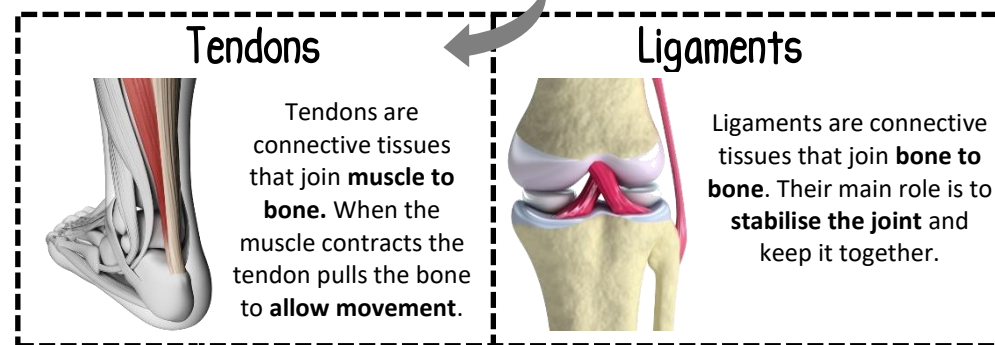
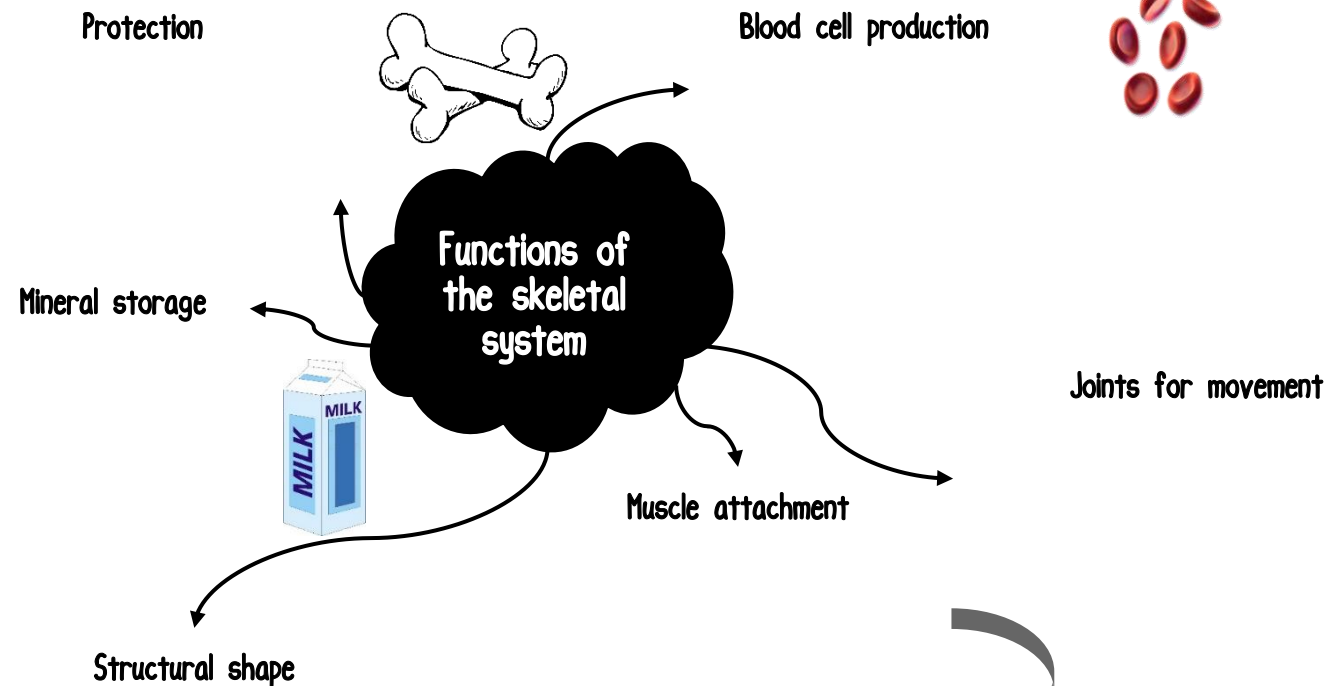


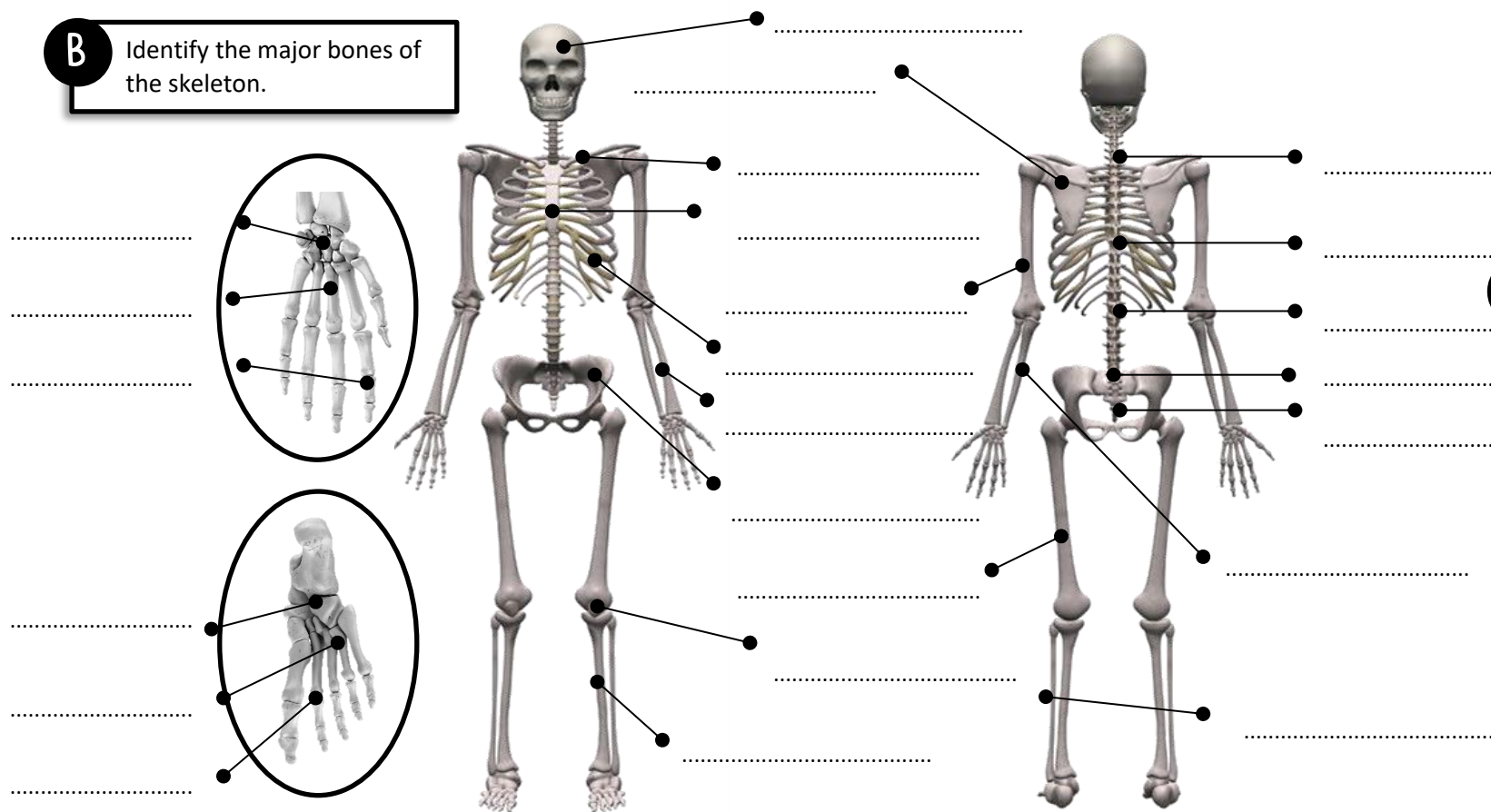
The Skeletal System

A Using examples, explain each function of the skeletal system.



Major Bones of the Skeleton

B Identify the major bones of the skeleton.



Classification of joints

C Identify the articulating bones at each of the joints and the movements each joint can perform, and give an example of the movements in sport.

