The Musculo-Skeletal System

Applied Anatomy & Physiology

Lesson 1: WALT

- The 5 functions of the skeletal system
- Location of bones
- Classification of bones

5 Functions of the Skeletal System

Just Put Main Skeletal People

Fill Out Booklet
Complete Worksheet 1.1.1

1. **Joints for Movement** – At joints 2 or more bones meet & work with muscles to form levers that allow movement

2. **Protection of vital organs from impact** - Cranium protecting the brain, rib cage protecting the heart & lungs

3. **Muscle Attachment** –Tendons join muscle to bone to act as anchors that pull on a bone

4. **Storing Calcium & Phosphorus** –

Minerals vital to develop (ossification) & maintain the strong and healthy bones needed for exercise

Phosphorus also helps to reduce muscle pain after a hard work-out. Found in milk, cheese & yoghurt

5. **Platelets, Red & White Blood Cell Production**

Produced in bone marrow (found in middle of long bones) which can respond to your activity and condition.

Red blood cells transport O2 to working muscles. White blood cells fight infection. Platelets clot blood

Labelling Partner Task

Bones - Location (20)

Cranium	Sternum	Scapula	Ribs
Vertebrae	Carpals	Metacarpals	Phalanges
Fibula	Tibia	Clavicle	Humerous
Pelvis	Radius	Ulna	Femur
Patella	Tarsals	Metatarsals	Phalanges

The Bones of the Skeleton

Complete Worksheet 1.1.3

- Skeleton consists of **206** bones – Need to know these 20!

4 Classifications of Bones

Fill in Booklet

1) LONG

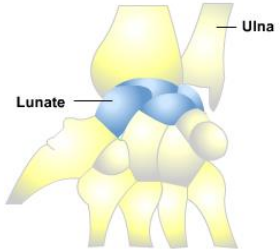
Longer than they are wide

e.g. Humerus, Femur, Tibia & Metacarpals

→ **Act as Levers**

Used for main movements of the body

2) SHORT



Box-like shape bones found at hands & feet

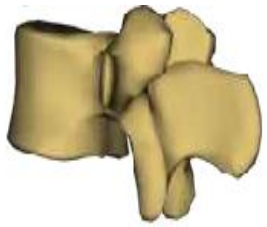
Only Carpals and Tarsals

→ **Weight Bearing**

Shock absorption and spreading loads.

Used for the delicate movements

3) IRREGULAR



Unusually shaped for special purpose

e.g. Vertebrae and Patella

→ **Protection of Vital Organs & Muscle Attachment**

Vertebrae protect spinal cord

Back muscles attach to the vertebrae column

4) FLAT

Thin plate like bones which cover large surface area

e.g. Cranium, Ribs and Pelvis

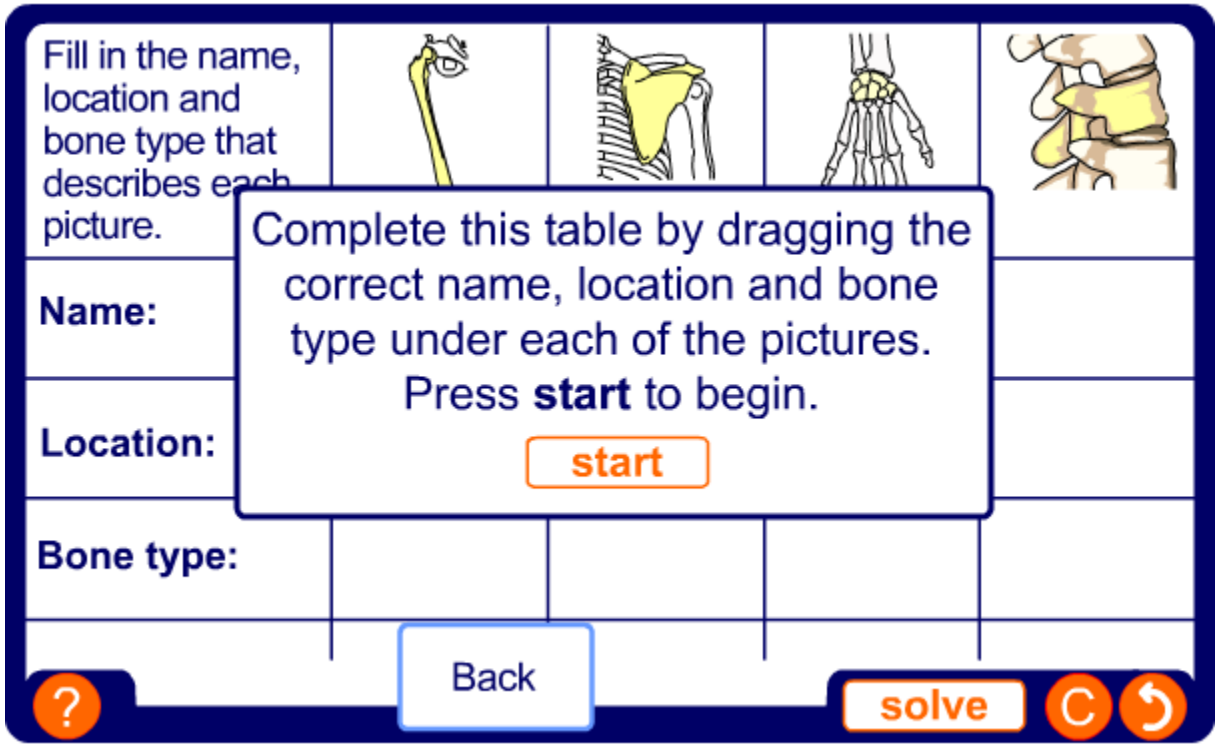
→ **Protection of Vital Organs & Muscle Attachment**

Cranium protects brain if hit by cricket ball

Classifications of Bones

Complete Worksheet 1.1.2A
Complete Worksheet 1.1.2B

Bone	Bone Type
Cranium	Flat
Clavicle	Flat
Scapula	Flat
Sternum	Flat
Pelvis	Flat
Ribs	Flat
Femur	Long
Phalanges	Long
Metatarsals	Long
Metacarpals	Long
Fibula	Long
Tibia	Long
Ulna	Long
Radius	Long
Humerous	Long
Tarsals	Short
Carpals	Short
Vertabrae Column	Irregular
Patella	Irregular



Lesson 2: WALT

- Bones Aiding Performance
- Functions of the vertebrae column
- Classification of Joints
- Connective Tissues at a Joint

Bones Aiding Performance

EXAMPLE 1: The Spin Bowler is relying on the metacarpals and phalanges to apply spin and rotation to the ball to deceive the batsman

EXAMPLE 2: Swinging a racket to play a forehand drive in tennis involves the long bones of the arm (**humerus**, **radius** and **ulna)** act as levers to help swing the racket and generate power onto the ball to hit to past an opponent

EXAMPLE 3: The short bones of the wrist (Carpals) support and spread the gymnasts body weight so they can maintain the balance with control to make it aesthetically pleasing

How can the different bones play a part in our sporting actions?

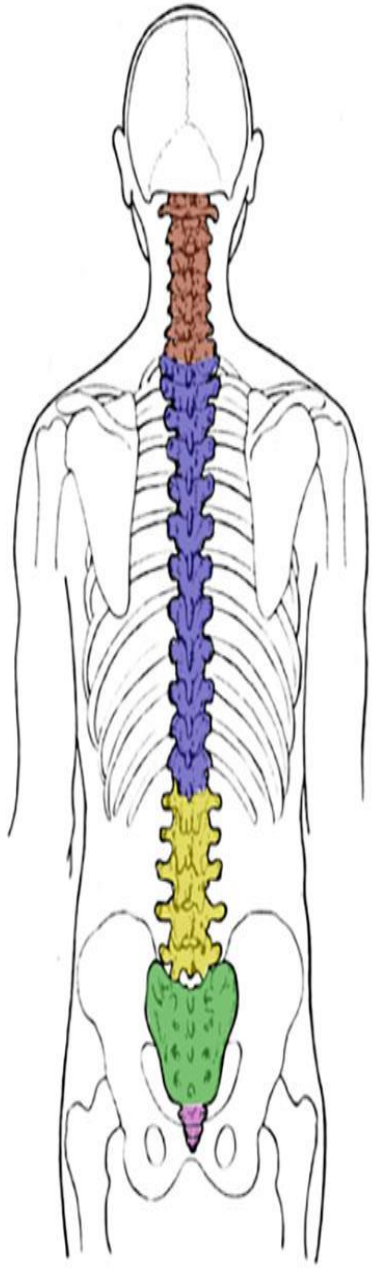
The Vertebral Column

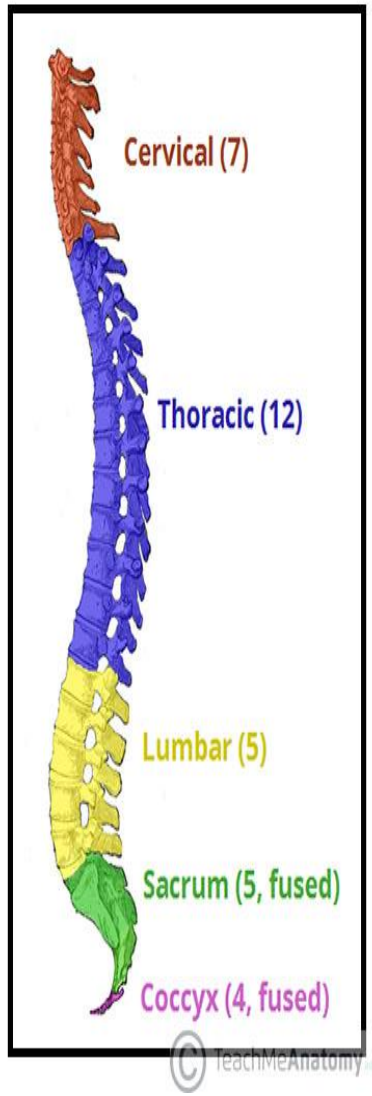
- Consists of 33 small specialised bones called vertebrae
- Protects the spinal cord & central nervous system
- Divided into 5 different regions and each region has its own function.
- The inverted ‘S’ shape gives it strength
- Between each vertebrae are discs of cartilage:

Act as a shock absorber

Reduces friction

Allows movement between the bones





Regions of the Vertebrae Column – Exam Tips

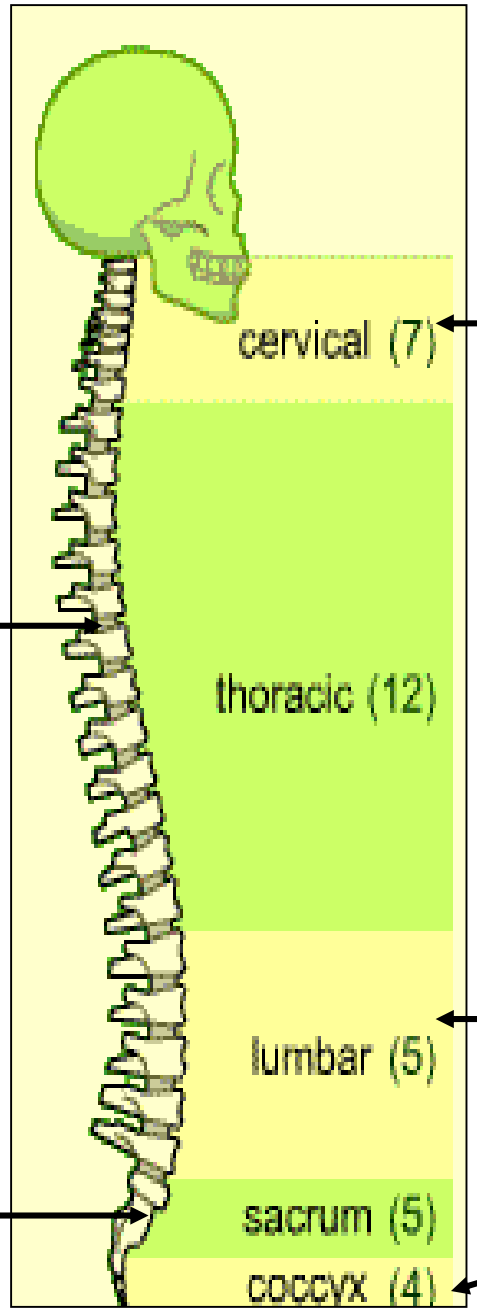
Come	**C**ERVICAL	**C**ute
To	**T**HORACIC	**T**eddies
London	**L**UMBER	**L**ove
See	**S**ACRAL	**S**ome
Chelsea	**C**OCCYX	**C**uddles

Think of the number of vertebrae in each section as a *telephone number*

7, 12, 5, 5, 4

Regions of the Vertebrae Column – Functions

Fill Out Booklet



- Smallest vertebrae
- Support head & neck
- Neck muscles attached
- 1st bone called the ATLAS allows head to nod
- 2nd bone AXIS allows head turn

- Larger vertebrae
- Ribs are attached to them
- Support the ribcage & help breathing
- Allow slight movement (Forwards, Backward & side to side)

- The largest vertebrae, supports a lot of weight
- Back muscles attached
- Allow the most movement
- Can be easily injured

- These are fused together (adulthood)
- Also fused to the pelvis
- Strong base & support most of the bodies weight

- Fused together
- Have no special purpose

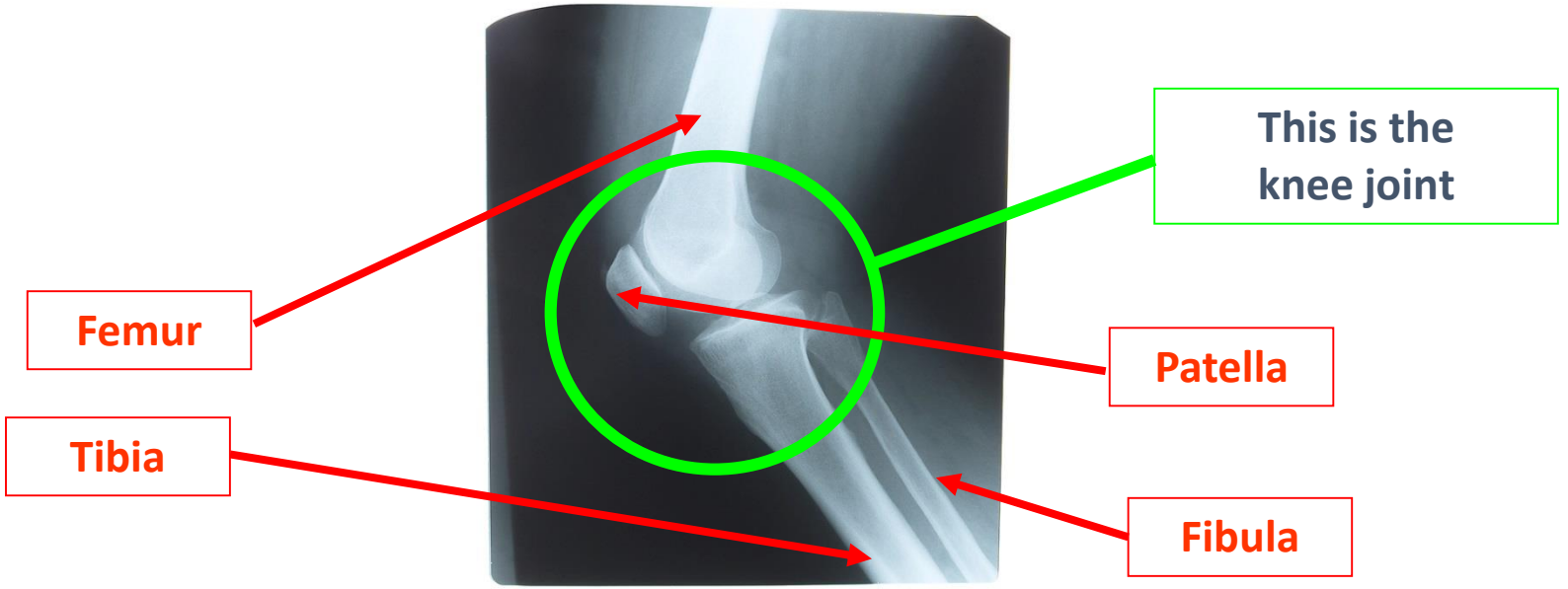
It is important for this rugby player that the weight against his shoulders is passed to his legs through a straight spine. A bent back could lead to injury of the spinal cord

The High Jumper is able to hyper extend her back in order to get her body over the bar. Back muscle attachment at the lumber helps create this shape.

The lumber and sacrum regions of the vertebrae column helps to support the weight and move the atlas ball

What is a Joint?

"A **JOINT** is a place where **TWO** or more bones meet"



3 Connective tissues at a Joint

Muscles work over a joint and are attached to bones by tendons to pull on a bone to produce movement

Bones are joined to bones by ligaments to keep joints stable and prevent dislocations

Cartilage on the ends of bones absorb shock, prevent friction (arthritis) and help lubricate the joint

Tendons, Ligament & Cartilage

Tendons non-elastic fibres that connect muscles to bones. Pull on a bone to produce movement.

Ligaments are tough, elastic fibres that link bones to bones. Keep joints stable and prevent dislocations.

Cartilage tough fibres that prevents the ends of bones rubbing together at joints. Its slippery surface also helps to lubricate the joint. Prevent friction.

Decide if each statement refers to tendons or ligaments.

1. Strong elastic fibres _____
2. Strong non-elastic fibres _____
3. Connect muscles to bones _____
4. Connect bones to bones _____
5. When stretched too far, joints may dislocate _____
6. Enable muscles to move the skeleton _____
7. Keep joints stable during exercise _____

? ligaments tendons solve

Fill Out Booklet

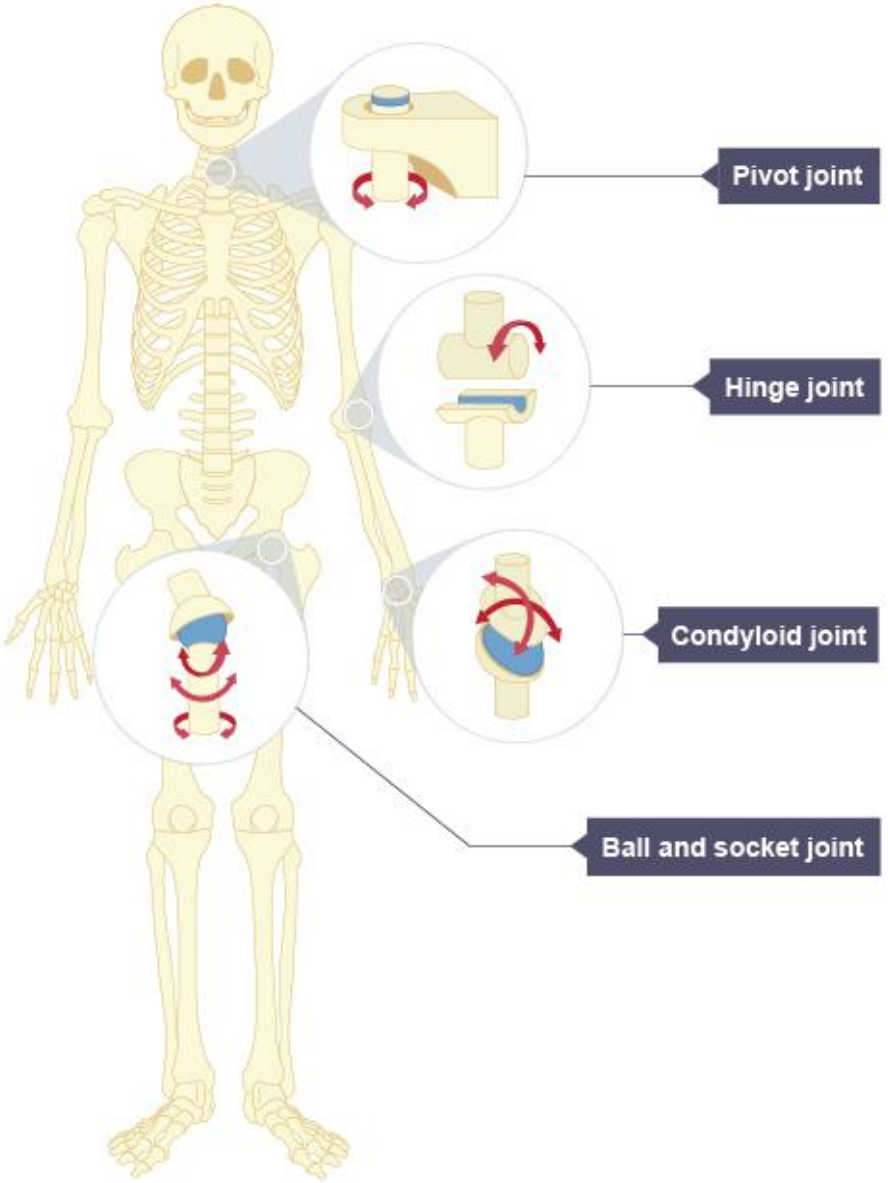
Synovial Joints & Movement

Ball & Socket: All but Plantar Flexion & Dorsi-Flexion

Hinge: Flexion & Extension

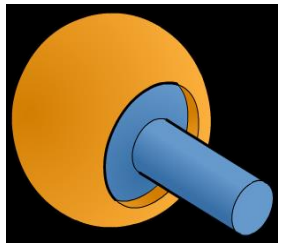
Pivot: Rotation

Condyloid: All but Rotation Plantar Flexion & Dorsi-Flexion

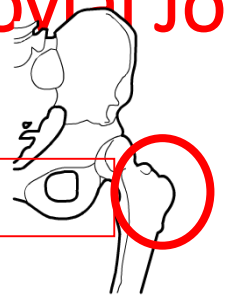


Classification of Joints:
4 Types of Synovial Joints

1. Ball & Socket



Shoulder and Hip



Shoulder rotation in butterfly stroke

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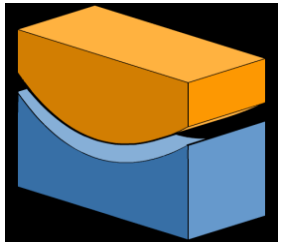
2. Hinge



Knee, Elbow & Ankle

Bend (flexion) and straighten (extension) the leg to kick a ball

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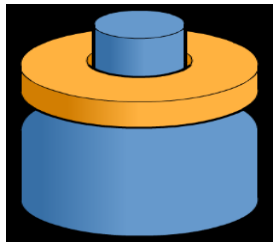
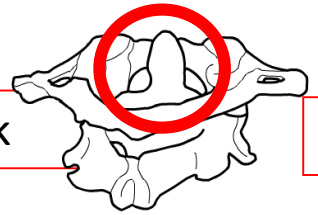
3. Pivot



Between Atlas & Axis of neck



Turn & nod head during header

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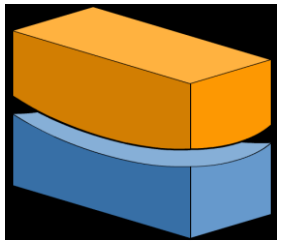
4. Condyloid



Between metacarpals & phalanges

Move wrist to generate spin on the ball

Lesson 3: WALT

- Movement possible at synovial joints

- Joint and movement analysis

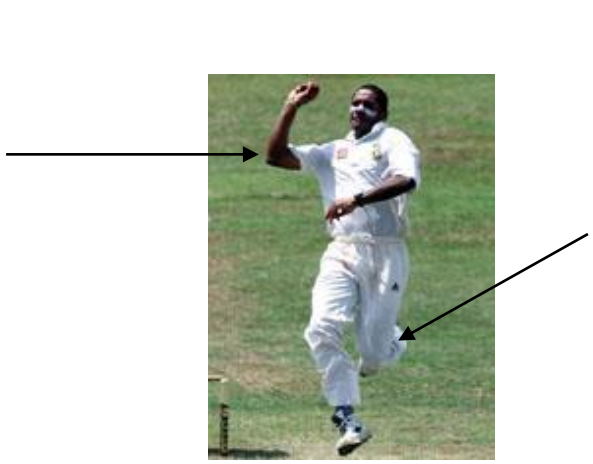
???Pop Quiz???
(1 mark each)

1) Name the 5 functions of the skeletal system
2) Name the 4 bones in the leg
3) Name the 4 classifications of bones
4) What is the role of tendons?
5) What are the 5 regions of the vertebrae?

Flexion

"A bending movement that decreases the angle between body parts"

EG. Bending elbow & knee when bowling

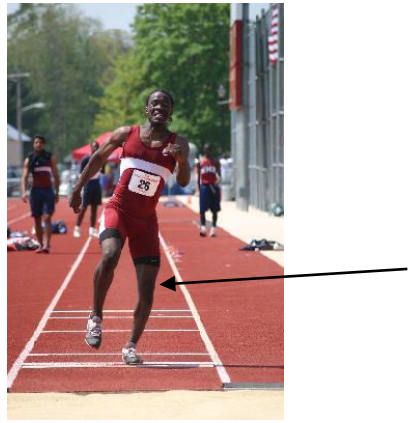


TIP: Think of it as bending part of the body at a joint

Extension

"A straightening movement that increases the angle between body parts"

EG. When taking off in the long jump the leg is extended at the knee



TIP: Think of it as straightening a part of the body at a joint

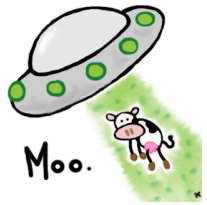
Adduction

"A movement that pulls towards the midline of the body"

EG Bringing the arms & hands together to begin the breaststroke action

TIP: Think ADD

Abduction



"A movement that pulls away from the midline of the body"

EG. Abduction of the arm for a goalkeeper to make a save

TIP: If somebody is abducted then they are taken away

Rotation

"Movement around a single axis or pivot point"

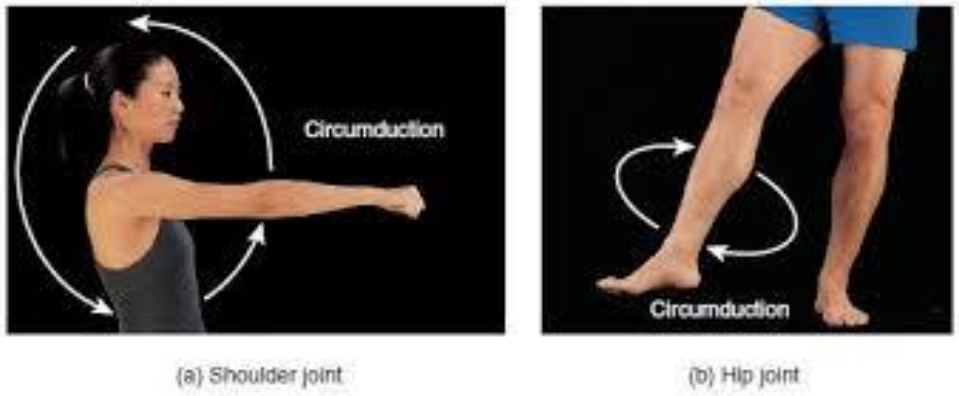
EG Playing a topspin shot in table tennis

Tip: A twisting action at a joint

Circumduction

“Moving in a circular or conical shape”

EG Cricketer bowling a ball
at the shoulder joint



(a) Shoulder joint (b) Hip joint

Tip: Drawing a circle in the air

Plantar-Flexion & Dorsi-Flexion

Plantar-Flexion

(plant toes into ground)

“Extending or pointing the toes down, away from the shin”

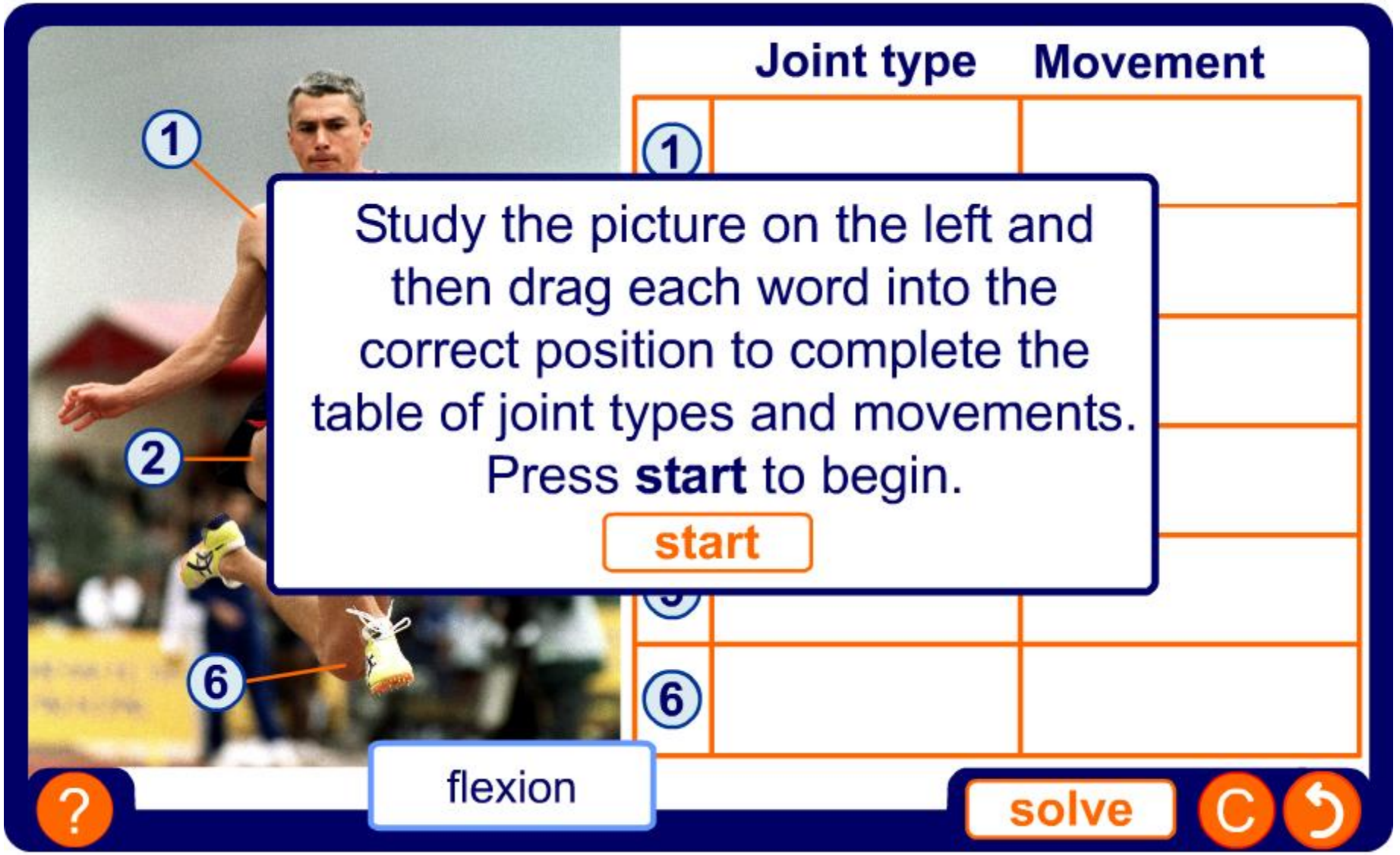
Dorsi-Flexion

(Point toes to sky)

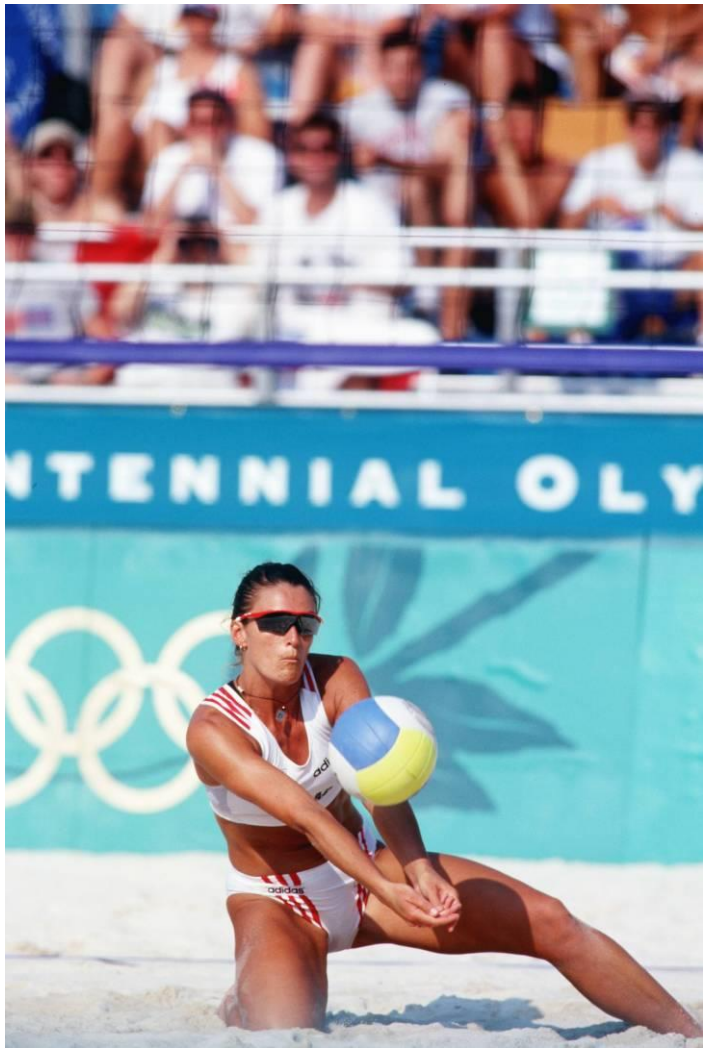
“Planting or flexing the toes up, closer to the shin”

Complete Worksheet 1.1.4A
Complete Worksheet 1.1.4B

Joints & Movement Analysis



Joint and Movement Analysis



Analyse the joint movements involved in these two sporting actions.

