



**AHS GCSE PE 20-21**

**Booklet 1**

**Fitness and Body**

**Systems**

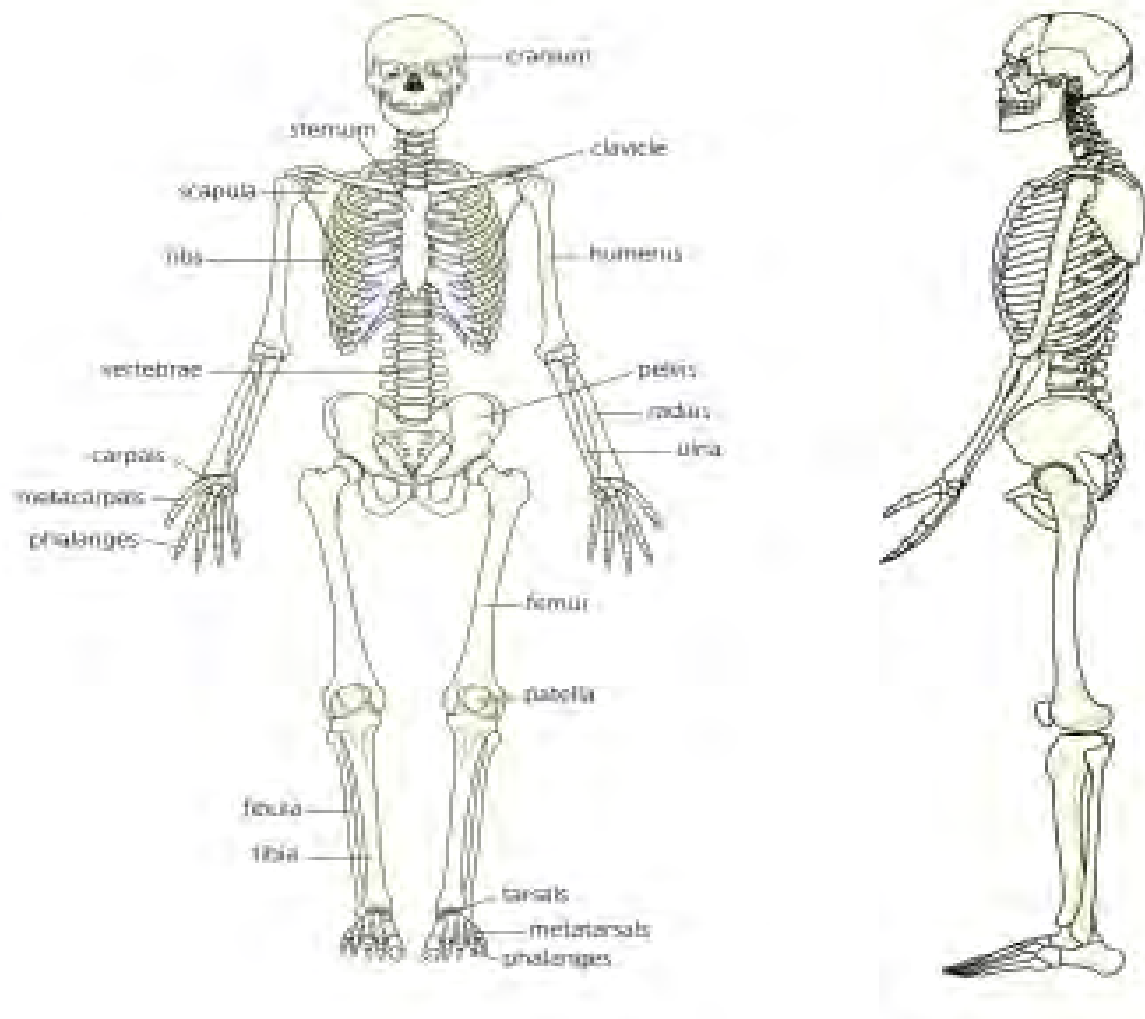
# MUSCULO-SKELETAL SYSTEM

The joints, bones & skeletal muscles working together.

Together they form the structure (anatomy) of the body



# Structure of the Skeleton



Skeleton consists of **206** bones – need to know 20 for exam

## Tips on Remembering

Humerous attached to your funny bone

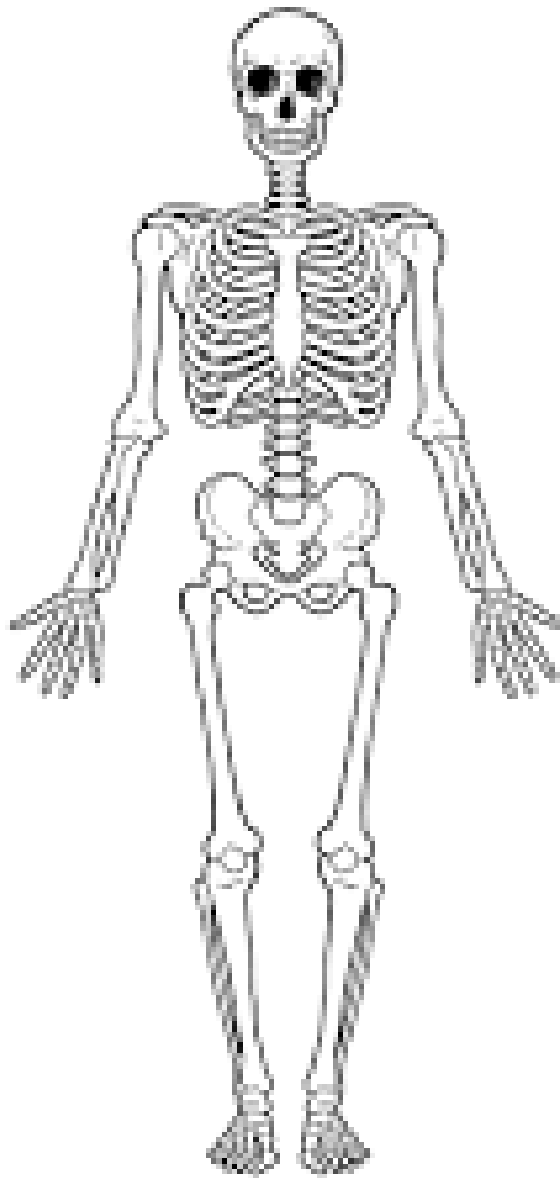
Tibia is ON TOP of the Fibula

Ulna is UNDERNEATH the radius

Carpals and Metacarpals - Cuffs

Tarsals and Metatarsals - Toes

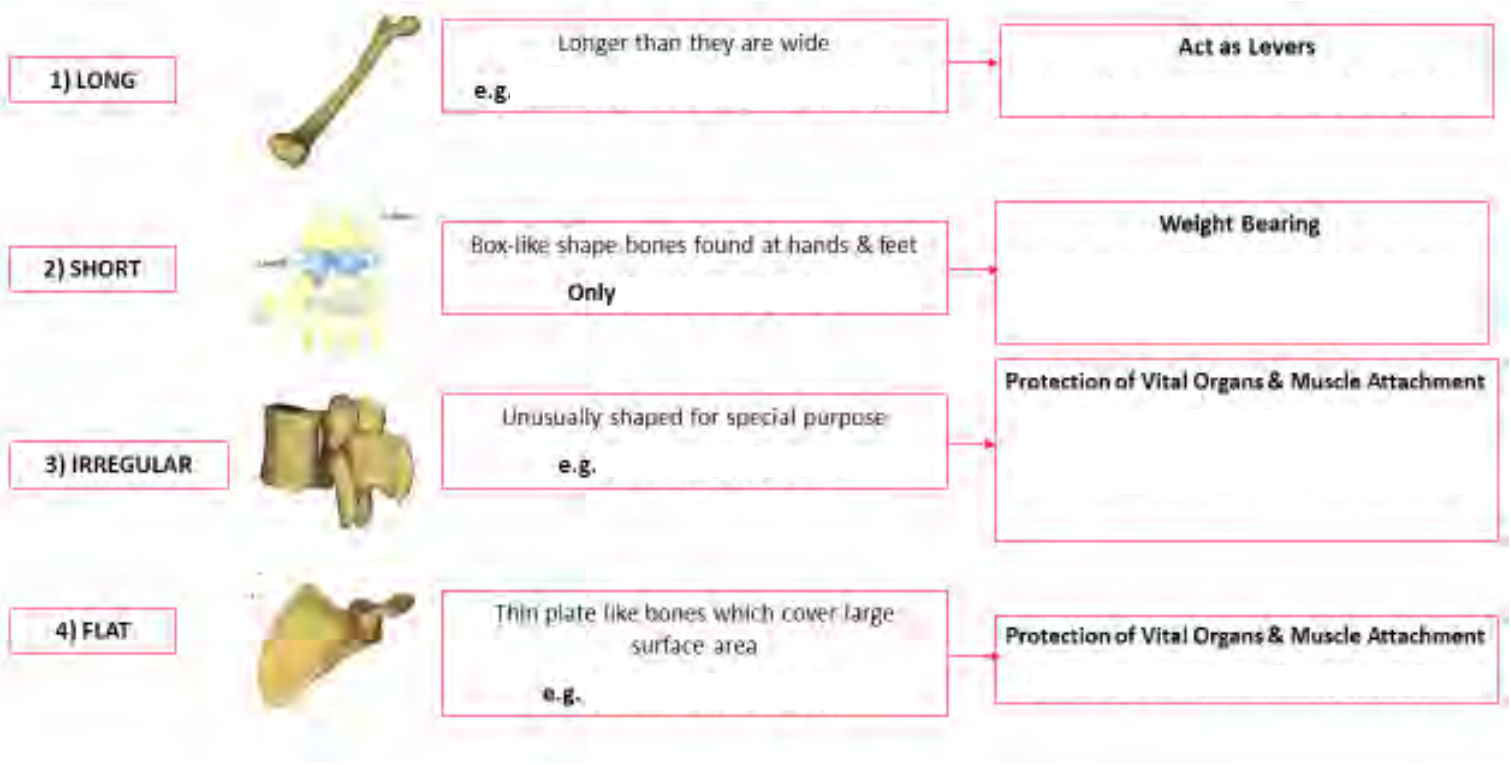
## Label the Bones on the Blank Skeleton



Classification of Bones

Example of use in sports performance


# Classification of Bones



## Classification Table

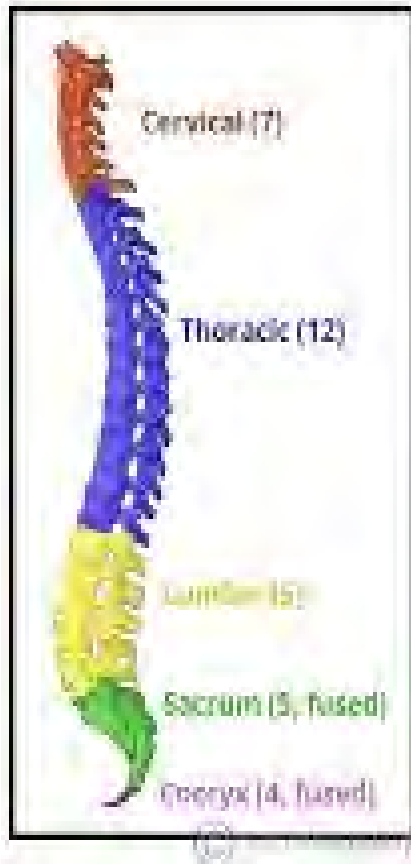
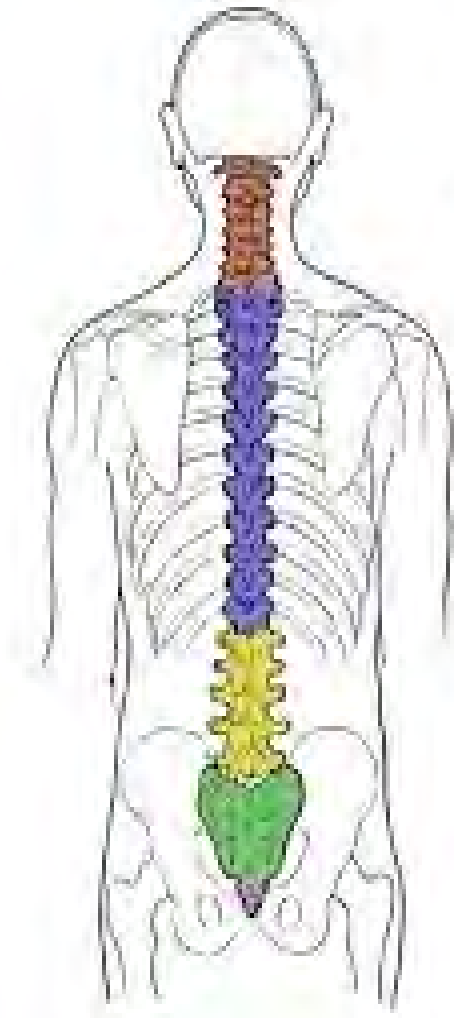
## 4 Step to Link Correctly

Bone	Bone Type	
	Short	→ 1) X2
	Short	
	Irregular	→ 2) X2
	Irregular	
	Long	→ 3) Limbs
	Long	
	Long	
	Long	
	Long	
	Long	
	Long	
	Long	
	Flat	→ 4) Remainder
	Flat	
	Flat	
	Flat	
	Flat	
	Flat	
	Flat	

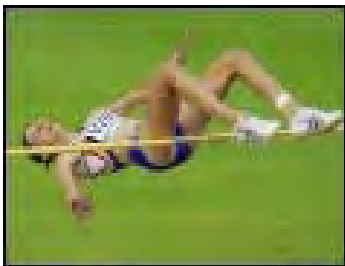
Shade in the different classification of bones on the previous page

# The Vertebrae Column

- \* Protects the spinal cord
- \* Inverted U shape gives it strength
- \* 33 specialist bones – Think of these as a phone number
- \* 5 regions with special functions (Come to London See Chelsea) (Cute Teddies Love Some Cuddles)



## Function of Regions



The High Jumper is able to hyper extend her back in order to get her body over the bar

Think of an example from your main sport when the vertebrae column is important

.....

.....

.....