Joint type	Joint	Bones of the joint	Movements	Sport example
Pivot	Neck			
Hinge	Knee			
	Elbow			
	Ankle			
Ball-and-socket	Shoulder			
	Hip			
Condyloid	Wrist			

To find out about how muscles work at different types of joint, go to 2.

Classification of bones

Bones aren't all one shape and come in many different sizes. Below are the different types of bones.

D Outline the functions of each type of bone.

Long Bones	Short Bones
Flat Bones	Irregular Bones

The Muscular System

Muscle types

You may think there is only one type of muscle. However, muscles come in three main types and have different characteristics:

A Outline the characteristics of each type of muscle and identify the role that each type plays in sport.


Cardiac muscle:	Voluntary muscle:	Involuntary muscle:
Characteristics:	Characteristics:	Characteristics:
Role in sport:	Role in sport:	Role in sport:

Muscle fibres

Muscles are made up of lots of tiny fibres. Each of the fibres can be classified into three types which impact on their use in physical activities.


Type I

Red in colour
AKA slow twitch
Dense supply of mitochondria
Aerobic respiration
Dense supply of myoglobin
Don't fatigue easily




Type IIa

AKA fast oxidative
Dense supply of mitochondria
High density of myoglobin
Aerobic and anaerobic respiration
Not so easy to fatigue
Fast and strong contractions



Type IIx

White in colour
Easily fatigued
AKA fast glycolytic
Anaerobic respiration
Low density of myoglobin
Low density of mitochondria
Fast and strong contractions



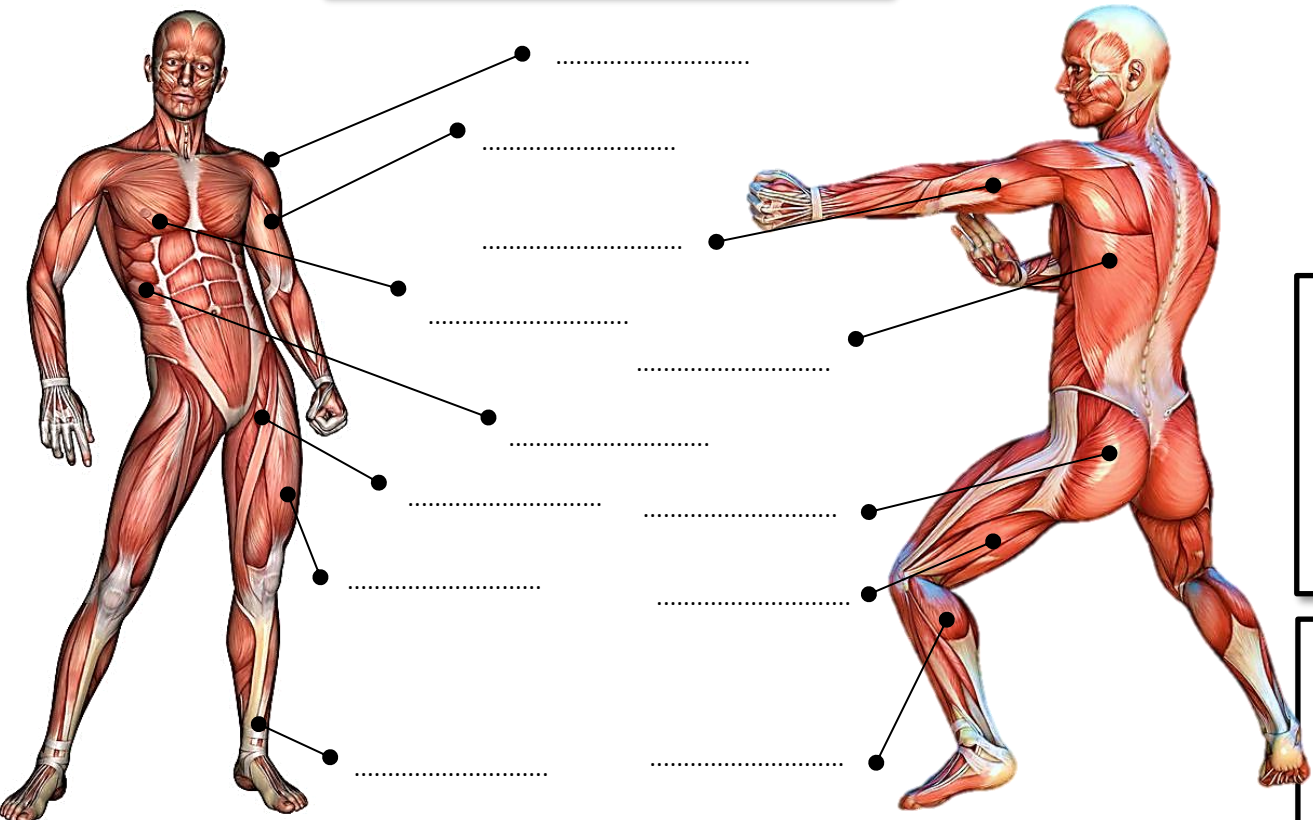
C Using sporting examples, explain the importance of each fibre type in sport.

Importance in sport:	Importance in sport:	Importance in sport:

Major Muscles of the Human Body

The voluntary muscles' main role is to allow movement by working with the skeleton. Each muscle is responsible for different movements.

B Identify the major muscles of the body.



Antagonistic pairs

Muscles work together in pairs in order to cause movement. Each pair is called an antagonistic pair.

The agonist:
The antagonist:

Working example: Flexion and Extension at the Elbow

D Explain the difference between the agonist and antagonist and then explain how this helps perform flexion and extension at the elbow. Then identify the agonist and antagonist at each of the other joints in the body.

Further examples of antagonistic pairs at different joints			
Joint	Movement	Agonist	Antagonist
Hip	Flexion		
	Extension		
Knee	Flexion		
	Extension		
Ankle	Plantar flexion		
	Dorsiflexion		

A

The Cardiovascular System

Functions of the cardiovascular system in sport



Role of Blood Cells

There are four components of the blood that help perform its functions.

B Outline the role of each type of blood cell.

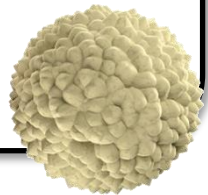
Plasma

Platelets

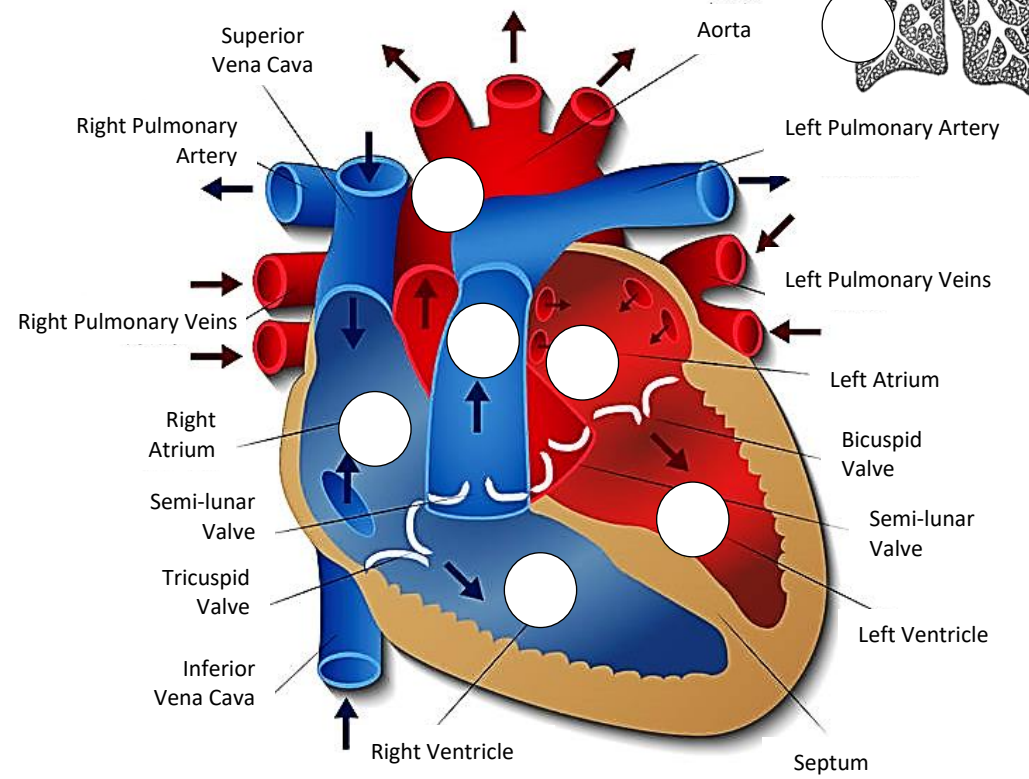


White Blood Cells

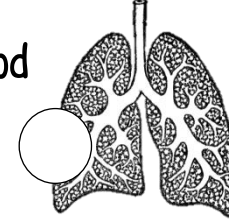
Red Blood Cells



The Cardiac Cycle and Pathway of the Blood



C Describe the pathway of blood around the cardiac cycle.