Lesson 4: WALT

- Types of Muscles
- Function of Muscles
- Location of Muscles & Muscle Actions

???Pop Quiz???

1) Name 3 long bones in the body
2) What do ligaments join? What is their function?
3) Where is cartilage found? Name 2 functions
4) Define a joint
5) What movements are possible at synovial joints? (8)

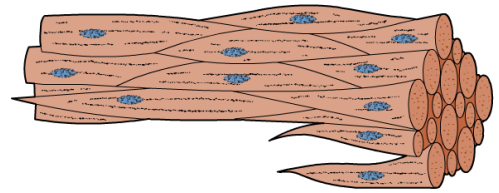
Types of Muscle

Involuntary muscle (smooth):

Found in the internal organs. Working to keep us alive & not under conscious control

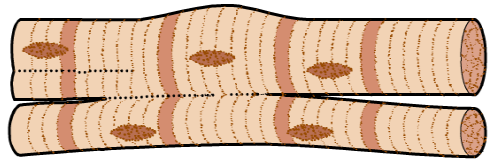
e.g. Vascular smooth muscles make up wall of blood vessels – **Vascular Shunting**

e.g. Digestive & urinary system



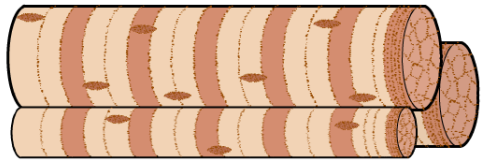
Cardiac muscle:

Only found in the heart and is not under our conscious control. Special as it never tires.



Voluntary muscle (skeletal):

Under our conscious control & attached to the skeleton to produce movement.



3 functions of the Voluntary Muscles

1. Movement & Flexibility

2. Posture

3. Define Body Shape

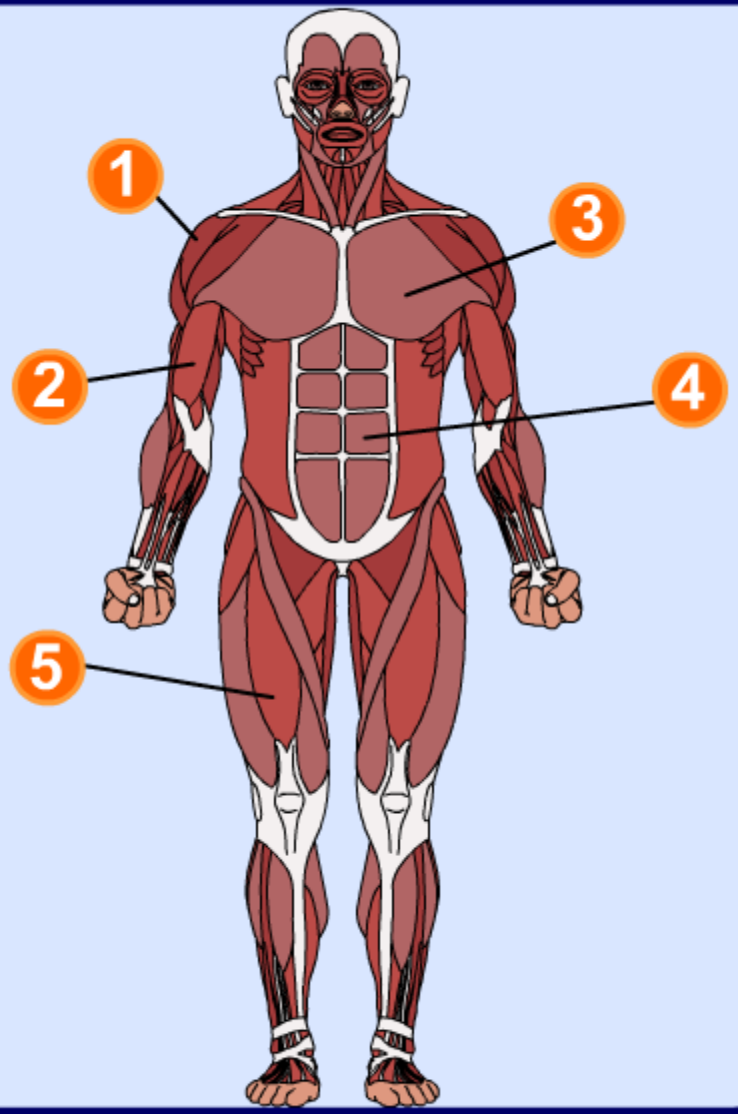
Labelling Partner Task

Location of Muscles (12)

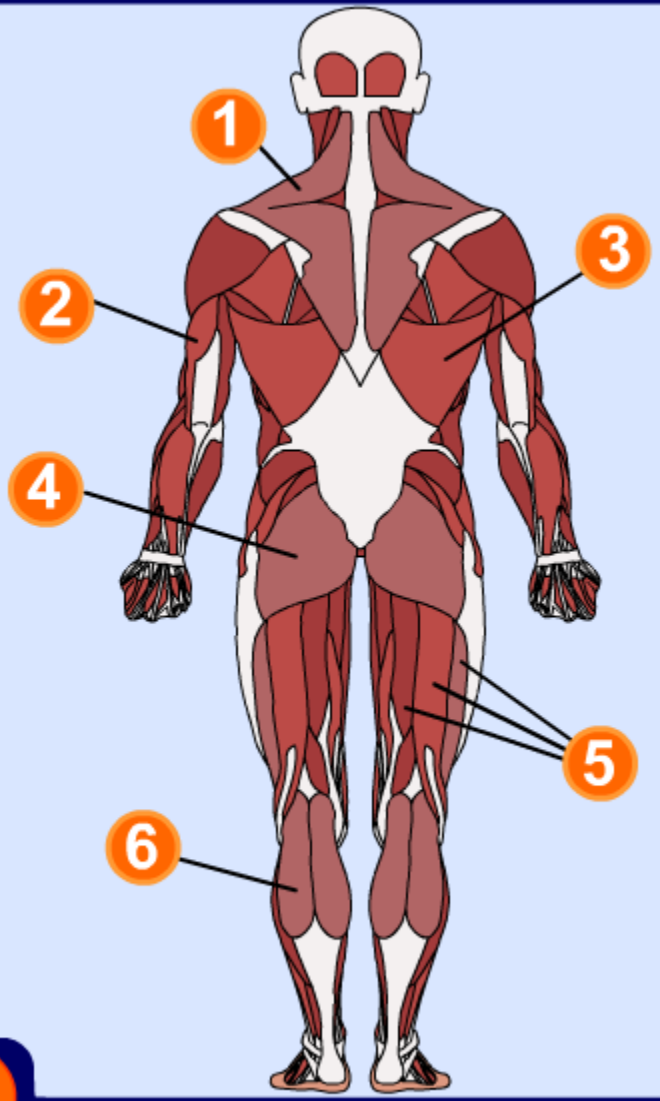
Deltoid	Biceps	Gastrocnemius
Triceps	Pectoralis Major	Latissimus dorsi
Gluteus Maximus	Hip Flexors	Quadriceps
Tibialis Anterior	Hamstrings	External Obliques

Voluntary Muscles (front)

Click on each number to learn about some of the muscles on the front of the body.



Voluntary Muscles (rear)



Click on each number to learn about some of the muscles on the back of the body.

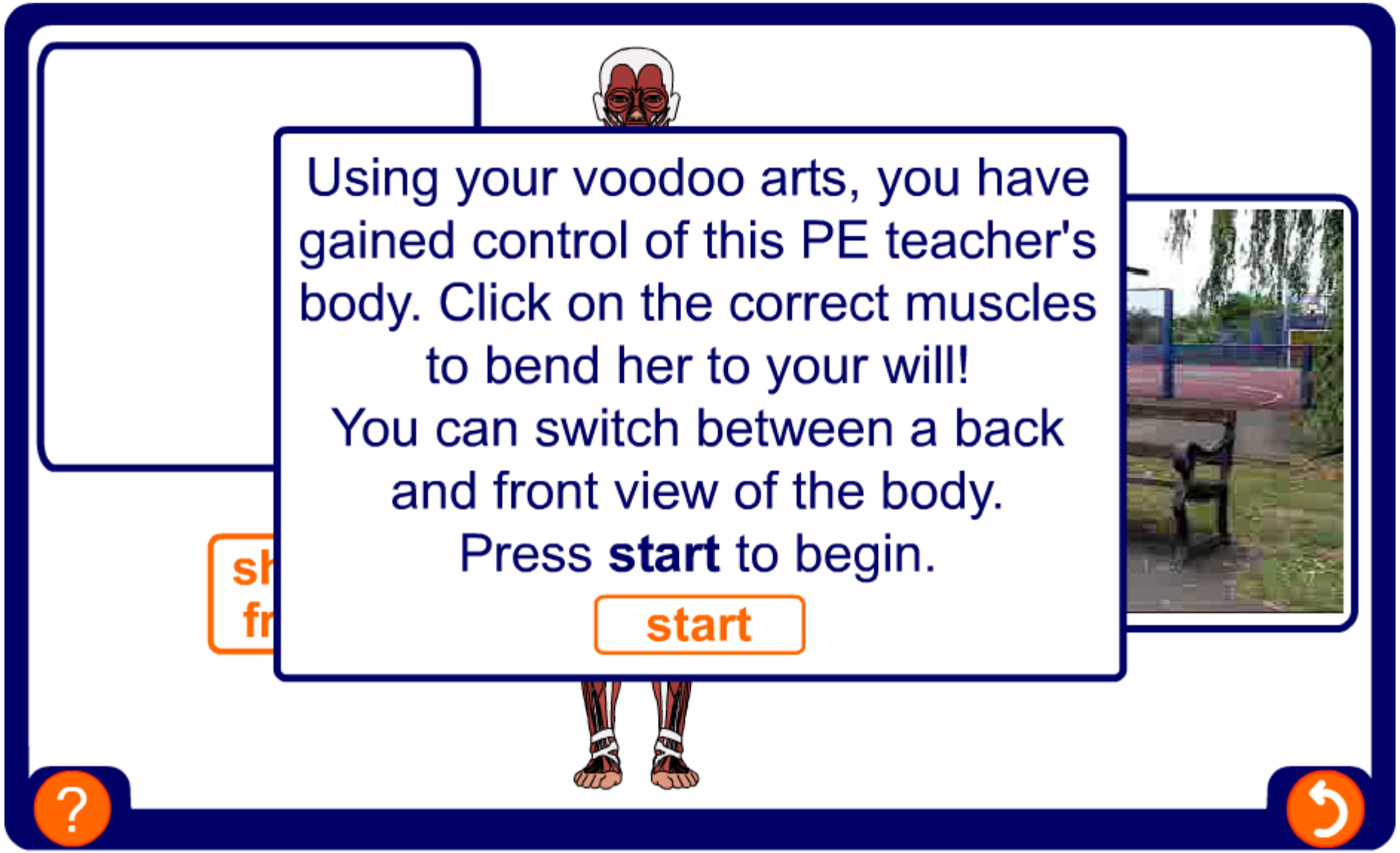
Muscle	Location	Function	Example in sport
Deltoid	Rounded, triangular muscle on the uppermost part of the arm and at the top of the shoulder	Move the arm in all directions at the shoulder	Serving in tennis
Pectoralis major	Covering the chest	Adduct the arm at the shoulder	Forehand drive in tennis
Latissimus dorsi	Broad sheet of muscle that extends from the lower region of the spine to the bone in the upper arm (humerus)	Adduct and extend the arm at the shoulder	Butterfly stroke in swimming
Biceps	Front of the upper arm	Flex the arm at the elbow	Pull-up, drawing a bow in archery

Triceps	Back of the upper arm	Extend the arm at the elbow	Press-up, throwing a javelin
External obliques	To the side of the abdomen, running from the lower half of the ribs down to the pelvis	Pull the chest downwards; flex and rotate the spinal column; one side contracting creates a side bend	Crunches in the gym
Gluteals	Form the buttocks. Gluteus maximus (the largest) lies just under the skin, and is attached to the femur (thigh bone)	Adduct and extend leg at the hips, pull the leg backwards	Pulling back leg before kicking a ball
Hip flexors	Sit deep in the front of the hip and connect the leg, pelvis and abdomen	Flex the hip, help move the leg and knee up towards the body	Lifting knees high in sprinting

Quadriceps	Four muscles found on the front of the upper leg	Extend the leg at the knee	Kicking a ball, jumping upwards
Hamstrings	Found on the back of the leg, stretching from the bottom part of the pelvis to the tibia (the shin bone)	Flex the leg at the knee	Bending knee before kicking a ball
Gastrocnemius	Starts at the back of the femur and comes together with the soleus muscle to form the Achilles tendon at the back of the ankle	Point the toes (plantar-flexes the ankle), help flex the knee	Running
Tibialis anterior	Runs down the shin	Pull the toes up towards the shin (dorsi-flexes the ankle)	Ski jumping

Voluntary Muscle Actions

Complete Worksheet 1.1.8A
Complete Worksheet 1.1.8B



Lesson 5: WALT

- Antagonistic Pairs
- Fast & Slow Twitch Muscle Fibres
- How the Skeletal & Muscular System Work Together

???Pop Quiz???

1) Name the 3 functions of voluntary muscles
2) List the 4 muscles in the leg
3) Define a joint
4) What are the 4 kinds of synovial joint?
5) Name the 3 types of muscle found in the body

4 Antagonistic Pairs

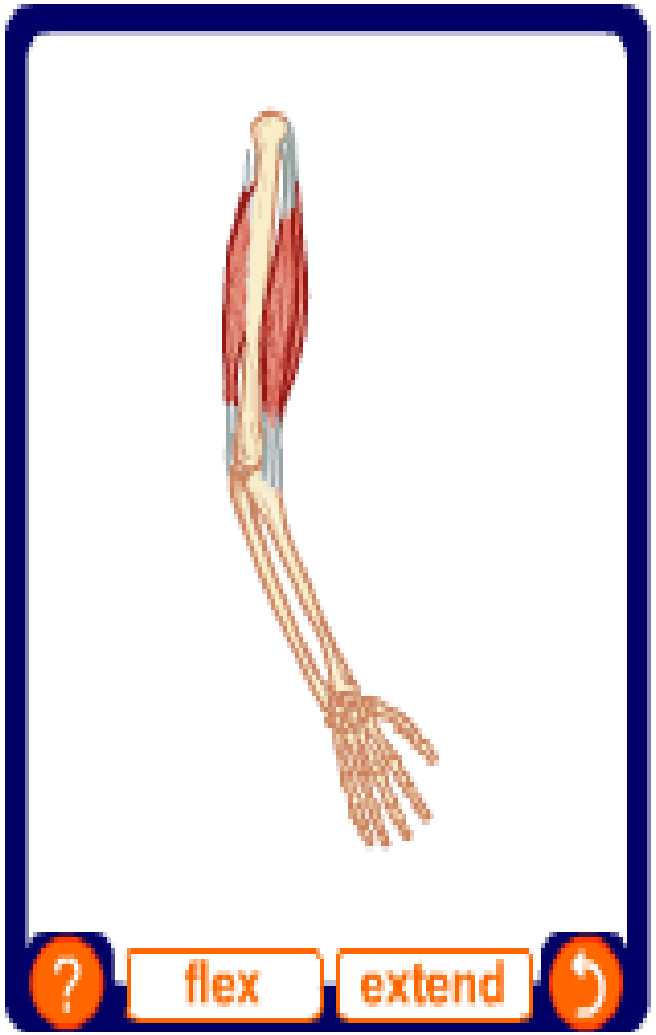
Complete Worksheet 1.1.9

One muscle contracts (shortens) while the other relaxes (lengthens) in order to produce movement

The contracting muscle is called the agonist or prime mover

The relaxed muscle is call the antagonist

1. Bicep & Tricep
2. Quadricep & Hamstring
3. Gastrocnemius & Tibialis Anterior
4. Hip Flexors & Gluteus Maximus



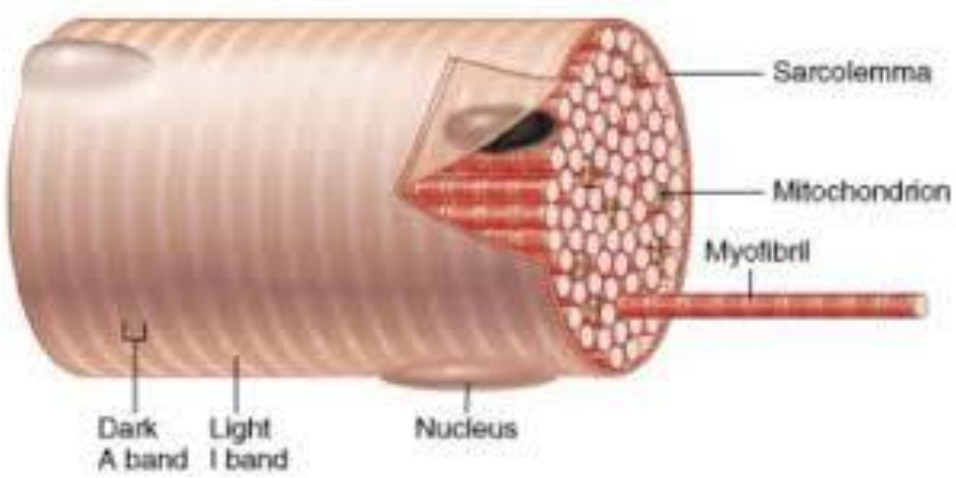
Muscle Fibres

- Voluntary muscles are made up of bundles of individual muscle fibres

Myofibrils - strands that grab onto one another to pull & make muscle contracts

Myoglobin – helps deliver O2 to muscle cells

Mitochondria - structures in muscle cells where respiration happens



- *3* types of voluntary muscle fibres:
- *Slow-twitch (type I)*
- *Fast-twitch muscle fibres (type IIa & IIx)*

- Different % of fibres in each individual which are inherit – can train to improve

Activity	Slow Twitch%	Fast Twitch %
Average human	50	50
Marathon runner	85	15
Weight lifter	15	85
Football player	35	65
Long jumper	25	75

Slow & Fast Twitch Muscle Fibres

Complete Worksheet 1.1.10

Type I: Slow twitch - aerobic work

EG Long distance running

Low intensity activity

Positives: High fatigue resistance - high myoglobin content

Negatives: Low speed & force of contraction

Type IIa: Fast twitch – aerobic & anaerobic work

EG 800m runners

Extended high intensity activity (30secs-2mins)

Positives: High speed & force of contraction, strength & speed endurance

Negatives: Not as fatigue resistant as type I & not as powerful as Type IIx

	Type 1	Type 11a	Type 11x
Force of Contraction	Low	High	Very High
Speed of Contraction	Slow	Medium	Fast
Fatigue Resistance	High	Moderate	Low
Aerobic or Anaerobic	Aerobic	Both	Anaerobic
Myoglobin	High	Medium	Low
Mitochondria	High	Medium	Low
Capillary Network	Good	Moderate	Low

Type IIx: Fast twitch - anaerobic work

EG 100m sprinter

Explosive activity

Positives: Very high speed of force & contraction

Negatives: Very low fatigue resistance due to rapid build up of lactic acid

Aerobic Training:

- Hypertrophy of slow twitch muscle fibres – Muscular Endurance
- Increased myoglobin content - improves 02 supply to muscles
- Increased size & strength of mitochondria – produces more energy anaerobically

Anaerobic Training:

- Hypertrophy of fast twitch muscle fibres
- Increased strength & power
- Increased tolerance to lactic acid

The Skeletal System & Muscular System Working Together

Main Functions in Sport: Movement, stability, protection & posture

- Muscular system is made up of more than 600 muscles, including voluntary/skeletal muscles
- The skeletal muscles connect to the bones and work with tendons and ligaments at a joint to allow movement.
- The muscles connect to the nervous system, which allows movement to start through nerve signals to and from the brain

- In the human body the musculo-skeletal system creates levers around every joint (fulcrum)

MOVE ONTO LEAVERS

Complete Worksheet 1.1.11B
Complete Quiz 1.1.11

Lesson 7: WALT

- Short Term Benefits on Exercise on Muscular System
- Long Term Benefits on Exercise on Musculo-Skeletal System
- Exam Questions & Revision

Lesson 6: WALT

- Short and long term effects

???Pop Quiz???

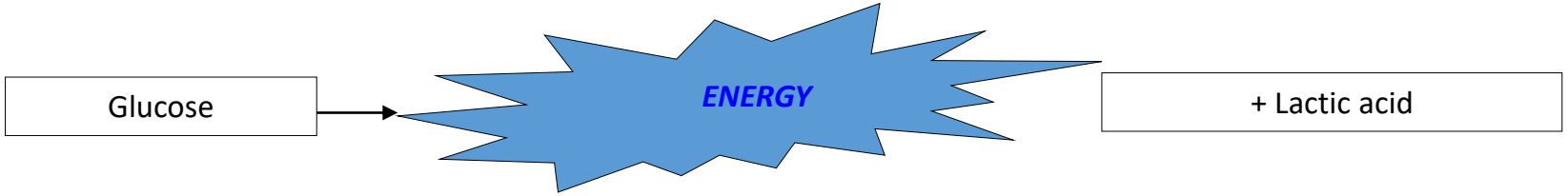
1) Name the 4 antagonistic pairs
2) Name the 3 bones of the arm
3) What are the 3 types of muscle fibres?
4) Choose one muscle fibre type and give a sporting example
5) List the 5 functions of the skeletal system

3 Short Term Effects of Exercise on the Muscular System

1. Muscle Fatigue – "When muscle get tired"

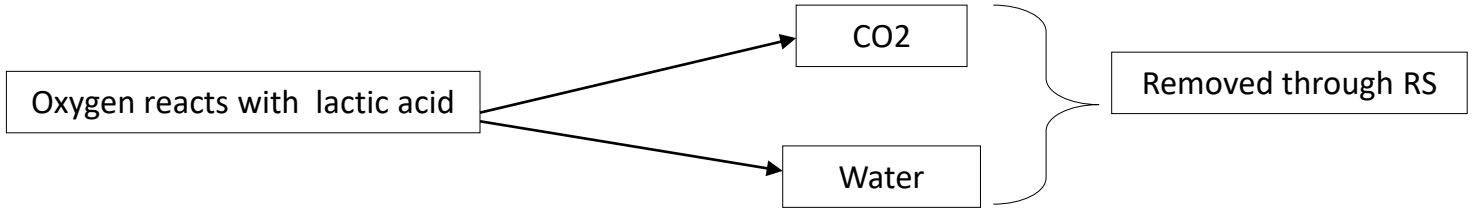
When muscle fatigue occurs, the muscles ability to produce force is reduced and can feel weak, painful & tired.

Muscle fatigue normally occurs during **anaerobic respiration** due a build up of **lactic acid** which causes



2. Lactate Accumulation – "When lactic acid gathers in the muscles/blood due to increased work intensity"

Leads to DOMS (delayed onset of muscular soreness) occurs if the lactic acid is not flushed out of the body



3. Cramp - Serve muscle fatigue which causes the muscle to spasm & over-contract in a painful way. Stop, hydrate and stretch

3 Long Term Effects & Benefits on Musculo-Skeletal System

1. Increased Bone Density – Prevents Osteoporosis

**** Rest for Adaptation & Recovery****

2. Increased Strength of Ligament & Tendons

3. Muscle Hypertrophy

Increased Muscular Strength
Increased Muscular Endurance
Increased Power = Muscular Strength x Speed

Apply Core Knowledge

1. Complete Quiz
2. Complete Questions in Purple Workbook
3. Complete Past Paper Questions

- What are the 5 functions of the skeletal system? (1 mark)
- List the 4 classification of bones & their functions? (2 mark)
- What are the 5 areas of the vertebral column and what are their functions? (2 marks)
- Give two examples of an antagonistic pairs (2 marks)
- What are the 4 types of synovial joint and where are they found? (1 mark)
- What are the 3 different types of muscle? (1 mark)
- Explain which types of muscle fibres suit Mo Farah as an endurance athlete and why? (2 marks)

Lesson 7

- Levers

???Pop Quiz???

1) Name the 3 short term effects of exercise on muscles
2) Name the 3 long term effects of exercise on muscles
3) What are the 3 types of muscle fibres? Sporting example of use?
4) What does DOMS stand for?
5) Name the 4 antagonistic pairs.

Lever Systems

2.1

Levers

The joints of our skeleton not only allow movement but they also act as levers.

When the muscles work with the skeleton. By pulling on the bones allowing movement of that body part. This may be to increase the speed of your own body (somersault/swimming) or an object such as a ball or shuttle.

Components of Levers

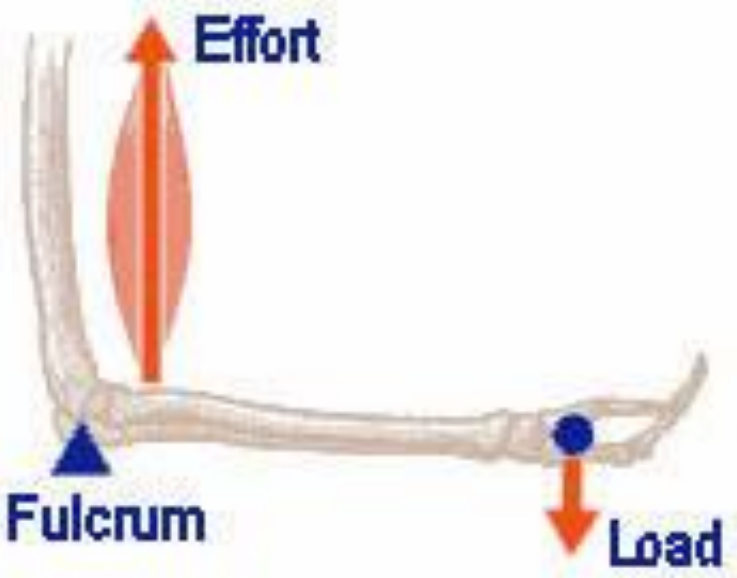
All levers have 4 parts:

•The **Lever**: A bone

• The **Fulcrum:** This is the point of movement, generally at the centre of a joint. (Pivot point)

• A **Load:** This is the body's weight or an external object (e.g. a bat or racquet). This will move as a result of the effort on the lever.

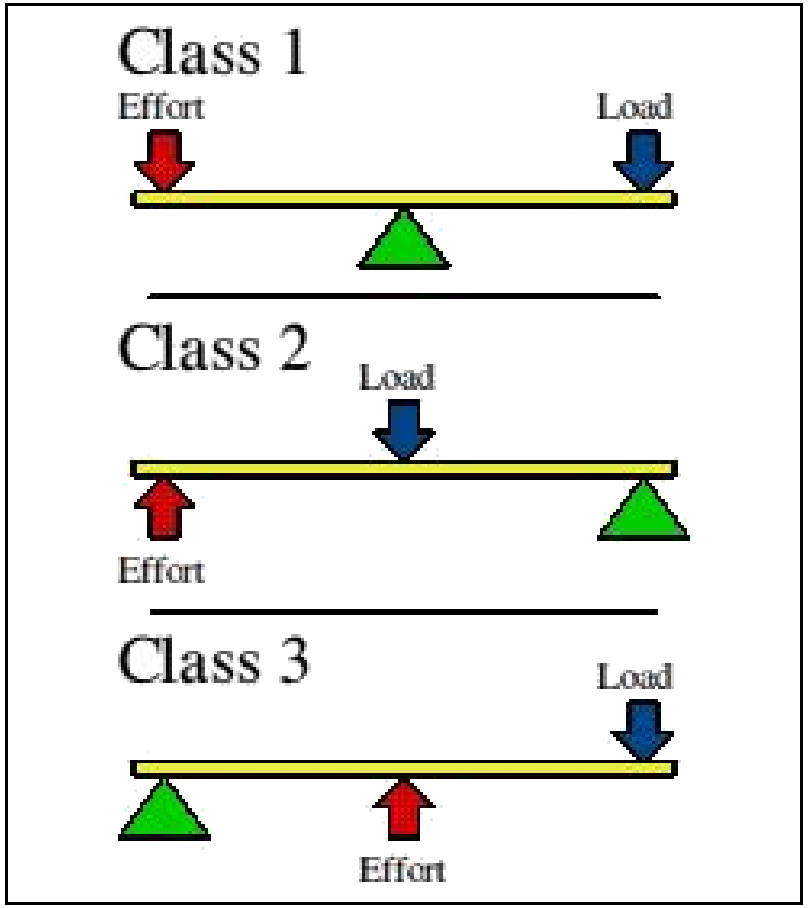
• An **Effort:** This is a muscular force that moves the load (e.g. the bicep muscle in a arm curl)



Classes/Types of Levers

There are three types of lever:

- 1st Class Levers
- 2nd Class Levers
- 3rd Class Levers



How to remember labels for levers

The capital letters represent the order the components appear on a lever:

EFL the ELF FEL over

OR

The letter below represents the component in the middle of the lever.

E.g. The fulcrum is in the middle of a 1st class lever, it doesn't matter which side the other two components are placed.