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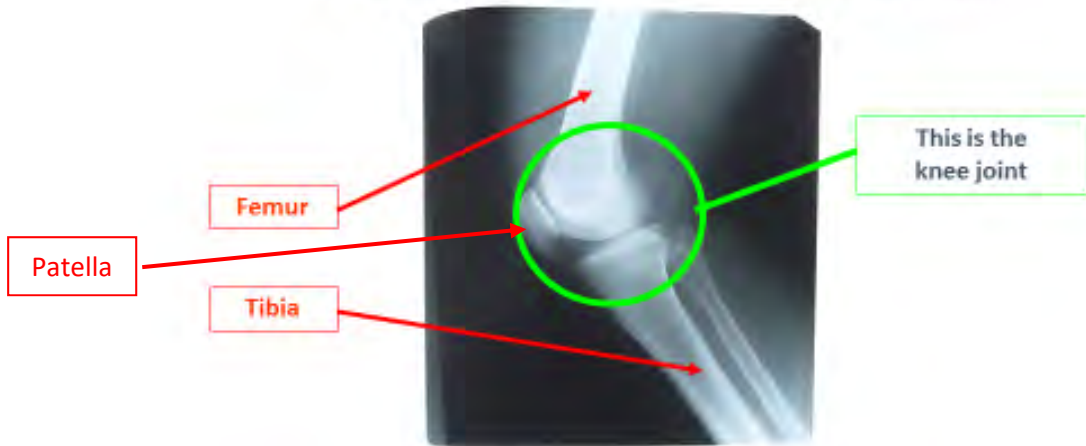
.....



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

# Joints

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



# Connective Tissues

<b>Tendon</b>	
<b>Ligament</b>	
<b>Cartilage</b>	



Explain the role that the ligaments and tendons play as he makes his movement.  
What would happen if his connective tissues did not do their jobs properly?

.....

.....

.....

.....



# 4 Synovial Joints & Movement

## 1) Ball & Socket:

*Movement:*

*Where:*

## 2) Hinge:

*Movement:*

*Where:*

## 3) Pivot:

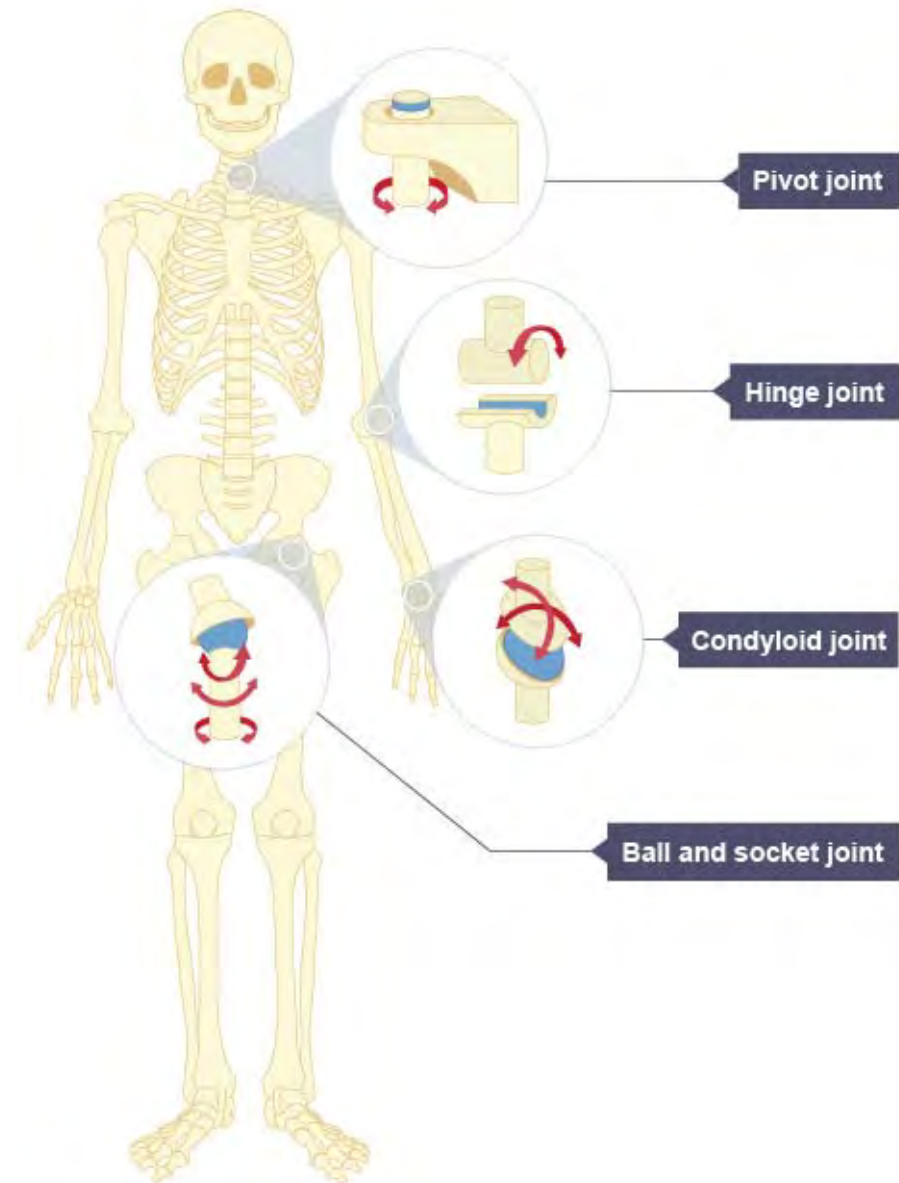
*Movement:*

*Where:*

## 4) Condyloid:

*Movement:*

*Where:*



# Range of Movement Possible at a Joint - 8 Movements

## 1) Flexion



TIP: Bending part of the body at a joint

## 2) Extension



TIP: Straightening a part of the body at a joint

## 3) Adduction



TIP: Think ADD



## 4) Abduction



TIP: If somebody is abducted then they are taken away

## 5) Rotation



Tip: Twisting action at a joint



## 6) Circumduction



Tip: Circular Motion



## 7) Plantar-Flexion

Tip: plant toes into ground

## 8) Dorsi-Flexion

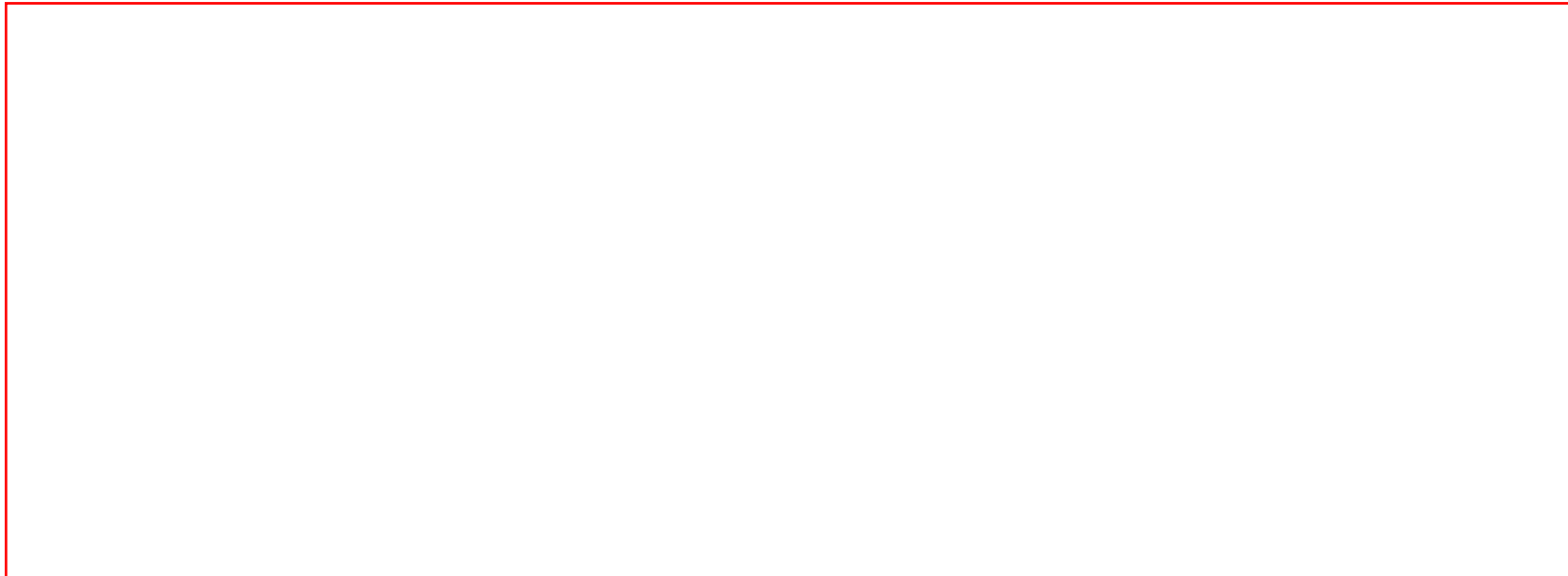
Tip: Point toes to sky



# Synovial Joints & Movement

Synovial Joint	Movements Possible	Location	Sporting Example

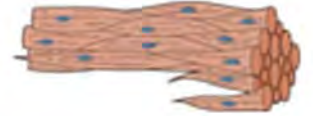
## Joint & Movement Analysis



# Muscular System

## 3 Types of Muscle

Involuntary muscle (smooth):



Cardiac muscle:



Voluntary muscle (skeletal):



## 3 Functions of the Voluntary Muscles

ity

Need to know 12 voluntary/skeletal muscles for the exam

## Muscle Location (12)



# Movements Muscle Produce

Muscle	Location	Function	Example in Sport
Deltoid	Shoulder – triangular muscle on the uppermost part of the arm and top of shoulder		
Pectoralis Major	Chest		
Latissimus Dorsi	Side of the Back – Broad sheet of muscle extending from lower spine to upper arm		
Biceps	Front of the upper arm		
Triceps	Back of the upper arm		
External Obliques	Side of the abdominals, extending from lower ribs to pelvis		
Gluteals	Buttocks		
Hip Flexors	Groin		
Quadriceps	Front of the upper leg		
Hamstrings	Back of the upper leg		
Gastrocnemius	Back of the lower leg		
Tibialis Anterior	Front of the lower leg		

## 4 Antagonistic Pairs

Muscles **WORK TOGETHER**. One muscle **CONTRACTS** (shortens) while the other **RELAXES** (lengthens) in order to produce a **WIDER RANGE OF MOVEMENT AT A JOINT**

The **CONTRACTING** muscle is called the **AGONIST** or **PRIME MOVER**

The **RELAXED** muscle is called the **ANTAGONIST**

Explain in detail how the 4 antagonistic pairs in the body produce movement

Bicep & Tricep:

Quadricep & Hamstring:

Gastrocnemius & Tibialis Anterior:

Hip Flexors & Gluteus Maximus:



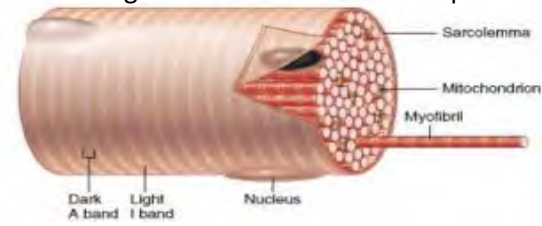
# Voluntary Muscle Fibres

Voluntary muscles are made up of bundles of 3 different muscle fibres. Percentage is down to genetics but can train to improve

**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 happen



## 3 Types of Muscle Fibres: Type I, Type IIa & Type IIx

### Type I: Slow twitch - aerobic work

EG Long distance running

Low intensity activity

Positives:

Negatives:



### Type IIa: Fast twitch – aerobic & anaerobic work

EG 800m runners

Extended high intensity activity (30secs-2mins)

Positives:

Negatives:



### Type IIx: Fast twitch - anaerobic work

EG 100m sprinter

Explosive activity

Positives:

Negatives:



### Effects of Aerobic Training:

	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

### Effects of Anaerobic Training:

## **3 Short Term Effects of Exercise on the Muscular System**

1.

2.

3.



When answering a question on long term effects structure your answer in this order:

1. Effects – what happens
2. Benefit – how it helps performer
3. Impact - on performance



## **3 Long Term Effects of Exercise on the Musculo-Skeletal System**

**(Rest & recovery needed for body to adapt & effects to take place)**

1.

2.

3.

# Exam Questions

What are the 5 functions of the skeletal system?

.....  
.....  
.....

List the classification of bones and their functions?

.....  
.....  
.....

What are the 5 areas of the vertebrae column and what are their functions?

.....  
.....  
.....

What is an antagonistic pair? Give 4 examples

.....  
.....  
.....

What are the 4 types of synovial joint and where are they found?

.....  
.....  
.....

Explain which type of muscle fibre would suit an endurance athlete

.....  
.....  
.....

What are the 3 short term effects of exercise on the muscular system?

.....  
.....  
.....

What are the 3 long term effects of exercise on the musculo-skeletal system?

.....  
.....  
.....

# 9 Markers – Edexcel Guidance

- 2 x 9 markers in each paper – 20-25% of your paper
- 3 mark bands- require linkage of points to show the required level of development. If a candidate ONLY demonstrates understanding through recall of knowledge they will not get out of mark band 1.