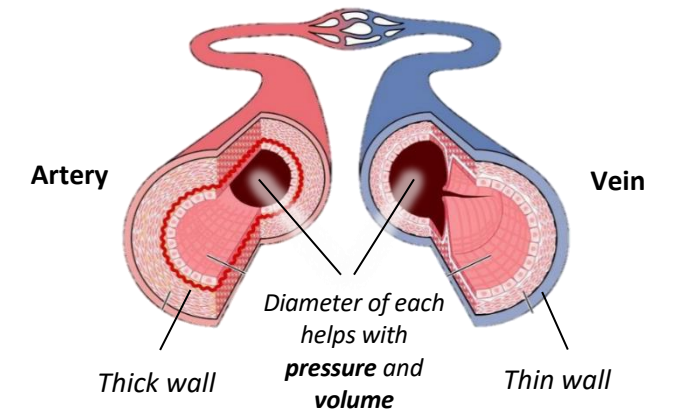
Structure of Blood Vessels

Blood vessels carry blood around the body and back to the heart. Each has a different structure and its structure is directly linked to its function.

D Complete the table below to outline the structure of each type of blood vessel.

Vessel	Arteries	Capillaries	Veins
Size/ Diameter			
Wall Thickness			
Valves			
Function during Physical Activity			

Capillaries



Blood Redistribution during Exercise

Blood is redistributed around the body during exercise so more blood is taken to the working muscles and less to the internal organs. This is known as vascular shunting.

This occurs by the arteries' smooth muscle layer either:

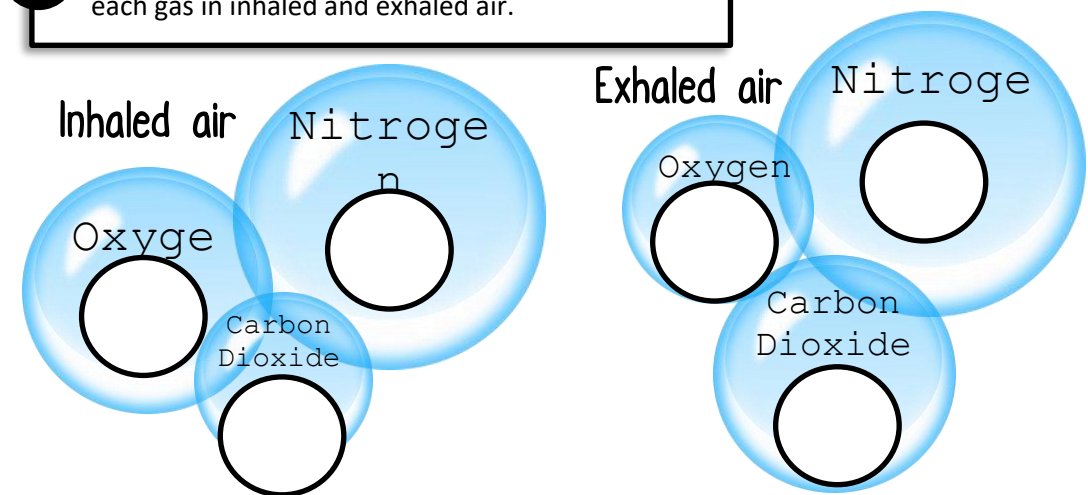
- ★ contracting (**vasoconstriction**) to reduce blood flow to a certain area, such as the internal organs
- or
- ★ widening (**vasodilation**) to increase blood flow to a certain area, such as the working skeletal muscles

The Respiratory System

The Composition of Air

The amount of each type of gas in the air changes during inspiration and expiration. It also changes as a result of exercise as some gases are used more and some gases are produced by the body.

A Fill in the gas bubbles below with the percentage of each gas in inhaled and exhaled air.



Gas	Change during exercise
Oxygen	The amount of oxygen in inhaled air will remain the same and in exhaled air will decrease, as more is used up during exercise
Nitrogen	The composition of nitrogen in inhaled and exhaled air will remain at the same level as rest
Carbon Dioxide	The composition of carbon dioxide in inhaled air will remain the same and in exhaled air will increase due to its creation as a waste product of aerobic exercise

The Mechanics of Breathing

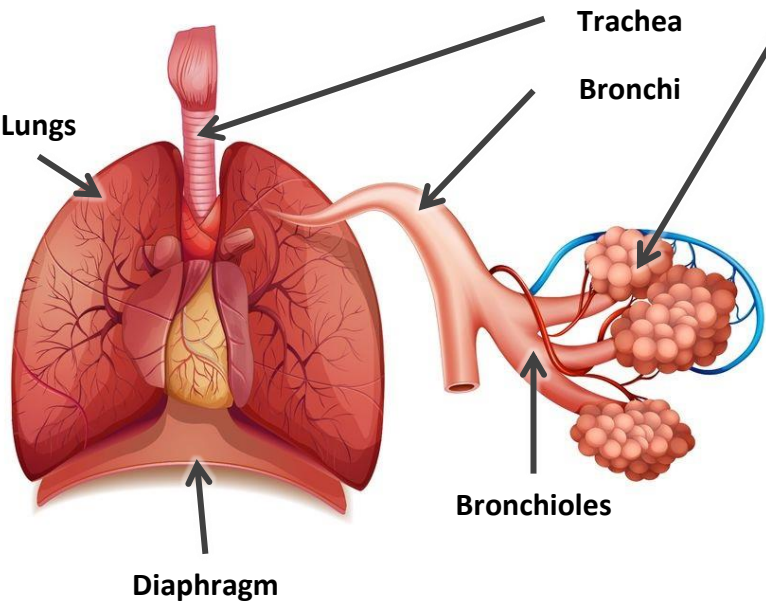
In order for us to get oxygen into our bodies, we have to breathe.

B Fill in the table below by identifying what happens during expiration and inspiration.

Changes to our mechanics of breathing lead to changes in our Tidal Volume.

		Expiration	Inspiration	Changes during exercise
Intercostal muscles	External			More forceful contraction of intercostal muscles
	Internal			
Ribs				
Diaphragm				More forceful contraction of the diaphragm
Lung volume				
Air pressure in lungs				Greater pressure difference between the lungs and environment
Air pressure is relatively high in...				

The Components of the Respiratory System



C Explain how the structure of the alveoli is suited to gaseous exchange.

Alveoli

Gaseous exchange and diffusion

- ✱ Oxygen breathed in moves from an area of high concentration (in the lungs) to an area of low concentration (in the capillaries).
- ✱ Oxygen combines with haemoglobin found in red blood cells to form oxyhaemoglobin.
- ✱ Haemoglobin also carries carbon dioxide.
- ✱ Carbon dioxide is taken to the lungs, passes through alveoli and is passed out.

Respiratory Values at Rest and during Exercise

A spirometer trace shows the volume of air inhaled and exhaled.

Change during exercise

D Define Tidal Volume and Vital Capacity and outline their change during exercise, then, in the space below, draw two spirometer traces to illustrate the difference in the volumes between rest and exercise

TV

Tidal Volume:	
Vital Capacity:	

VC



Aerobic Exercise

A Describe aerobic exercise and complete the equation that is used to summarise it. Then list as many sports as you can that use aerobic respiration.

