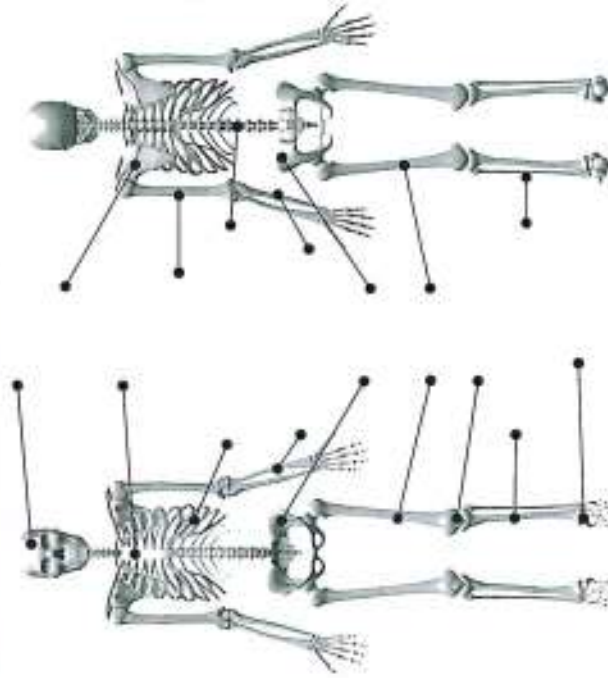


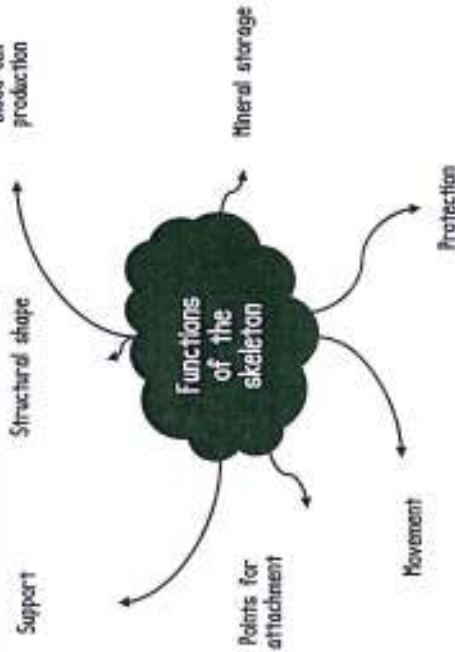
Musculoskeletal System

Major Bones of the Skeleton

A Identify the bones of the human body.

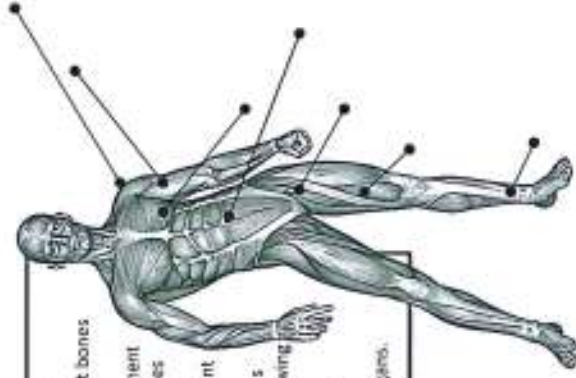


B Explain each function of the skeleton.



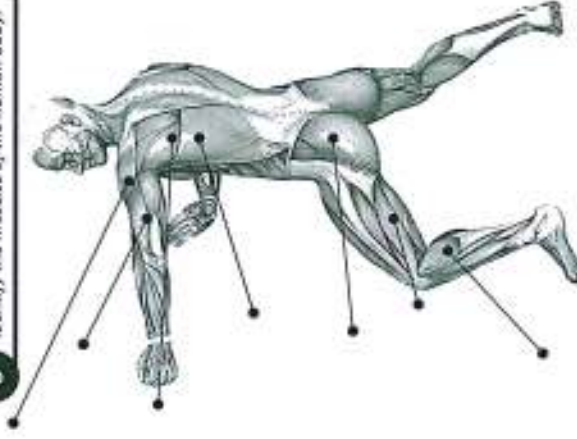
The Skeleton's Role in Movement

- Movement is possible due to the way that bones interact at joints.
- The structure of the skeleton allows movement to occur by providing points at which muscles can attach via tendons.
- The movement that is possible at each joint depends on the type of joint:
 - ★ Short bones allow movement that is more controlled and fine, e.g. throwing a dart.
 - ★ Long bones allow gross movement, e.g. throwing a javelin.
 - ★ Flat bones provide protection for vital organs.