Level	Mark	Descriptor
	0	No rewardable material
1	1-3	<ul style="list-style-type: none"><li>• Demonstrates isolated elements of knowledge and understanding, with limited technical language used (AO1).</li><li>• Limited attempt to apply knowledge to question context (AO2).</li><li>• Generic assertions may be presented (AO3 - evaluation).</li></ul>
2	4-6	<ul style="list-style-type: none"><li>• Demonstrates mostly accurate knowledge and understanding, including appropriate use of technical language in places (AO1).</li><li>• Applied knowledge to question context (AO2).</li><li>• Attempts at drawing conclusions, with some support from relevant evidence (AO3 – evaluation).</li></ul>
3	7-9	<ul style="list-style-type: none"><li>• Demonstrates accurate knowledge and understanding throughout, including appropriate use of technical language (AO1).</li><li>• Applied detailed knowledge to question context throughout (AO2).</li><li>• Reaches valid and well-reasoned conclusions supported by relevant evidence (AO3 – evaluation).</li></ul>

**AO1) KNOW & UNDERSTAND QUESTION TOPIC:** simple statement to recall, define, describe

**AO2) APPLY KNOWLEDGE USING SPORTING EG's:** link knowledge and understanding to the question.

**AO3) ANALYSE & EVALUATE:** justify and conclude your answer. Show wider knowledge.

# 9 Markers – 3 Steps

Step 1) Highlight A01, A02 and A03 within the question

Step 2) Plan your answer by breaking down your answers into the 3 row template

Step 3) Number templates into paragraphs

**Q)** Evaluate the relevance of the different muscle fibre types for a 5000m runner

Points to Answer:

A01 –

A02 –

A03 –

A01
A02
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A03
Wider Knowledge:

**Q)** Evaluate the relevance of the different muscle fibre types for a 5000m runner

# Command Words

Access	Gathering opinions to make a judgement
Analyse	Break something down and examine
Classify	Grouping based on characteristics
Define	Definition of word/term
Describe	Detailed description
Discuss	Advantages & disadvantages
Examine	Justified answer based on analysis
Explain	Justified answer with linked reasoning
Evaluate	Supported judgement in relation to question context e.g. sport or sports performer in question
Justify	Give reasons for your answers
Predict	Predict what is likely to happen in the future
Relative	Judgement based on order of importance
State	Recall facts

The meaning of key words which will be in exam questions  
Can be found at the back of you pop quiz booklets

# **Movement Analysis**

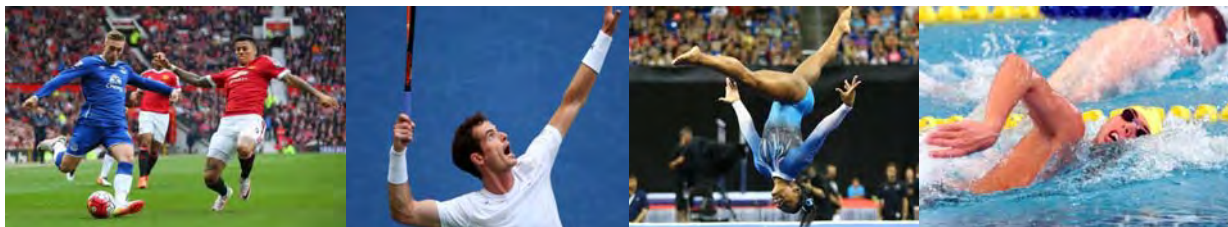
Types of Levers  
Planes and Axes of Movement



# 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.



All levers have 4 parts:

The **Lever** —

The **Fulcrum** ▲

A **Load** ■

An **Effort** ↓↑

1 F

2 L

3 E



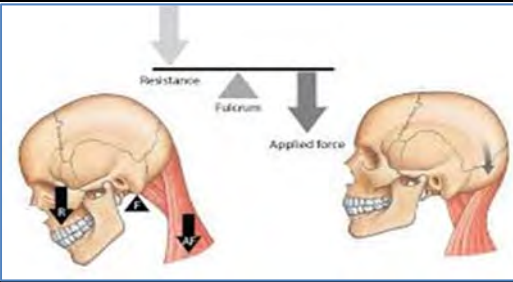
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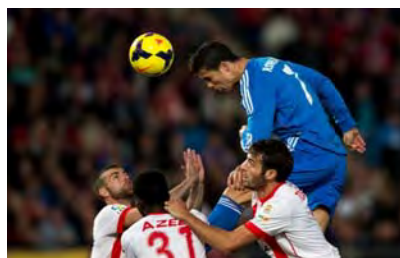


## Classes of Levers

There are three types of levers. In each type the fulcrum, load and effort are in different places. It is important that you know each one with a relevant example.

**Task:** Complete the table below.

Class of Lever: <b>1<sup>st</sup> Class Lever</b>	
Diagram of Lever:	
Example in the body:	
Sporting Examples:	





## Classes of Levers

Class of Lever: **2<sup>nd</sup> Class Lever**

Diagram of Lever:

Example in the body:



Sporting Examples:



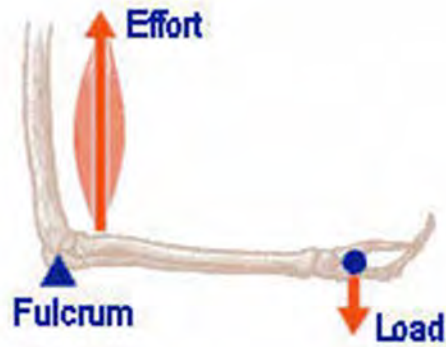


## Classes of Levers

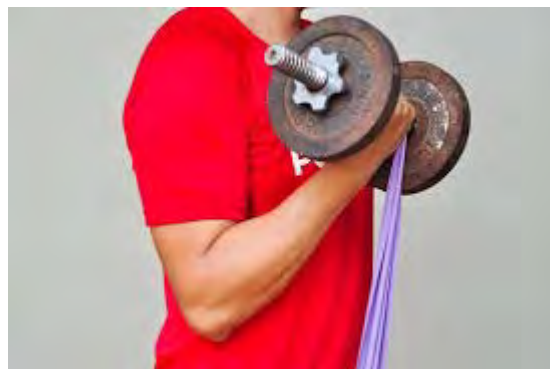
Class of Lever: **3<sup>rd</sup> Class Lever**

Diagram of Lever:

Example in the body:



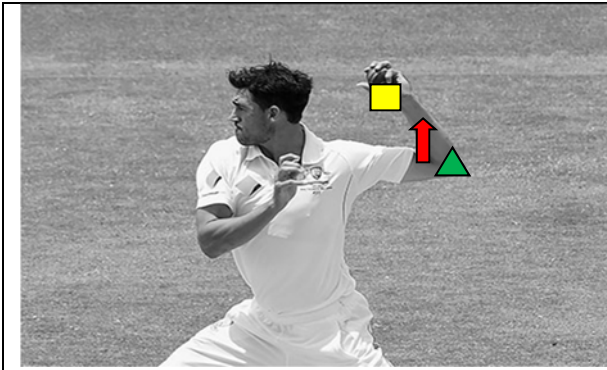
Sporting Examples:



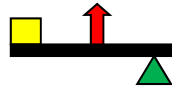
## Identifying Levers

**Task:** Using the notes and diagrams in your booklet look at the photos below 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.

Fulcrum: ▲      Effort: ↑      Load: ■



Lever Type: 3<sup>rd</sup>



Lever Type: \_\_\_\_\_



Lever Type: \_\_\_\_\_



Lever Type: \_\_\_\_\_



Lever Type: \_\_\_\_\_



Lever Type: \_\_\_\_\_

## Mechanical Advantage and Disadvantage

Lever systems provide **mechanical advantage** or **disadvantage**.

Levers have 2 main functions:

- 1.
- 2.

Lever	Advantages	Disadvantages
1 <sup>st</sup> and 2 <sup>nd</sup> class		
Due to the load being closer to the fulcrum than the effort		
3 <sup>rd</sup> class		
Due to the effort being closer to the effort than the load		

## Mechanical Advantage and Disadvantage

Class of Lever	Example	Sporting Example	Mechanical Advantage or Disadvantage?	Explanation
1 <sup>st</sup> Class				
2 <sup>nd</sup> Class				
3 <sup>rd</sup> Class				

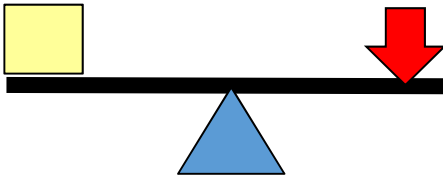
*Qu. Draw and label a 2<sup>nd</sup> class lever. (1 mark)*

# Mechanical Advantage and Disadvantage

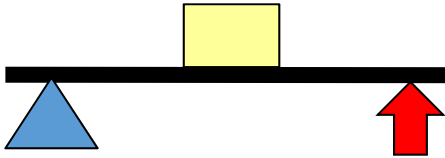
Mark on the effort & resistance arms

Mechanical advantage or disadvantage? Why?

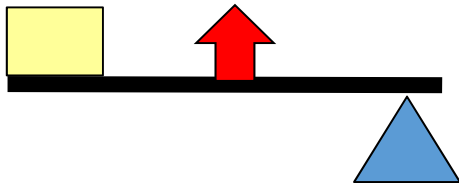
1<sup>st</sup> Class



2<sup>nd</sup> Class



3<sup>rd</sup> Class



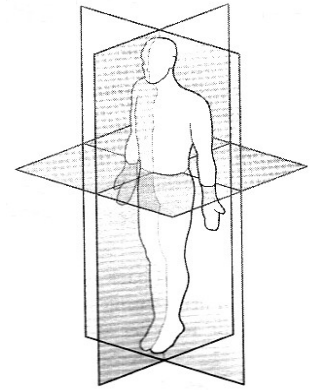


## Planes and Axes of Movement

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.

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**.



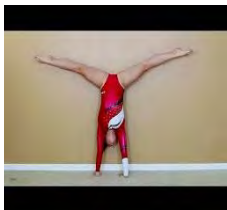
The Sagittal Plane:



Sagittal



The Frontal Plane:



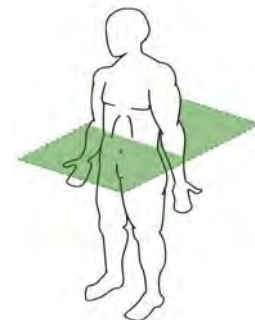
Frontal



The Transverse Plane:



Transverse



## Planes of Movement in Sport

**Task:** Using your notes identify which plane of movement the action is taking place in in the photos below. Think about what is happening at the joint (flexion, extension, rotation etc.).



The arms and legs are working in which plane of movement?



The arms and legs are working in which plane of movement?



The hips/knees are working in which plane of movement?



The arm/shoulder is working in which plane of movement?



The arm/shoulder is working in which plane of movement?

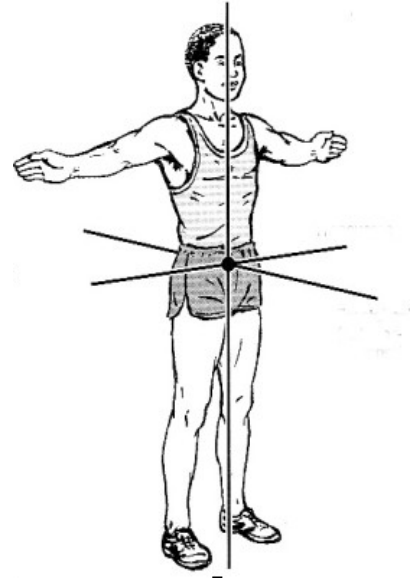
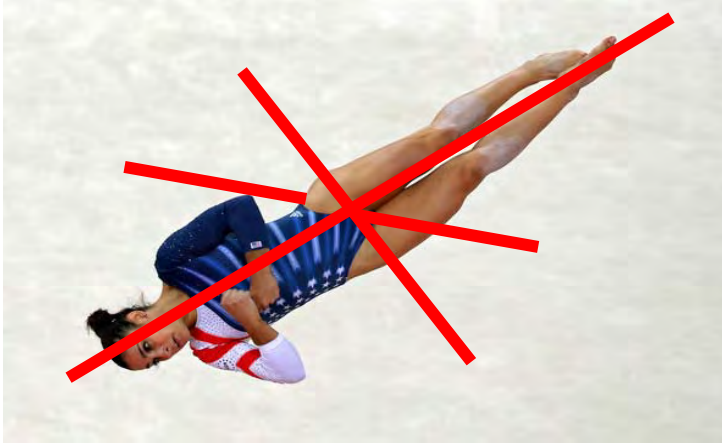


The arm/shoulder is working in which plane of movement?

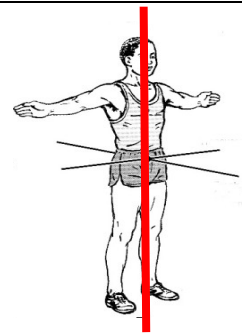
## Axes of Movement

Axes are like invisible skewers running through the body.

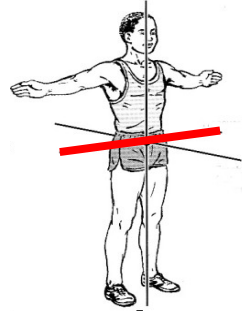
All movements rotate around one of the axes.



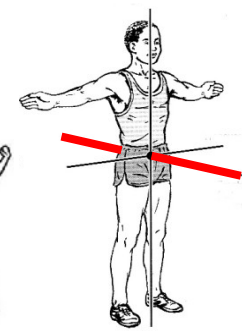
**Vertical Axis:**



**Frontal Axis:**



**Sagittal Axis:**



## Planes and Axes Combined

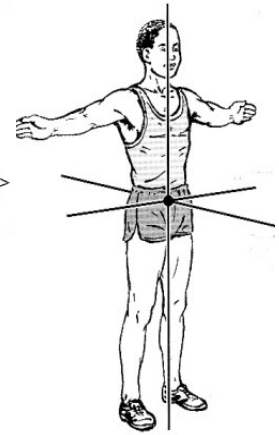
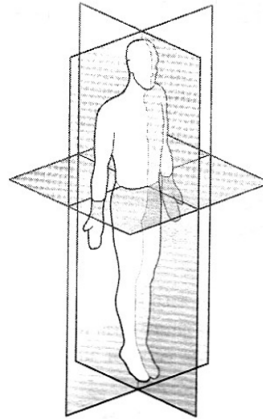
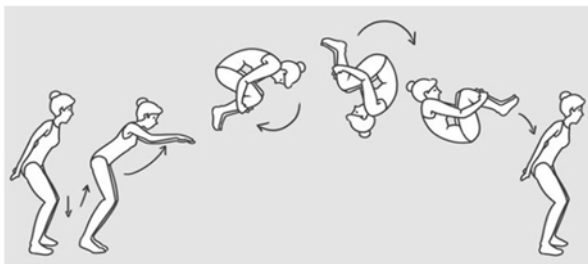
Each movement involves movement in a plane that is around an axis.

