersons interested in physical activity when Extrinsic Rewards have gone.

The learning of complex tasks/ skills is heavily dependent on Intrinsic Motivation.

Most motivation is a mixture of both types – Internal and External.

Motivation



Intrinsic motivation	Extrinsic motivation- tangible rewards	Extrinsic motivation intangible rewards
Inner drive	Trophy	Praise
Enjoyment	Certificate	Encouragement
Determination	Award	Recognition
	Money	

Goal Setting

"I can't seem to motivate myself. I know I can improve my fitness and my ability in sport but I can't seem to get there.

What can I do?

Set Goals to raise motivation

- Goal-setting is a good way of staying motivated. It's a way of aiming towards long term targets, by setting short term goals for achievement on the way.

- By setting goals you can …

Goal Setting

Goals can be Short Term or Long Term.

- The ultimate objective (The Long Term Goal) is very important. However, the key to success is the day to day Short Term goals. They provide a focus for training in each and every session, that will help achieve their long term goal. Short term goals can act as incentives and signposts as to whether you are on target or not.
- Goals can be Performance or Outcome Goals.
- Performance Goals focus on the work that it takes to achieve a particular result.

- **Outcome Goals are opposite to Performance Goals. Whilst the work that it takes to meet a goal is very important, the outcome goals focus on the result of the work and not the actual work.**
- **There is more control over performance goals than over outcome goals: the best time for a 800m race could be improved but it will still not secure a win in the race.**
- **Performance Goals give a performer a better chance of success, which leads to an increase in confidence and motivation.**

Goal Setting

By setting goals you can

- Achieve more (Working harder)
- Improve performance
- Improve quality of training
- Evaluate your performance
- Focus your attention
- Be prepared mentally for performing
- Determine exactly what is to be achieved
- Increase motivation to achieve
- Gain direction (Sign posting)
- Gain confidence
- Feel in control
- Be less anxious
- Increase pride and satisfaction in your performance
- Check progress against targets

Goal Setting

SETTING TARGETS - S.M.A.R.T.

•By knowing what you want to achieve, you know what you need to concentrate on and improve.

•Goals that are too easy to achieve provide little motivation, but unrealistic difficult goals can lead to a loss of confidence and eventual rejection of the goal.

•When setting goals, they should be OBJECTIVE not VAGUE e.g. "to get fit" is too vague – compare with – " I'm going to lose 5 kg, be able to do 50 sit ups without a break and run 5 km in under 20 minutes by the end of a 12 week training programme."