Describe:

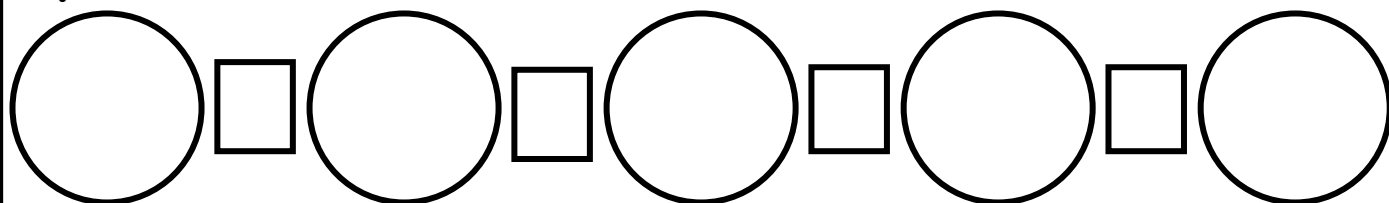
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Equation:



Sports:

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Anaerobic Exercise

B Describe anaerobic exercise and complete the equation that is used to summarise it. Then list as many sports as you can that use anaerobic respiration.

Describe:

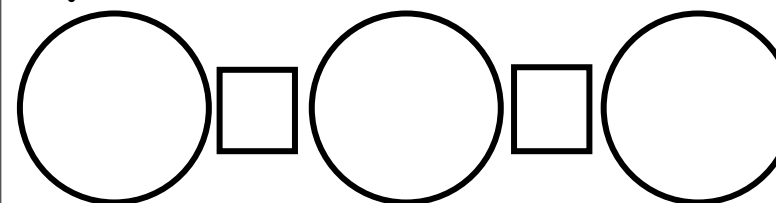
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Equation:



Sports:

.....

.....

Aerobic and Anaerobic Exercise

Fuel for Exercise

Athletes need to replenish their fuel stores through the food that they eat. Different foods provide energy for different forms of exercise:

C Explain the importance of carbohydrates and fats for exercise.

Carbohydrates:

.....

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Fats:

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Using Both Systems

D Explain how the two sports below require athletes to work both aerobically and anaerobically.



Often, sports require athletes to work both aerobically and anaerobically during a competition. Below are different scenarios when an athlete would be required to use both of these energy systems when taking part in the same sport:

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Short-term Effects of Exercise

A Describe the short-term effects of exercise in the boxes below.

Exercise leads to a number of changes to the body as we begin to take part and continue up to 24–36 hours after participation.



Revision Success Tip!

Make sure you understand how the cardiovascular and respiratory systems work together as they will be tested together in your exam.

Excessive post-exercise oxygen consumption (EPOC)

C Using the graph to help you, explain what EPOC is.

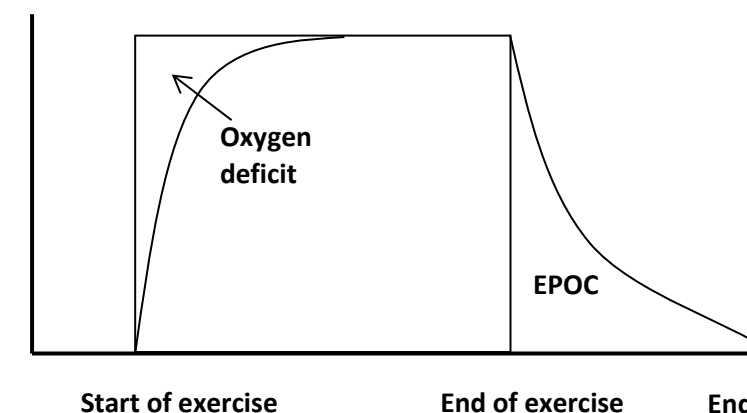
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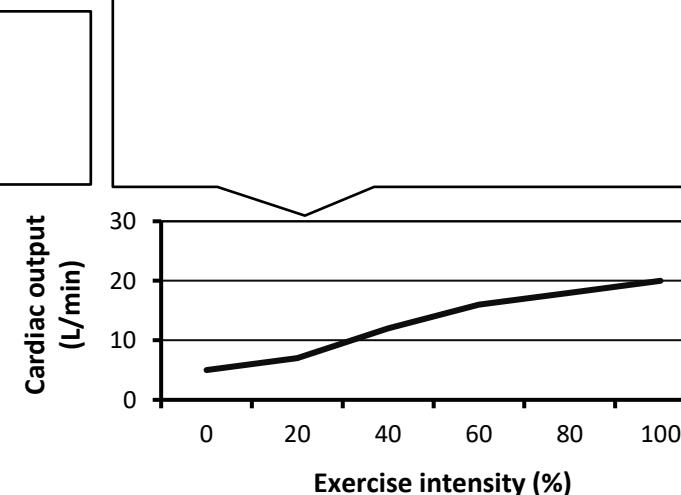
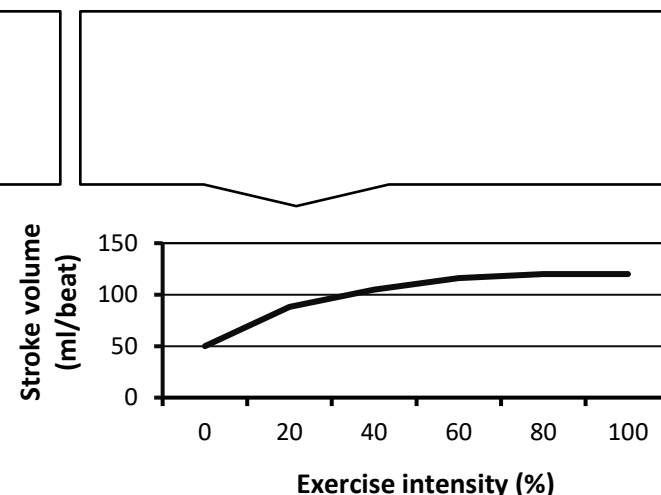
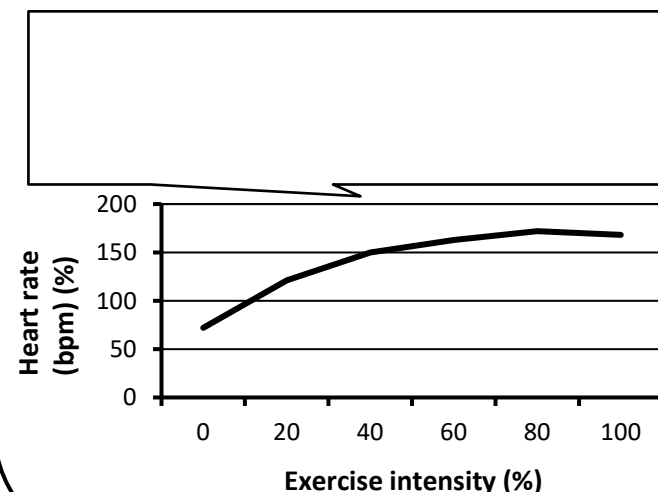
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The graph below outlines the breathing rate of an athlete during and after **anaerobic** exercise:



Heart rate, stroke volume and cardiac output during exercise

B Annotate and explain each of the graphs below to describe the changes to heart rate, stroke volume and cardiac output as we exercise.



Cardiorespiratory function

D Explain how the cardiovascular and respiratory systems work together during exercise during recovery from exercise.

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Lever Systems

- ✱ Movement at the joints occurs by one of the three classes of lever.
- ✱ Depending on the lever system, the movement is either at a mechanical advantage or disadvantage.
- ✱ A mechanical advantage allows heavy loads to be moved with minimal effort, whereas a mechanical disadvantage allows loads to be moved quickly.
- ✱ Mechanical advantage = $\text{Effort arm} \div \text{Load arm}$

A Draw a first-, second- and third-class lever system and give one example of each lever system in sport.

1st
class

Usually
Mechanical
Advantage

Example:

2nd
class

Mechanical
Advantage

Example:

3rd
class

Mechanical
Disadvantage

Example:

Movement Analysis (Including Planes and Axes)

Analysis of Movement

B Identify the types of movement and the lever system that occurs during each phase of the five movements shown.