**Task:** 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.

Movement: Front or Back Somersaults

Plane of Movement:

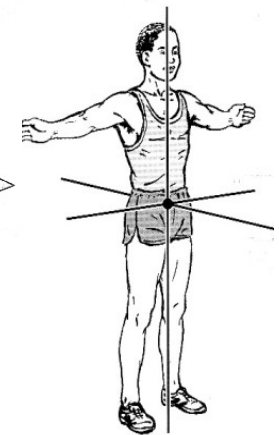
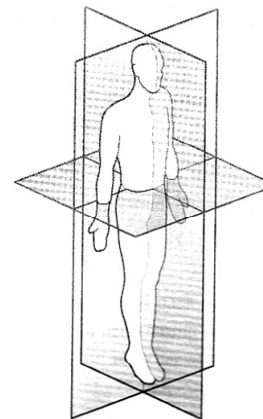
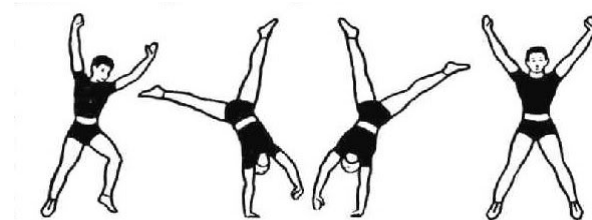
Axis of Rotation:



Movement: Cartwheel

Plane of Movement:

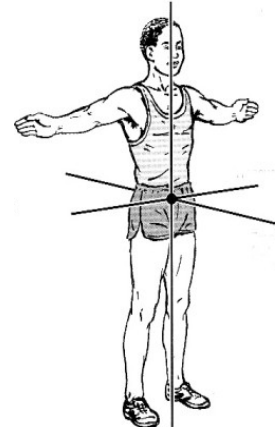
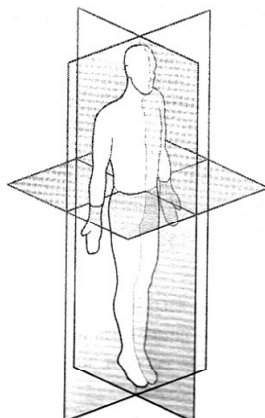
Axis of Rotation:



Movement: Full Twist Jump on Trampoline

Plane of Movement:

Axis of Rotation:





## 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**

<u>Plane</u>	<u>Axis</u>
Sagittal	Frontal
Frontal	Sagittal
Transverse	Vertical



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)



***Qu. 1. Name the plane that allows abduction and adduction at the shoulder and hip. (1 mark)***

***Qu. 2. What type of movement is allowed at the transverse plane? (1 mark)***

***Qu.3. State the name of the axis that allows movement in the transverse plane (1 mark)***

# **The Cardio-Respiratory System**

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

# Respiratory System



## Functions

1.

2.

## Composition of Air

Gas	Amount in inhaled air	Amount in exhaled air
Oxygen		
Carbon dioxide		
Nitrogen		
Other gases		2%

# Pathway of air

The diagram shows a human torso with the respiratory system highlighted. Labels with arrows point to various parts: the nasal cavity, oral cavity, pharynx, larynx, trachea, bronchi, bronchioles, and alveoli. There are ten empty orange-bordered boxes for labeling: five on the left and five on the right. A label 'Bronchioles' is already present at the bottom center. At the bottom left is a question mark icon, and at the bottom right is a 'solve' button, a circular 'C' icon, and a circular refresh icon.

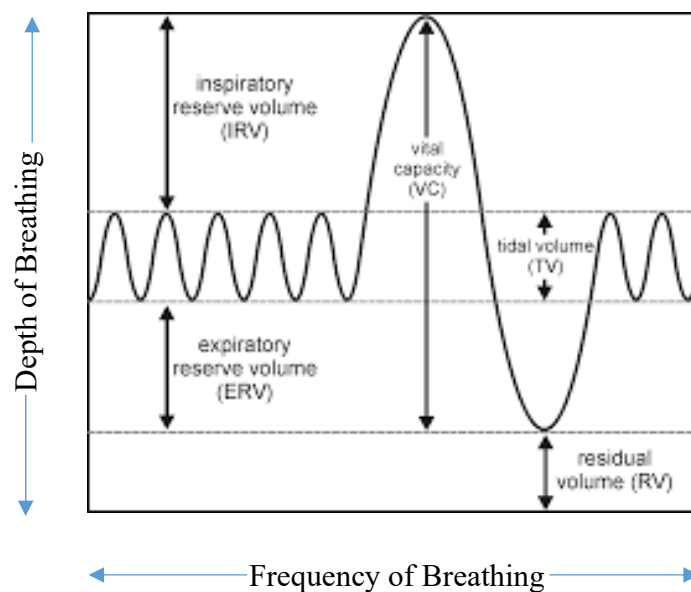


# Mechanics of Breathing & Definitions

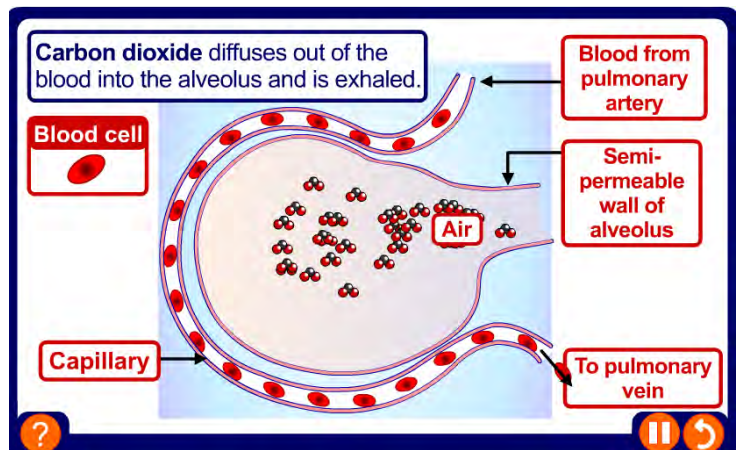
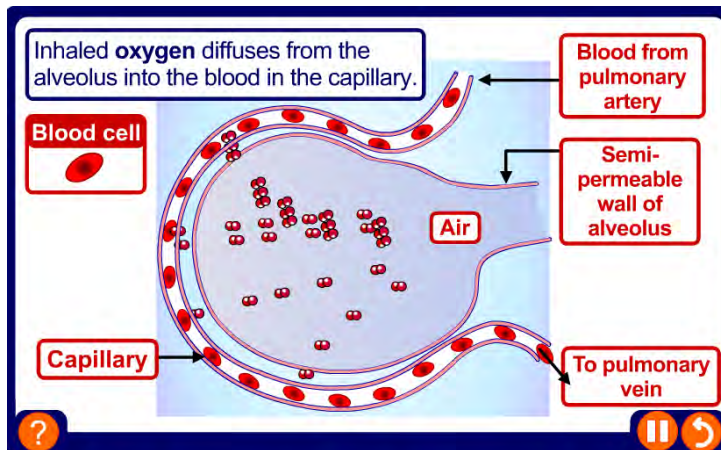
Breathing In	Breathing Out
1.	1.
2.	2.
3.	3.
4.	4.

<b>Lung Volume</b>	
<b>Tidal Volume</b>	
<b>Vital Capacity</b>	

## Spirometer Graph



## Alveoli & 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 concentration to reach a balance.

- The cardiovascular system needs the respiratory system to be efficient at removing O<sub>2</sub> 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

Alveoli	Capillaries
High oxygen concentration	Low oxygen concentration
Low carbon dioxide concentration	High carbon dioxide concentration

# Aerobic Respiration



Aerobic energy production takes place WITH OXYGEN

The body will be able to work aerobically if the activity is of a MODERATE OR LOW INTENSITY  
E.g. marathon running, endurance cycling or long distance swimming.

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.

**Aerobic Respiration Equation:**

**Fuel Source:**

**Long Term Effects of Aerobic Training:**

# Anaerobic Respiration



Anaerobic energy production takes place WITHOUT THE PRESENCE OF OXYGEN

- Used for HIGH INTENSITY activity and for POWERFUL MUSCLE CONTRACTIONS eg long jump, high jump and javelin.
- Oxygen cannot be processed quickly enough for body to use during aerobic respiration. Therefore OXYGEN DEBT & LACTATE ACCUMULATION occur
- LACTIC ACID is a by-product of anaerobic energy production. When lactic acid builds up DOMS occurs and muscles become fatigued and cannot function properly. An athlete would need to rest and repay the oxygen debt before they can produce another burst of high intensity anaerobic work.

**Anaerobic Respiration Equation:**

**Fuel Source:**

**Long Term Effects of Anaerobic Training:**

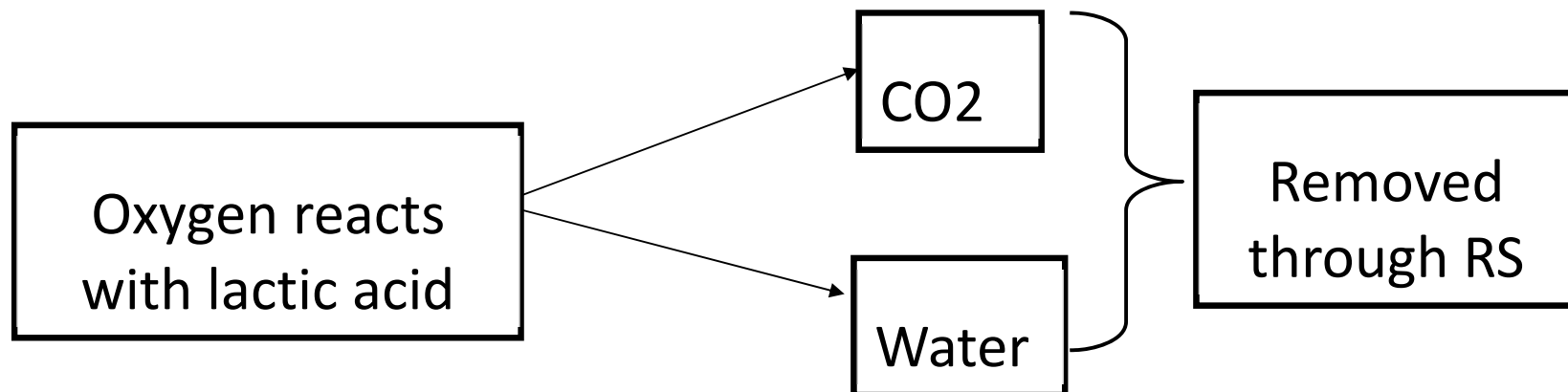
# Oxygen Debt

## Definition:

An Oxygen debt is created when muscles work anaerobically. This means that when you have finished exercising, and in the recovery phase, your cardiovascular and respiratory systems continue to work hard to repay the debt and replenish your muscles with oxygen.

To repay the oxygen debt you will need to either stop or slow down to allow you to breath faster and deeper to bring in more oxygen and remove waste products.

## EG:



**The 5 Short Term Effects of Exercise on  
the Respiratory System**

1.

2.

3.

4.

5.

**The 6 Long Term Effects of Exercise on  
the Respiratory System**

1.

2.

3.

4.

5.

6.

## The impact of exercise

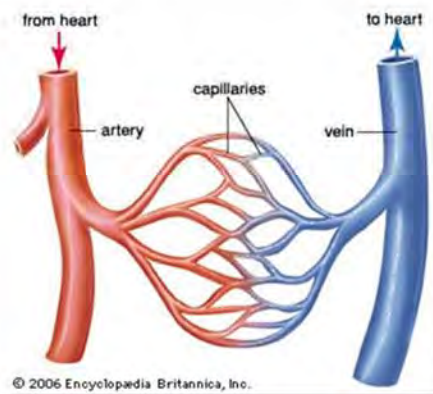
Improved efficiency of the lungs will allow...

- 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.
- **VO<sub>2</sub> max** is increased (the volume of oxygen an athlete can consume while exercising at maximum capacity).
- Increase in blood vessels (**capillaries** around the alveoli).

# Cardiovascular System

The cardiovascular system is made up of

1.
2.
3.



## Functions of the cardiovascular system

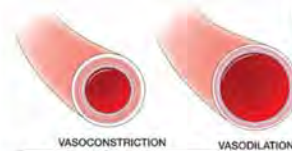
1. **Transport** of oxygen, carbon dioxide and nutrients (glucose)
2. **Clotting** – Platelets form clots, which seal open wounds. Guarding the body against infection and excessive bleeding.
3. **Regulation of body temperature** – Vasodilation increases blood flow towards the skin to be cooled. Body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

### Vasodilation

When veins dilate, widening of the lumen to increase blood flow.

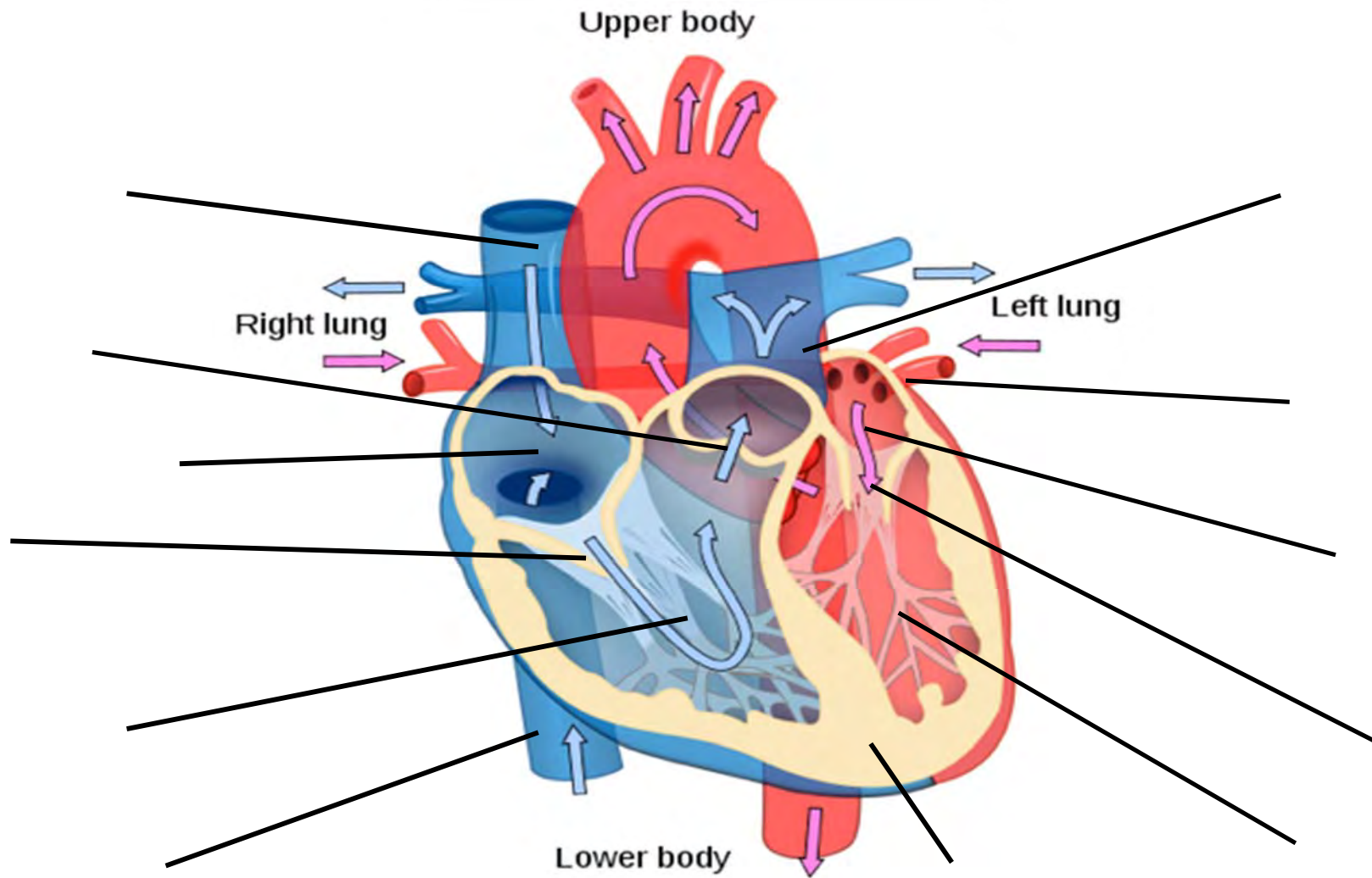
### Vasoconstriction

When veins shrink, narrowing of the lumen to decrease blood flow.