Goal Setting

S. (SPECIFIC)
Goals should be as specific as possible regarding what you want to achieve – Focusing attention.

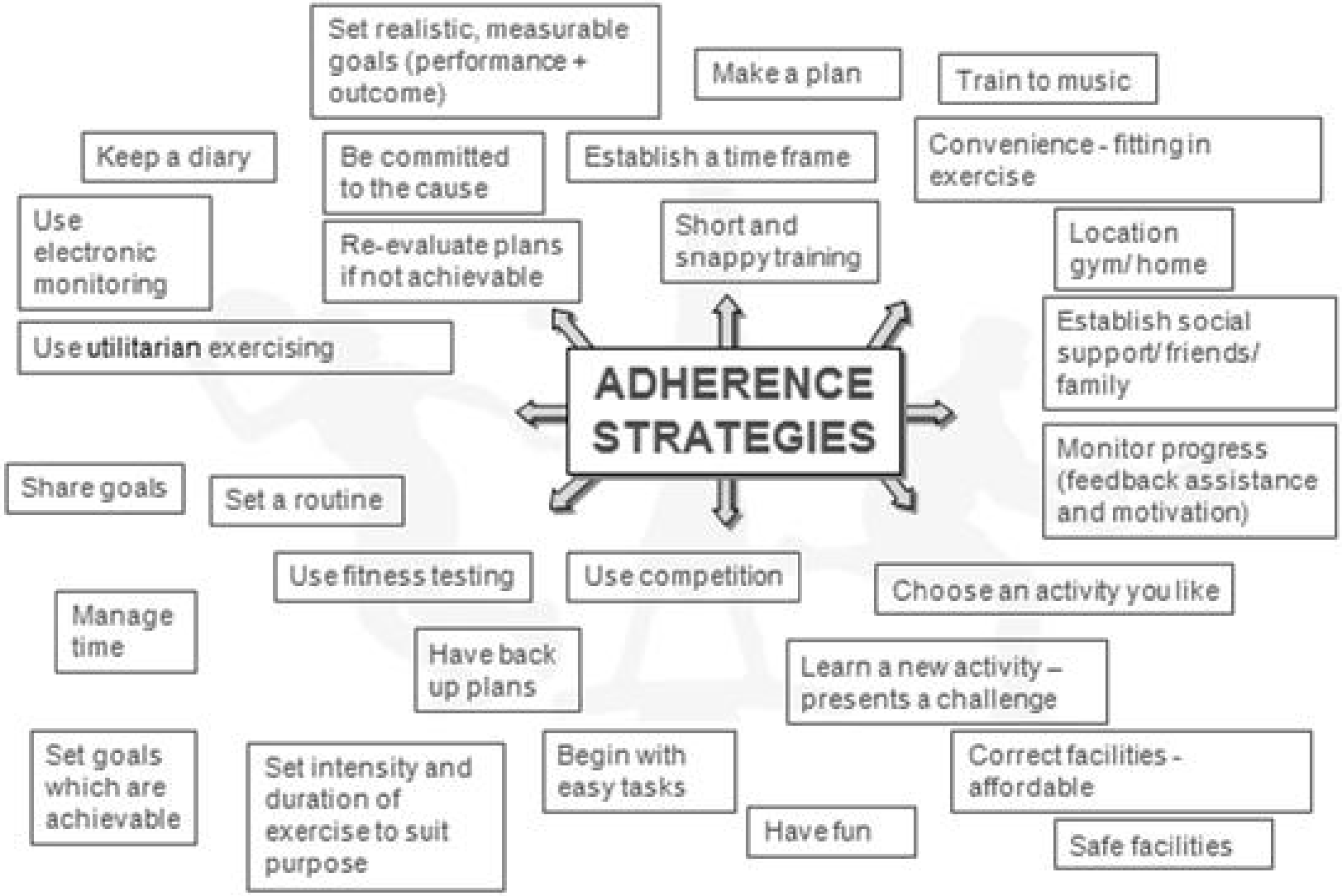
M. (MEASUREABLE)
You need to be able to tell when you have reached a goal – they should access PROGRESS against a standard and when to set new goals.

A. (AGREED / ACCEPTED)
The goals should be discussed and agreed with you and your coach, otherwise you will not be motivated. The acceptance by both parties gives ownership and confidence to the performer.

R. (REALISTIC)
Goals should be challenging but attainable. They can be motivational, give direction and control anxiety.

T. (TIME-PHASED)
You need a time frame so that you have reached all of your short term goals before the performance. If goals are time-phased they provide a focus and motivation to achieve.

Adherence


ADHERENCE STRATEGIES
Set realistic, measurable goals (performance + outcome)
Make a plan
Train to music
Keep a diary
Be committed to the cause
Establish a time frame
Convenience - fitting in exercise
Use electronic monitoring
Re-evaluate plans if not achievable
Short and snappy training
Location gym/ home
Use utilitarian exercising
Establish social support/ friends/ family
Share goals
Set a routine
Monitor progress (feedback assistance and motivation)
Use fitness testing
Use competition
Choose an activity you like
Manage time
Have back up plans
Learn a new activity – presents a challenge
Set goals which are achievable
Set intensity and duration of exercise to suit purpose
Begin with easy tasks
Correct facilities - affordable
Have fun
Safe facilities

Learning and Skill

LEARNING

1) A permanent change in performance as a result of practice and/ or experience.
2) 2) The act of gaining knowledge or acquiring skill.

ABILITY

An innate physical characteristic which facilitates movement. Ability is inherited e.g. to be a good golfer you need to have been born with basic natural capacity – coordination, balance and flexibility

SKILL

A learned ability to bring about pre-determined results with maximum certainty and efficiency

Skills are the complex, critical and intricate movements performed during physical activity

Effective performance

PERFORMANCE

Taking part in physical activity: how a skill is carried out.

TECHNIQUE

The Basic movements in sport, when put together form a pattern of movement – skill e.g. receiving, dribbling, making a pass in Hockey

Learning and Skill

Match the ability which is important for performing the following activities well:

Activity	Ability
Badminton serve	Co-ordination
Handstand	Balance
100m sprint	Speed
Feint dodge (netball)	Agility
Fencing	Reaction time
Javelin	Power