1 F

2 L

3 E

Lever Functions

- Levers have 2 main functions:
  - To move a load faster and further than is possible without a lever.
  - To move a heavier load than can be moved without a lever.
  - 1st and 2nd class levers work at a mechanical advantage (can lift a large load with relatively small amount of effort)
  - 3rd class levers work at a mechanical disadvantage (The effort and the load are on the same side of the fulcrum)

1st Class Levers

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

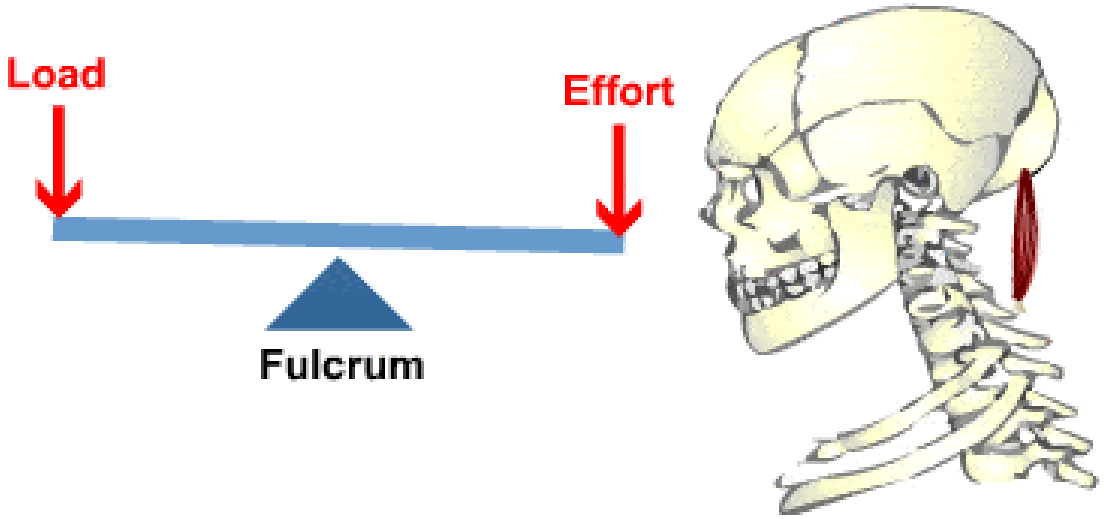
An **Effort:** This is a muscular force that moves the load.

Lever Description:

- The **fulcrum** is between the effort and the load.
- Both the **effort** and the **load** are in the same direction.
- They have a mechanical advantage.

Examples of this is when the head and neck are being extended and flexed (nodding).

Qu. How is a tricep dip an example of a 1st class lever?



1st Class Levers

An **example** of a first class lever is when the head and neck are being extended and flexed (nodding).

The neck joint (atlas and axis) is the **fulcrum.**

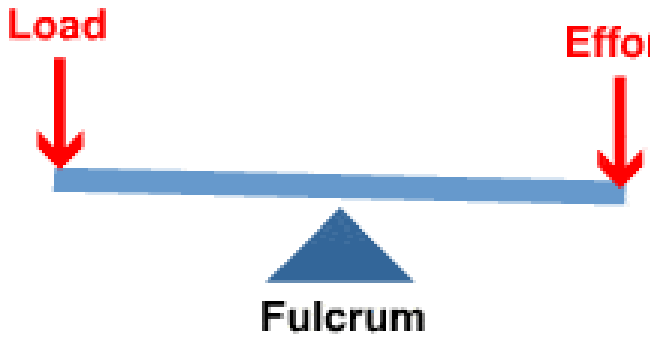
The **load** is the weight of the head coming down on the ball.

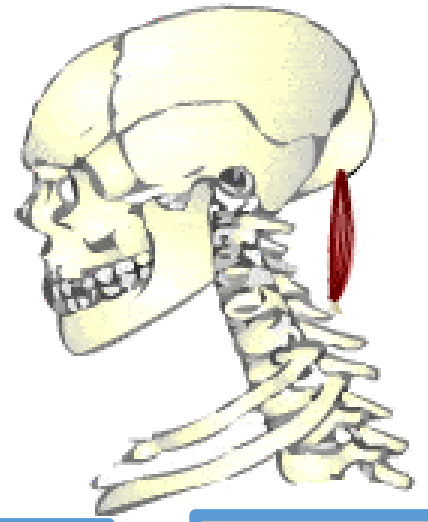
The **effort** is the muscles at the back of the neck pulling down.

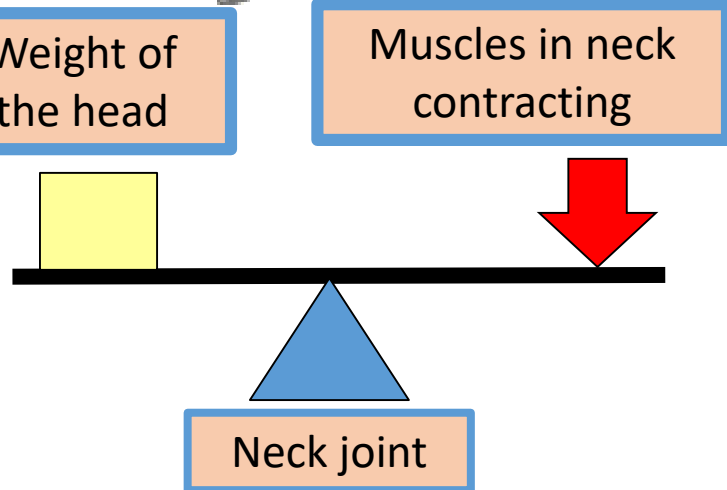
The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

An **Effort:** This is a muscular force that moves the load.





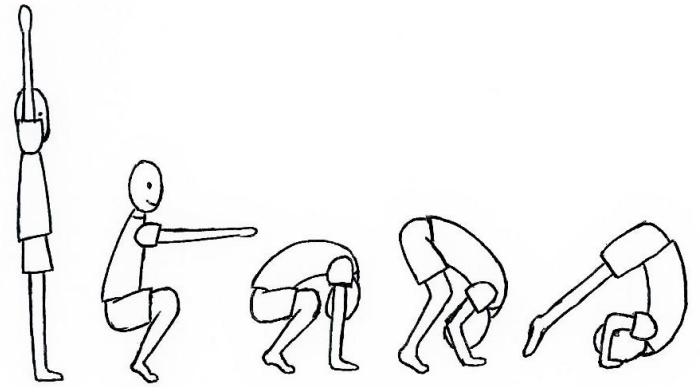


1st Class Levers
Sporting Examples

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

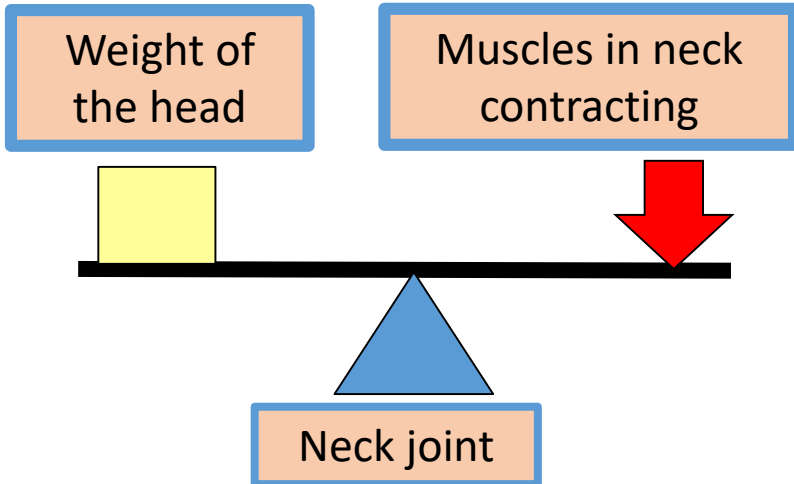
An **Effort:** This is a muscular force that moves the load.



A footballer moving their head forwards to head the ball.

A high jumper moving their head backwards to clear the bar and see the mat.

A gymnast tucking their chin to their chest to perform a forward roll.



2nd Class Levers

In second class levers:

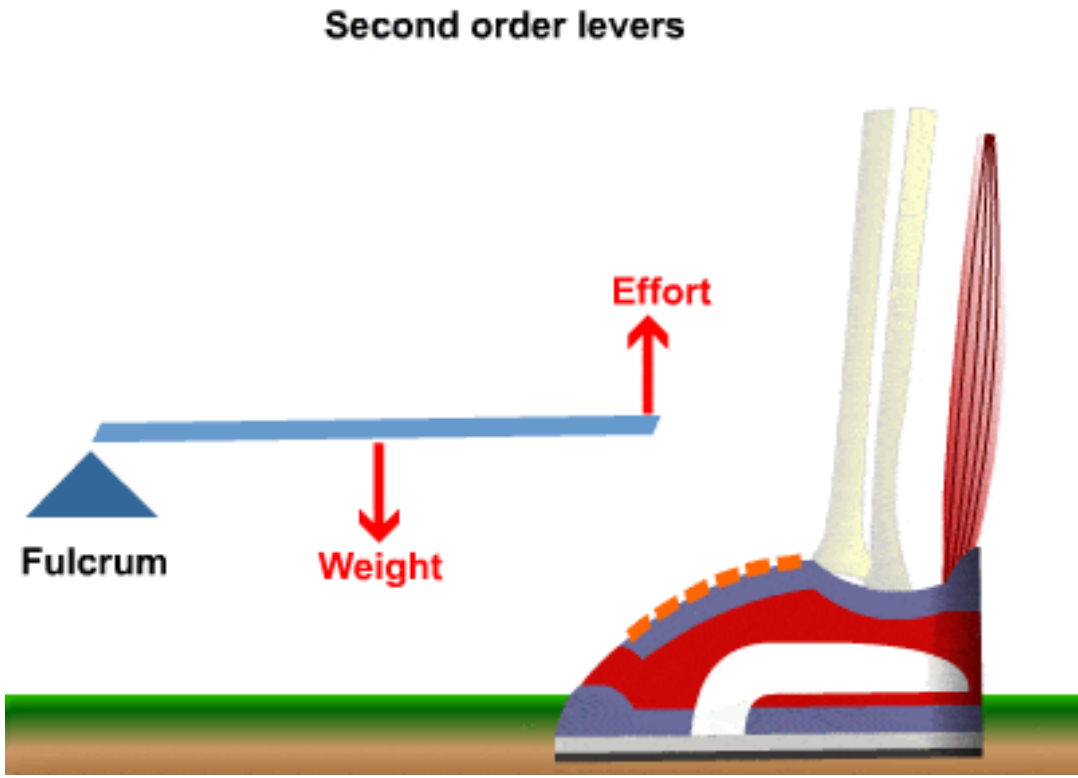
- The **fulcrum** is at one end of the lever.
- The **load** is in the middle of the lever.
- The **effort** is at the opposite end of the lever to the fulcrum with the direction of effort opposite to the load.

An example of this is stepping up onto your toes at the take off for long jump.

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

An **Effort:** This is a muscular force that moves the load.



2nd Class Levers

An **example** of a second class lever is stepping up onto your toes during calf raises.

The ball of your foot is the **fulcrum.**

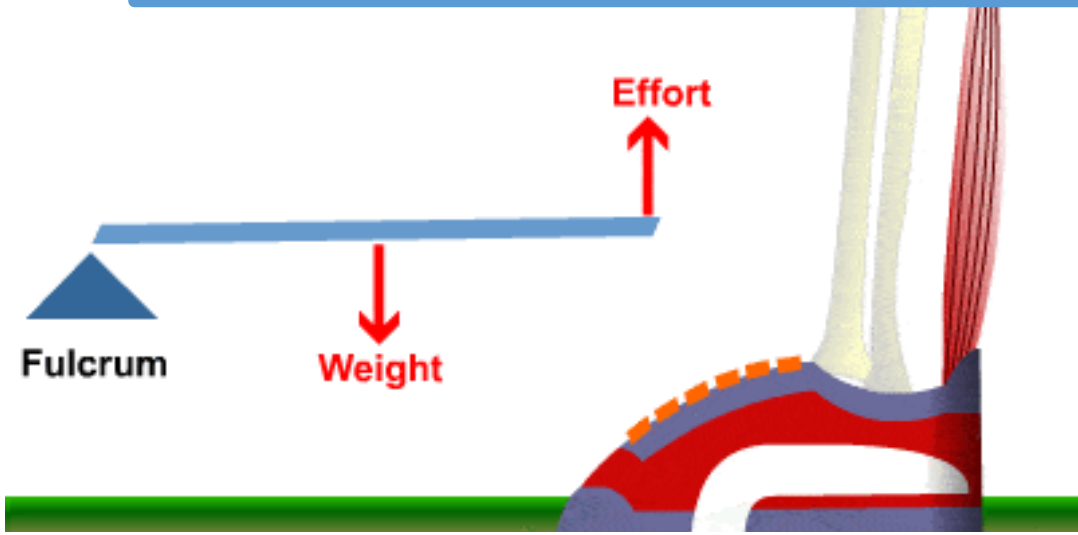
The **load** is the weight of the body going through the middle of the foot.

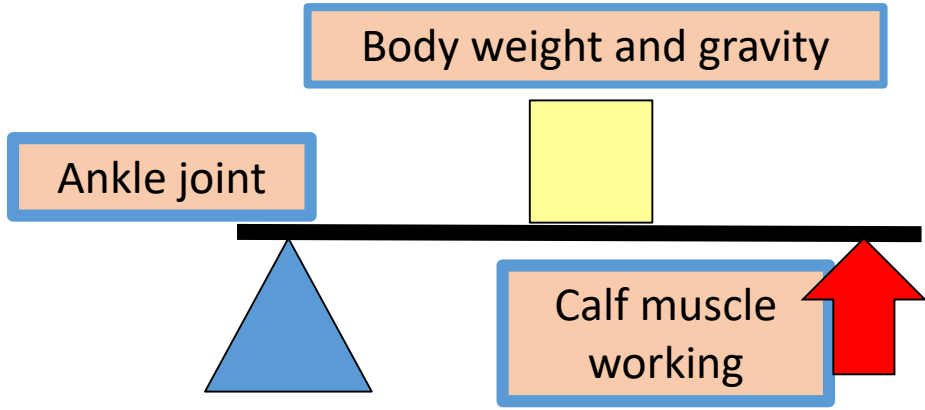
The **effort** is the gastrocnemius pulling the body up to the toes.

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

An **Effort:** This is a muscular force that moves the load.





2nd Class Levers Sporting Examples

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

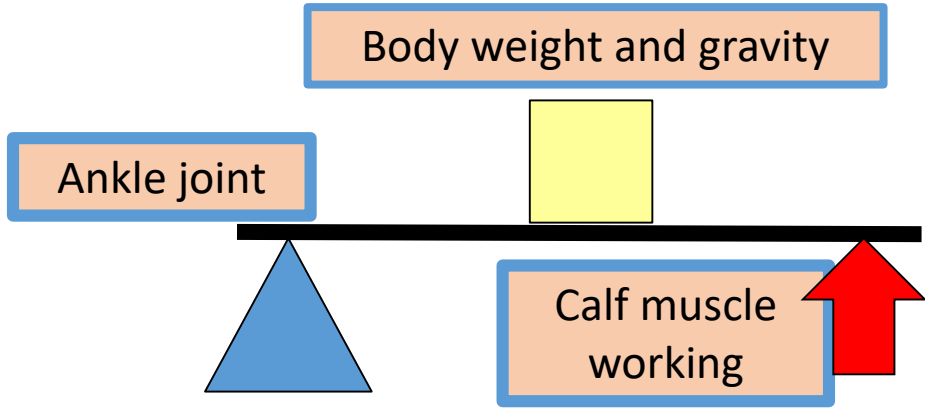
A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

An **Effort:** This is a muscular force that moves the load.

A diver on their tip toes at the edge of the board before their dive.

A long jumper going up onto their tip toes as they take off from the board.

A netballer standing on their tip toes to make themselves as tall as possible when defending.



3rd Class Levers

In third class levers:

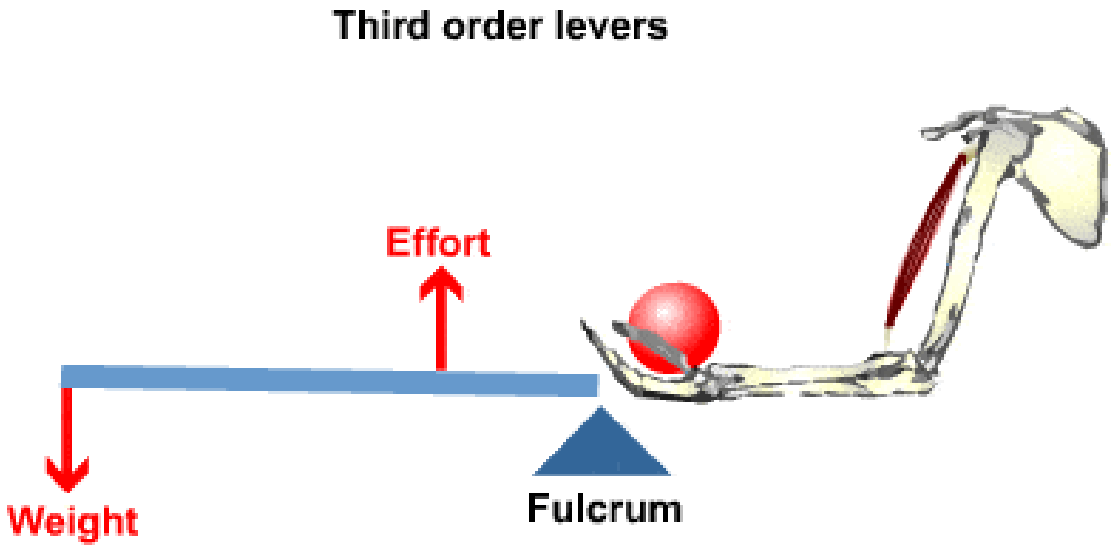
- The **fulcrum** is at one end of the lever.
- The **effort** is in the middle of the lever.
- The **load** is at the opposite end of the lever to the fulcrum.
- They have a mechanical disadvantage.
- They are the most common lever in the body.

An **example** of this is a bicep curl.

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

An **Effort:** This is a muscular force that moves the load.



3rd Class Levers

An **example** of a third class lever is a biceps curl.

The elbow joint is the **fulcrum.**

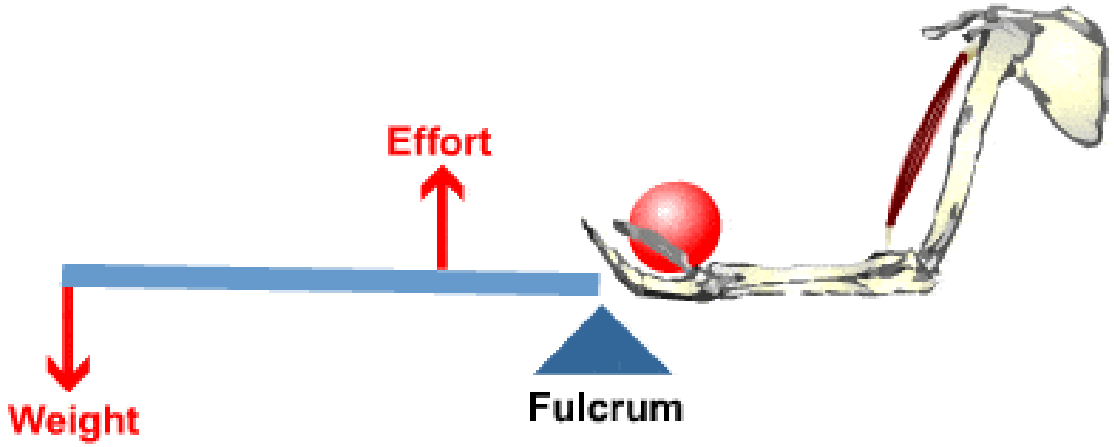
The **load** is the weight or object in the hand.

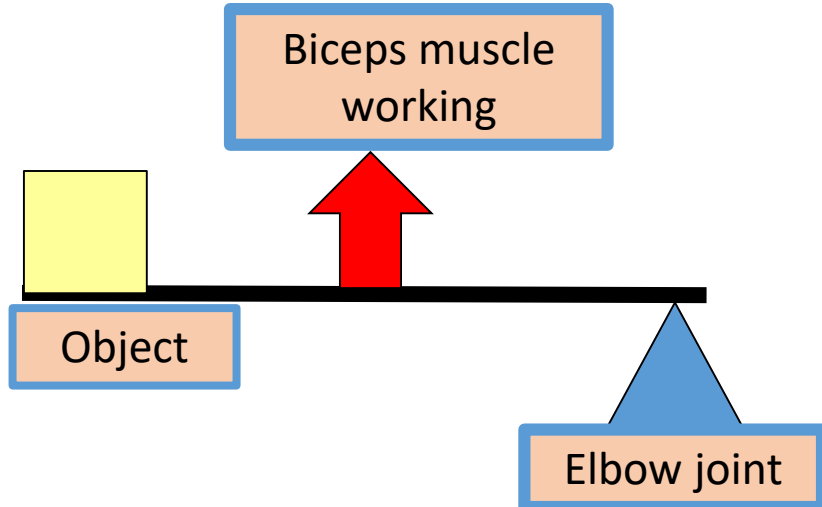
The **effort** is the biceps contracting to pull on the lower arm.

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

An **Effort:** This is a muscular force that moves the load.





3rd Class Levers
Sporting Examples

The **Fulcrum:** This is the point of movement, generally at the centre of a joint.

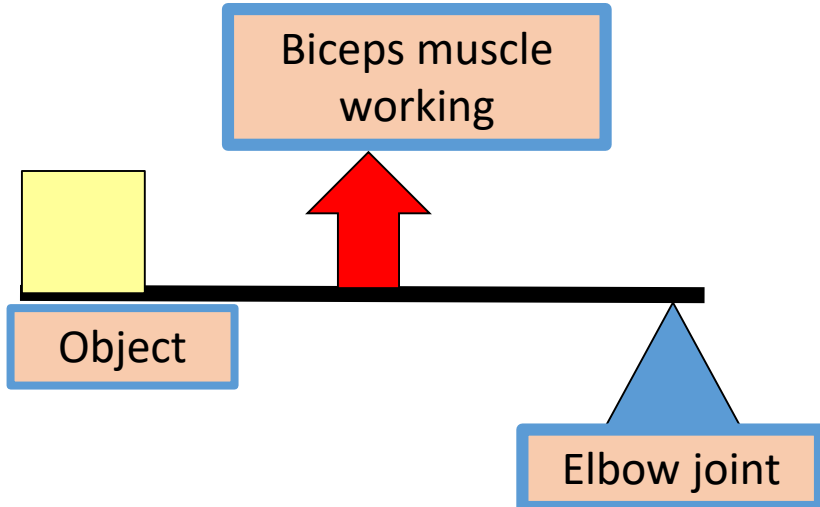
A **Load:** This is the body's weight or an external object (eg. a bat or racquet). This will move as a result of the effort on the lever.

An **Effort:** This is a muscular force that moves the load.

Somebody lifting the weight during a bicep curl.

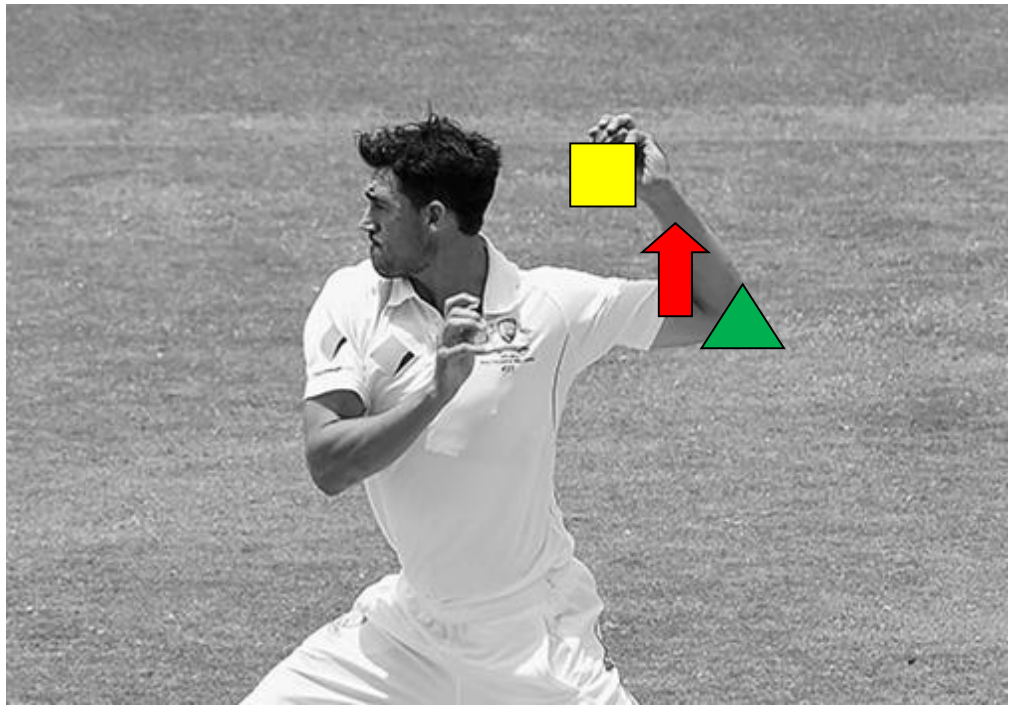
A javelin thrower as they bring their arm through to release the javelin.

A fielder in cricket as they bring their arm through to release the ball.

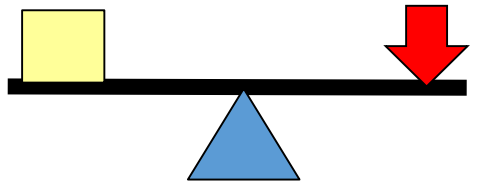


Identifying Levers

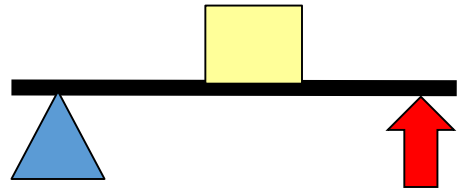
Task: Using the notes and diagrams in your booklet look at the photos and label them with the type of lever and the symbols for the fulcrum, load and effort. The first one has been done for you.



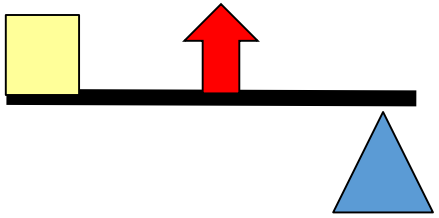
1st class levers



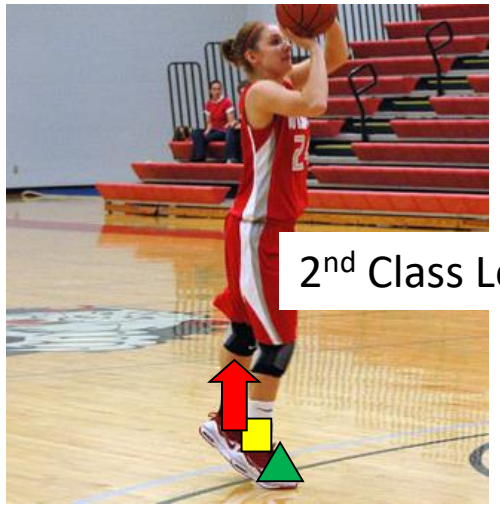
2nd class levers

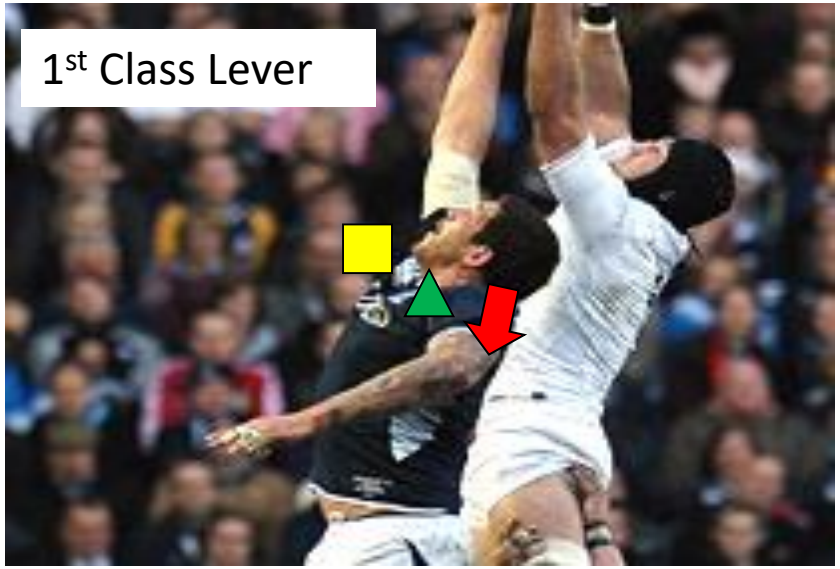


3rd class levers



Identifying Levers



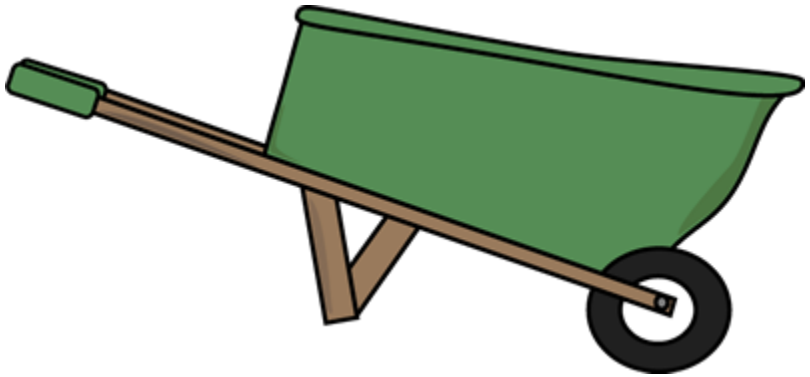


Mechanical Advantage

Levers are used to make a small amount of force into a bigger amount of force. This is known as gaining a mechanical advantage.

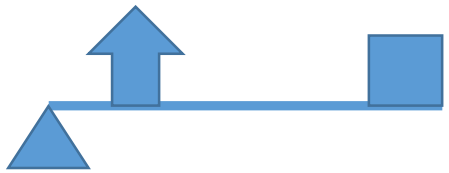
A mechanical advantage is when a lever allows you to move a large load with a smaller effort.

The longer the effort arm the greater the advantage e.g. 2nd class lever.



Mechanical Disadvantage

- Most levers in the body are **third class levers** where the resistance arm is always greater than the effort arm, this is called a **mechanical disadvantage.**



- The longer the resistance arm of the lever, the greater the speed at the end of it.

- It is important that when bowling or passing a ball the arm should be fully extended to generate more force with greater speed.

Advantages and Disadvantages of Levers

Lever	Advantages	Disadvantages
1st and 2nd class	Provides little effort to lift heavy loads	Small range of movement and cannot move load quickly
Due to the load being closer to the fulcrum than the effort		
3rd class	Provides speed and wide range of movement	Greater force is required than the load so the load can be moved
Due to the effort being closer to the fulcrum than the load		

Mechanical Advantage and Disadvantage

Class of Lever	Example	Sporting Example	Mechanical Advantage or Disadvantage?	Explanation
1st Class	Seesaw	Heading in football	Can be either	MA: Fulcrum is directly in the middle (Seesaw) MD: If the resistance arm is longer than the effort arm.
2nd Class	Wheelbarrow	Long jump take off	Mechanical advantage	The load is closer to the fulcrum than the effort making the resistance arm shorter than the effort arm.
3rd Class	Shovel	Bicep curl	Mechanical disadvantage	The effort is closer to the fulcrum than the load making the effort arm shorter than the resistance arm.