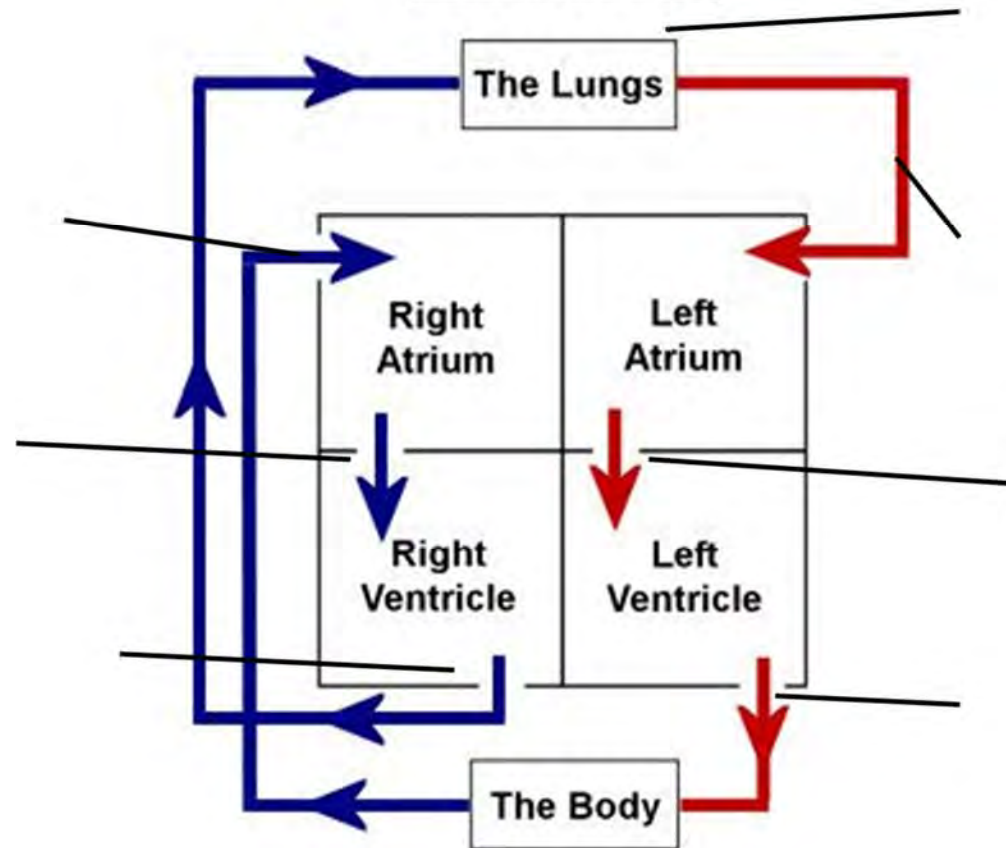


# Heart Structure



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

# Blood Flow



Blood Pressure	
<b>Blood pressure</b>	
<b>Systole</b>	
<b>Diastole</b>	

**120**

Systolic Pressure

---

**80**

Diastolic Pressure

**DR SClaxton**

# Blood Vessels

## Arteries

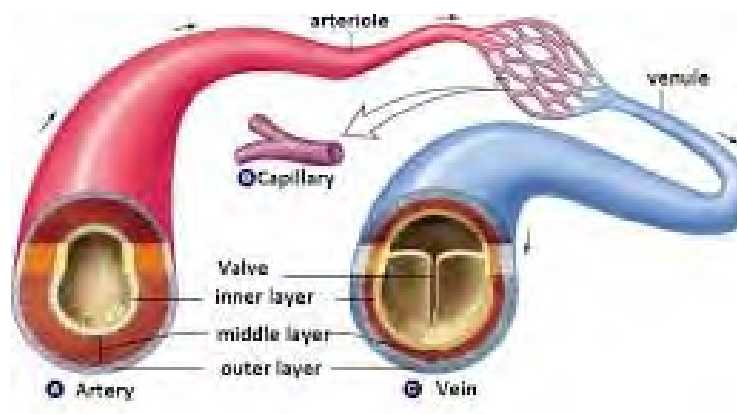
1. C
2. U
3. T
4. B
5. V

## Veins

1. C
2. U
3. T
4. H

## Capillaries

1. W
2. V
3. W
4. C



# Blood Vessels

Red Blood cells (Erythrocyte)



White Blood cells (Leukocyte)



Platelets



Plasma



# Blood Distribution

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

- 
- 
- 

**VASOCONSTRICTION – Narrowing of the lumen**

**VASODILATION – Widening of the lumen**

*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 these countries (Kenya) are exceptionally good at long distance running.
- Other Athletes may train in high altitudes to increase their blood count.

### Low blood cell count

- Known 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.

## The 5 Short Term Effects of Exercise on the Cardiovascular System

1.

2.

3.

4.

5.

**Heart Rate**

X

**Stroke Volume**

=

**Cardiac Output**

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

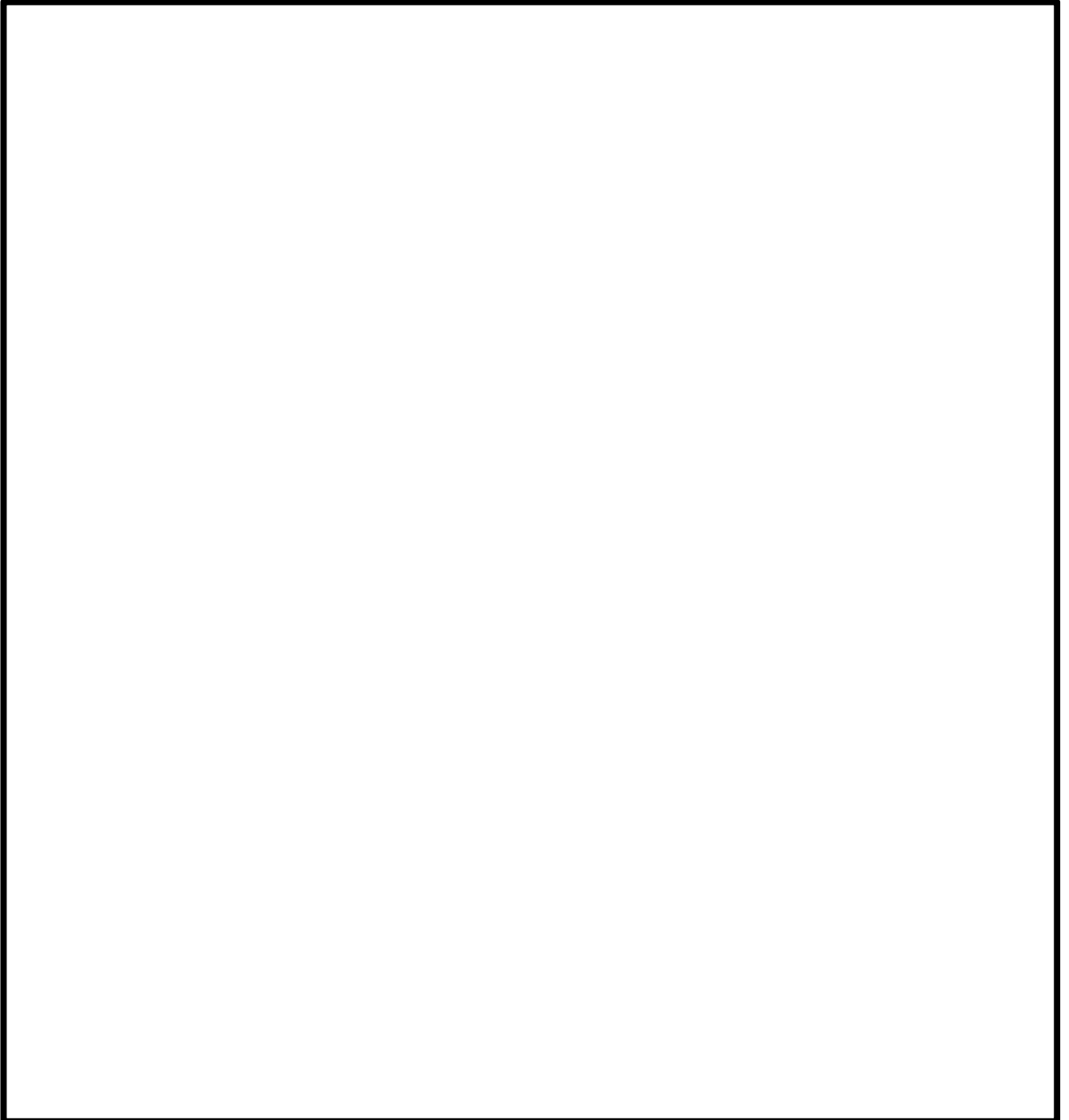
The amount of blood pumped by the heart during each beat (75-

The amount of blood pumped by the heart in one minute (5l rest & 21-35l active)

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

<b>C</b>	<b>C</b>	<b>C</b>
Increased <b>Cappilirisation</b>	Cardiac Hypertrophy	Decrease in <b>Coronary Heart Disease (CHD)</b>

- Draw the journey of gases that travel through the cardio-respiratory system.
- Labelling all the components the gases pass through.





# Questions

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

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.....

2. What sports require cardiovascular fitness?

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.....  
.....

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

.....  
.....  
.....  
.....  
.....  
.....

# 9 Markers – 3 Steps

Step 1) Highlight **A01**, **A02** and **A03** within the question

Step 2) Plan your answer by breaking down your answers into the 3 row template

Step 3) Number templates into paragraphs

**AO1) KNOW & UNDERSTAND QUESTION TOPIC:** simple statement to recall, define, describe

**AO2) APPLY KNOWLEDGE USING SPORTING EG's:** link knowledge and understanding to the question.

**AO3) ANALYSE & EVALUATE:** justify and conclude your answer. Show wider knowledge.

**Q) Evaluate the extent to which the redistribution of blood flow is necessary during a hockey match**

Points to Answer:

A01 –

A02 –

A03 –





# Interpreting Data

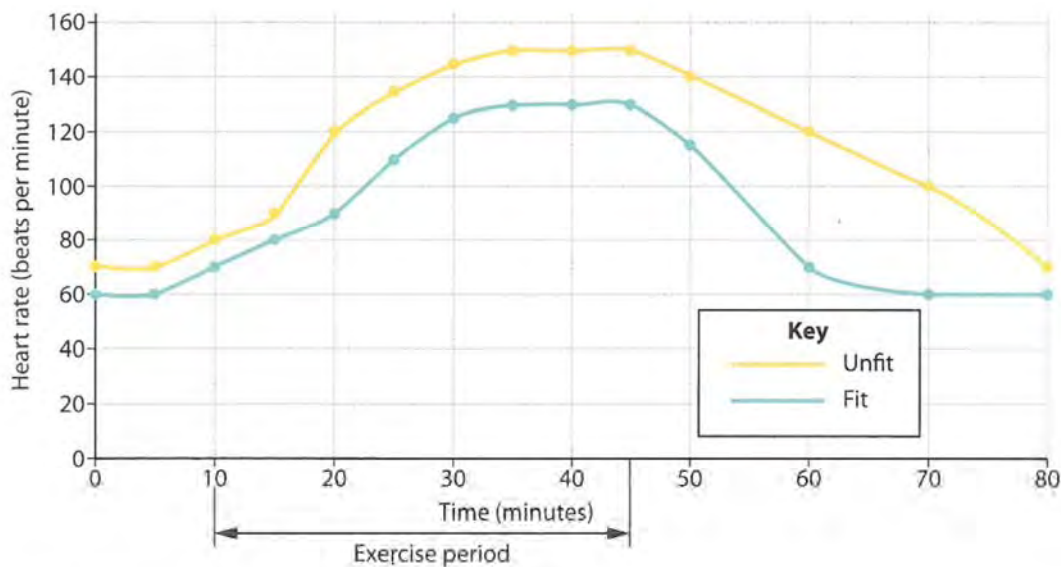
# Short & Long Term Effects of Exercise

## Interpreting Graphs

Graphs are important as they allow you to:

1. Look at a particular area of what is happening as you exercise
2. Make a quick visual comparison
3. Look in detail and analyse what is happening as you exercise

### Heart Rate Graphs:

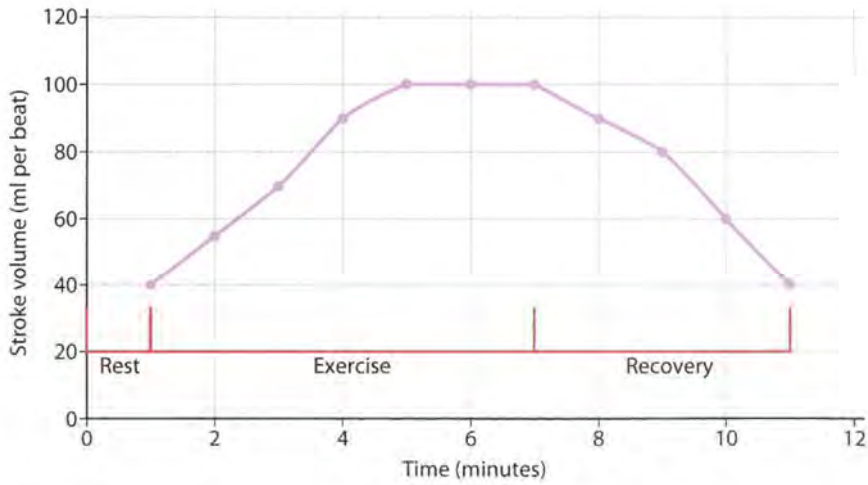


**Figure 1.18** Heart rate patterns before, during and after exercise for two different athletes

Analyse the key differences between the unfit and fit athletes

- 1.
- 2.
- 3.
- 4.