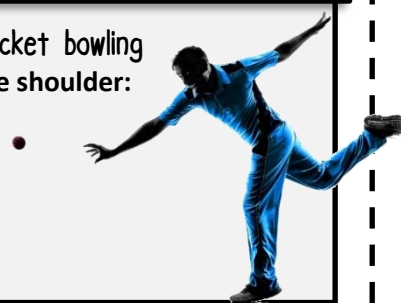
Push-up
Movement at the elbow:

Lever system:



Cricket bowling
Movement at the shoulder:

Lever system:



Jumping
Movement at the ankle:

Movement at the hip:

Lever system at the ankle:



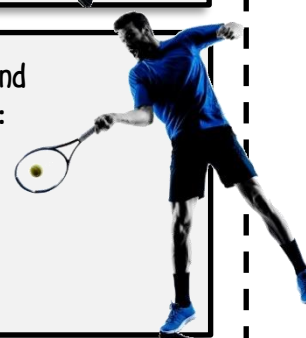
Running
Movement at the knee:

Lever system:



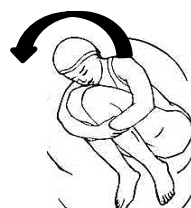
Tennis forehand
Movement at the shoulder:

Lever system:



Front somersault
Plane:

Axes:



360° Twist
Plane:

Axis:



C Identify the plane of movement and the axis of rotation in each of the three movements shown.

Plane:
Axis:

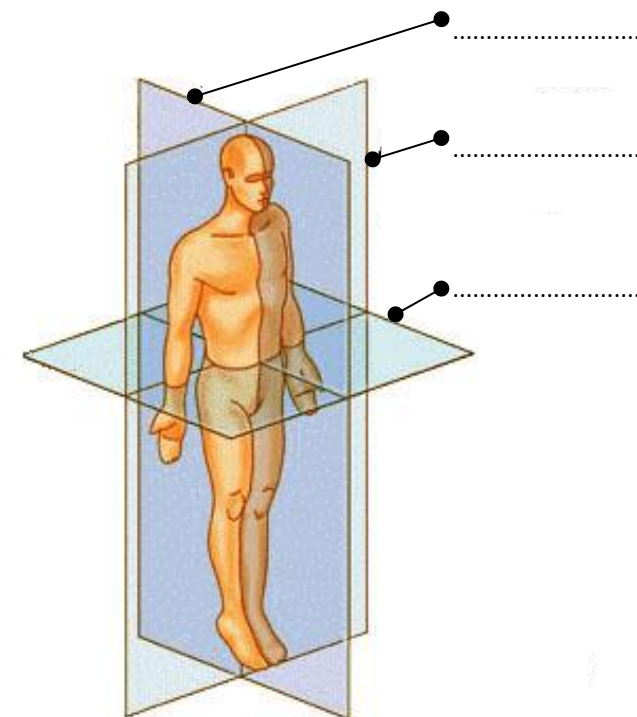
Cartwheel



D Identify the three planes of movement and the three axes of rotation (below).

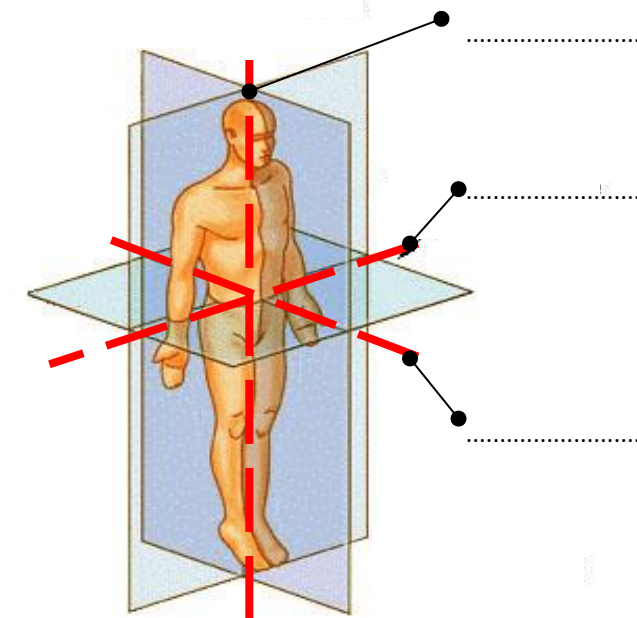
Planes of Movement

Any movement at a joint occurs in one of the planes:



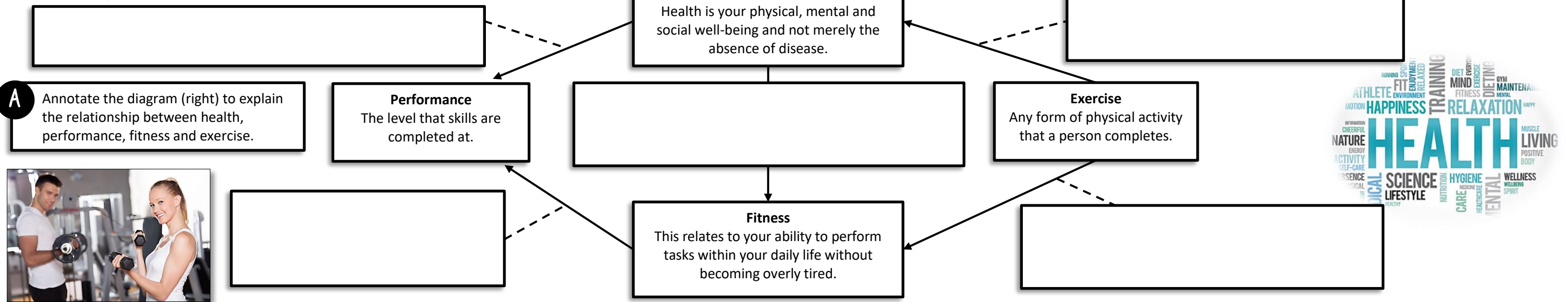
Axes of Rotation

Any time the body rotates, it does so around one of the three axes:



Health, Fitness and Fitness Components

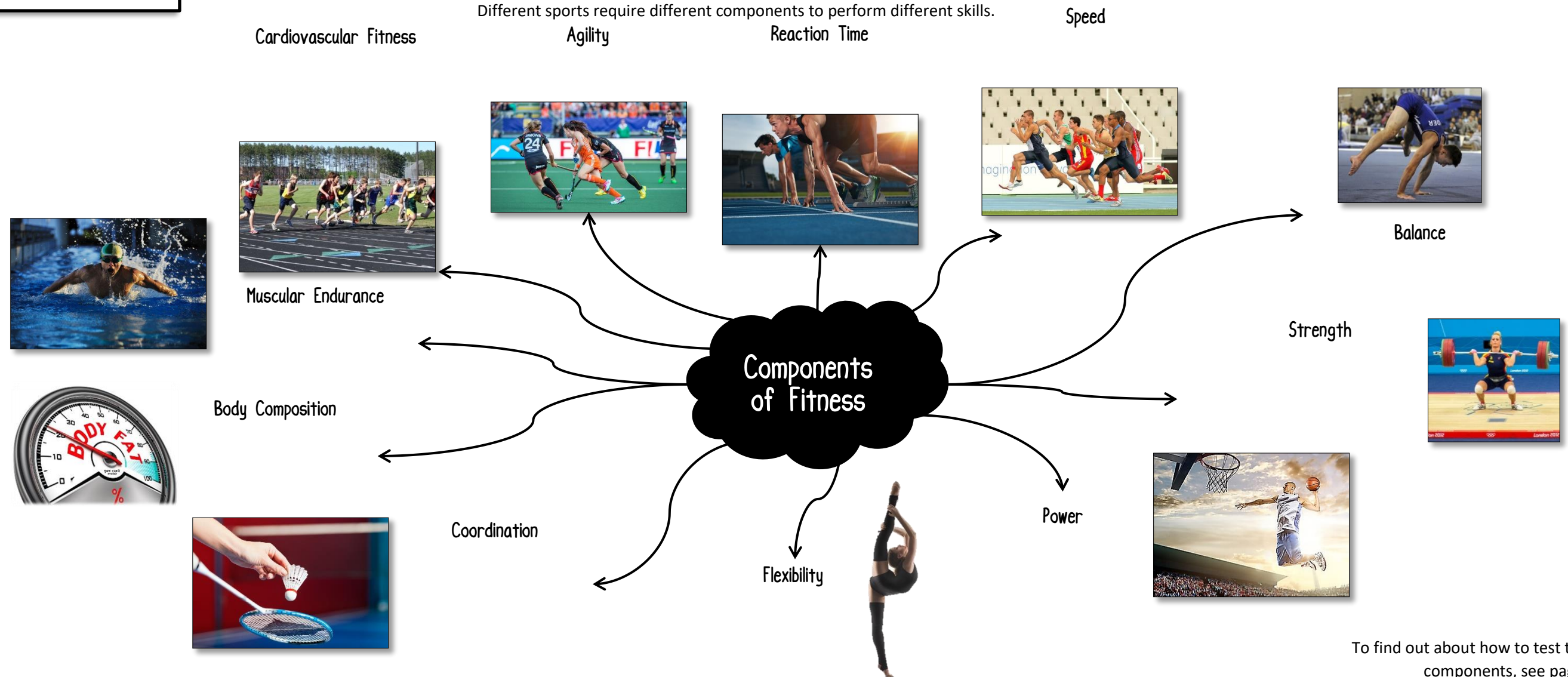
Relationship between Health, Fitness, Exercise and Performance



B Define each of the components of fitness given on the spider diagram.