Exam Questions

2. There are not too many examples of first class lever systems in the body. State the component in the middle of a first class lever system. (1)

3. Give an example of a first class lever system in the body and its use in sport. (2)

4. Third class lever systems are common in the body. State the component in the middle of a third class lever system. (1)

Exam Questions

5. The picture above shows a performer at the start of a race. Identify, sketch and label the lever system operating at the ball of the foot during this sprint start.

6. Give an example of a third class lever system in the body and its use in sport. (2)

7. State the mechanical advantage provided by a second class lever. (1)

8. Explain the mechanical disadvantage and use an example from sport to support your explanation. (3)

9. The picture shows a basketball player running past his opponent. Name, sketch and label the lever system operating at the knee during the running action. (3)

Exam Questions

2. There are not too many examples of first class lever systems in the body. State the component in the middle of a first class lever system. (1)

Fulcrum

3. Give an example of a first class lever system in the body and its use in sport. (2)

Atlas and Axis in the neck as the head moves forward to play an attacking header in football.

Fulcrum: Atlas and Axis

Load: Weight of the head

Effort: Muscles of the neck

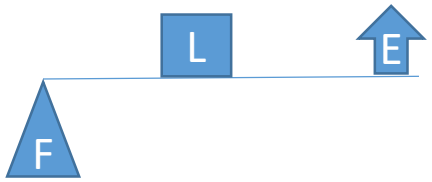
4. Third class lever systems are common in the body. State the component in the middle of a third class lever system. (1)

Effort

Exam Questions

5. The picture above shows a performer at the start of a race. Identify, sketch and label the lever system operating at the ball of the foot during this sprint start. (3)

Second Class Lever



6. Give an example of a third class lever system in the body and its use in sport. (2)

Found at the knee when the leg extends when running.
Fulcrum: Knee
Load: Weight of the leg
Effort: Quadriceps

7. State the mechanical advantage provided by a second class lever. (1)

They make it easier to move a heavy load

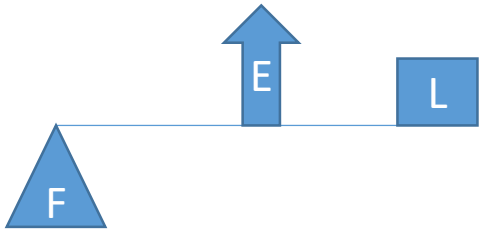
Exam Questions

8. Explain the mechanical disadvantage and use an example from sport to support your explanation. (3)

Where more effort is needed to move a load then the size of the load. The effort required to bicep curl 5kg is greater than 5kg because the effort is closer to the fulcrum than the load being lifted.

9. The picture shows a basketball player running past his opponent. Name, sketch and label the lever system operating at the knee during the running action. (3)

Third class lever



Lesson 8

- Planes and Axes of movement

Planes and Axes of Movement

Planes and Axes of Movement

- There are three planes of motion in which we move. Most of our movements are not straight up and down, or side to side etc, especially in sports. They tend to combine a mixture of movements in different planes.

- Which different types of movements can you see in this video?

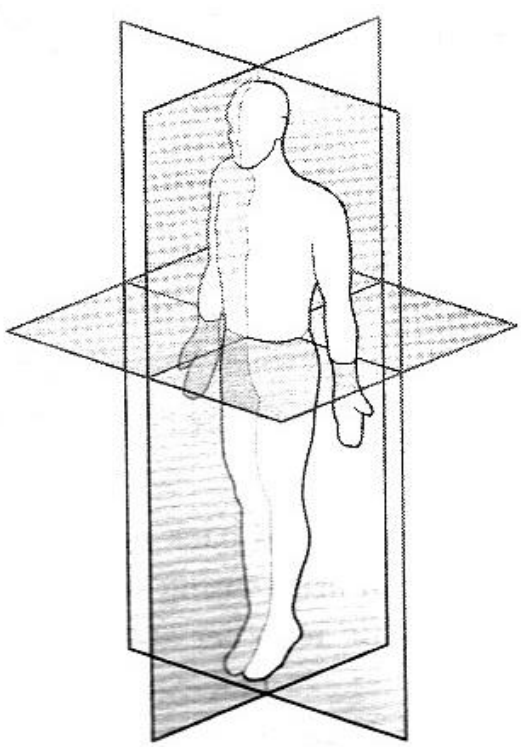
https:// www.youtube.com/watch?v=kWeecKjJb6s

Planes of Movement

To help explain movement, the body can be viewed as having a series of imaginary slices/glass panes running through it.

These are referred to as **planes of movement**.

https://www.youtube.com/watch?v=iP7fpHuVaiA

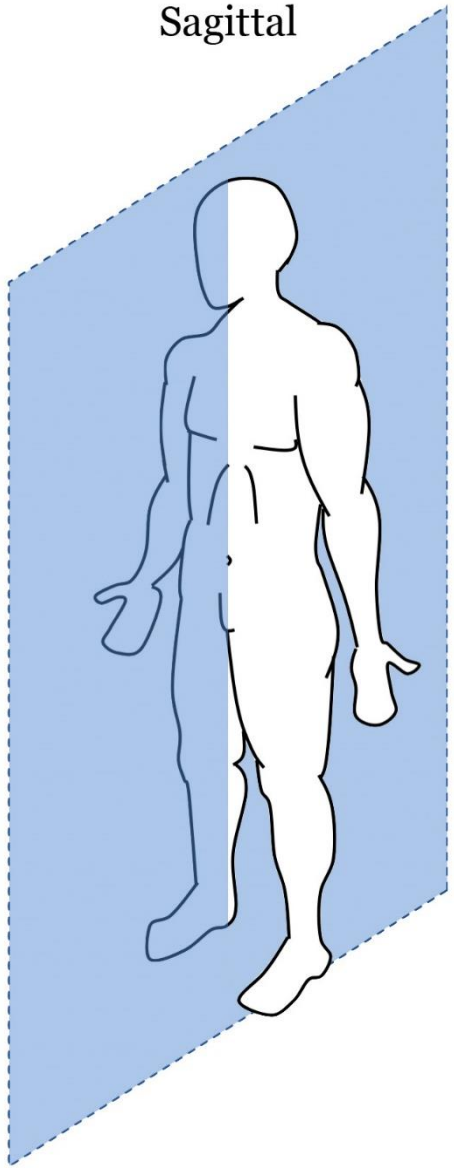


The Sagittal Plane

The **Sagittal Plane** is a vertical plane that divides the body into right and left sides.

Movements that take place in this plane are the up and down movements of **flexion** and **extension.**

S**porting example**: Somersault



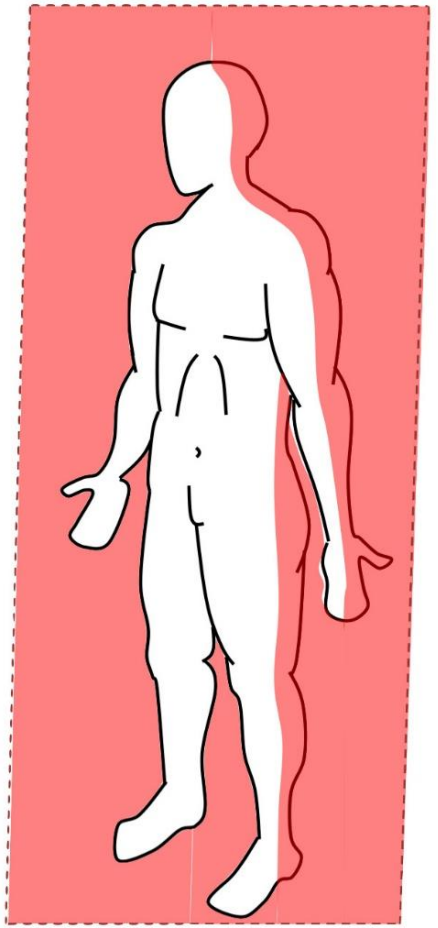
The Frontal Plane

The **Frontal Plane** is also a vertical plane but it divides the body into front and back.

Movements that take place in this plane are sideways movements of abduction and adduction.

A **sporting example** includes abduction or adduction of the hip joint.

For example a cartwheel.

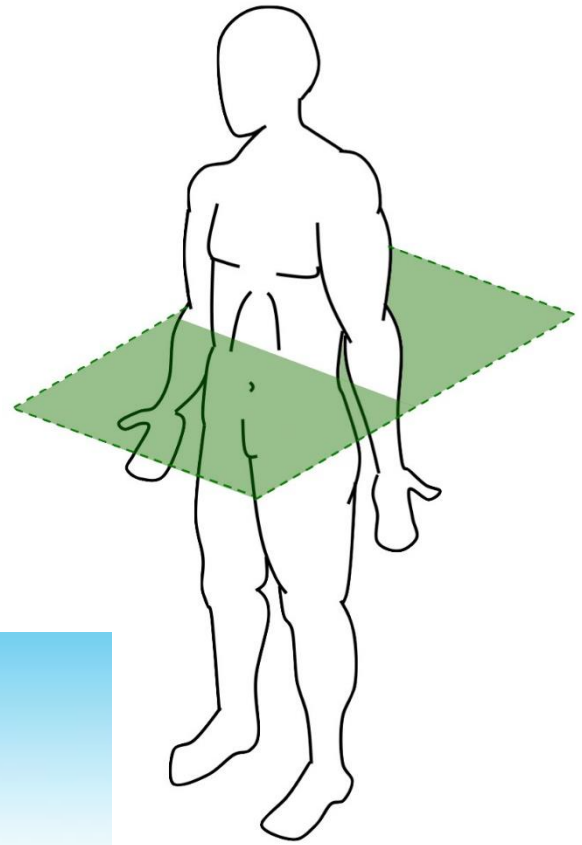


The Transverse Plane

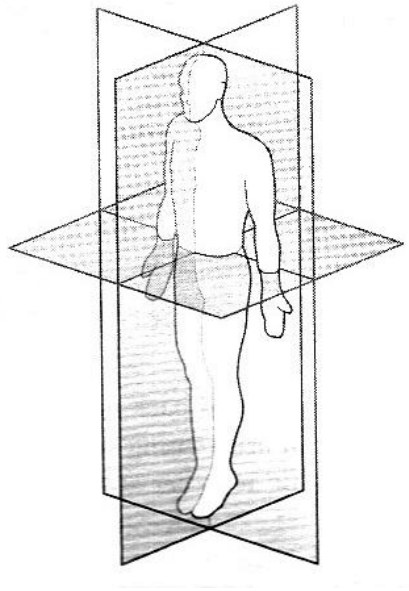
The **Transverse Plane** is a horizontal plane that divides the body into upper and lower halves.

Movements that take place in this plane are **rotational**.

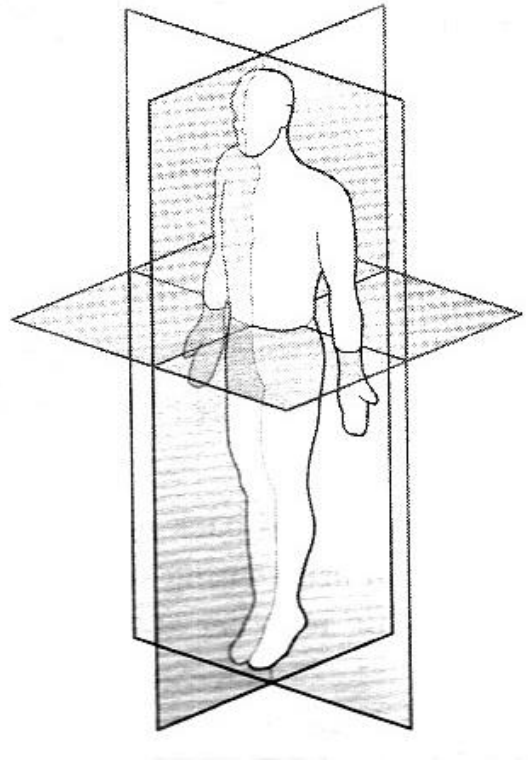
Sporting example: Full twist in trampolining.



Planes of Movement in Sport - Questions



Planes of Movement in Sport - Answers



Frontal

Sagittal

Sagittal

Transverse

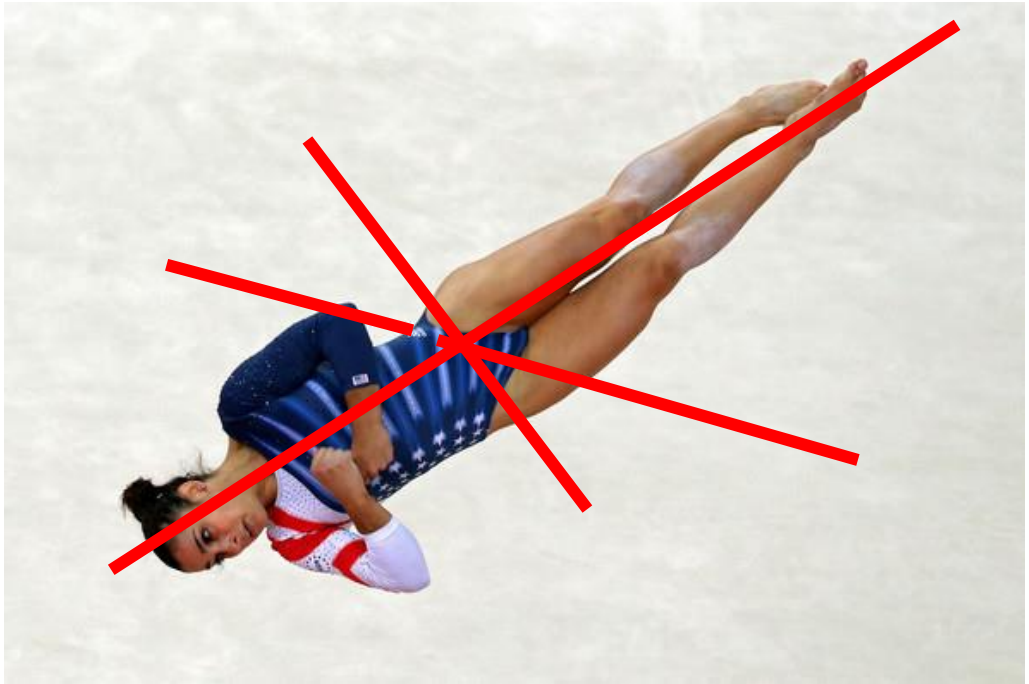
Frontal

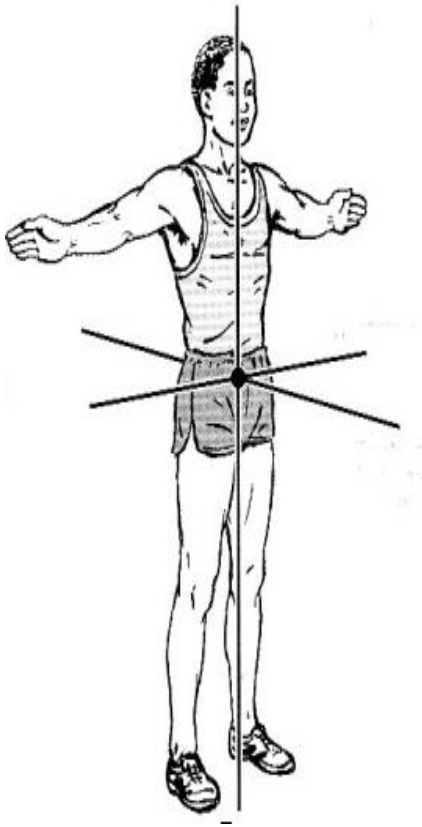
Transverse

Axes of the Body

Axes are like invisible skewers running through the body.

All movements rotate around one of the axes.

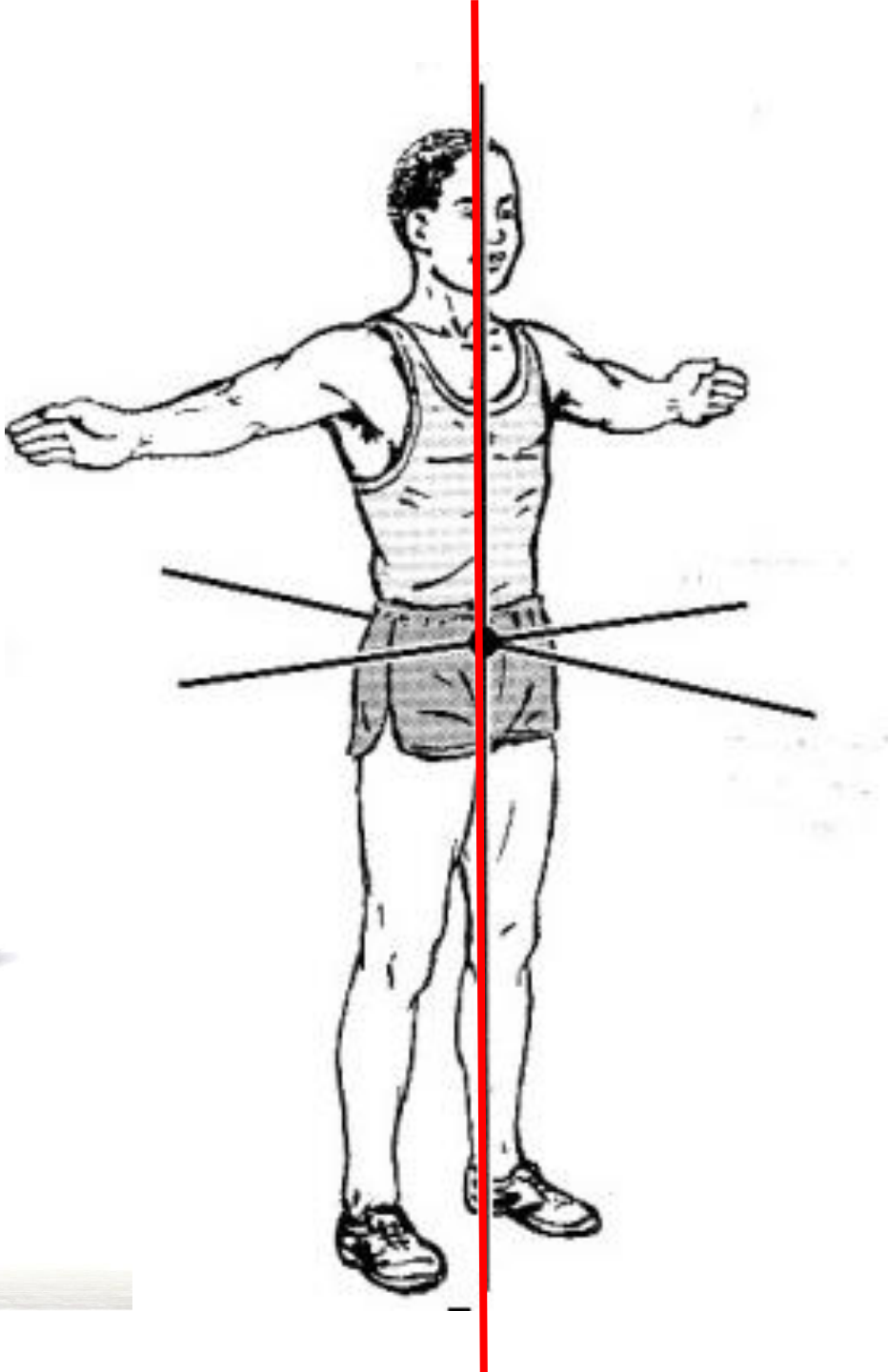




Vertical Axis

The **vertical axis** runs through the body vertically from the top to bottom.

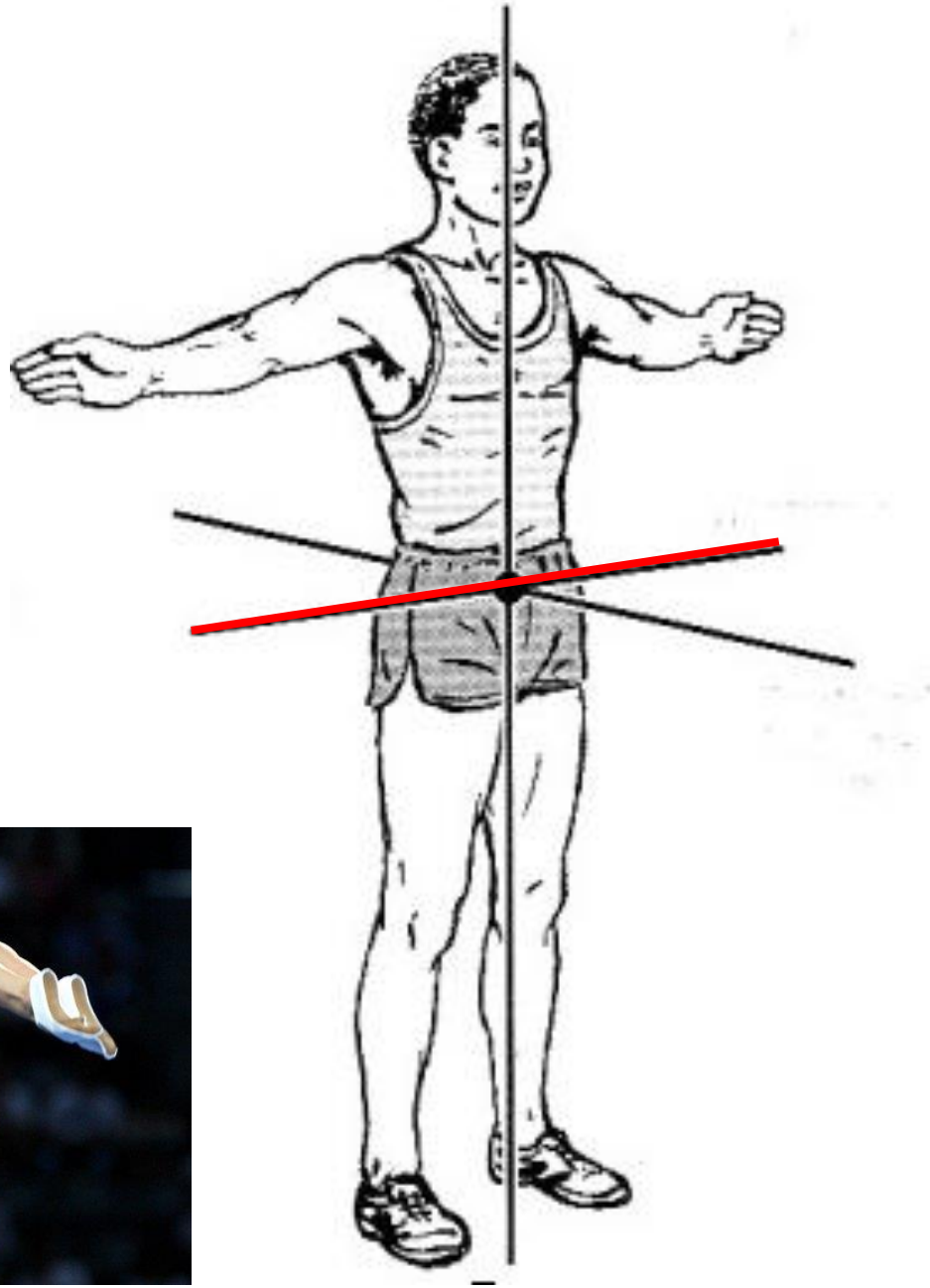
A **sporting example** includes performing a pirouette (full twist) in dance.



Frontal Axis

The **frontal axis** runs through the body horizontally from the left to right.

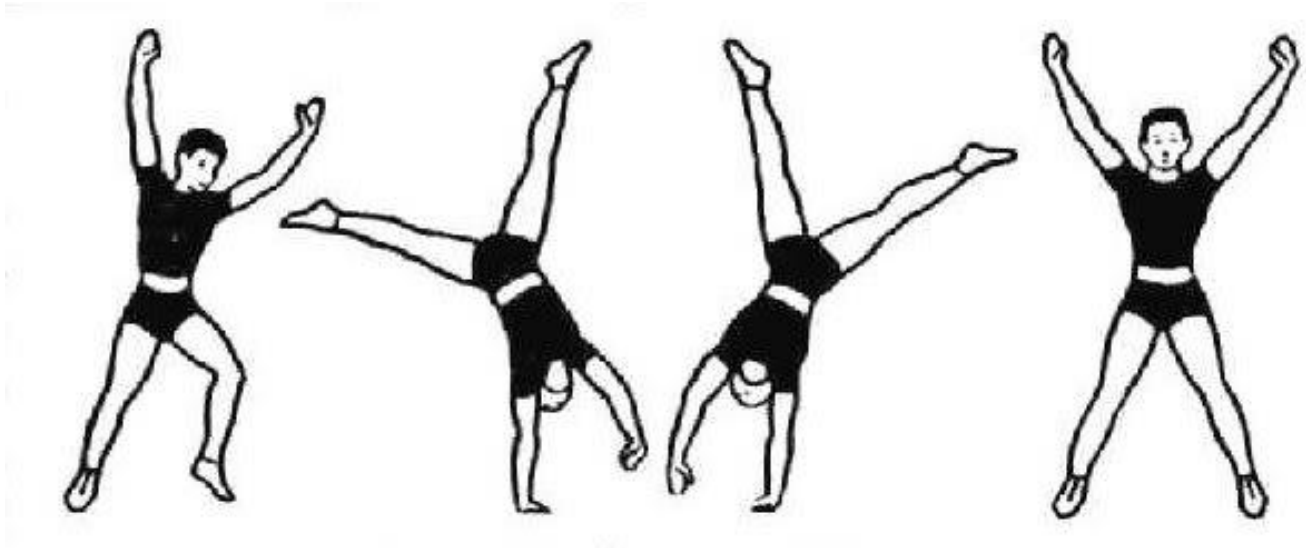
A **sporting example** includes performing a somersault in gymnastics or trampolining.

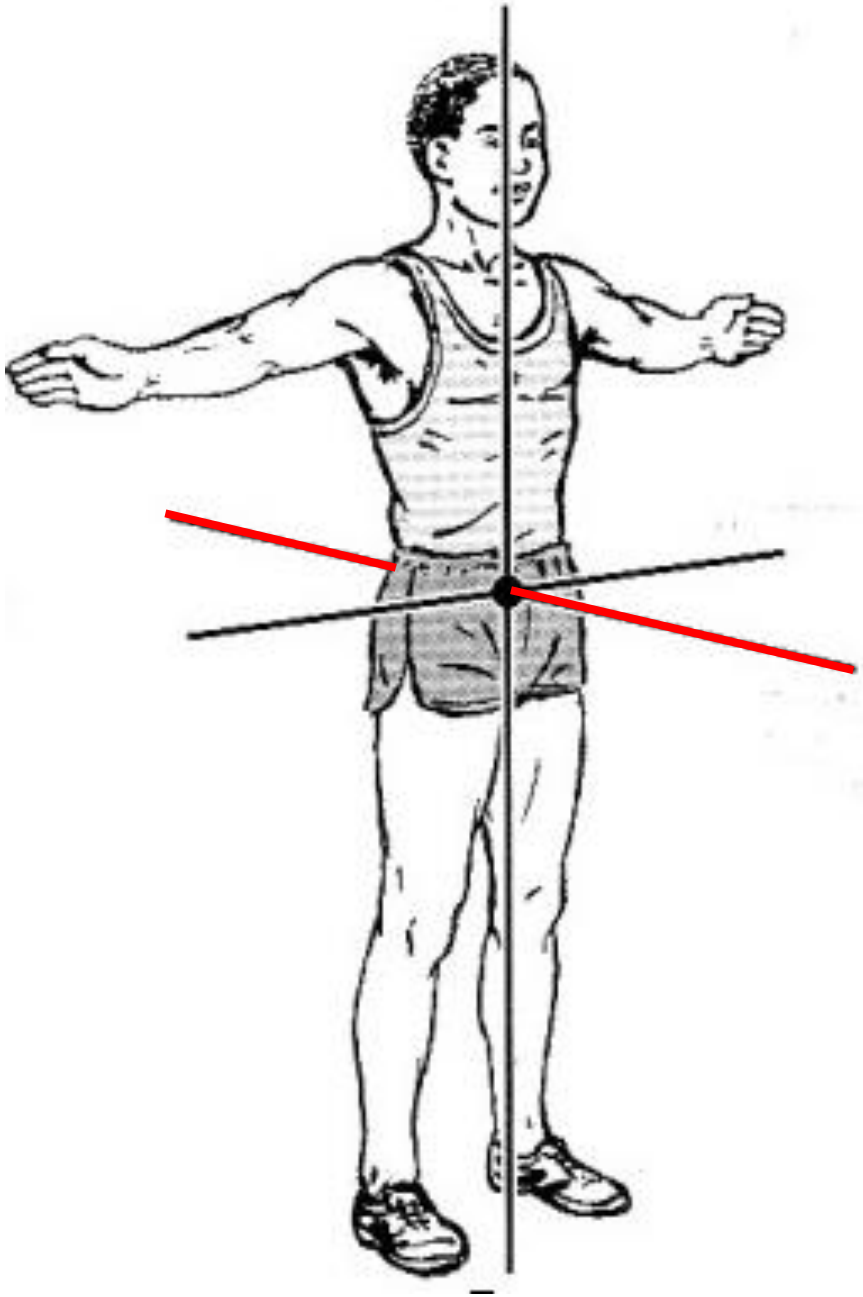


Sagittal Axis

The **sagittal axis** runs through the body horizontally from the back to front.

A **sporting example** includes performing a cartwheel in gymnastics.