## Stroke Volume Graph – Exercise Session:

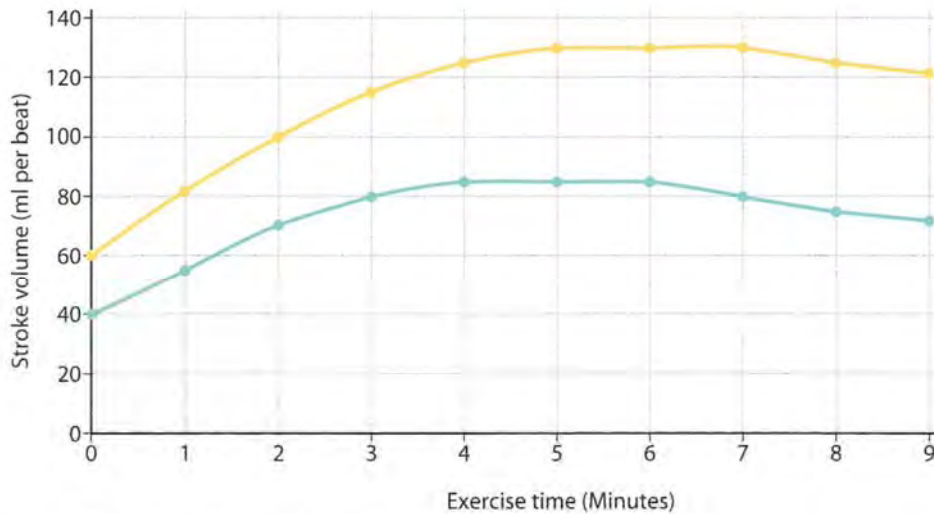


What happens to Stroke Volume during the session?

- 
- 
- 

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

## Stroke Volume Graph – Level of Fitness:



**Figure 1.21** Stroke volume graphs for two different athletes

The graph above shows stroke volume during exercise for two different athletes. One of the athletes (A) is very fit; the other athlete (B) does not do much exercise:

Which line belongs to which athlete? (1mark)

Explain your answer (4 Marks)

.....

.....

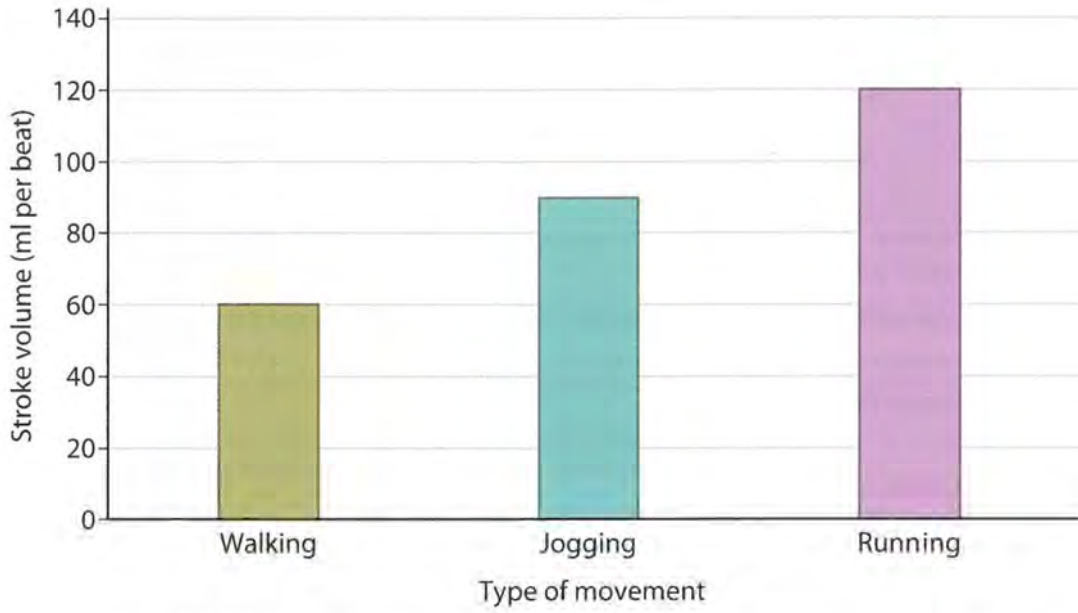
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## Stroke Volume Graph – Intensity of Training:



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

Would the graph look different for an elite athlete versus an untrained athlete? Why?

.....

.....

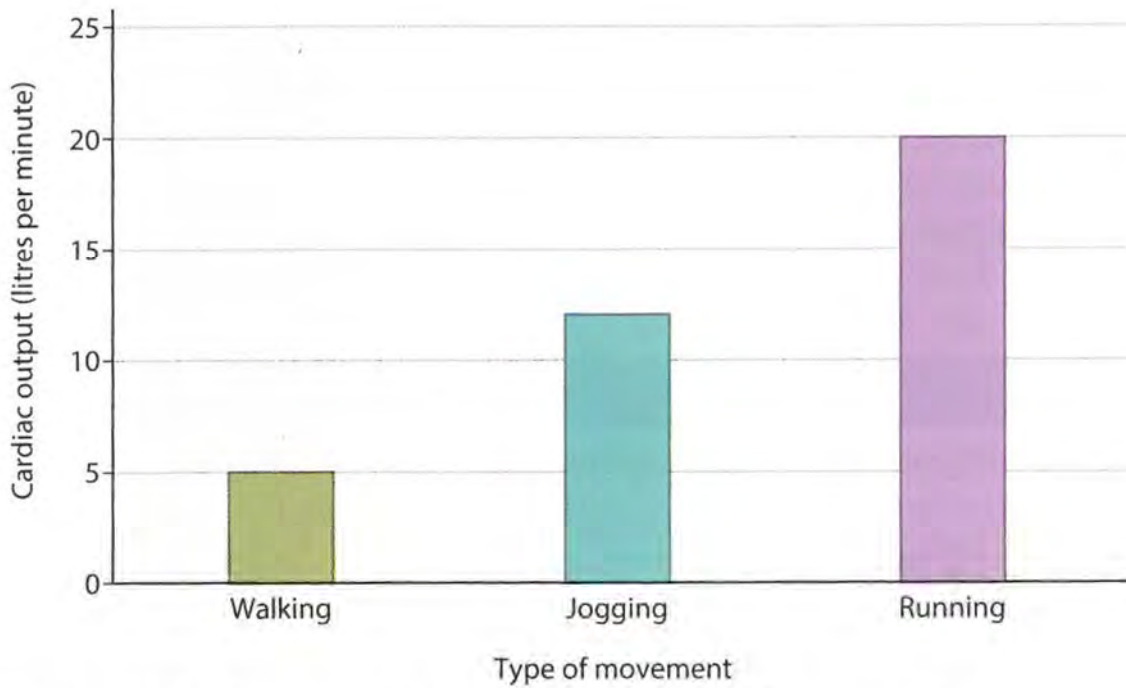
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Cardiac Output Graph – Intensity of Training:



**Figure 1.22** Cardiac output for an athlete moving at different speeds

Using figure 1.22 explain the changes in cardiac output when moving at different speeds: walking, jogging and running (3 marks)

.....

.....

.....

.....

.....

# Fitness and Training


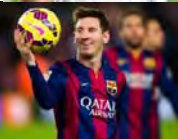


# The relationship between health and fitness and the role that exercise plays in both

<b>Health</b>	
<b>Fitness</b>	
<b>Performance</b>	
<b>Exercise</b>	



The link.....

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**.

Is it possible to be fit not healthy?	
	
	
	
	

# Components of Fitness

# Health Related Exercise

## Muscular Muscles Can Feel Big

	Definition	Example
Muscular Strength		
Muscular Endurance		
Cardiovascular Fitness		
Flexibility		
Body Composition		

# Skill Related

## ABC-PRS

	Definition	Example
Agility		
Balance		
Co-ordination		
Power		
Reaction time		
Speed		

# 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.

## 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.
  - 2.
  - 3.
  - 4.
  - 5.

<p><u>Test results</u> &lt; = Less than &gt; = More Than</p>
--

# Testing the Components of Fitness

Fitness Test	Purpose	Protocol
Cooper 12 minute		12 minutes run or swim, measuring the distance you cover.
Harvard step		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		Use a grip dynamometer with your strongest hand. 3 attempts recording best.
1 minute press up		Number of correctly performed press ups (straight back, 90 degree elbow bend) in 1 minute.

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

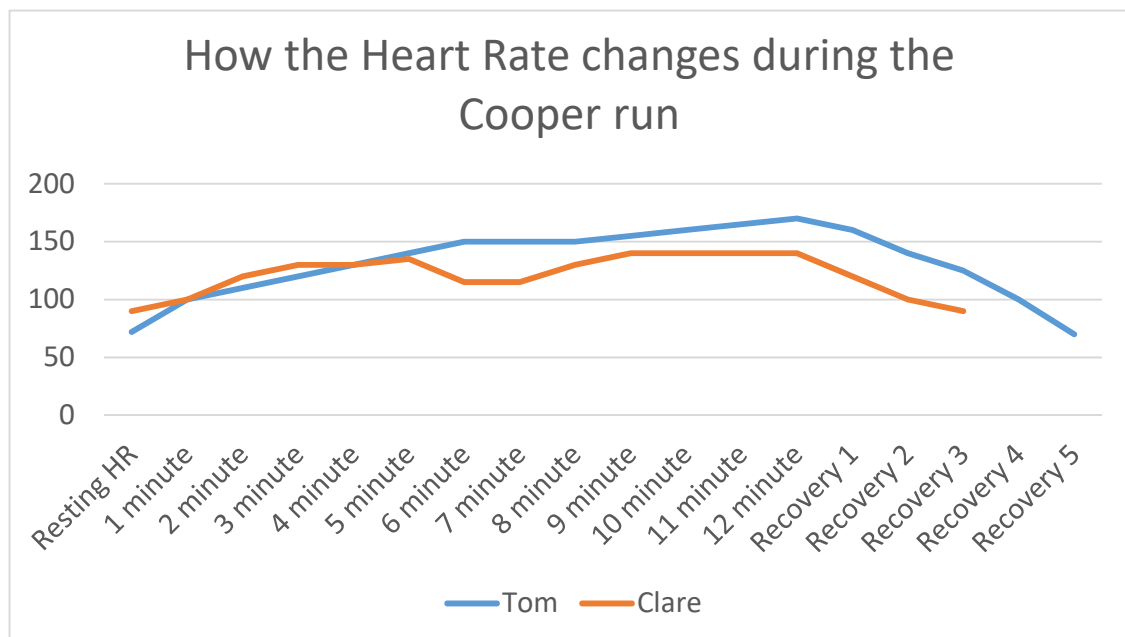
Fitness Test	Purpose	Protocol
Illinois Agility Run		<p>Lay face down on the floor at the "Start" - The athlete jumps to their feet and negotiates the course around the cones to the finish.</p> 
Vertical jump		Stand side on and flat footed. Mark where your finger tips reach. Place chalk on your fingers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



# Interpretation of data

Quantitative	Qualitative

1. Does the graph below show quantitative or qualitative data? \_\_\_\_\_
2. Who has the lowest RHR? \_\_\_\_\_
3. Who has the fastest recovery time? \_\_\_\_\_



# 9 Markers – 3 Steps

Step 1) Highlight **A01**, **A02** and **A03** within the question

Step 2) Plan your answer by breaking down your answers into the 3 row template

Step 3) Number templates into paragraphs

**Q)** To do well in competition, canoeists need good strength, flexibility and speed.  
Discuss the suitability of using the fitness tests shown in table 1 to assess the fitness of canoeists for their sport



sit and reach test	30m sprint	one-minute press-up test
--------------------	------------	--------------------------

**AO1) KNOW & UNDERSTAND QUESTION TOPIC:** simple statement to recall, define, describe

**AO2) APPLY KNOWLEDGE USING SPORTING EG'S:** link knowledge and understanding to the question.

**AO3) ANALYSE & EVALUATE:** justify and conclude your answer. Show wider knowledge.

Points to Answer:

A01 –

A02 –

A03 –



# Principles and Methods



Successful athletes do not just train **hard**, they also train **effectively**; they apply the **Principles of Training**.

# Principles of Training

Specificity:

Overtraining

FIRST-OP

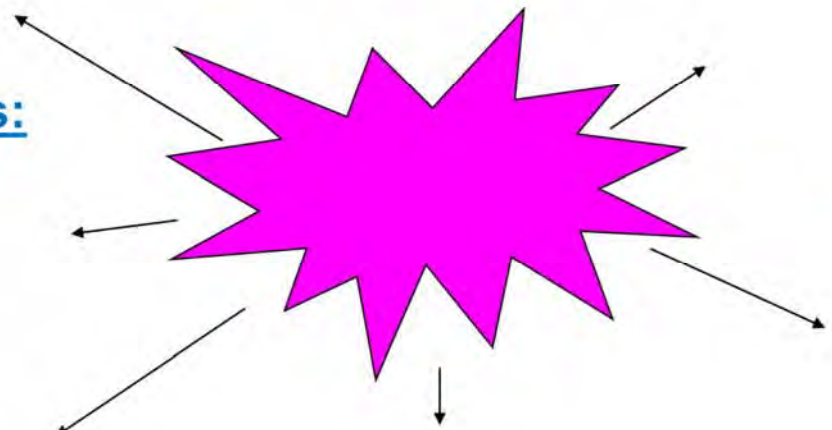
Individual needs:

Progressive Overload:

Thresholds of Training:

Reversibility:

FITT:



# Understanding the F.I.T.T Principle

	Example	How the FITT principle overlaps with Principles of Training (First-OP)
<b>F</b> requency		
<b>I</b> ntensity		
<b>T</b> ime		
<b>T</b> ype		

## Rest & Recovery

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



# Thresholds of Training

Allows us to train effectively and safely. (**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 in as you exercise.