Components of Fitness and Physical Activity

The different components of fitness which can be improved through physical training are outlined below.
Different sports require different components to perform different skills.

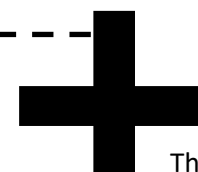


To find out about how to test these components, see page 9.

Reasons for Fitness Testing

A Identify three reasons for fitness testing.

1.
2.
3.



Fitness Testing

There is a range of different fitness tests which can be used to evaluate the different components of fitness.

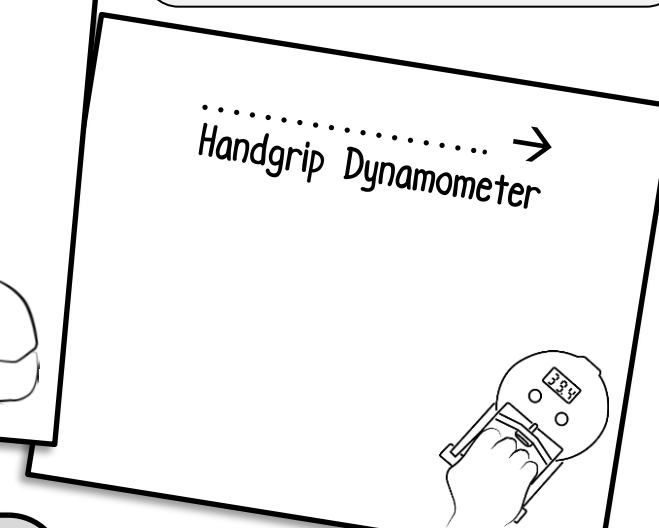
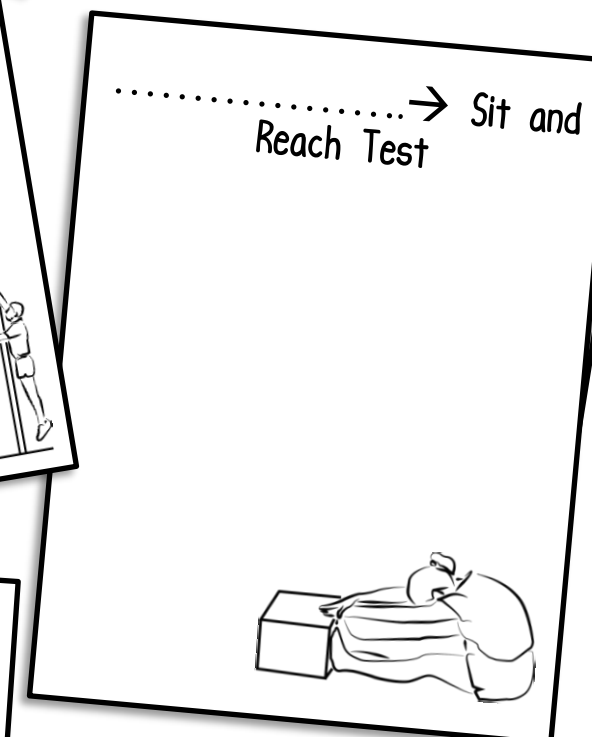
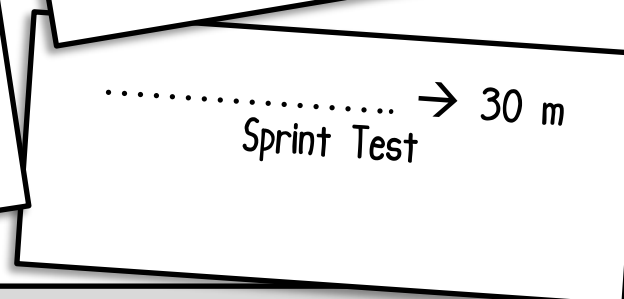
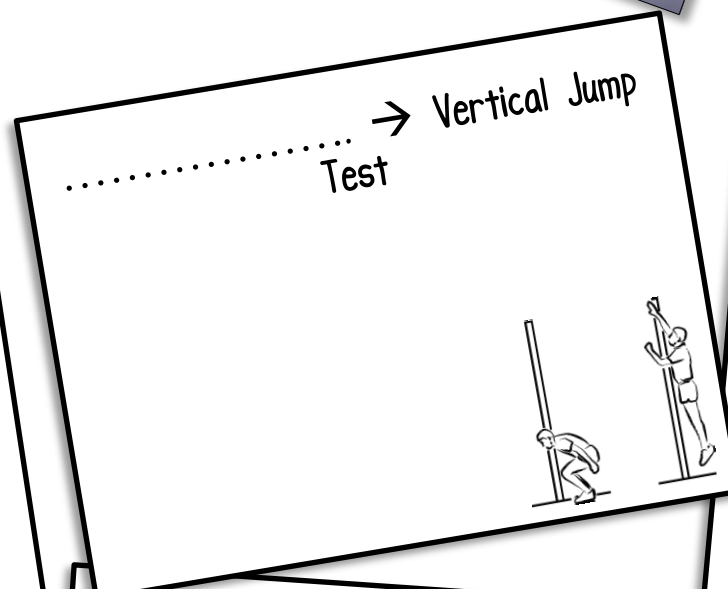
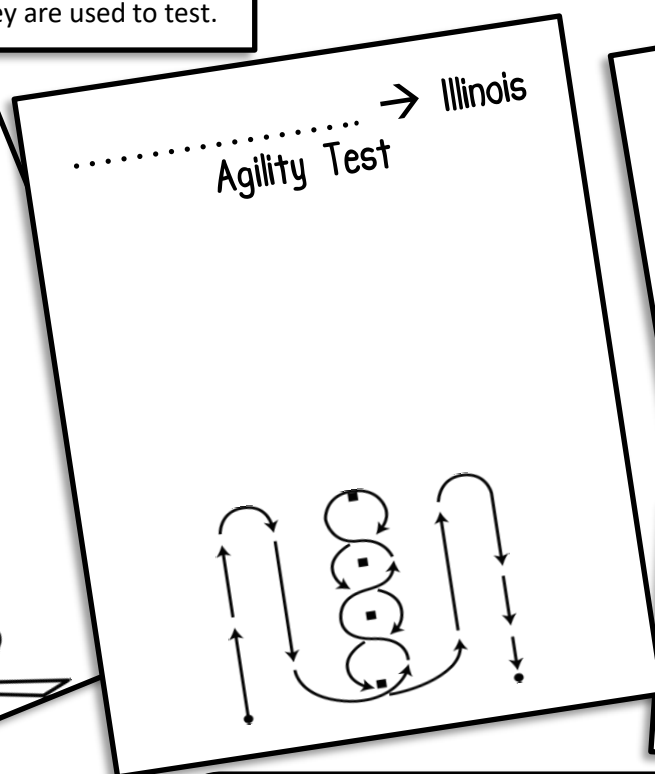
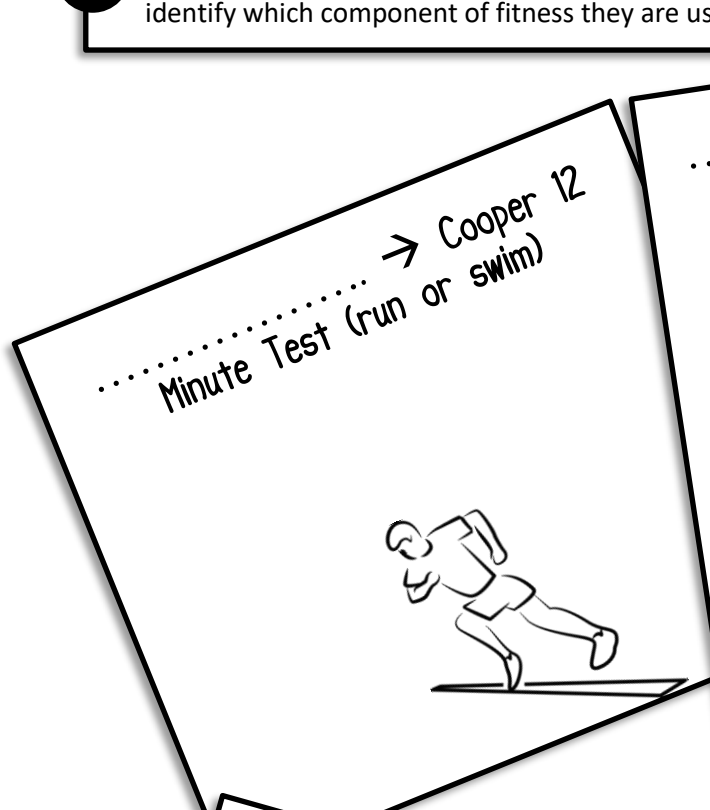