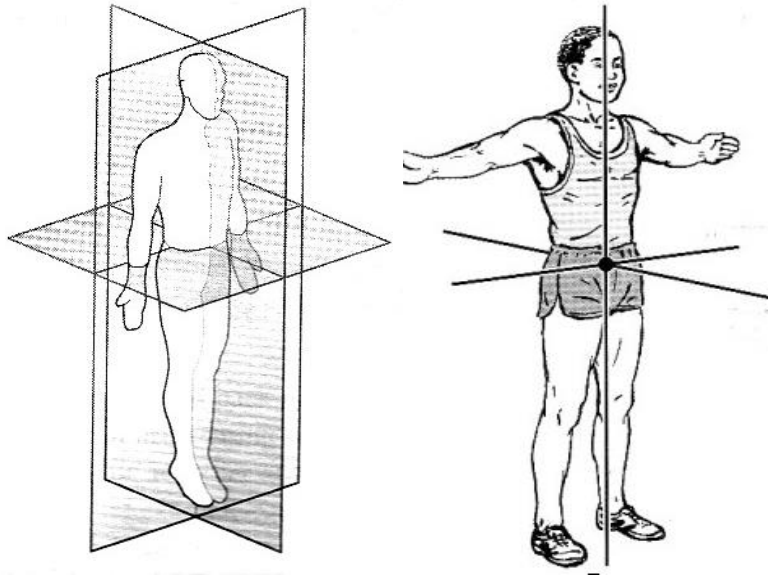
Golden Rules

- Movement in the **sagittal plane** can only be around the **frontal axis**.
- Movement in the **frontal plane** can only be around the **sagittal axis.**
- Movement in the **transverse plane** can only be around the **vertical axis.**

The sagittal plane and axis go through the body at the same point (belly button)

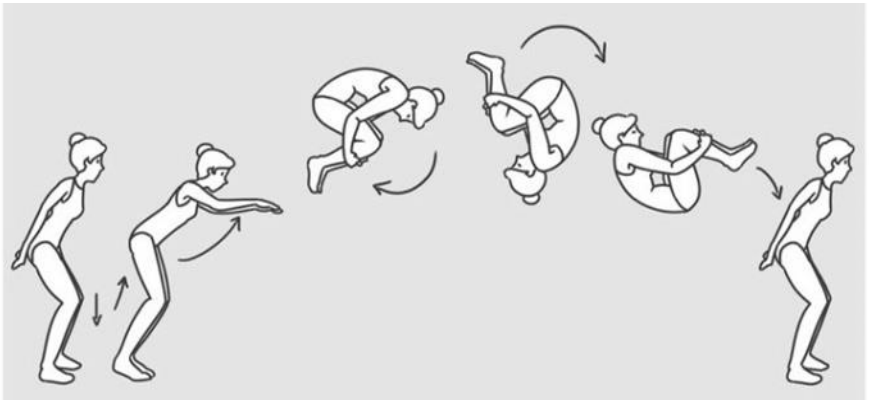
The frontal plane and axis go through the body at the same point (hips)

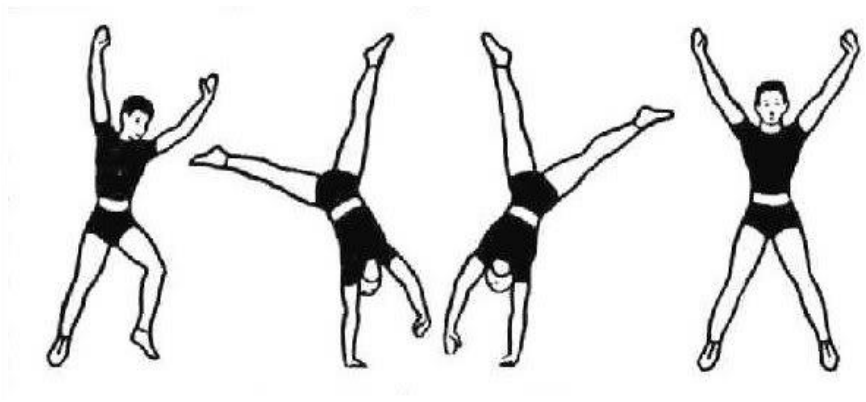
Planes and Axes Combined

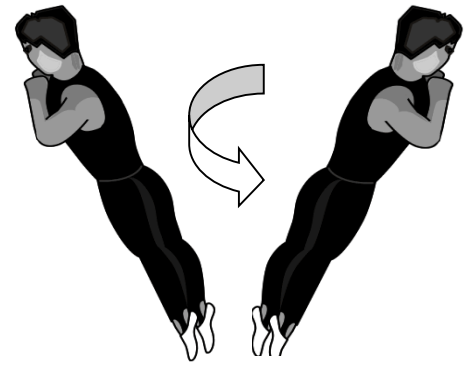


- Each movement involves movement in a plane that is around an axis.

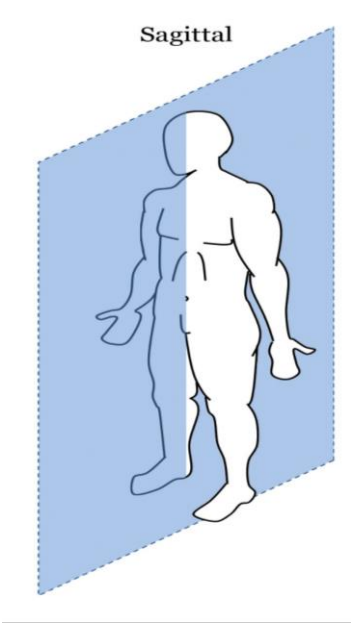
- **Task:** Using all your notes from this unit, with your partner discuss which plane and axis you think these movements take place in. Colour in the correct plane and highlight the axis. These are the three movements you need to know.

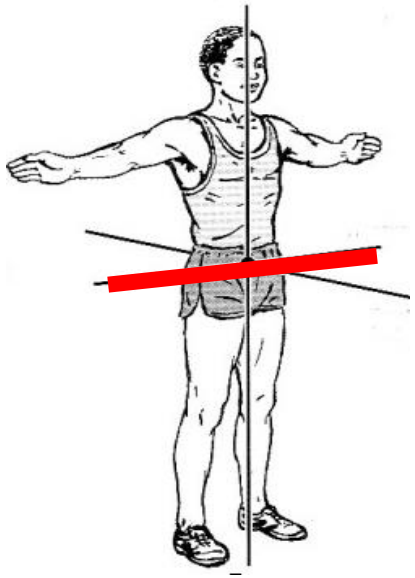




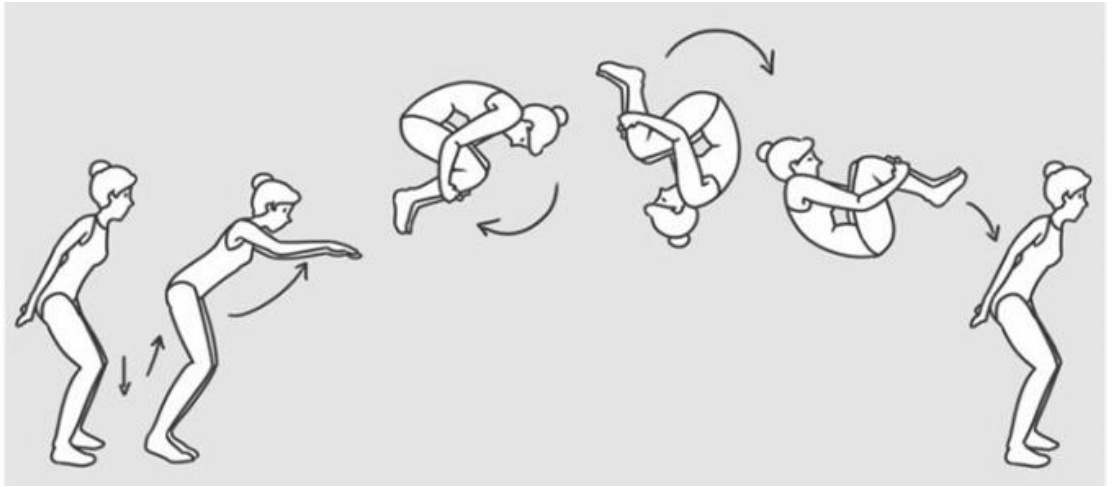


Planes and Axes Combined

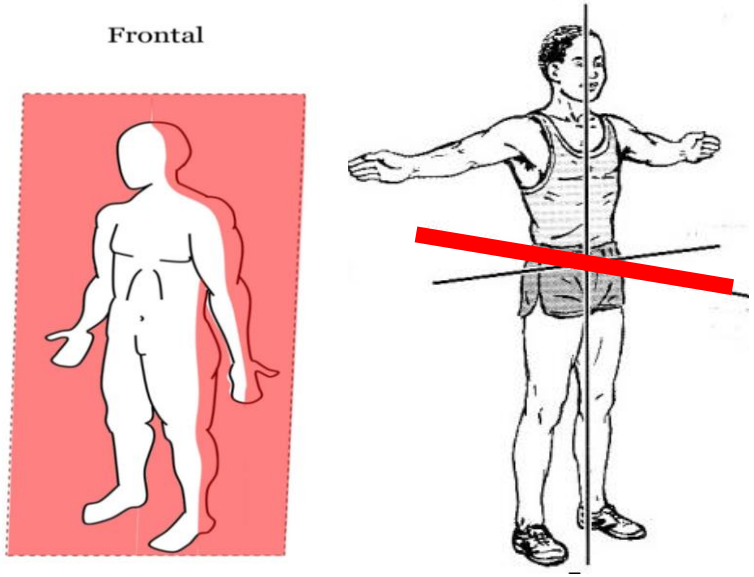




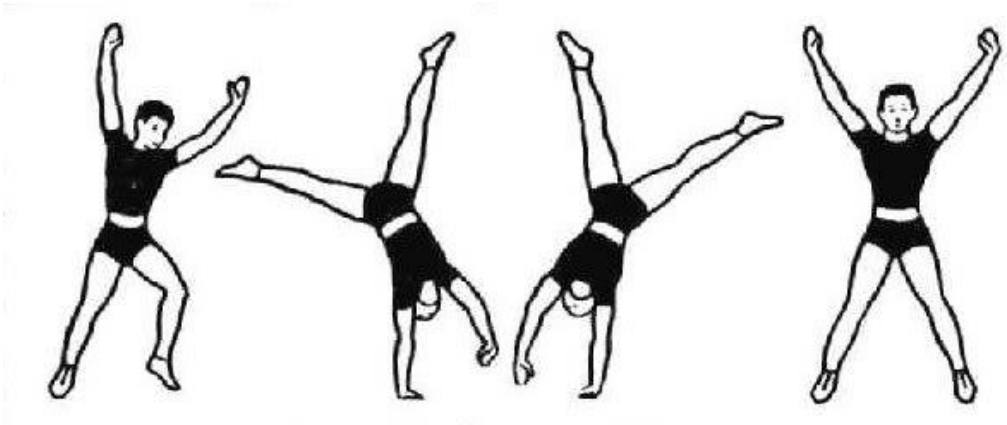
- Movement: **Somersaults/Forwards Roll**
- Plane of Movement: **Sagittal**
- Axis of Rotation: **Frontal**



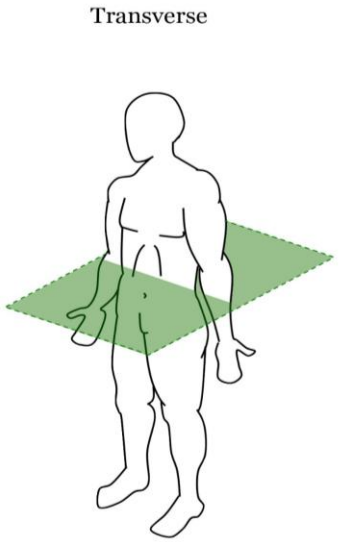
Planes and Axes Combined

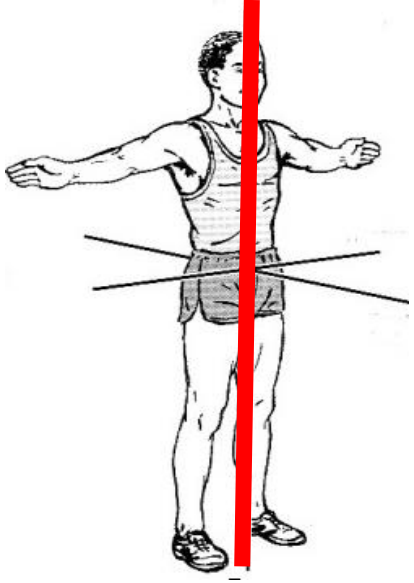


- Movement: **Cartwheel**
- Plane of Movement: **Frontal**
- Axis of Rotation: **Sagittal**

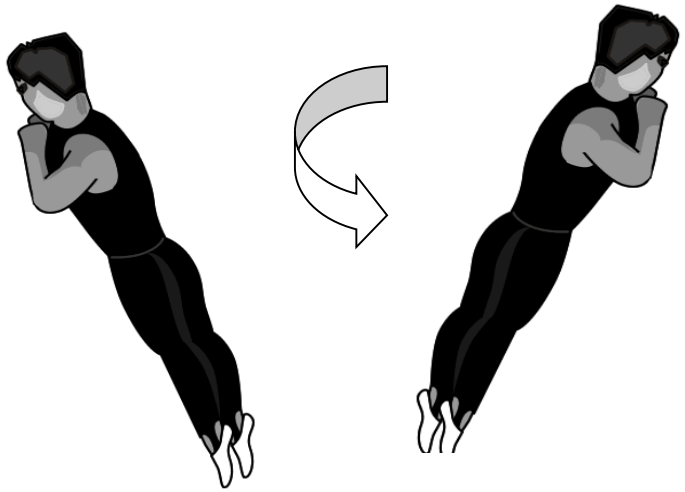


Planes and Axes Combined





- Movement: **Full Twist**
- Plane of Movement: **Transverse**
- Axis of Rotation: **Vertical**



Practice Exam Questions

1. Give an example of where each lever is found in the body, and an example of a sporting action in which it is used. (3)

First class _____

Second class _____

Third class _____

2. Which one of the following describes a second class lever system? (1)

a. The load is at the right hand end of the lever

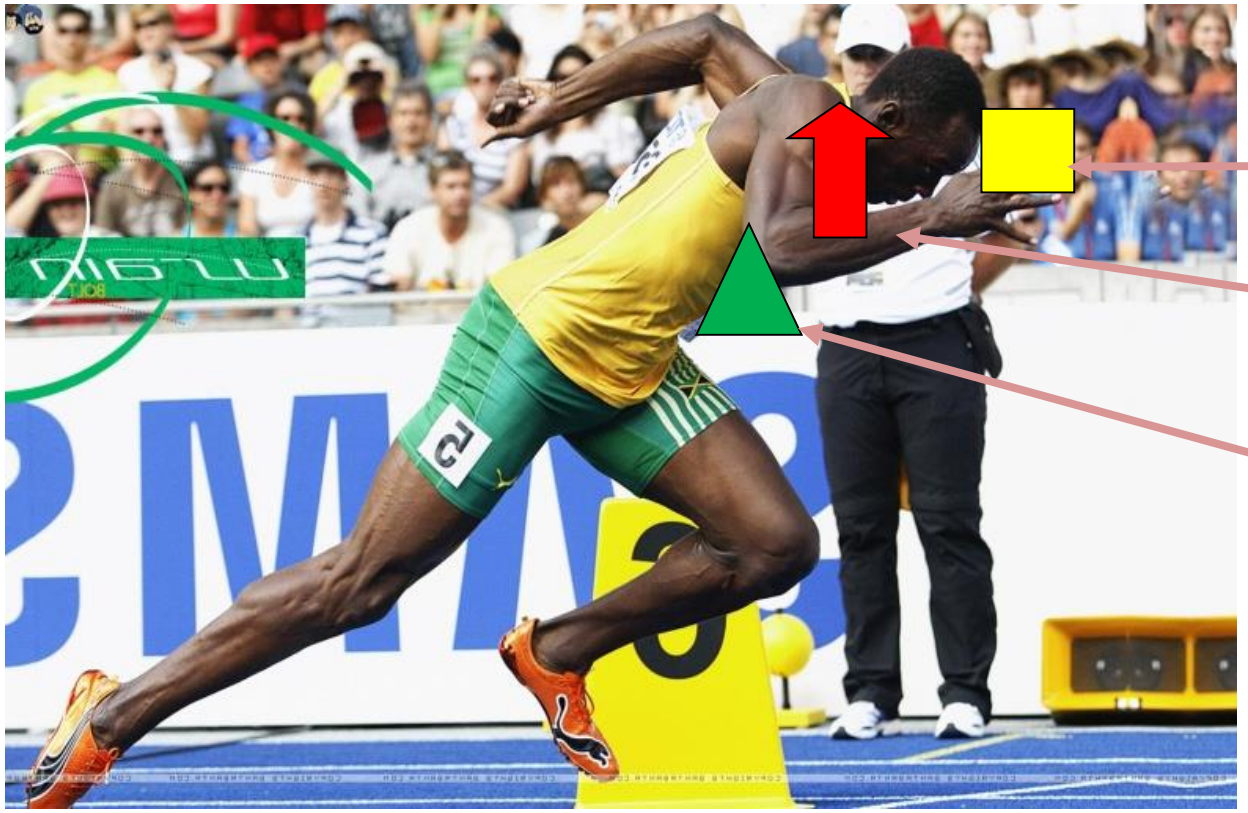
b. The fulcrum is in the middle of the lever

c. The load is in the middle of the lever

d. The load and the fulcrum are at the same point on the lever

Practice Exam Questions

3.Label the lever system below. (4)



Lever Class: _____

Practice Exam Questions

4. Describe the following parts of the lever system and discuss how they allow the performer to lift the weight.

The Fulcrum (2)

The Effort (2)

Practice Exam Questions

1. Give an example of where each lever is found in the body, and an example of a sporting action in which it is used. (3)

First class **The neck joint. This is used to head a football.**

Second class **The ankle joint. This is used to stand on tip toes to mark a player in netball.**

Third class **The elbow joint. This is used to lift a weight during a bicep curl.**

2. Which one of the following describes a second class lever system? (1)

a. The load is at the right hand end of the lever

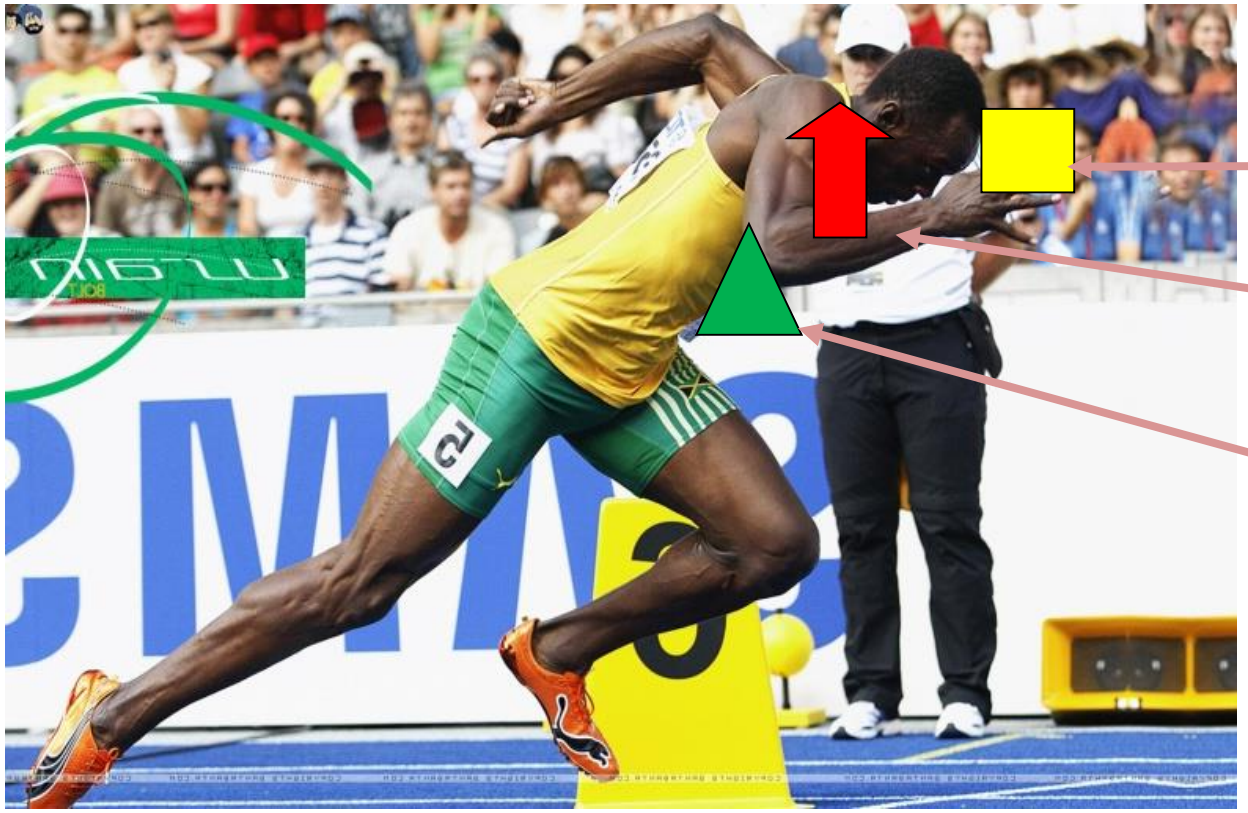
b. The fulcrum is in the middle of the lever

c. The load is in the middle of the lever

d. The load and the fulcrum are at the same point on the lever

Practice Exam Questions

3.Label the lever system below. (4)



Lever Class: Third

Load

Effort

Fulcrum

Practice Exam Questions

4. Describe the following parts of the lever system and discuss how they allow the performer to lift the weight.

1 mark for linking bone of muscle to component of lever system and 1 mark for linking it to its use in the biceps curl.

The Fulcrum (2)

The Fulcrum is the elbow (1) this allows the arm to bend/flex (1)

The Effort (2)

The biceps muscle provides the effort (1) which allows the weight lifter to lift the weight (1)

The structure and functions of the Cardio-respiratory system

Lesson 1: WALT

- Functions of the respiratory system
- Composition of air
- Pathway of air
- Mechanics of breathing
- Definitions

Pop Quiz

1. Name the 5 functions of the skeletal system.
2. Name the 2 muscles of the arm
3. Draw the 3 classes of levers
4. Which lever has a mechanical disadvantage?
5. Name the 3 planes and 3 axes of the body.

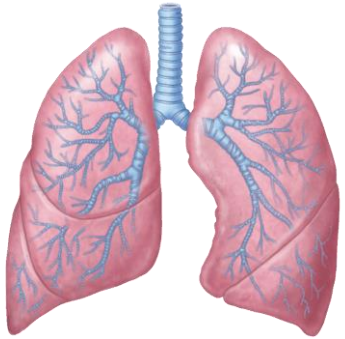
Cardio-Respiratory System

Is the interaction of the heart and lungs to supply oxygen to the muscles during exercise.

To understand the cardio-respiratory system we need to look at both the cardiovascular system and respiratory system.

Respiratory System

Functions of the respiratory system



1. Brings oxygen into the body to help produce energy aerobically.

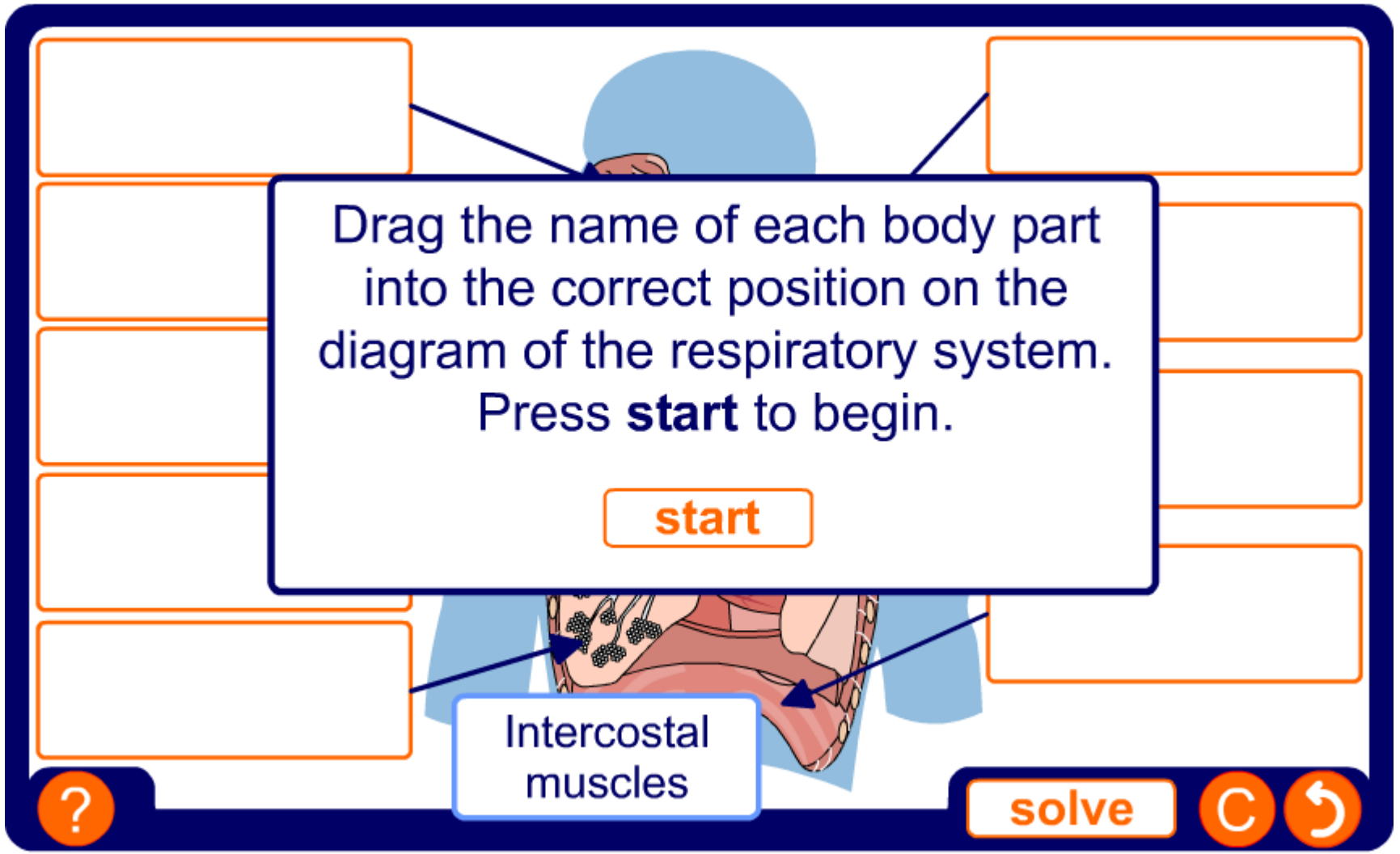
2. Expels carbon dioxide, a waste product that is created in the muscles when exercising.

Composition of Air

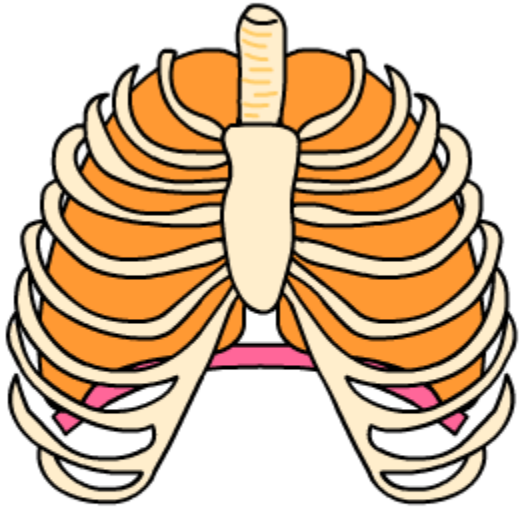
Gas	Amount in inhaled air	Amount in exhaled air
Oxygen	21%	16%
Carbon dioxide	0.04%	4%
Nitrogen	78%	78%
Other gases	0.96%	2%

Hairs filter the air.
Moist & Heat???

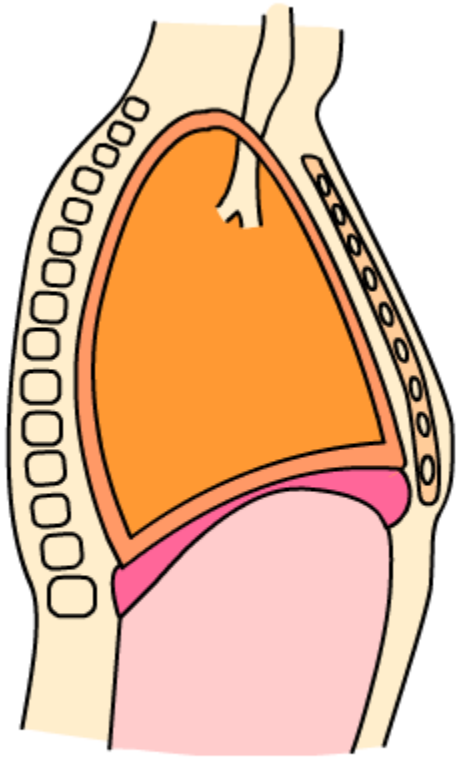
Pathway of air



Breathing in



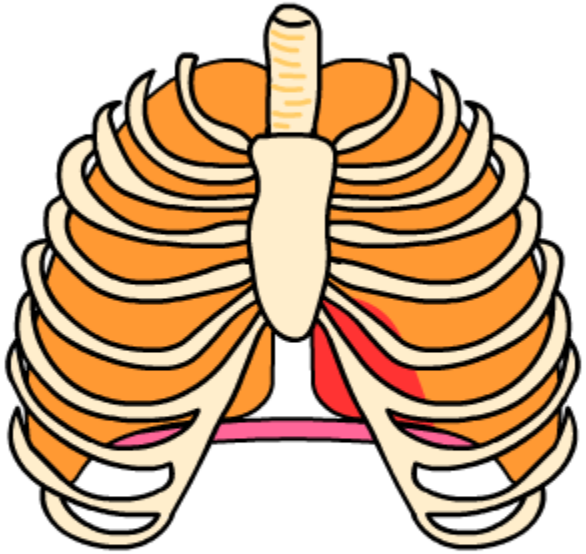
Front view of chest

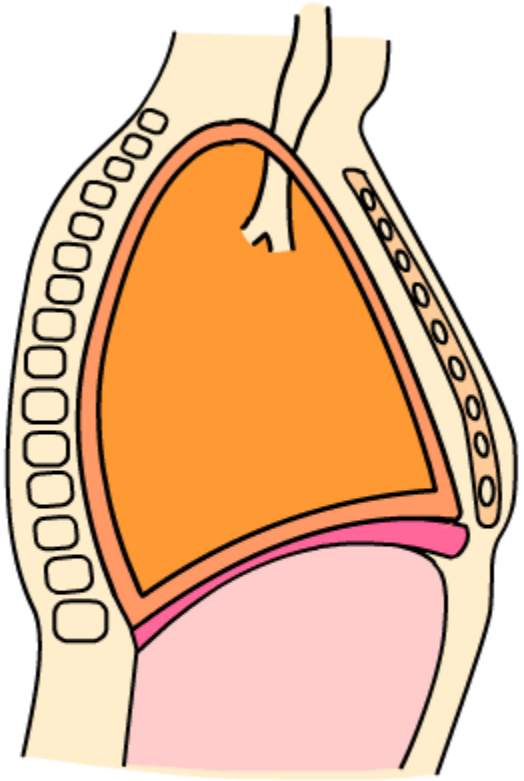


Side view of chest

AIR PRESSURE INSIDE LUNGS DROPS FALLS FORCING AIR INTO LUNGS

Breathing out





Front view of chest

Side view of chest

AIR PRESSURE INSIDE THE LUNGS RISES FORCING AIR OUT OF LUNGS

Lung Volume: The capacity of the lungs. (How much air they can the hold)

Tidal Volume: "The amount of air inspired & expired with each normal breath at rest or during exercise."

(During exercise your TV will increase due to the increased demand for oxygen and the need to remove carbon dioxide).