To work out your target zone use a simplified version of the

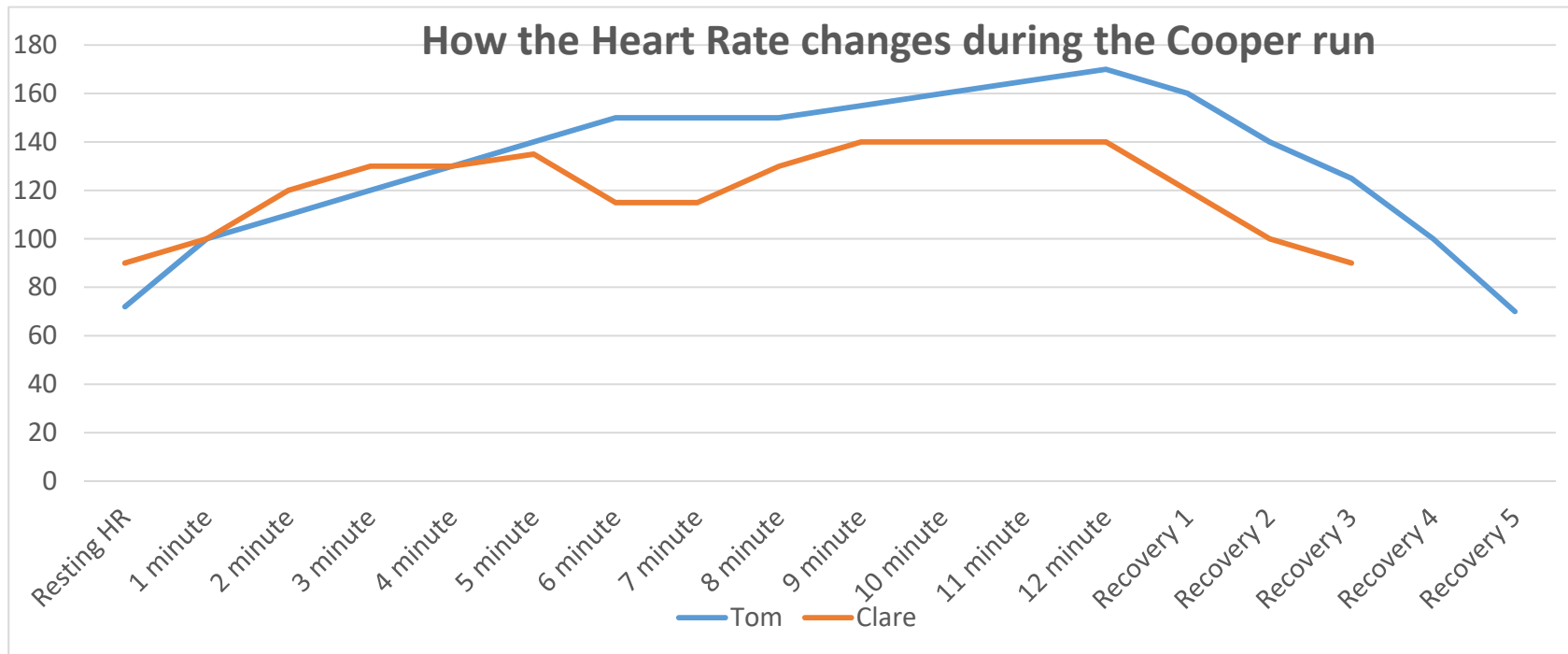
## KARVONEN FORMULA

**Maximal Heart Rate (MHR)  $220 - \text{Age}$**

My MHR is

---

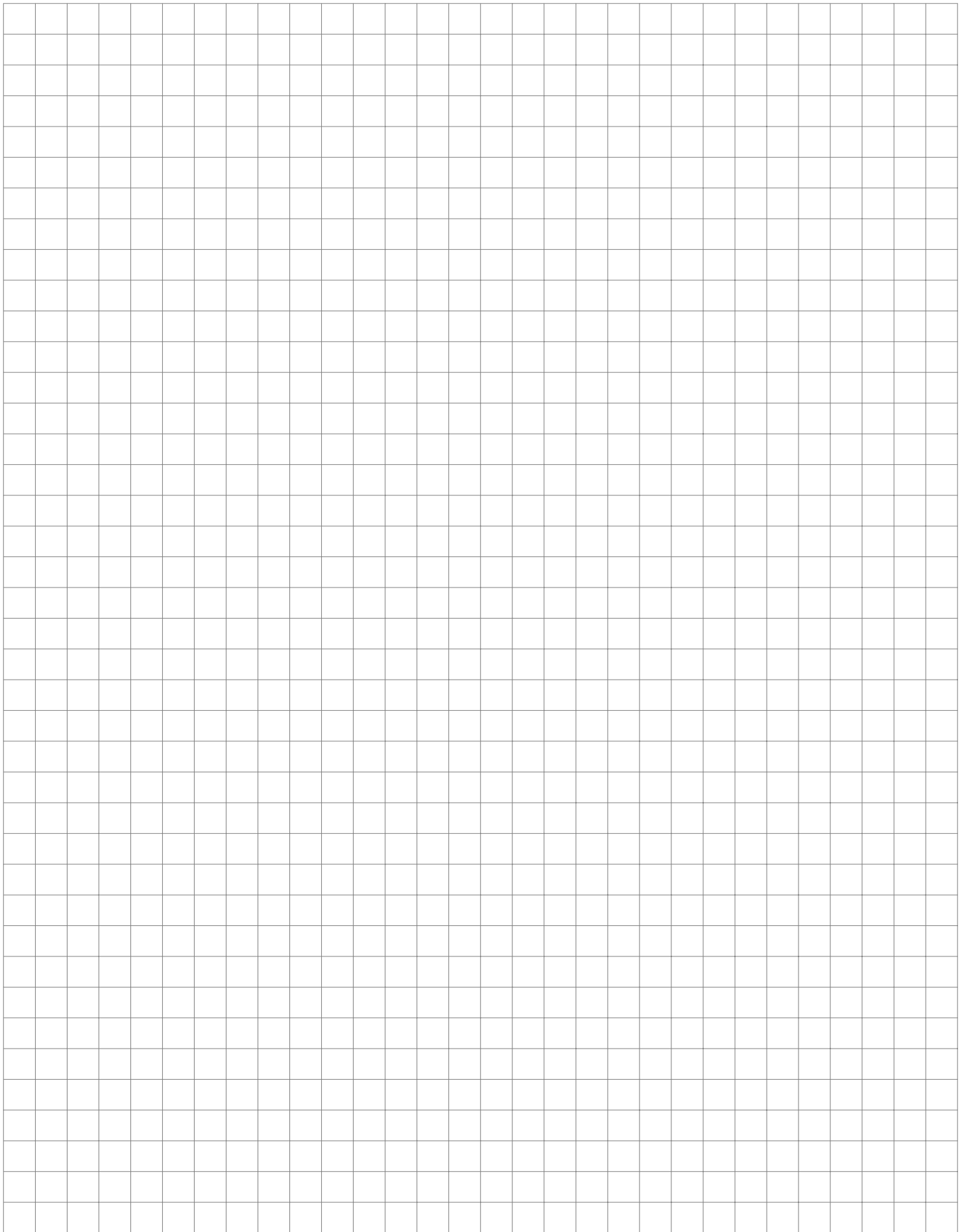
- If you wanted to improve your **cardiovascular fitness** you would need to train within your **aerobic target zone. (60-80% MHR)**
- If you wanted to improve your **speed or power** you would need to train within your **anaerobic target zone. (80-90% MHR)**



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 safely? \_\_\_\_\_

Name	MHR	60%	80%
Clare			
Tom			



# Methods of Training

# 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

**I** \_\_\_\_\_  
**F** \_\_\_\_\_  
**C** \_\_\_\_\_  
**C** \_\_\_\_\_  
**P** \_\_\_\_\_  
**W** \_\_\_\_\_



# Cardiovascular Fitness

	Advantages	Disadvantages
<p><b><u>Continuous</u></b></p> <p>Exercising for extended period of time without rest.</p> <p>E.G jogging, running, swimming, cycling or rowing.</p>		
<p><b><u>Interval</u></b></p> <p>High intensity exercise followed by rest or active recovery.</p> <ul style="list-style-type: none"><li>• Work periods you work <b>anaerobically</b> (80-90%).</li><li>• Rest/active recovery, should work <b>aerobically</b> (60-80%).</li><li>• Alternating between your upper aerobic threshold and lower anaerobic threshold.</li><li>• Develops both speed and cardiovascular fitness.</li></ul>		
<p><b><u>Fartlek</u></b></p> <p>Swedish for “speed play” and is a form of interval training. There are no rest periods just changes in intensity and terrain.</p> <p>E.G <b>60</b> second <b>jog</b> – <b>30</b> second hard <b>run</b> – <b>10</b> second <b>sprint</b> – <b>30</b> <b>walk</b> and so on.</p> <p>Most suitable for games players. (football/rugby/netball)</p>		

# Strength and Muscular Endurance

	Advantages	Disadvantages
<p><b><u>Weight/resistance training</u></b></p> <p><b>Strength</b> = low repetitions using heavier weights.</p> <p><b>Muscular endurance</b> = High repetitions using lighter weights.</p> <p><b>Free weights</b> (dumbbells) = Experienced performer, greater range of movement, activates core &amp; stabilising muscles. Higher risk of injury!!</p> <p><b>Resistance machines</b> = Beginners, promotes good technique providing stability and control.</p> <p>Work bigger muscles groups first (back, chest legs) as they will need more energy.</p>		
<p><b><u>Circuit</u></b></p> <p>Circuit training can improve Strength, muscular endurance and cardiovascular fitness, depending on the exercises included.</p> <p>Circuits include different exercises called stations, which are completed by a set number of repetition or time.</p>		

# Power

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

Advantages

Disadvantages

## 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.





# 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 boost wellbeing. Develops strength, balance and flexibility

**Spinning** = High intensity work out on stationary bikes with changes of pace throughout. Develops muscular and cardiovascular endurance.



# 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)**

Sprinter.....

.....  
.....  
.....  
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.....

Marathon Runner.....

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

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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)**

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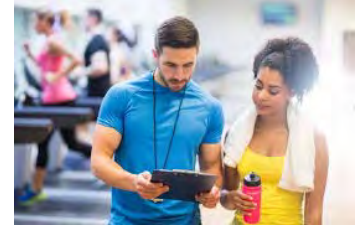
# How to optimise training and prevent injury



## Optimising Training and Preventing Injuries

### PAR-Q: Physical Activity Readiness Questionnaire

A PAR-Q is a self-screening tool that can be used by anyone who is planning to start an exercise or training programme.



### Categories of Questions Asked on a PAR-Q

- 1.
- 2.
- 3.
- 4.

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

If an individual answers NO to **all** the questions in a PAR-Q they are fit to participate in an exercise programme. If they answer YES to **any** questions, they may need to see their GP or make changes to their exercise programme. E.g. They may need to start very slowly and gradually increase the intensity and frequency of their training sessions.



## Physical Activity Readiness Questionnaire (PAR-Q)

Many health benefits are associated with regular exercise, and the completion of the PAR-Q is a sensible first step to take if you are planning to increase the amount of physical exercise in your life. For most people, physical activity should not pose any problem or hazard. The PAR-Q is designed to identify the small number of adults for whom physical activity might be inappropriate or those who should seek medical advice concerning the type of activity most suitable for them.

- 1. Do you have a bone or joint problem such as arthritis, which has been aggravated by exercise or might be made worse with exercise? Yes / No
- 2. To your knowledge, do you have high blood pressure? Yes / No
- 3. To your knowledge, do you have low blood pressure? Yes / No
- 4. Do you have Diabetes mellitus or any other metabolic disorder? Yes / No
- 5. Has your doctor ever said that you have raised cholesterol (serum level above 6.2mmol/L)? Yes / No
- 6. Do you have or ever suffered a heart condition? Yes / No
- 7. Have you ever felt pain in your chest when you do physical exercise? Yes / No
- 8. Is your doctor currently prescribing you drugs or medication? Yes / No
- 9. Have you ever suffered from shortness of breath at rest or with mild exercise? Yes / No
- 10. Is there any history of Coronary Heart Disease within your family? Yes / No
- 11. Do you ever feel faint, have spells of dizziness or have ever lost consciousness? Yes / No
- 12. Do you currently drink more than the average amount of alcohol per week? Yes / No  
21 units for men and 14 units for women (1 unit = 1/2 pint of beer/cider or 1 small glass of wine)
- 13. Do you currently smoke? Yes / No
- 14. You do NOT currently exercise regularly (at least 3 times per week) and/or work in a job that is physically demanding. Yes / No
- 15. Are you, or is there any possibility that you might be pregnant? Yes / No
- 16. Do you know of any other reason why you should not participate in a programme of physical activity? Yes / No

### If you answered YES to one or more questions:

If you have not already done so, consult with your doctor by telephone or in person before increasing your physical activity and/ or taking a fitness appraisal. Inform your doctor of the questions that you answered 'yes' to on the PAR-Q or present your PAR-Q copy. After medical evaluation, seek advice from your doctor as to your suitability for:

- 1. Unrestricted physical activity starting off easily and progressing gradually, and ...
- 2. Restricted or supervised activity to meet your specific needs, at least on an initial basis.

### If you answered NO to all questions:

If you answered the PAR-Q honestly and accurately, you have reasonable assurance of your present suitability for:

- 1. A graduated exercise programme
- 2. A fitness appraisal.

### Assumption of Risk

I hereby state that I have read, understood and answered honestly the questions above. I also state that I wish to participate in activities, which may include aerobic exercise, resistance exercise and stretching. I realise that my participation in these activities involve the risk of injury and even the possibility of death. I hereby confirm that I am voluntarily engaging in an acceptable level of exercise, which has been recommended to me.