Reasons against Fitness Testing

B Identify three reasons against fitness testing.

1.
2.
3.

C Describe each of the fitness tests on the cards below and identify which component of fitness they are used to test.



Revision Success Tip!

You should understand how to read normative data tables of each of the fitness tests, but you do not need to remember the ratings for each.



Fitness Data Collection

D Explain, using examples in sport, the two types of data that can be collected from fitness testing.

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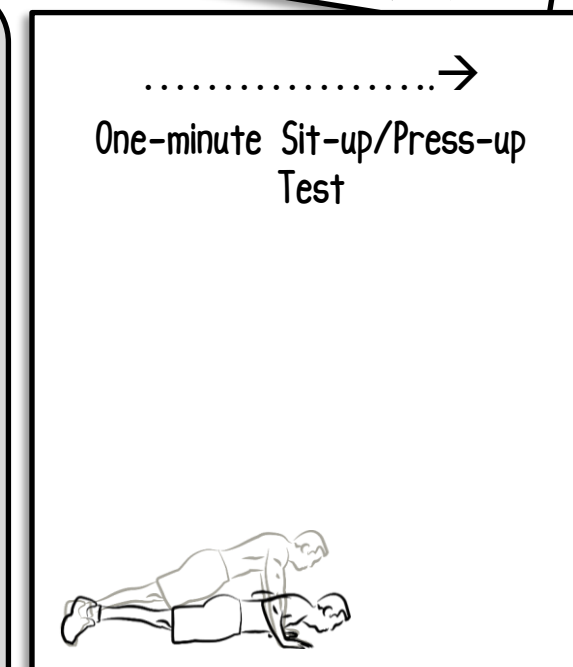
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Principles of Training and their Application to Training Programmes

There are two key principles which should be applied when creating and delivering any training programme. These principles ensure that the participant is able to develop their skills over time.

A Identify and describe the five principles of training.

Principles of training: SPORT

S	e.g. a cyclist should perform most of their training on a bike
P	e.g. once bench-pressing 50 kg becomes easier, the load should be increased to 52.5 kg
O	e.g. it is important for athletes to have rest days or days where they do recovery exercises
R	e.g. it is important for an athlete to undertake some form of training during a post-season break, to prevent fitness loss
T	e.g. when trying to improve muscular endurance, a low intensity should be used

In order to apply progressive overload in training the FITT principles of overload should be applied

Principles of overload: FITT

F	Frequency: The number of training sessions undertaken each week.
I	Intensity: The amount of work undertaken during each training session.
T	Time: The amount of time spent training during each session.
T	Type: The method of training undertaken during each session.

B Provide a sporting example of how the FITT principles of training could be used during a weight training programme.

The Karvonen Formula

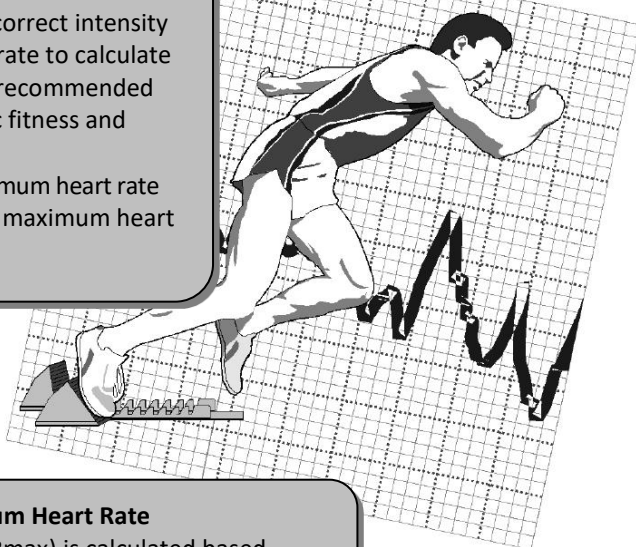
In order to target specific aerobic or anaerobic components of fitness, athletes must train at the right intensity. The correct intensity of training can be calculated in the following way:

Training Zones

In order to train at the correct intensity athletes use their heart rate to calculate their *training zone*. The recommended training zone for aerobic fitness and anaerobic fitness is:

Aerobic: 60–80% of maximum heart rate

Anaerobic: 80–90% of maximum heart rate



Maximum Heart Rate

Maximum heart rate (HRmax) is calculated based upon age using the following equation:

$$\text{HRmax} = 220 - \text{age (years)}$$

Calculating Training Zones: worked example:

C Using the space below, calculate your own aerobic and anaerobic heart rate training zones.



Aerobic Training Zone =

Anaerobic Training Zone =

Remember!

It is important that training intensity and rest periods are appropriate for the **individual needs** that an athlete has.

The method of training should be selected based on the **fitness requirements**, the **facilities** a person can use and their current **fitness level**.

Training **intensity** should be taken into account using the **Karvonen formula**; for example:

- ↳ An athlete who wants to increase their **aerobic** fitness should work at **60–80%** of their maximum
- ↳ An athlete who wants to improve their **anaerobic** fitness should work at **80–90%** of their maximum

Training methods

The type of training that is performed by athletes depends on the sport for which they are training. The different types of training and their uses are outlined below:

Circuit Training

What?

A number of activities at different stations; the athletes move between each station with little or no rest



Fitness Components?

All components

Advantages

Disadvantages

Useful for?

Continuous Training

What?

Physical activity which involves prolonged periods of aerobic exercise, such as running or cycling



Fitness Components?

Cardiovascular and muscular endurance

Advantages

Disadvantages

Useful for?

Fartlek Training

What?

A mix of continuous and interval exercise performed on different terrains, at different speeds or with different periods of high-intensity and low-intensity work



Fitness Components?

Cardiovascular and muscular endurance

Advantages

Disadvantages

Useful for?

Interval Training

What?

Intermittent periods of high-intensity exercise with periods of recovery or low-intensity exercise

Credit: LocalFitness.com.au



Fitness Components?

Power, cardiovascular and muscular endurance

Advantages

Disadvantages

Useful for?

Plyometric Training

What?

An eccentric contraction is performed and followed by a larger, concentric contraction



Fitness Components?

Power

Advantages

Disadvantages

Useful for?

Weight Training

What?

Weights are lifted in a series of movements which target different muscle groups



Fitness Components?

Strength, power and muscular endurance

Advantages

Disadvantages

Useful for?

A

Evaluate the advantages and disadvantages of each of the types of training and provide a type of sportsperson who would benefit from each type.

Fitness Classes for Specific Components of Fitness

Yoga	Pilates	Aerobics	Spinning	Body Pump
What? Performing a range of stretches in a relaxing environment	What? A range of exercises performed in a controlled manner	What? A class exercise where aerobic exercise is performed in time to music	What? A high-intensity cycling class led by an instructor	What? A class exercise where weights are lifted in time with music
Fitness Components? Flexibility, balance and coordination	Fitness Components? Strength, balance and coordination	Fitness Components? Cardiovascular fitness and muscular endurance	Fitness Components? Cardiovascular fitness, muscular endurance, power and speed	Fitness Components? Cardiovascular fitness, strength, muscular endurance
Advantages	Advantages	Advantages	Advantages	Advantages
Disadvantages	Disadvantages	Disadvantages	Disadvantages	Disadvantages
Useful for?	Useful for?	Useful for?	Useful for?	Useful for?