Vital capacity: "The greatest amount of air that can be made to pass into & out of the lungs by the most forceful inspiration & expiration." (5 litres)

(Expiratory reserve Vol = Max out) (inspiratory reserve Vol = Max in)

http://www.teachpe.com/anatomy/respiratory_volumes.php lung spirometry graph

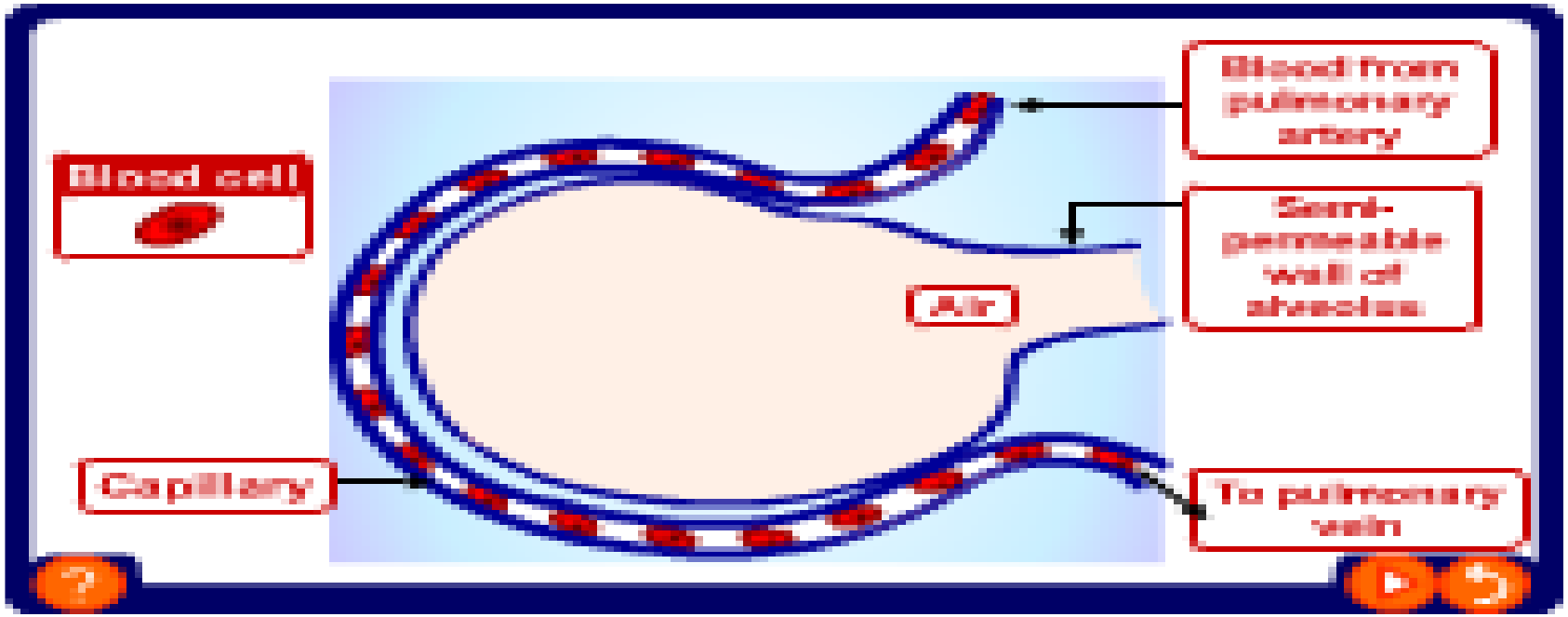
Lesson 2: WALT

- Gaseous exchange and diffusion
- Aerobic respiration
- Anaerobic respiration
- Oxygen Debt

Pop Quiz

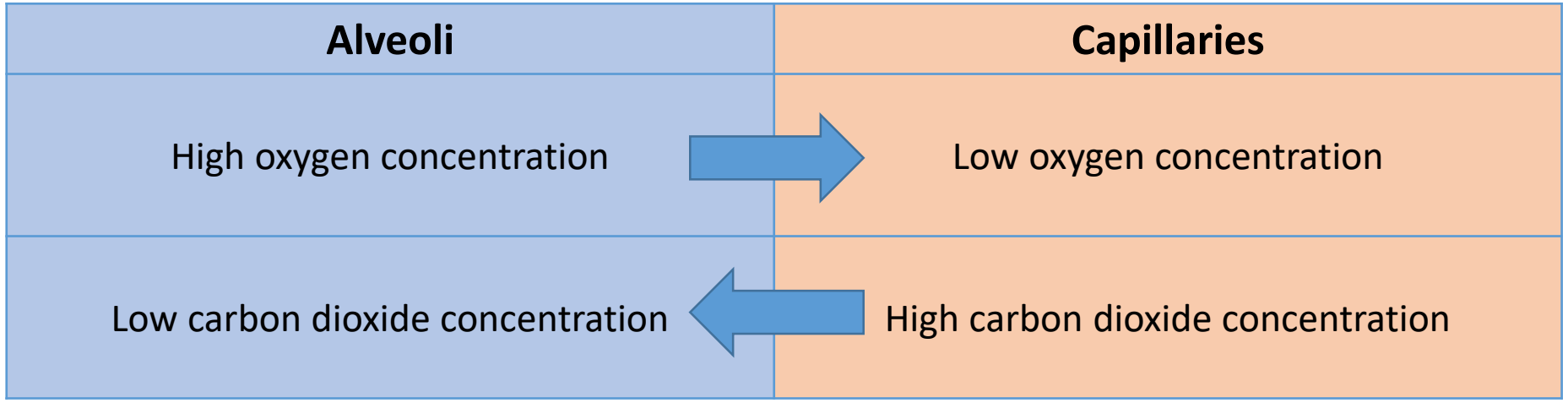
1. Name the 4 classifications of bones
2. List the 4 muscles in the leg
3. Define tidal volume
4. What joint movements take place in the frontal plane?
5. What are the functions of the respiratory system?

Gaseous exchange

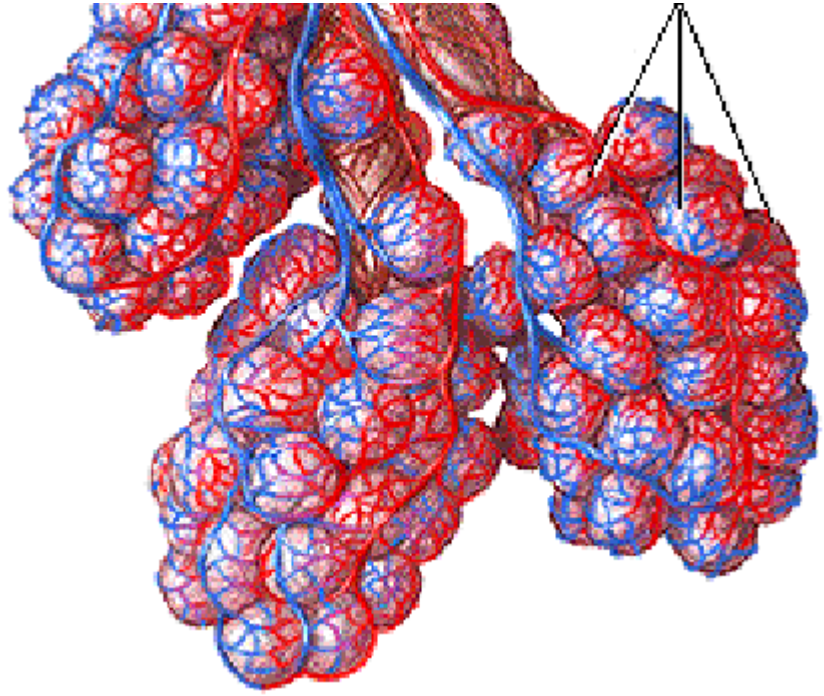


In order to understand gaseous exchange you need to know the process of diffusion.

- Molecules move from an area of high concentration to an area of low concentrate to reach a balance.



- The cardiovascular system needs the respiratory system to be efficient at removing O2 from the air. The most important part of the respiratory system is the alveoli.
- There are around 400 alveoli in your lungs, providing a massive surface area for diffusion to take place
- Alveoli have moist thin walls, perfect for gases to diffuse through
- Capillaries and alveoli are wrapped very close together



Gaseous exchange during exercise

Gaseous exchange is greater during exercise due to

- Higher concentration of oxygen in the alveoli to the blood, blood to muscles.
- Higher concentration of carbon dioxide muscles to blood, blood to alveoli.

Aerobic Respiration

Aerobic energy production takes place in the presence of oxygen

The body will be able to work aerobically if the intensity of the activity is moderate or low. E.g. marathon running, endurance cycling or long distance swimming.

Aerobic energy production can use **carbohydrates** or **fats** as a fuel source.

Glucose + oxygen → energy + Co2 + water

Glucose and oxygen are brought to the muscles by the blood, where respiration takes place and energy is released. Carbon Dioxide and water are the waste products – these are absorbed by the blood and taken away.

Fuel Source

- Moderate intensity of up to 2 hours = Carbohydrates & Fat
- Moderate intensity over 2 hours = Fat

Aerobic Training

- Hypertrophy - slow twitch muscle fibres – improved muscular endurance
- Increased myoglobin content – improves oxygen supplies to muscles

Anaerobic Respiration

Anaerobic energy production takes place **without** the presence of oxygen

When the intensity of the activity is too high and muscular contractions need to be powerful and fast e.g. long jump, high jump, javelin, oxygen cannot be processed quick enough for the body to use it.

Lactic acid is a by-product of anaerobic energy production. When lactic acid builds up muscles become fatigued and cannot function properly. An athlete would need to rest before they can produce another burst of high intensity anaerobic work.

Carbohydrate → glucose = Energy + lactic acid

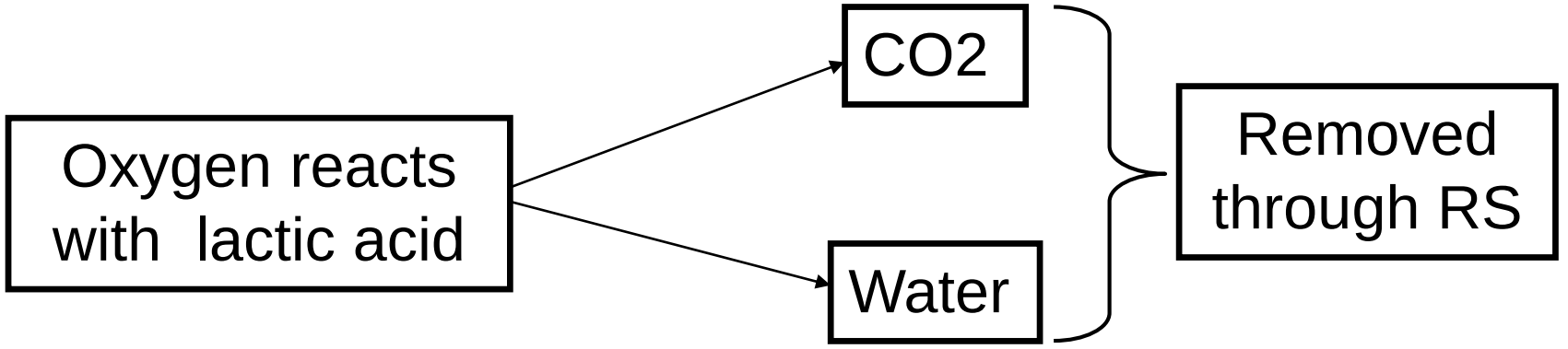
Fuel Source: Carbohydrates

Anaerobic Training

- Hypertrophy - fast twitch muscle fibres – improved muscular strength & power
- Increased tolerance to lactic acid – can work hard for longer

Oxygen used during anaerobic exercise (at the end of 400m race, hard rally in tennis, a combination of powerful punches) will often result in oxygen debt.

Oxygen debt The amount of oxygen needed at the end of a physical activity to break down lactic acid into water and carbon dioxide.



How can we see the oxygen debt taking place after sport?

Lesson 3: WALT

- Short term and long term effects of exercise on the respiratory system.
- 9 mark question

The Short-Term Effects of Exercise

Respiratory system

The 5 Short Term Effects of Exercise on the Respiratory System
1. Increase depth of breathing
2. Increased rate of breathing
3. Increased gaseous exchange
4. Increased tidal Volume
5. Oxygen debt –depending on the intensity of the exercise

The Long Term Effects of Exercise

Respiratory System

The 6 Long Term Effects of Exercise on the Respiratory System
1. Increased intercostal strength
2. Increased diaphragm strength
3. Increase lung capacity
4. Increased vital capacity
5. Increased number of alveoli
6. Increased VO2 max

The impact of exercise

Improved efficiency of the lungs will allow..

- Better delivery of oxygen to the working muscles, meaning the body will cope better with the demands of exercise.
- Carbon dioxide is removed quicker, meaning the body will cope better with an increase in the production of carbon dioxide during exercise.
- More alveoli become available for gaseous exchange.
- VO2 max is increased (the volume of oxygen an athlete can consume while exercising at maximum capacity).
- Increase in blood vessels (capillaries around the alveoli).

Lesson 4: WALT

- Components of the Cardiovascular system
- Functions
- Structure of the heart

Pop Quiz

1. What is ossification?
2. Define a joint
3. Name the 3 short term effects of exercise on muscles
4. Explain diffusion
5. Name the 2 respiratory muscles.

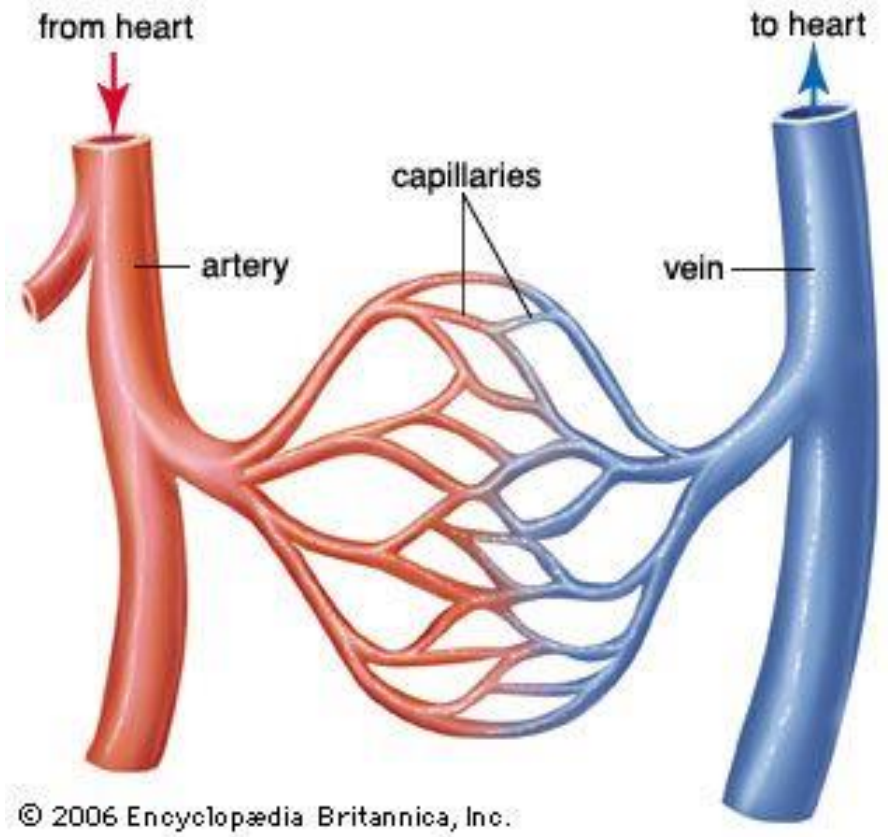
Cardiovascular System

https://www.youtube.com/watch?v=_Igd03h3te8&safe=active

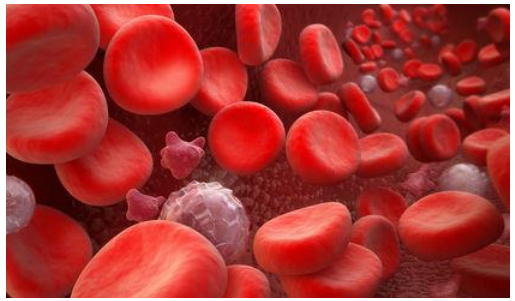
The cardiovascular system is made up of

1. Heart

2. Blood vessels



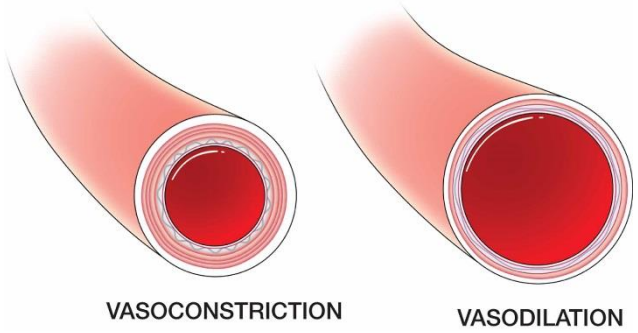
3. Blood



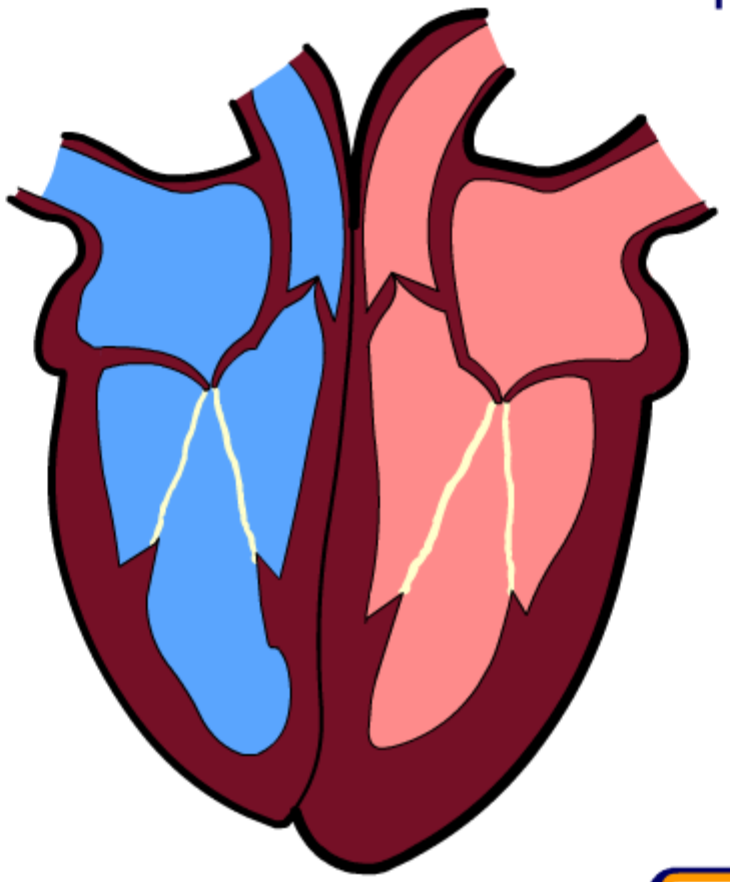
Functions of the cardiovascular system

1. **Transport** of oxygen, carbon dioxide and nutrients (glucose)
2. **Clotting** – Platelets form clots, which seal open wounds. Guarding the body against infection and excessive bleeding.
3. **Regulation of body temperature** – Vasodilation increases blood flow towards the skin to be cooled. Body temperature needs to stay around 37C.

Vasodilation	Vasoconstriction
When veins dilate, widening of the lumen to increase blood flow.	When veins shrink, narrowing of the lumen to decrease blood flow.



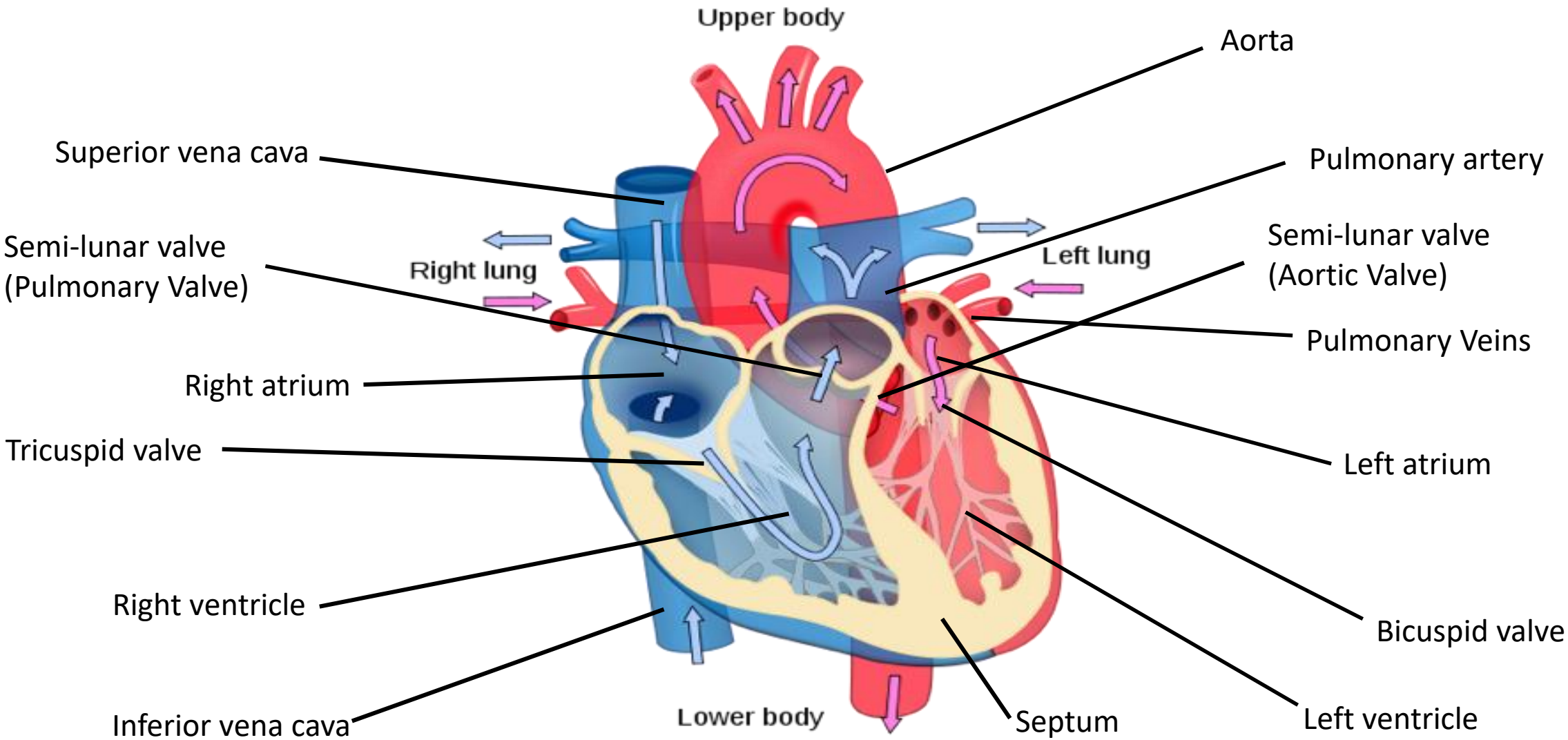
View the heartbeat animation on a loop or in stages.



loop stages

Right side (on you)	Left side (on you)
Deoxygenated blood (goes to lungs)	Oxygenated blood (goes to body therefore is thicker)

Heart Structure

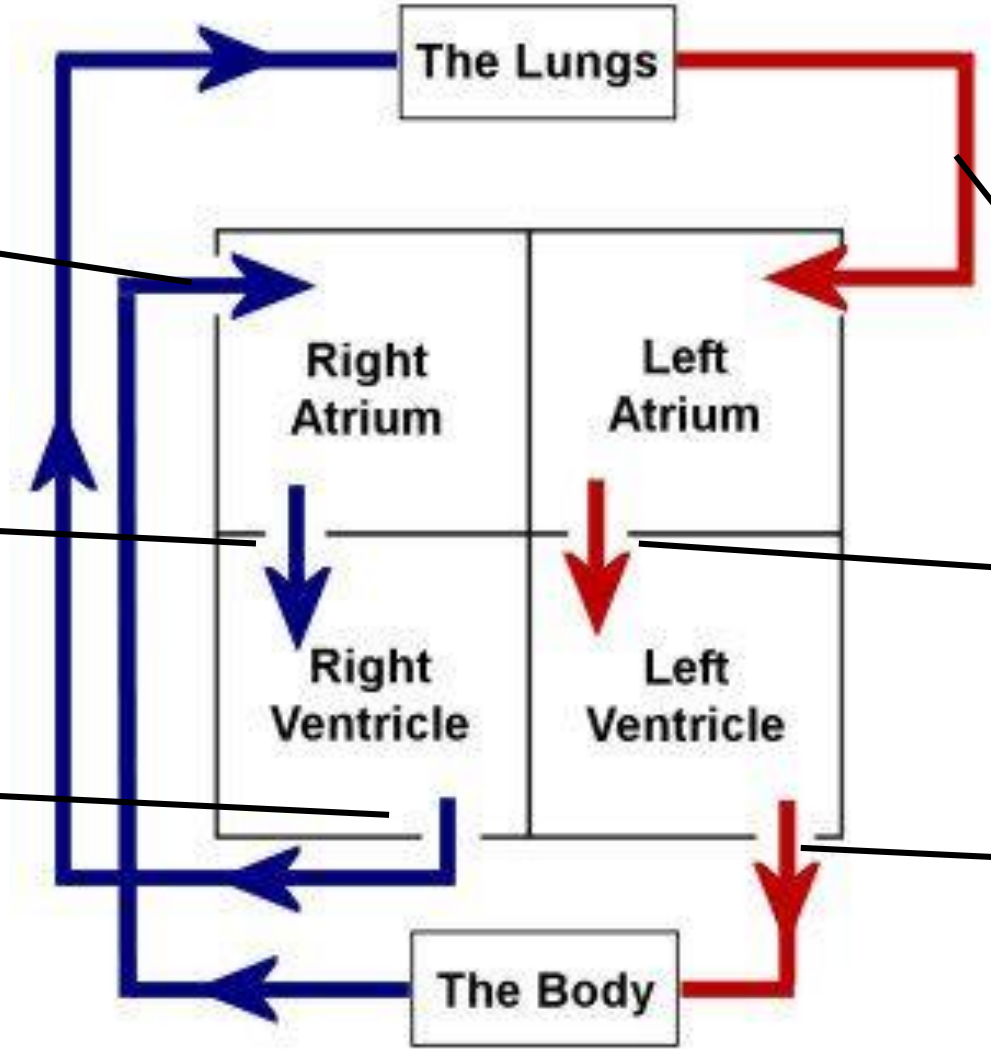


Lesson 5: WALT

- Blood flow
- Blood pressure
- Blood vessels

Blood Flow

4. Blood is oxygenated by the lungs



1. Deoxygenated Blood returns from the body to the right atrium by the vena cava's

5. Oxygenated blood returns to the heart through the Pulmonary Veins and enters the left atrium

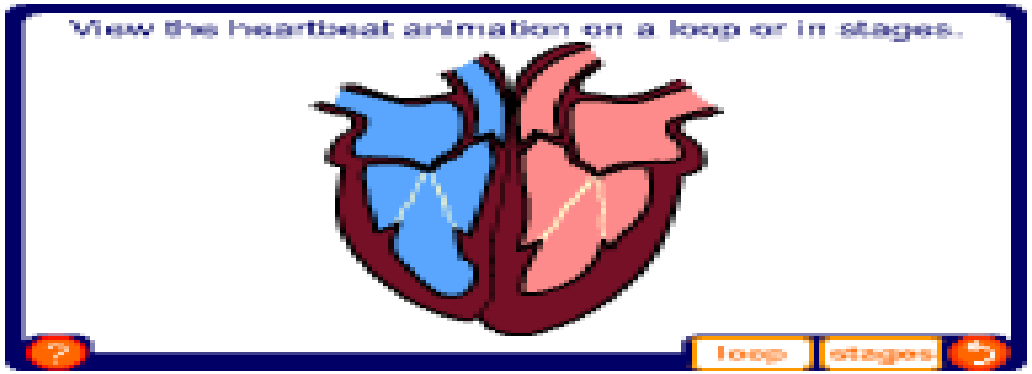
2. Tricuspid valve

6. Bicuspid valve

3. Deoxygenated blood leaves the right ventricle and travels to the lungs through the pulmonary arteries. The semi-lunar valves prevent blood re-entering the heart

7. Oxygenated blood is pumped through the Aorta to the muscles and organs. The semi-lunar valves prevent blood re-entering the heart

Blood Pressure



Blood pressure is the pressure of the blood against the walls of the blood vessels, especially the arteries.

Systole the phase of the heartbeat when the muscle contracts and pumps blood chambers into the arteries.

Diastole the phase of the heartbeat when the heart muscle relaxes and lets the chambers fill with blood.

$$\frac{\textbf{120}}{\textbf{80}}$$

Systolic Pressure

Diastolic Pressure

DR SClaxton

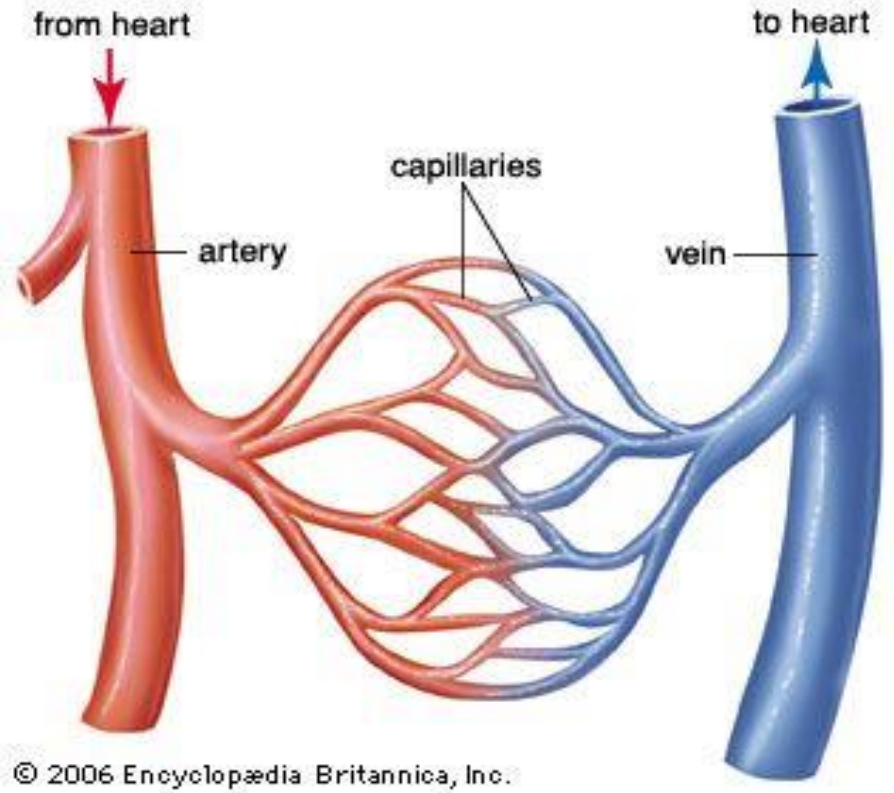
Blood Vessels

Arteries

- Carries **Oxygenated** blood Away from the heart, except the pulmonary
- Under high pressure
- Thick muscular walls and small lumens
- Blood is pushed along = makes them pulse
- Vasodilation and vasoconstriction occurs during exercise

Veins

- Carries **deoxygenated** blood towards the heart, except the pulmonary
- Under low pressure and blood travels slowly
- Therefore has **valves** to prevent back flow
- Have thinner walls and larger lumens than arteries



Capillaries

- Walls are one cell thick
- Very narrow so blood cells have to slow down.
- Wraps around muscles and organs so **Gaseous exchange** takes place.
- Carry both oxygenated and deoxygenated blood

Lesson 6: WALT

- Blood composition
- Blood distribution

Pop Quiz

1. What are the regions of the vertebrae & how many bones are in each region?
2. Draw the 3 classes of levers
3. What are the 4 valves in the heart?
4. What do myoglobin and mitochondria do?
5. Describe systolic blood pressure?