NAME CLIENT NAME STAFF

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_ / \_\_\_\_ / \_\_\_\_ SIGNATURE \_\_\_\_\_ DATE \_\_\_\_ / \_\_\_\_ / \_\_\_\_



## Preventing Injury

**P**eople \_\_\_\_\_

**P**lease \_\_\_\_\_

**P**repare \_\_\_\_\_

**W**hen \_\_\_\_\_

**C**ontinuously \_\_\_\_\_

**R**unning \_\_\_\_\_

# People Please Prepare When Continuously Running

## Preventing Injury

Completing a **PAR Q**

Effective use of the **Principles of Training**

Wearing **Protective Clothing and Equipment**

Complete a thorough **Warm Up**

- 1.
- 2.
- 3.

**Check Equipment and Facilities**

Adhering to the **Rules** of the activity

# Injury Prevention

Choose one of the sports that you are doing for GCSE PE and try to think of one example of safety, which might be involved with each heading.

**For example: Rules of the game: stops fouling**

Your sport	Ways in which this may prevent injury
Rules of the game/competition	
Types of safety equipment used	
Correct use of the principles of training	
Preparation for taking part	1
Recovery after the activity	2
Checking equipment and facilities	

Now fill in the table again for another of your chosen activities.

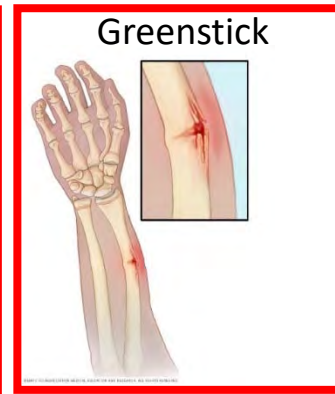
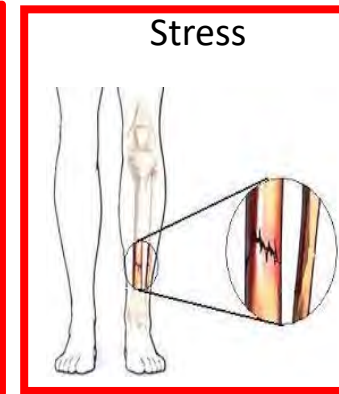
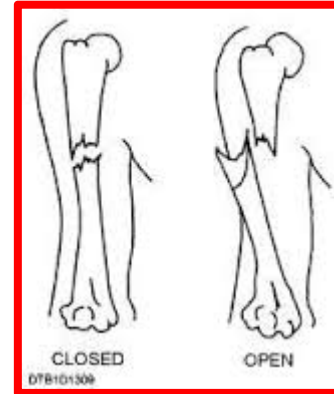
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Correct use of the principles of training	
Preparation for taking part	1
Recovery after the activity	2
Checking equipment and facilities	

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# Hard Tissue Sporting Injuries (Linked to bones)



**Dislocation**



**Fractures**

**Compound (Open):**

**Simple (Closed):**

**Stress:**

**Greenstick:**

# Hard Tissue Sporting Injuries (Linked to bones)



Sprain



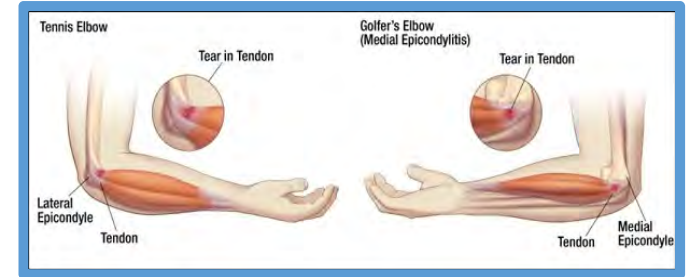
Torn Cartilage



Concussion



# Soft Tissue Sporting Injuries (Linked to muscles)



**Strain**

**Abrasions**

**Golfers Elbow:**

**Tennis Elbow:**



## RICE

### The treatment for soft tissue injuries



<b>Rest</b>	
<b>Ice</b>	
<b>Compression</b>	
<b>Elevation</b>	

#### Exam 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)

# Warming up and Cooling down



# 3 Stages of an Exercise Session

- 1) Warm-up
- 2) Main Activity
- 3) Cool-Down

## 3 Stages of a Warm-Up

- 1) Cardiovascular Phase
- 2) Stretches (8-10 secs) & Joint Mobilisation
- 3) Skills/Psychological

## 5 Reasons why we Warm-Up

- 1.
- 2.
- 3.
- 4.
- 5.

## 3 Stages of a Cool-Down

- 1) Cardiovascular Phase
- 2) Stretching for 10-15mins (30-35 secs hold on each stretch)
- 3) Relaxation Phase for 10-15 mins

## 6 Reasons why we Cool-Down

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.



**Performance  
Enhancing Drugs  
PEDs**



## Performance Enhancing Drugs

*Why a sports performer may take performance enhancing drugs (PEDs)*



### 3 Pressures

- 1.
- 2.
- 3.

### Consequences of drug taking:

1. Disqualification from competition
2. Stripped of titles and medals
3. Loss of sponsorship
4. Serious health risks

# PERFORMANCE ENHANCING DRUGS

**B**eat \_\_\_\_\_

**D**rugs \_\_\_\_\_

**A**nd \_\_\_\_\_

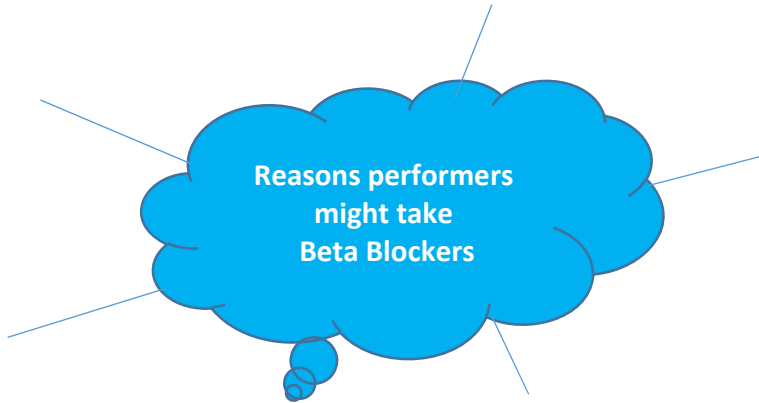
**S**ay \_\_\_\_\_

**N**o \_\_\_\_\_

**P**eople \_\_\_\_\_

# Beta Blockers

Beta blockers are drugs that are designed to treat various health issues, particularly those associated with the heart such as high blood pressure. They work by blocking the effects of adrenaline, so helping to slow down the heart. They can also reduce anxiety and stress levels.



## Health Risks/Side Effects



- Lowering the heart rate too much can be dangerous and lead to heart failure
- Depression
- Insomnia and nightmares

## Sports most likely to use them



- 
- 
- 
- 

A double medallist from North Korea was expelled from the Olympic Village in Rio 2016 and stripped of his medals after testing positive for drugs. Kim Jong-su won silver in the 50m pistol event and bronze in the 10m air pistol, but in a drugs test Kim was found to have taken an illegal beta-blocker.



# Diuretics

Diuretics are drugs that increase the rate of urination, so increasing the amount of fluid the body loses. Unlike other performing-enhancing drugs, diuretics are not banned because they directly enhance performance, but because of other potential benefits.

Diuretics are also taken in an attempt to reduce the concentration of any banned substance that may be present in the urine.



## Health Risks/Side Effects



- Dehydration, which can cause dizziness, muscle cramps, headaches and nausea
- Heart and kidney failure

## Sports most likely to use them



- 
- 
- 

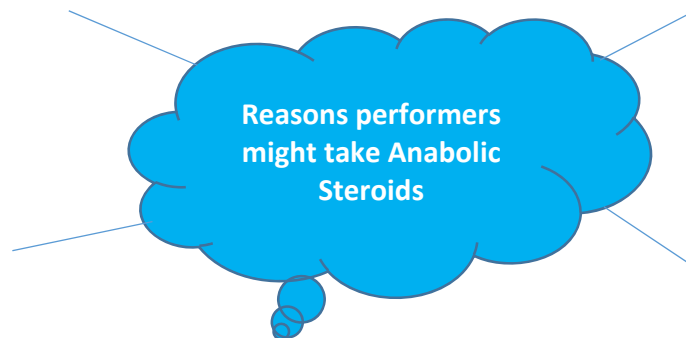
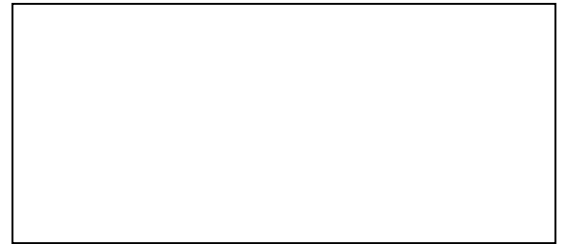
Veronica Campbell-Brown, one of Jamaica's most successful female athletes of all time, tested positive for a **banned diuretic** - something that is viewed as a masking agent by the World Anti-Doping Agency. Campbell-Brown won 200m and 4x100m relay golds at the 2004 Olympics and retained her 200m title in 2008. At London 2012, Campbell-Brown took bronze in the 100m and was a member of Jamaica's silver medal-winning sprint relay team. She will face a two year ban.



# Anabolic Steroids

Anabolic steroids have the same chemical structure as the male hormone testosterone. This is produced naturally by the body, but performers increase the amount they have by taking artificially produced versions of it.

Anabolic steroids are reputed to be the drugs most commonly used to enhance performance in sport.



## Health Risks/Side Effects



- Liver damage
- Cardiac Heart Disease (Increased risk of heart attack and stroke)
- High blood pressure
- Infertility
- Increased risk of muscle and tendon injury
- Aggression and mood swings

## Sports most likely to use them



•

Justin Gatlin has been banned from international competitions twice in his career. His most recent ban of four years in 2006 was for taking Anabolic Steroids. Gatlin returned to international track racing in 2010. At the Rio Olympics Gatlin came second in the 100m final. At the 2017 World Athletics in London Gatlin came 1<sup>st</sup> in the 100m final beating Usain Bolt in his final race. Many experts and the press are debating whether his performance was still being enhanced as a result of the drugs he had taken, giving him an unfair advantage.

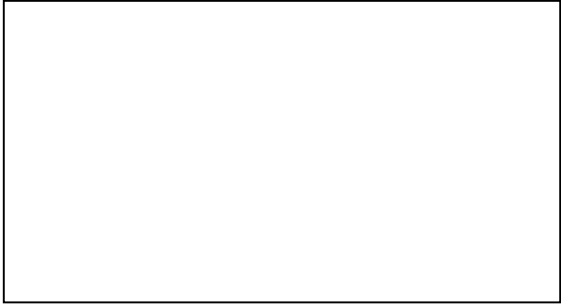




# Stimulants

Stimulants are a category of drugs that temporarily elevate mood. They increase brain activity, making an individual feel more awake and alert, and as if they have more energy. They are also useful to offset the effects of lactic acid. Stimulants are the second most commonly used drug in sport.

This group of drugs includes amphetamines, ephedrine and cocaine, as well as nicotine and caffeine.



## Health Risks/Side Effects



- Anxiety
- Insomnia
- Heart rate irregularities
- Aggression

## Sports most likely to use them



- 
- 
- 

Former world champion Tyson Gay and Jamaica's ex-100m world record holder Asafa Powell failed drug tests in July 2013. Tyson Gay, 30, the joint-second fastest man ever over 100m, was told by the US Anti-Doping Agency that a sample from an out-of-competition testing was positive for stimulants. Tyson Gay was banned for 1 year. Asafa Powell, the all-time fourth quickest, tested positive for a banned stimulant and was banned for 18 months.



# Narcotic Analgesics

Narcotic analgesics are designed to relieve pain temporarily. They act on the brain and spinal cord to dampen the effect of painful stimuli, thus masking pain. Drugs in this category include heroin, methadone, pethidine and morphine. These drugs act by depressing the central nervous system and give relief from painful injuries. By allowing the injured player to take part, they can increase the risk of severe or long lasting injury.



## Health Risks/Side Effects



- Anxiety and depression
- Nausea, sickness
- Addiction
- Concentration loss
- Further damage to injury

## Sports most likely to use them



- 
- 
- 

Kieren Fallon, the six times champion jockey tested positive for cocaine. He was banned for 6 months in June 2006.

# Peptide Hormones

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

- **Growth Hormone (GH)** Used by athletes to increase their muscle development.
- **Erythropoietin (EPO)** Produced naturally in the kidneys, it regulates the production of red blood cells. Artificial EPO can be injected to increase the production of red blood cells, therefore increasing the amount of haemoglobin available to take up oxygen.



## Health Risks/Side Effects



GH	EPO
•	•
•	•
•	•
•	•

## Sports most likely to use them



- GH - sports needing increased strength (Weight lifters, athletics throwing events)
- EPO – sports needing increased O2 delivery (Long distance events, e.g. cycling)

Blood Doping...

Lance Armstrong won the Tour de France seven times before the United States Anti-Doping Agency released a 1000 page report detailing extensive allegations of blood doping and other performance-enhancing drug use, disqualifying him from all of his wins.





## Drugs Questions



1. Which one of the following performance-enhancing drugs is an athlete most likely to take if they are suffering from a painful injury? (1)  
A Anabolic steroids  
B Beta blockers  
C Diuretics  
D Narcotic analgesics
  
2. Describe the circumstances that might lead to a performer taking stimulants, even though they are a banned performance-enhancing drug.

**(2 Marks)**

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3. How does Erythropoietin (EPO) aid performance in long-distance runners?

**(3 Marks)**

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# 9 Markers – 3 Steps

Step 1) Highlight **A01**, **A02** and **A03** within the question

Step 2) Plan your answer by breaking down your answers into the 3 row template

Step 3) Number templates into paragraphs

**Q)** Discuss the suitability of the circuit shown in figure 1 to improve Padme's javelin performance

- A01) KNOW & UNDERSTAND QUESTION TOPIC:** simple statement to recall, define, describe
- A02) APPLY KNOWLEDGE USING SPORTING EG'S:** link knowledge and understanding to the question.
- A03) ANALYSE & EVALUATE:** justify and conclude your answer. Show wider knowledge.

Points to Answer:

**A01** –

**A02** –

**A03** –