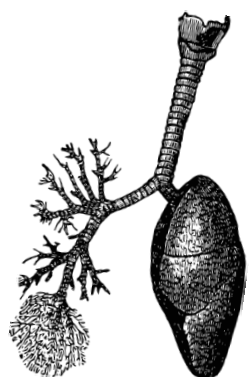
The Long-term Effects of Exercise

Taking part in regular physical activity can lead to a range of positive adaptations in different body systems:

A Complete the boxes to identify and explain the long-term effects of exercise on the skeletal system, muscular system, respiratory system and cardiovascular system (one has been given for you).



Skeletal system



Respiratory system



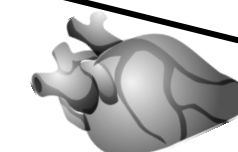
Certain **components of fitness** will improve, such as flexibility which will lead to improved performances



Muscular system



Cardiovascular system



Remember!

Although it is important to take part in regular physical activity, it is also important to take time to **rest and recover** from physical activity.

Taking a rest allows the body to **adapt** to the demands of physical activity by repairing damaged tissues.

It ensures that fatigue and burnout are avoided and, therefore, maintains performance levels and general health.



How to Optimise Training and Prevent Injury

Preventing Injuries

- PAR-Q:
- A PAR-Q should be performed prior to taking part in physical activity.
 - It is a physical activity readiness questionnaire.
 - It assesses whether the individual is at risk of injury or may experience a health conditions if they take part in exercise





There are a number of steps which can be taken in order to reduce the risk of an individual injuring themselves during physical activity.

A Outline four ways the risk of injury can be reduced when competing in sport.



Treatment Methods

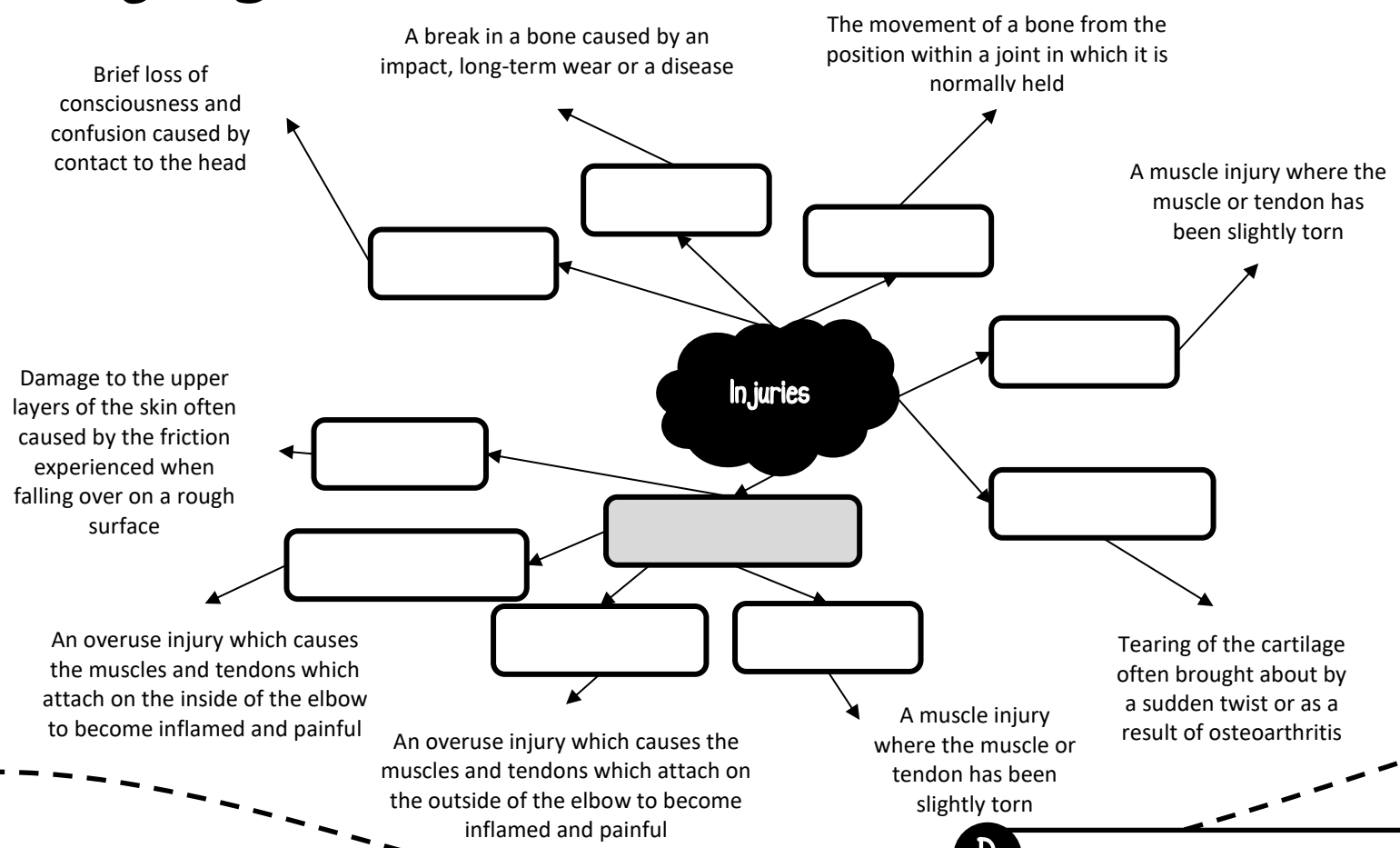
There are four simple steps which should be followed when treating an injury:

Technique	What Happens
R 	
I 	
C 	
E 	

B Identify the techniques for the RICE method below and explain what each involves.

Types of Injuries




C Identify each of the injuries being explained.



Performance-enhancing Drugs

Some athletes resort to using banned substances in order to gain an advantage due to the benefits of sporting success. Below are the different types of PEDs that can be used:

D Identify the performance-enhancing drug outlined below and suggest an athlete who would benefit from using it.

<p>Name:</p> <ul style="list-style-type: none">+ Increases muscle mass- Kidney problems- Cardiovascular disease- High blood pressure <p>Athlete:.....</p> 	<p>Name:.....</p> <ul style="list-style-type: none">+ Improve fine control+ Lower arousal and anxiety- Heart problems- Dizziness <p>Athlete:.....</p>	<p>Name:.....</p> <ul style="list-style-type: none">+ Weight loss+ Help athletes hide other drug use- Dehydration- Kidney problems- Cardiovascular problems- Dizziness <p>Athlete:.....</p>	<p>Name:.....</p> <ul style="list-style-type: none">+ Painkillers+ Can exercise when injured- Addictive- Can lead to overtraining- Can make injuries worse <p>Athlete:.....</p>
<p>Name:</p> <ul style="list-style-type: none">+ Increases muscle mass and strength+ Improved recovery- Increased metabolism- Reduced cardiovascular fitness- Muscle pain <p>Athlete:.....</p> 	<p>Name:.....</p> <ul style="list-style-type: none">+ Increased oxygen-carrying capacity+ Exercise for longer- Heart disease- Stroke- Infection <p>Athlete:.....</p>	<p>Name:.....</p> <ul style="list-style-type: none">+ Increased energy+ Exercise for longer- Heart problems- Can lead to overtraining- Addictive <p>Athlete:.....</p>	<p>Name:.....</p> <ul style="list-style-type: none">+ Increased oxygen-carrying capacity+ Increased aerobic endurance- Infection- Heart disease- Stroke- Allergic reaction <p>Athlete:.....</p> 








Effective Use of a Warm-up and Cool-down

A Identify and describe each stage of a warm-up and cool-down.

Cool-down

It is important to perform a cool-down following physical activity in order to improve the recovery of the body.

A Identify and describe each stage of a warm-up and cool-down.

				Physical Activity			
							

B Explain the benefits of performing a warm-up and cool-down.

Benefits of Warming Up

Benefits of Cooling Down