Blood

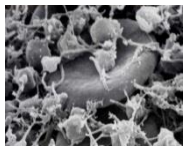
Red Blood cells (Erythrocyte)

- Transports **oxygen** by binding to haemoglobin.
- Very important for **aerobic sports** e.g. **marathon runners**.

White Blood cells (Leukocyte)

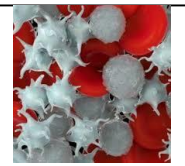
- Immune system, **fighting disease** and **infection**. (destroying pathogens with antibodies)
- **Keeps athletes healthy so they can train and compete**.

Platelets



- Formed in bone marrow.
- **Clot** and **scab** around open wound (Thrombokinase)
- **Prevents infection** and **blood loss**.
- Serotonin causes blood vessels to contract.
- Very important for **contact sports** e.g. **rugby**

Plasma



- **Fluid** that allows blood to **flow**.
- Made of 90% water

Short Term Effects of Exercise on the Vascular System
Vascular Shunting

(Vascular Shunting – Redistribution of blood when exercise begins):

- At rest a high percentage of blood is directed towards the vital organs.
- When we start to exercise blood is directed towards the voluntary muscles to allow them to work aerobically
- Vascular shunting is achieved by altering the size of the arteries lumen supplying different areas of the body

VASOCONSTRICTION – Narrowing of the lumen

- Blood vessels are constricted (squeezed) to make them smaller.
- When you start to exercise, chemical changes trigger signals from nervous system
- These signals cause the blood vessels that supply the INACTIVE areas (i.e the digestive system) to CONSTRICT, reducing blood flow to these areas.

VASODILATION – Widening of the lumen

- This means that blood vessels are dilated to make them bigger.
- When you start to exercise, chemical changes trigger signals from nervous system.
- These signals cause the blood vessels that supply the ACTIVE areas (the working muscles) to DILATE, increasing blood flow to these areas. This means that these muscles receive more oxygen and nutrients for aerobic respiration.

Without vascular shunting you would find taking part in sport unsustainable. Your muscles would be forced to work anaerobically and this would lead to early muscle fatigue

Blood cell count

High blood cell count

- People who are born at high altitude have a higher cell count because there is less oxygen. Their blood needs to be super-efficient at absorbing oxygen.
- Athletes from theses countries (Kenya) are exceptionally good at long distance running.
- Other Athletes may train in high altitudes to increase their blood count.
- https://www.youtube.com/watch?v=L7XvtDjoyXE&safe=active

Low blood cell count

- Know as **Anaemia** (Lack of red blood cells or haemoglobin)
- Loss of blood or lack of iron can make you anaemic.
- Iron helps to produce red blood cells. You can get iron from foods like liver and spinach.

Lesson 7: WALT

- Short and long term effects of exercise on the cardiovascular system

The Short-Term Effects of Exercise

Cardiovascular system

1. Increased Heart Rate
2. Increased Stroke Volume
3. Increased Cardiac Output
4. Redistribution of Blood Flow
5. Increased Blood Pressure

Remember the Cardiac Equation

Heart Rate x **Stroke Volume** = **Cardiac Output**

The number of times the heart beats per minute (70bpm)

The amount of blood pumped by the heart during each beat (75-130ml)

The amount of blood pumped by the heart in one minute

(5l rest & 21-35l active)

The Long Term Effects of Exercise

Cardiovascular System

There are 10 long term effects of exercise to the cardiovascular system(CCC)

C	C	C
Increased **Cappilirisation**	**Cardiac Hypertrophy**	Decrease in **Coronary Heart Disease (CHD)**
Increased Gaseous Exchange	Increased Resting Stroke Volume	Healthier Veins and Arteries
	Increased Cardiac Output	Drop in Resting Blood Pressure
	Decreased Resting Heart Rate	
	Faster Recovery Time	

Page 42 in booklet

- Draw the journey of gases that travel through the cardio-respiratory system.

- Labelling all the components the gases pass through.

Lesson 8: WALT

- Questions
- 9 mark question
- Interpreting Data

Questions

1. Explain the importance of the capillaries in the cardiovascular system?

2. What sports require cardiovascular fitness?

3. Explain what problems may face athletes not used to competing/training at high altitude?

Interpreting Data & Graphs

Applied Anatomy & Physiology

Interpreting Graphs – Heart Rate

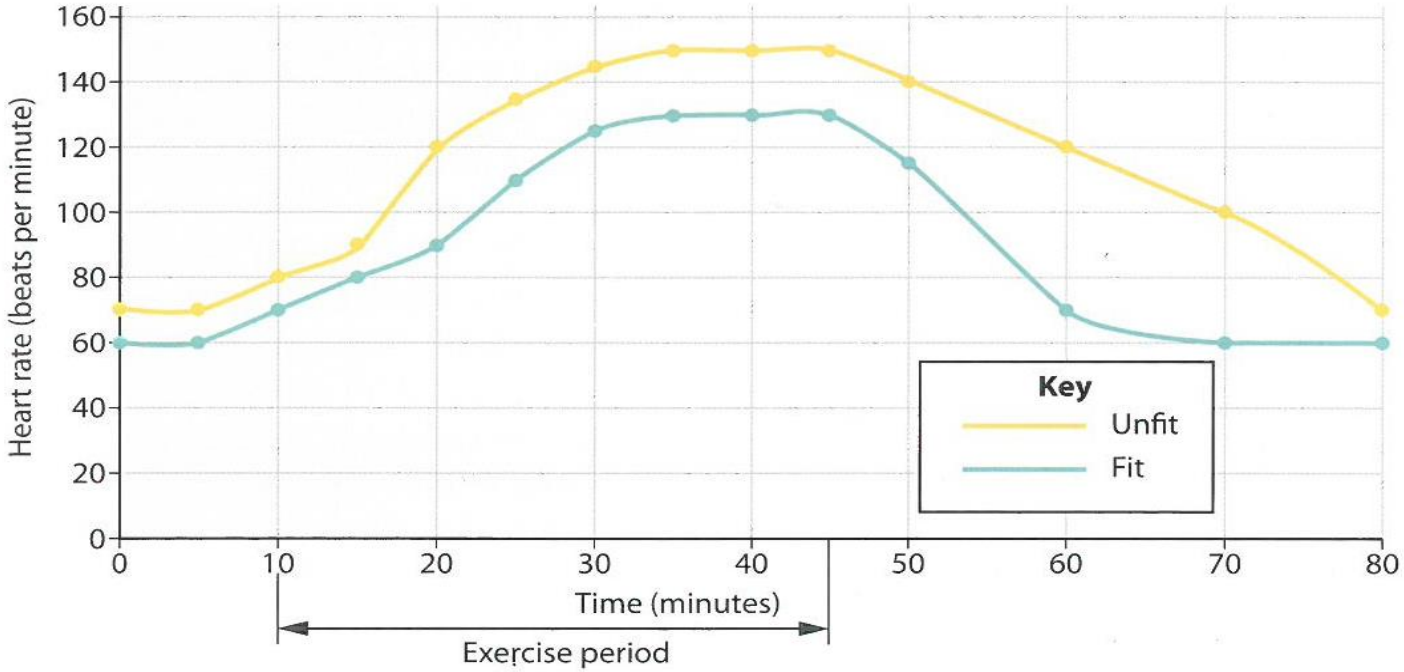


Figure 1.18 Heart rate patterns before, during and after exercise for two different athletes

Interpreting Graphs – Stroke Volume

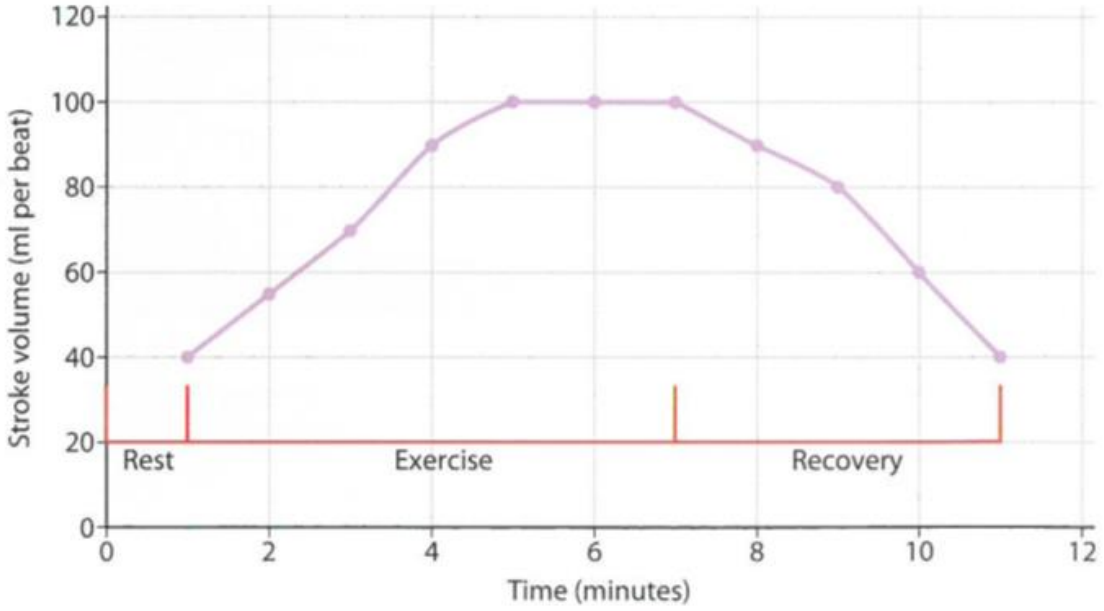


Figure 1.19 Stroke volume over time as someone goes from rest to exercise to recovery

Exercise Session

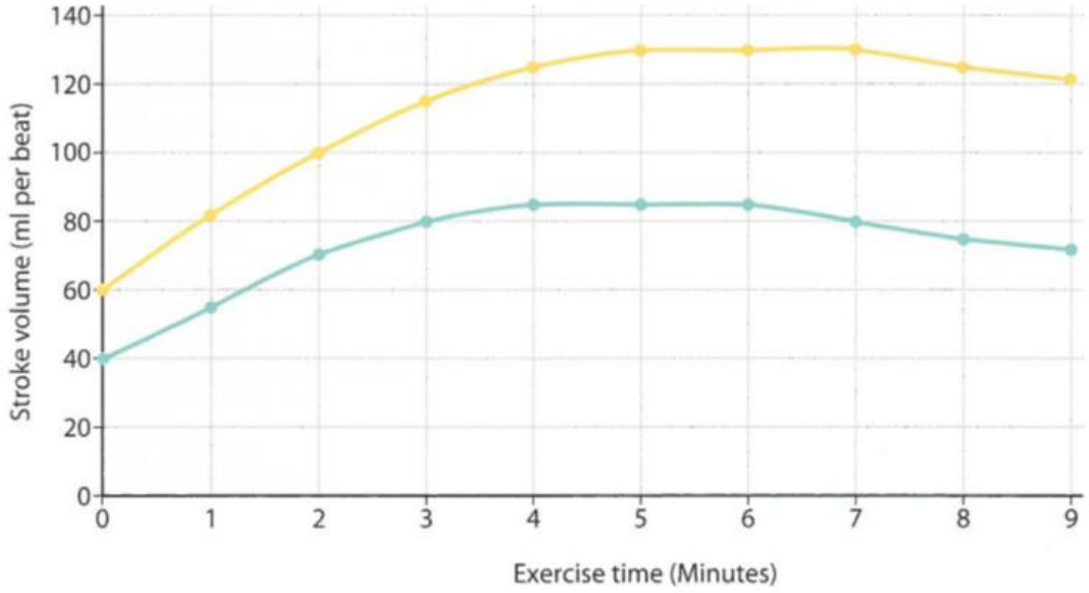


Figure 1.21 Stroke volume graphs for two different athletes

Level of Fitness

Interpreting Graphs – Cardiac Output

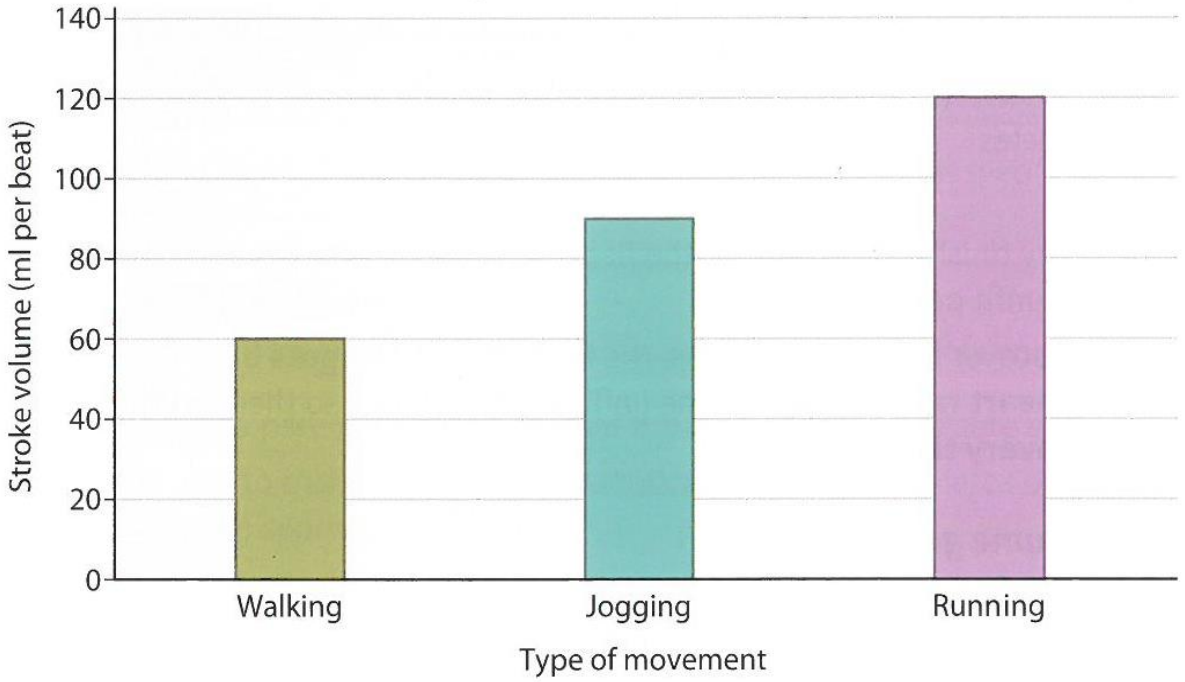


Figure 1.20 Average stroke volume for an athlete moving at different speeds

Intensity of Training

Interpreting Graphs – Stroke Volume

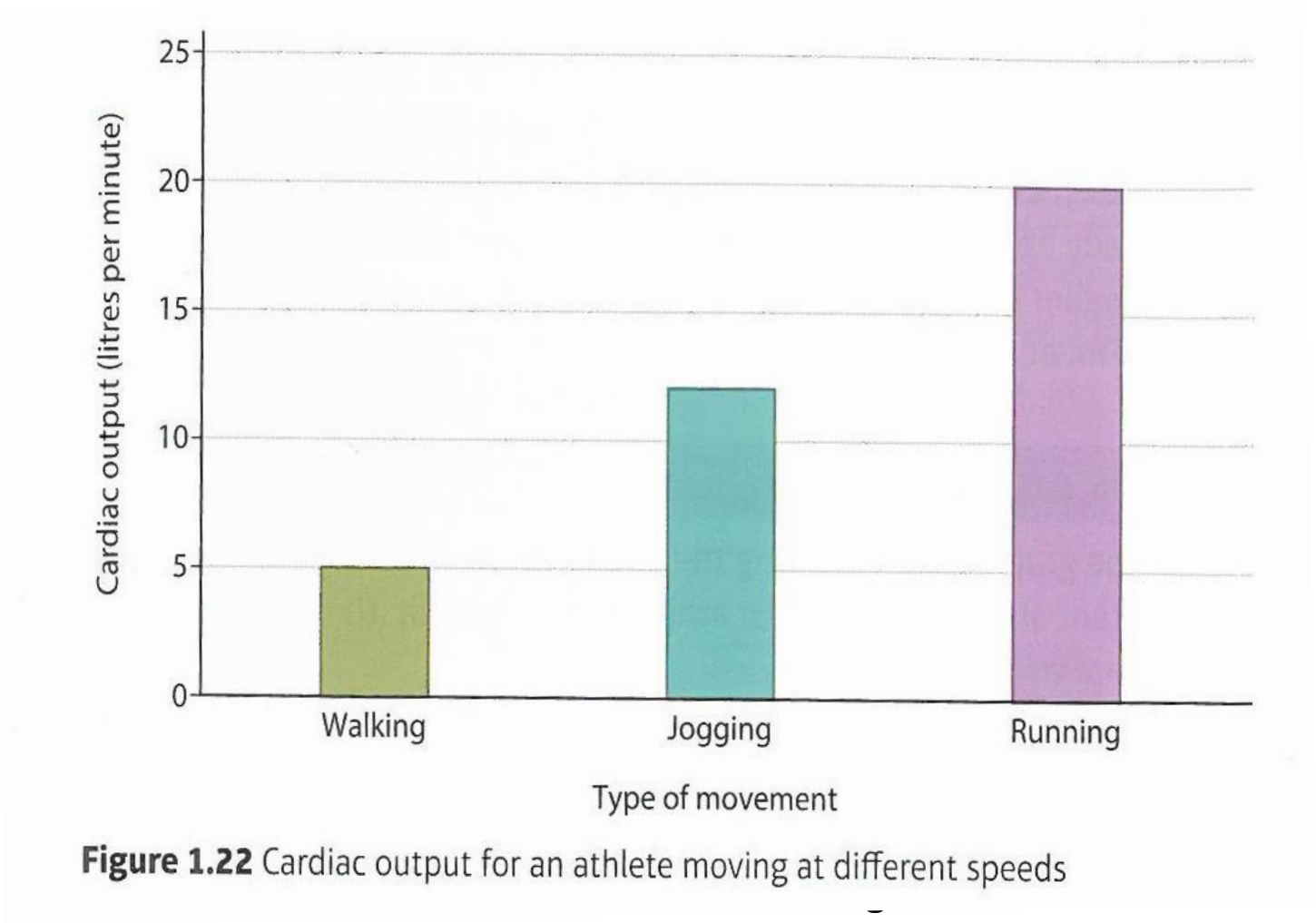


Figure 1.22 Cardiac output for an athlete moving at different speeds

Intensity of Training

9 Mark Questions

Edexcel Guidance

1) **KNOW & UNDERSTAND-** recall, define, describe

2) **APPLY KNLOWEDGE**– link their knowledge and understanding to the question.

3) **ANALYSE & EVALUATE-** justify their answers to the question within a conclusion

- 9 mark questions require linkage of points to show the required level of development

- On the extended writing questions it is essential that there is evidence of recall, explanation and relevant application through the discussion

- If a candidate ONLY demonstrates understanding through recall of knowledge they will not get out of band 1

Evaluate the extent to which the redistribution of blood flow is necessary during a hockey match?

9 marks

Evaluate the extent to which the redistribution of blood flow is necessary during a hockey match?

9 marks

Evaluate

Review/analyse information – bring it together to form a conclusion/judgment based on strengths/weaknesses. Come to a supported judgement of a subjects qualities in relation to its context.

Key points to consider

- **What is meant by redistribution of blood flow?**
- **What is meant by vasodilation and vasoconstriction?**
- **What types of movements occur during a hockey match?**
- **Where would vasoconstriction and vasodilation take place?**
- **What are the active areas of the body during hockey?**

Key points to consider

- **What is meant by redistribution of blood flow?**

Redistribution of blood flow is also known as vascular shunting, where blood is directed away from inactive areas to active areas.

- **What is meant by vasodilation and vasoconstriction?**

Vasodilation: Widens the internal diameter of the arteries/arterioles supplying oxygenated blood to the active areas.

Vasoconstriction: narrows the internal diameter of the arteries/arterioles supplying oxygenated blood to the inactive areas

- **What types of movements occur during a hockey match?**

High and low intensity e.g. running, sprinting, jogging back into position.

- **What are the active areas of the body during hockey?**

The working muscles: Quadriceps, Hamstrings, Gastrocnemius

- **Where would vasoconstriction and vasodilation take place?**

Vasodilation: Working muscles

Vasoconstriction: Parts of the body not requiring oxygenated blood e.g. digestive system

AO1: Core knowledge

Knowledge and understanding of redistribution of blood flow.

AO2: Application

Application of knowledge of redistribution of blood flow to the hockey match.

Specific examples that would impact on requirement for redistribution of blood flow during activity.

AO3: Evaluation

Making connections between the need for redistribution of blood flow and the hockey match, and conclusion.

Evaluate the extent to which the redistribution of blood flow is necessary during a hockey match?

AO1	AO2	AO3
Redistribution of blood flow is also known as vascular shunting, where blood is directed away from inactive areas to active areas.	Inactive areas during the hockey match, the digestive system experiences vasoconstriction.	Advantages/disadvantages of redistribution of blood flow to the hockey player (oxygen/nutrient supply).
Vasoconstriction narrows the internal diameter of the arteries/arterioles supplying oxygenated blood to the inactive areas	Active areas during the hockey match, the working muscles, experiences vasodilation.	Consideration of why redistribution is required in terms of increased demand by the muscles during different parts of the match (for example walking, jogging, and sprinting) and of potential impact of blood flow to the brain (which remains active during the match).
Vasodilation widens the internal diameter of the arteries/arterioles supplying oxygenated blood to the active areas.	Consideration of the impact of the nature of hockey on the redistribution of blood flow, for example intensity of exercise during a game of hockey will vary from periods of low intensity to periods of high intensity which will affect the redistribution of blood flow.	Conclusion making a judgement that without redistribution of blood players would not be able to sustain match play.

Question Number	Indicative content (AO1 – 3 marks; AO2 – 3 marks; AO3 – 3 marks for evaluation)	Mark
18	Reward acceptable answers. Responses may include, but are not limited to, the following: Knowledge and understanding of redistribution of blood flow (AO1) • Redistribution of blood flow is also known as vascular shunting, where blood is directed away from inactive areas to active areas. • Vasoconstriction narrows the internal diameter of the arteries/arterioles supplying oxygenated blood to the inactive areas. • Vasodilation widens the internal diameter of the arteries/arterioles supplying oxygenated blood to the active areas. Application of knowledge of redistribution of blood flow to the hockey match (AO2) Specific examples that would impact on requirement for redistribution of blood flow during activity. • Inactive areas during the hockey match, the digestive system experiences vasoconstriction. • Active areas during the hockey match, the working muscles, experiences vasodilation. • Consideration of the impact of the nature of hockey on the redistribution of blood flow, for example intensity of exercise during a game of hockey will vary from periods of low intensity to periods of high intensity which will affect the redistribution of blood flow. Making connections between the need for redistribution of blood flow and the hockey match, and conclusion (AO3 – evaluation) • Advantages/disadvantages of redistribution of blood flow to the hockey player (oxygen/nutrient supply). • Consideration of why redistribution is required in terms of increased demand by the muscles during different parts of the match (for example walking, jogging, and sprinting) and of potential impact of blood flow to the brain (which remains active during the match). • Conclusion making a judgement that without redistribution of blood players would not be able to sustain match play. Students who only show achievement against AO1 will not be able to gain marks beyond level 1.	(9)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	• Demonstrates isolated elements of knowledge and understanding, with limited technical language used (AO1). • Limited attempt to apply knowledge to question context (AO2). • Generic assertions may be presented (AO3 – evaluation).
Level 2	4–6	• Demonstrates mostly accurate knowledge and understanding, including appropriate use of technical language in places (AO1). • Applied knowledge to question context (AO2). • Attempts at drawing conclusion, with some support from relevant evidence (AO3 – evaluation).
Level 3	7–9	• Demonstrates accurate knowledge and understanding throughout, including appropriate use of technical language (AO1). • Applied detailed knowledge to question context throughout (AO2). • Reaches a valid and well-reasoned conclusion supported by relevant evidence (AO3 – evaluation).

KNOWLEDGE & UNDERSTANDING

APPLIED IN CONTEXT - WITH EXAMPLES

EVALUATION

Fitness and Training

Lesson 1 and 2: WALT

- Relationship between health and fitness
- Components of fitness

Pop Quiz

1. Define vital capacity
2. Name the 4 antagonistic pairs
3. What does DOMS stand for?
4. Name two areas in the body where gaseous exchange takes place?
5. Name the 5 short term effects of exercise on the cardiovascular system.

The relationship between health and fitness and the role that exercise plays in both

- Learn the terms health, exercise, fitness and performance
- The relationship between health and fitness
- The role that exercise plays in keeping someone fit and healthy

TASK

- Discuss with the person sitting next to you how you would explain each of the following:

Health

Fitness

Exercise

Performance

Health:

“A state of complete emotional (psychological), physical and social well being & not merely the absence of disease & infirmity.”

Fitness:

“Ability to meet the demands of the environment”

Performance:

“How well a task is competed”

Exercise:

“Physical activity that maintains or improves health and physical fitness” (not competitive)

The Link….. Exercise improves health and fitness therefore performance will improve.

If people do not exercise and live a **sedentary** lifestyle, they can develop health problems such as heart disease, high blood pressure and back pain. These problems can be reduced with physical activity and are known as **Hypokinetic diseases**.

The relationship between fitness and health

Is it possible to be fit not healthy?

Anxiety

Growth hormone deficiency

Diabetes

ACTN3 ‘Sports Gene’

Components of fitness

How they benefit sport and fitness
How we measure them

Health Related Exercise

These five elements help us stay physically fit and healthy.

Health Related Exercise

Muscular Muscles Can Feel Big

	Definitions
MUSCULAR ENDURANCE	The ability to use the voluntary muscles many times without getting tired.
MUSCULAR STRENGTH	The amount of force a muscle can exert against a resistance
CARDIOVASCULAR FITNESS	The ability to exercise the entire body for long periods of time.
FLEXIBILITY	The range of movement possible at a joint
BODY COMPOSITION	The percentage of body weight that is fat, muscle and bone

Muscular Strength

Muscular strength allows you to lift heavy weights and is vital for sports that needs strength and power.

- Weight lifter
- Rugby

You can increase muscular strength through weight training. Some performers cheat and take steroids to increase their muscular strength

Muscular Endurance

Muscular endurance is a measure of the length of time your voluntary muscles can contract without getting tired. This can be repeated contractions, or one contraction held for a long time.

- Marathon runner
- Gymnast

Cardiovascular Fitness

Is the efficiency of your cardiovascular system getting oxygen, and nutrients to your working muscles. And the removal of waste products such as carbon dioxide. This will allow you to perform at a high intensity for a long time.

- Football
- Rugby
- Netball
- 1500m

Flexibility

If you are not flexible, you have less range of movement and your joints will get stiff. Flexibility is obviously needed for gymnast, but it is crucial for every sport to be performed well and prevent injury.

Body Composition

The way we are built is called body composition (% of muscle, fat & bone)

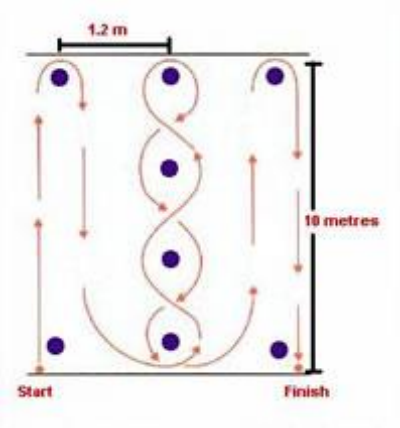
It is important that fat % is kept low to avoid diseases like heart disease and diabetes.

Different sports favour different body types. Long distance runner needs less weight to carry. A rugby prop needs to be heavy to push the scrum.

Some aspects you cant improve because of genetics (height) but the others can be improved through exercise.

Skill-Related Fitness (ABC-PRS)

Helps people to become good at physical activity



Skill Related Components

ABC-PRS

	Definitions
Agility	The ability to control the movement of your whole body and change position quickly.
Balance	Being able to keep the body stable, while at rest or in motion.
Co-ordination	The ability to use two or more body parts together.
Power	The ability to undertake strength performances quickly.
Reaction Time	The time between the presentation of a stimulus and the onset of movement.
Speed	The rate at which an individual can perform a movement to cover a distance.

Agility

Ability to change position and control the body at speed. 100m sprinter doesn’t need agility, but the following these do.

- Football
- Rugby
- Boxing
- Floor gymnast

Balance

There are two types of balance static (still) and dynamic (on the move)

Most sports need a mixture of both. Why would a hammer thrower need balance and what type?

Co-ordination

There are different types of co-ordination. Hand-eye, foot-eye etc.

Most people are better on one side of their body. i.e. right footed and right handed. Some people however perform different sports with different sides of their body.

Stuart Broad is a right-arm bowler

but bats left handed.

Power

Power = Strength x Speed

Why do theses sports need power?

- Sprinters
- Golf
- Throwing events
- Long Jump

Reaction Time

Explain where reaction time is in the picture?

List other sports and explain why they need reaction time?

Speed

Is the rate at which your body, or part of your body, is able to perform a movement.

Lesson 3 and 4: WALT

- Fitness testing and protocols
- Interpretation data

Pop Quiz

1. Why are the pulmonary blood vessels different?
2. Define cardiovascular fitness
3. What is the name of the artery which carries oxygenated blood away from the heart to the rest of the body?
4. List the 11 components of fitness
5. Define health

Fitness testing

The purpose of fitness testing is to gather information about your current fitness levels (strengths and weaknesses) in 1 or more of the 11 components. These can be used in your PEP (personal exercise programme) as baseline scores and retested to see if any improvement has occurred.

Pop Quiz /10

Define:

- Fitness
- Exercise
- Performance
- Cardiovascular Fitness
- Muscular Endurance
- Reaction Time
- Power
- Speed
- What does FITT stand for?
- Name the methods of training

Test Protocol

- The official procedure for the test. (Instructions)

- The test must be conducted the same way each time for the results to be valid.

1. Equipment
2. Protocol
3. Temperature/Weather
4. Time of day
5. Participants health

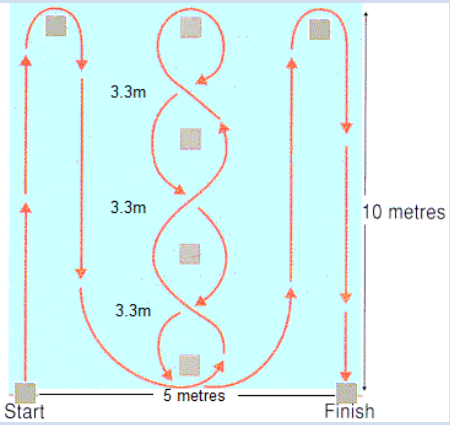
Test results

< = Less than

> = More Than

Fitness Test	Purpose	Protocol
Cooper 12 minute	Tests **cardiovascular fitness** and estimates VO2 max.	12 minutes run or swim, measuring the distance you cover.
Harvard step	Tests **cardiovascular fitness**, you need muscular endurance but it is not measured.	Step on and off a 45cm bench every 2 seconds for 5 minutes. Measure your HR at 1, 2 and 3 minutes into the recovery. If you're still above your RHR continue to record every minute.
Hand grip	Tests **muscular strength** in the hand	Use a grip dynamometer with your strongest hand. 3 attempts recording best.
1 minute press up	Tests **muscular endurance**	Number of correctly performed press ups (straight back, 90 degree elbow bend) in 1 minute.

Fitness Test	Purpose	Protocol
1 minute sit up	Tests abdominal **muscular endurance**	Number of correctly performed sit ups (bent knees, hands to knee, lower back on floor) in 1 minute.
Sit and reach	Tests **flexibility** of the hamstrings and lower back muscles	Straight legs against a bench/box. Past your toes (+ score) level with toes (zero score) short of toes (- score) 3 practices 4th is recorded.
30m sprint	Tests **speed**	Start in a stationary position, sprint 30m x2 attempts

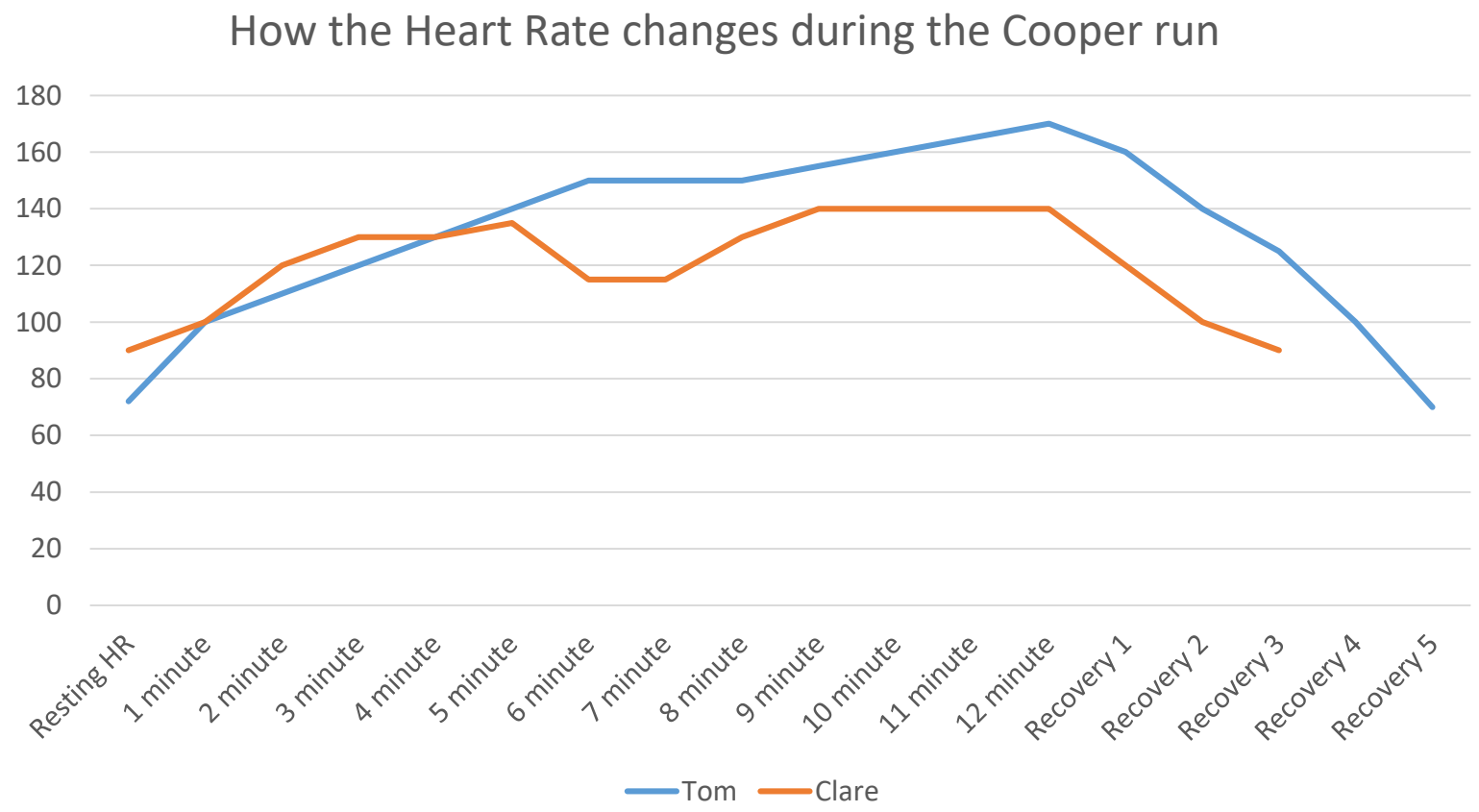
Fitness Test	Purpose	Protocol
Illinois Agility Run	Tests **Agility**	Lay face down on the floor at the “Start” . The athlete jumps to their feet and negotiates the course around the cones to the finish. 
Vertical jump	Tests leg **power**	Stand side on and flat footed. Mark where your finger tips reach. Place chalk on your fingers and jump and mark the wall. Measure the difference between the two marks. 3 attempts

Interpretation of data

Quantitative	Qualitative
Includes numbers	Information about qualities feeling/opinions
Number of laps on the 12 minute cooper run	How you felt you run on the 12 minute cooper run
Easy to measure	Difficult to measure
Closed question in a questionnaire	Open question in a questionnaire

Interpretation of Graphs

You will need to be able to interpret graphs for your PEP and your exam.



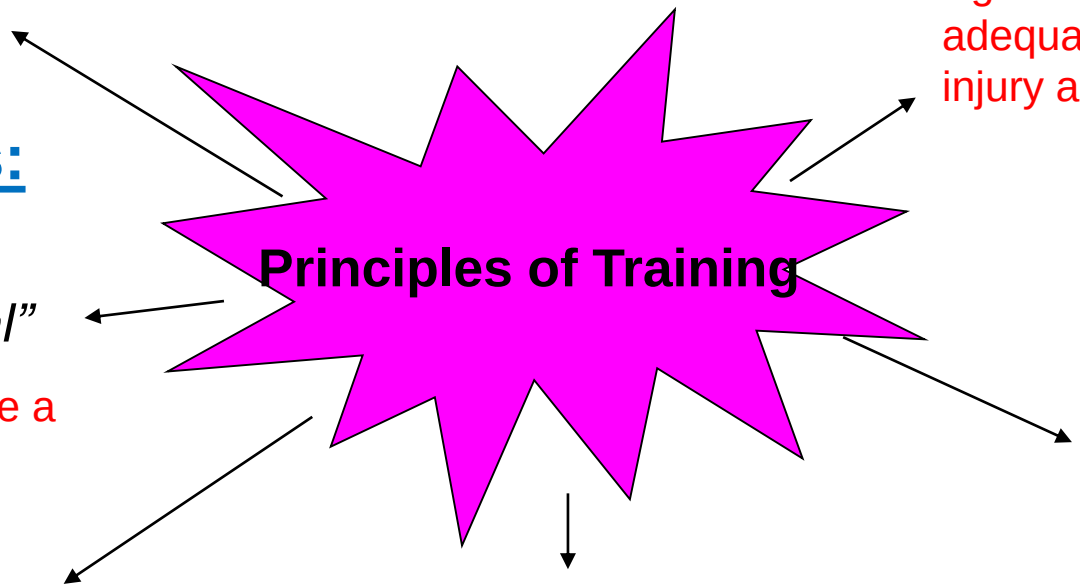
Methods and principles of training

Lesson 5 and 6: WALT

- Principles of training
- Thresholds of training
- Methods of training

Successful athletes do not just train hard, they also train effectively; they apply the principles of training.

FIRST-OP



Specificity:

"Matching training to the requirements of an activity"

Eg. Sprinter – power not agility

Overtraining

"Training beyond your ability to recover."

Eg. Too much progressive overload without adequate rest and recovery, can cause injury and illness.

Individual needs:

"Matching training to the requirements of an individual"

Eg. A beginner runner would not use a marathon runners PEP.

Progressive Overload:

"Gradually increasing the amount of overload to improve fitness but without injury"

Thresholds of Training:

"Your target zone you aim to work within depends upon the intensity of your activity or the aim of your training programme.

Reversibility:

"Gradually losing fitness instead of progressing or remaining at the current level."

EG. Illness or injury.

FITT:

Frequency, Intensity, Time
Type – to achieve overload

F.I.T.T	Example	Overlaps with Principles (First_OP)
Frequency	**How often training takes place**. EG. • Increasing training sessions from two to three times per week.	• Reversibility • Overtraining • Progressive Overload
Intensity	**How hard the exercise is.** EG. • Increased resistance (lifting weight) • Increased effort (Incline/speed of treadmill)	• Individual needs • Progressive Overload
Time	**The length of the session or of a particular exercise.** EG. • Increase sets • Increase repetitions • Decrease rest time • Increase overall length of training session	• Specificity
Type	**The method of training used** EG. • Switch between continuous, interval and fartlek training or between running and swimming to improve cardiovascular fitness.	• Progressive Overload

FITT overlapping with Principles of Training

Frequency – Reversibility, Overtraining, Progressive Overload
Intensity – Individual Needs, Progressive Overload
Type – Specificity
Time- Progressive Overload

When you train, **adaptations** occur to your body.

EG. You will get bigger biceps if you progressively overload your biceps during training.

You need **rest** and **recovery** for this to occur.

Thresholds of Training

Allows us to train effectively and safe. (**Target Zone**)

- Work done below the threshold will have little or no impact on improving fitness.

- Work done above the threshold could damage fitness and cause injury.

Your **target zone** is the range you want your heart rate to be as you exercise.

To work out your target zone you can use a simplified version of the **Karvonen** formula.

Maximal Heart Rate (MHR) 220 – Age

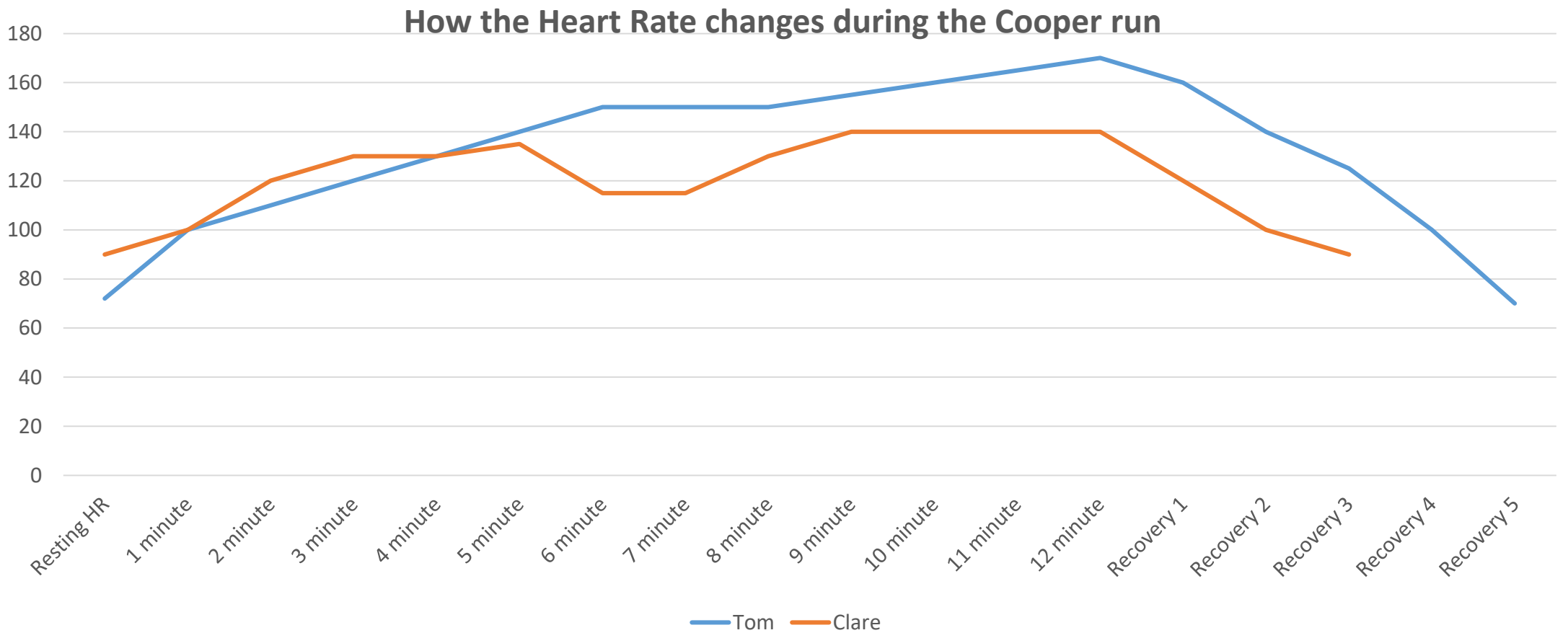
- If you wanted to improve your cardiovascular fitness you would need to train within an aerobic target zone. (60-80% MHR)

- If you wanted to improve your speed or power you would need to train within an anaerobic target zone. (80-90% MHR)

Clare is 16 and Tom is 40. They both want to improve their cardiovascular fitness for the London marathon.

- Work out their MHR.
- Work out their Aerobic training zone.
- Which runner is training effectively and safe?

Name	MHR	60%	80%
Clare			
Tom			



Methods of training

When choosing the right method of training you need to consider:

- The requirements of the particular sport or activity
- The facilities available in the local area
- The individual's current level of fitness

Intense **F**arting **C**an **C**ause **P**ainful **W**ind

Interval

Fartlek

Circuit

Continuous

Plyometrics

Weight/resistance

Cardiovascular Fitness

	Advantages	Disadvantages
Continuous Exercising for extended period of time without rest. E.G jogging, running, swimming, cycling or rowing.	• Doesn't require expensive equipment • Mimics long distance events. • A wide range of activities. E.G (Run/Cycle/Swim)	• Can get boring • Doesn't improve anaerobic fitness
Interval High intensity exercise followed by rest or active recovery. • Work periods you work **anaerobically** (80-90%). • Rest/active recovery, you should work **aerobically** (60-80%). • Alternating between your upper aerobic threshold and lower anaerobic threshold. • Develops both speed and cardiovascular fitness.	• You burn about twice as many calories than continuous training. • Greater ability to cope with the production of lactic acid. • Increasing your ability to work aerobically for longer.	• Longer rest/recovery time between sessions due to high intensity. (48 hours) • High intensity, harder to motivate yourself.

Cardiovascular Fitness

	Advantages	Disadvantages
Fartlek Swedish for “speed play” and is a form of interval training. There are no rest periods just changes in intensity and terrain. E.G **60** second jog – **30** second hard run – **10** second sprint – **30** walk and so on. Most suitable for games players. (football/rugby/netball)	• Less boring than continues and interval • Develop pace setting skills • Intensity and length modified by needs of performer • Can be done over different terrains.	• Self-disciplined to change pace • Weather dependent.

Power

https://www.youtube.com/watch?v=dvggf9hPwtM&safe=active

Plyometrics

Before you train power you need to develop your strength and speed to avoid injury.

Plyometric exercise are high impact exercises that teach the muscles to perform their maximum contractions faster.

E.G Jumping and throwing events.

Advantages

- Little or no equipment.
- Short, high intensity.
- Simulates movements in your sport.

Disadvantages

- 3 days rest between each session.
- Must have good levels of strength and muscular endurance.
- Can cause stress on joints and muscle soreness.

Strength and Muscular Endurance

	Advantages	Disadvantages
Weight/resistance training **Strength** = low repetitions using heavier weights. **Muscular endurance** = High repetitions using lighter weights. **Free weights** (dumbbells) = Experienced performer, greater range of movement, activates core & stabilising muscles. Higher risk of injury!! **Resistance machines** = Beginners, promotes good technique providing stability and control. Work bigger muscles groups first (back, chest legs) as they will need more energy.	• Can be tailored to individual needs and abilities. • Can be altered to prevent boredom. • Can strengthen the whole body or specific muscles. • Easily monitored.	• Can be expensive to join a gym/buy equipment. • Incorrect technique can cause injury. • You need a spotter when lifting heavy free weights.

Strength and Muscular Endurance

	Advantages	Disadvantages
Circuit Circuit training can improve Strength, muscular endurance and cardiovascular fitness, depending on the exercises included. Circuits include different exercises called stations, which are completed by a set number of repetition or time.	• Creative and fun • Match exercises to specific training needs. • Large groups can train at the same time. • Doesn't require a lot of equipment or space. • Different fitness levels can train together.	• It can take a while to set up. • Techniques can be affected by fatigue. Therefore injury can occur.

All components

	Advantages	Disadvantages
Fitness Classes Like circuit training fitness classes can improve a range of components of fitness. **Body Pump** = Exercise to music using low weights with many repetitions at moderate to high intensity to develop muscular endurance and strength. **Aerobics** = Aerobic exercise to music, covering a variety of exercises for 30 – 60 minutes to develop cardiovascular fitness. **Pilates** = A series of core stability exercises using resistance to focus on the quality of the exercise rather than the quantity. It focuses on correct breathing, relaxation and stress reduction. Develops strength, flexibility and balance. **Yoga** = A series of postures and poses. Breathing, relaxation phase and meditation to boots wellbeing. Develops strength, balance and flexibility **Spinning** = High intensity work out on stationary bikes with changes of pace throughout. Develops muscular and cardiovascular endurance.	• Lots of variety, reducing boredom. • Instructor can challenge and motivate you to work harder. • Meet new people. • Way to increase knowledge.	• Can be expensive • Group class not tailored to individual needs. • In large classes instructor may not be able to correct technique.

Personal Exercise Programme

A well designed and completed **PEP** can develop your health and fitness.

Using the correct methods and principles of training will increase your fitness and therefore improve all areas of health.

To do this a **PEP** requires these four areas.

1. Planning (aims and design)

Using the correct method of training for your needs.

2. Developing

Providing progressive overload

3. Monitoring

Working in the correct training zone

4. Evaluating

Changing your aim if it is met or adapting your training if it is not being met.

Questions

1. Oliver is a swimmer. What principle of training should he use to make sure that his training is going to improve his performance in his sport? **(1 mark)**

2. Choose two methods of training for both a sprinter and a marathon runner, and explain how they would help them prepare for their sports? **(3 mark)**

3. Explain the relationship between health and exercise. **(3 marks)**

4. Explain the difference between how co-ordination is used by a golfer taking a putt and a swimmer during a 100m butterfly race? **(4 marks)**

5. Endurance and power athletes will often use weight training as part of their training programme. Describe how weight training can be used to develop muscular strength or muscular endurance. **(2 marks)**
6. Describe the training principles of progressive overload and explain why they are important? **(6 marks)**

Pop Quiz

1. List the components of health related fitness
2. List the components of skill related fitness
3. What does FITT stand for?
4. What are the principles of training?
5. Describe interval training

Optimising Training and Preventing Injury

PAR-Q

- **PAR-Q: Physical Activity Readiness Questionnaire**

- A self screening tool used by anyone who is planning to start an exercise or training programme.

- *Qu. When should a PAR-Q be completed and why?*

- Complete the PAR-Q in your booklet

Preventing Injury

- **P**eople
- **P**lease
- **P**repare
- **W**hen
- **C**ontinuously
- **R**unning
- **P**rotective Clothing and Equipment
- **P**rinciples of Training
- **P**AR Q
- **W**arm Up
- **C**hecking Equipment and Facilities
- **R**ules

Injury Prevention through personal readiness

- Complete a **P**AR Q – Identify any potential health risks and limit/adapt participation accordingly.

- Effective use of the **P**rinciples of training - **Overtraining** can lead to overuse injuries e.g. repetitive strain injury. Ensure an **increase** in training is **gradual**. Training should meet the **individual's needs** and be **specific** to their sport. Training should be at the appropriate intensity taking into consideration **thresholds** of training.

- Wear the appropriate **P**rotective clothing – e.g. wear shin pads for protection.

- **W**arm up effectively – to increase the elasticity of the muscles and reduce the risk of injury.

- **C**heck equipment and facilities – check that the equipment and facilities being used are safe and clear of anything which could be harmful. E.g. check the padding around the rugby posts which are in place to soften the impact in the event of a collision.

- Adhere to the **R**ules of the activity – rules are in place to keep players safe. E.g. high tackles in rugby are banned because they could be dangerous. The competition must also be **balanced**. E.g. same age players playing against each other in a netball tournament, same sex players playing against each other in a rugby tournament and same weight category boxers fighting against each other in a boxing match.

Pop Quiz

1. What do the 3 P’s stand for in injury prevention?
2. How do you work out your maximum heart rate?
3. What is your aerobic training zone (%)
4. Name a fitness class and describe it
5. What is the role of white blood cells?

Types of Injuries

Dislocation

Bones are dislocated at a joint

- A dislocation is when a bone at a joint is forced out of its normal position, often as a result of a hard blow which causes the bones to be displaced.

E.g. a dislocated shoulder is when the bone in the upper arm comes away from the shoulder socket.

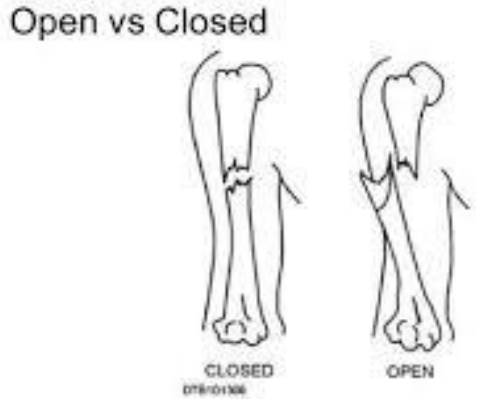
- Dislocations are very painful
- Symptoms include:
  - Deformity (Misshapen joint)
  - Swelling
  - Pain
  - Being Unable to move the injured part of the body

Treatment: RICE as a temporary measure. But it is essential to seek medical attention as soon as possible.

Fractures
A fracture is a broken bone

- There are different types of fracture:
  - A Compound (Open) Fracture, where the bone penetrates the skin
  - A Simple (Closed) Fracture, where the broken bone does not penetrate the skin.
  - Stress Fractures are injuries commonly caused through overuse. This is where a small crack forms in the bone.
  - Greenstick Fractures are common in younger children. This is where the bone bends on one side and breaks on the other.
  - **The symptoms of a fracture include:**
    - Bruising
    - Swelling
    - Deformity
    - Pain at the site of the injury

    Treatment: You must seek medical attention immediately.



Sprain

An injury at a joint where some of the fibres of the ligaments are torn.

- A sprain happens when the **ligament** is stretched too much or tears.

- Examples of how a sprain occurs in sport:
  - Forceful twisting e.g. a sudden change of direction to dodge an opponent in netball could cause a sprain.
  - Overstretching the joint

- The symptoms include:
  - Pain
  - Swelling
  - Bruising

Treatment: RICE

Torn Cartilage

An injury at a joint where small tears appear in the cartilage.

- Cartilage is a firm elastic substance which lines adjoining bones. It absorbs the impact of bones with reducing friction.

- Tearing your cartilage, especially your knee cartilage is a common injury.

- Examples of how torn cartilage occurs in sport:
  - Forceful twisting
  - Sudden impact/stopping e.g. a miss-timed or bad tackle in football can cause a torn cartilage injury.

- Symptoms include:
  - Pain
  - Swelling
  - Stiffness at the joint restricting movement

  Treatment: Seek medical attention and then rest and strengthening exercises.

Concussion

'The sudden but short-lived loss of mental function that occurs after a blow or other injury to the head' (NHS)

- Concussion is a mild head/brain injury. It is caused by a blow to the head or by whiplash (sudden and severe movement of the head) shaking the brain inside the skull.

- **Symptoms**:
  - Headaches
  - Dizziness
  - Nausea/Vomiting
  - Unconsciousness
  - Confusions immediately after the injury

- Examples of how a concussion occurs in sport:
  - Rugby, where there can be a clash of heads or a sudden impact with the ground.
  - Cycling, where falling off the bike may lead to a bang on the head.

- Concussion is the least serious type of brain injury but it could be masking something more serious like a bleed on the brain or swelling on the brain.

Treatment: An athlete should always seek medical help after receiving a blow to the head.

Soft Tissue Injuries

- **Strain**: The muscle or tendon is stretched too much or tears. Strains occur due to overstretching.

- Completing a warm up can help to reduce the chance of strains occurring,

- **Symptoms**:
  - Pain
  - Swelling
  - Bruising

  Treatment: **RICE**

Soft Tissue Injuries

- **Tennis Elbow** is a joint injury where the tendons are inflamed.

Pain is felt on the **OUTSIDE** of the elbow.

Can be caused by poor technique or overuse. E.g. repetitive use when playing a backhand in tennis can damage the tendons resulting in tennis elbow.

- **Golfers Elbow** is a joint injury where tendons are inflamed.

Pain is felt on the **INSIDE** of the elbow.

Can be caused by poor technique or overuse. E.g. excessive practice of a particular shot on a driving range without appropriate rest.

Treatment for tennis an golfers elbow is RICE

- **Abrasions** are minor injuries to the skin such as a graze or a cut.

Little or no bleeding

Treatment: Cleaned and covered with a sterile dressing.

RICE

- **Rest** (Stop playing)
- **Ice** (Use an ice pack and apply pressure to the injury)
- **Compression** (Use pressure to hold to ice pack in place to limit swelling and provide some pain relief)
- **Elevation** (Raise the injury above the heart if possible)

Questions:

1. Which one of the following is a soft tissue injury (1 mark)

A. Compound fracture

B. Greenstick fracture

C. Stress fracture

D. Strain

2. Define the term abrasion and give an example of how it can occur in sport (2 marks)

3. Identify one potential cause of golfers elbow. (1 mark)

Pop Quiz

1. What is a strain?
2. Movement in the transverse plane can only happen around which axis?
3. Define fitness
4. What part of the elbow does tennis elbow affect?
5. What is the definition of performance?

Effective use of Warm-Up & Cool-Down

Applied Anatomy & Physiology

3 Stages of an Exercise Session

Warm-up → Main Activity → Cool-Down

5 Reasons Why be Warm-Up

1. Increases the temperature of muscles, tendons and ligaments – reduces chance of injury
2. Increases heart rate and body temperature safely - reduces chance of injury
3. Increase flexibility – aids performance
4. Psychologically prepares you for exercise – aids performance
5. Increases oxygen delivery to working muscles – aids performance

Fill in Booklet

3 Stages of a Warm-Up

Cardiovascular Phase → Stretches (8-10 secs) & Joint Mobilisation → Skills/Psychological

Fill in Booklet

3 Stages of a Cool-Down

Complete Worksheet 3.6.1-3.6.3

Cardiovascular Phase → 10-15 mins Stretching (30-35 secs) → 10-15 mins Relaxation phase

6 Reasons Why Cool-Down?

1. Gradually returns body temperature, breathing and heart rate to their resting rate
2. Psychologically unwind
3. Removal of lactic acid –preventing DOMS
4. Removal of carbon dioxide and waste products
5. Avoids blood pooling in lower limbs whilst leads to dizziness
6. Improves flexibility

Apply Core Knowledge

- State three phases of a warm-up (3 marks)
- List 5 reasons why a warm-up is important (1 mark)
- List 6 reasons why a cool-down is important (1 mark)
- Evaluate the extent to which a warm-up is necessary for a hockey goalkeeper (9 marks)

1. Complete Quiz Questions
2 Complete Questions in Purple Workbook
3. Complete Past Paper Questions

Performance Enhancing Drugs

Why do sportsmen and women take Performance Enhancing Drugs (PEDs)?
3 Pressures

- **Coach**
  - A coach could pressurise an athlete into taking PEDs to improve their performance. This could lead to the athlete being more successful and the coach's reputation and subsequent earnings could improve.

- **Peer**
  - If an athlete is aware that fellow athletes are taking drugs, they may be influenced to take them. If fellow athletes encourage them to take them they may also be inclined to take PEDs.

- **To Win**
  - The pressure to win may be so great that the athlete is willing to risk everything and take PEDs. Winning a race or event would lead to lucrative sponsorship deals, media coverage and financial winnings. All of this may influence an athlete to take PEDs.

Performance Enhancing Drugs

- Beat
- Drugs
- And
- Say
- No
- People

- **B**eta Blockers
- **D**iuretics
- **A**nabolic Steroids
- **S**timulants
- **N**arcotic Analgesics
- **P**eptide Hormones

Drug Cheats

- Lance Armstrong:
- https://www.youtube.com/watch?v=2jtDH-10m2s

- Justin Gatlin
- https://www.youtube.com/watch?v=BpP4iNS5cM4

Beta Blockers

Drugs that are used to control the heart rate and have a calming and relaxing effect

- **Reasons performers might take Beta Blockers:**
  - Reduction in heart rate
  - Calming effect
  - Reduce anxiety
  - Increase chance of winning
  - Allow performer to remain in control

- **Health Risks**
  - Reducing heart rate too far can be dangerous and lead to heart failure
  - Depression
  - Insomnia/nightmares
  - Tiredness

Diuretics

Drugs that elevate the rate of urine production.

- **Reasons performers might take Diuretics:**
  - To achieve quick weight loss (due to loss of fluid from the body)
  - To mask or hide other performance-enhancing substances the performer may have taken, making them harder to detect

- **Health Risks**
  - Dehydration (headaches, nausea and dizziness)
  - Heart and Kidney failure

Anabolic Steroids

Drugs that mimic the male sex hormone testosterone and promote bone and muscle growth.

- **Reasons performers might take Anabolic Steroids:**
  - Increase muscle mass
  - Develop bone growth
  - Increase in strength
  - Allow the athlete to train harder for longer

- **Health Risks**
  - Liver damage
  - Cardiac Heart Disease
  - High blood pressure
  - Increased risk of muscle and tendon injury
  - Aggression and mood swings
  - Infertility

Stimulants

Drugs that have an effect on the central nervous system, such as increased mental and/or physical alertness.

- **Reasons performers might take Stimulants:**
  - Increase alertness (performer is quicker to respond)
  - Increases heart rate (therefore more O2 delivery)
  - Increases aggression and competitiveness
  - Reduces tiredness

- **Health Risks**
  - Anxiety
  - Insomnia
  - Heart Rate irregularities
  - Aggression

Narcotic Analgesics

Narcotics: Drugs that affect mood or behavior, including drowsiness and relieving pain.

Analgesics: A painkilling or pain relieving drug.

- **Reasons performers might take Narcotic Analgesics:**
  - They increase the performer's pain threshold.
  - They give a sense of euphoria.
  - They give a sense of being invincible
  - They mask injury pain so the performer can continue to compete

- **Health Risks**
  - Anxiety and depression
  - Nausea
  - Addiction
  - Concentration loss
  - Further damage to existing injuries

Peptide Hormones

Peptide hormones are found naturally in the human body. They increase muscle growth and increase the red blood cell count.

- **Reasons performers might take Growth Hormones:**
  - GHs increases muscle mass and therefore strength
- **Health Risks**
  - Arthritis
  - Heart failure
  - Abnormal growth in feet and hands

- **Reasons performers might take EPO:**
  - EPO increases red blood cell production and therefore increases O2 delivery to working muscles
- **Health Risks**
  - Increased thickness of blood
  - Blood clots/strokes
  - Deep vein thrombosis
  - Increased risk of heart attack

Blood Doping

- Blood is taken out of the body and frozen.
- The athlete's body then replenishes this lost blood.
- Before competition the athletes injects the thawed blood back into their body resulting in more red blood cells and therefore more 02 carrying capacity.
- Blood doping **is a banned process**, **not a banned substance.**

- This process increases the athlete's VO2 Max and their endurance.
- Risks: Infection leading to blood poisoning, increased thickness of blood leading to blood clots, strokes and deep vein thrombosis. Risk of diseases such as HIV or hepatitis, due to shared needles and blood sharing.