Major Muscles of the Human Body

C Identify the muscles of the human body.



To find out about how muscles work at different types of joint, go to ⑥.

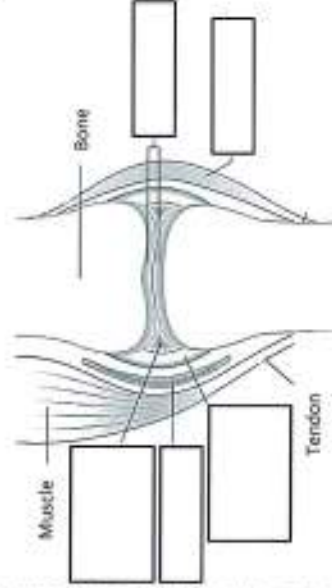
Joints

Joints are formed where two bones meet. Some joints are fixed and allow no movement, while others are freely moveable, such as a synovial joint.

How joint structures help prevent injury

Structure	Prevents injury by...

Structure of a synovial joint



Synovial joints come in different types: hinge joints (found at the elbow, knee and ankle) and ball-and-socket joints (found at the hip and shoulder). They allow different movements to be performed. To find out more about movements at a joint, go to ⑦.

Movement at a Joint

The Role of Muscles at the Joint

- ☑ Muscles connect to bones via tendons.
- ☑ When muscles contract, tendons pull on the bone and cause it to move at the joint.
- ☑ Muscles work together (in pairs) at joints to cause movement. Each pair of muscles is called an antagonistic pair:
 - ★ The agonist (prime mover) contracts, pulling on the bone to cause movement.
 - ★ The antagonist relaxes, so as not to impede the movement.

A Describe the two types of muscle contraction.

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2

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B Identify the antagonist and agonist when lifting and lowering a dumbbell, and identify the types of contraction during each phase.



Lifting the dumbbell

Antagonist =

Agonist =

Muscle contraction =

Lowering the dumbbell

Antagonist =

Agonist =






Muscle contraction =



Movement at Different Joints

Different joints allow for different movements.

C Complete the table to identify the joint type, the bones of each joint, the movement possible, and the main muscles causing the movement at each joint.

Joint	Joint type	Bones of the joint	Movement possible	Main muscles contracting to cause movement
Knee 				
Elbow 				
Ankle 				
Shoulder 				
Hip 				

Ball-and-socket joint:

- ☑ Has the largest range of motion
- ☑ Movement can occur in all planes



Hinge joint:

- ☑ Has a limited range of motion
- ☑ Movement can only occur in one plane

Movement in Sport

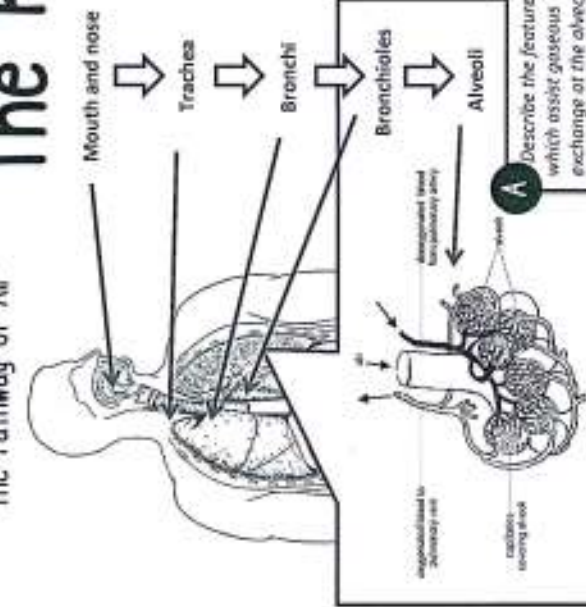
D Identify the types of movement shown in each of the pictures.

Callouts for the pictures:

- For the ankle
- For the elbow
- For the shoulder
- For the kicking leg
- For the elbow

The Respiratory System

The Pathway of Air



A Describe the features which assist gaseous exchange at the alveoli.

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Gaseous Exchange

- 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.

B Fill in the table by describing what is happening during inspiration and expiration in relation to the seven factors.

	Expiration	Inspiration
External Intercostal Muscles		
Internal Intercostal Muscles		
Ribs		
Diaphragm		
Lung Volume		
Air pressure in lungs		
Air pressure is relatively high in...		

Expiration: air out

As air pressure in the lungs increases, it forces air out of the lungs.

Inspiration: air in

As air pressure in the lungs decreases, air is sucked into the lungs.

As we exercise, the abdominal muscles support expiration by pulling the ribs down more forcefully so air can be pushed out more quickly.

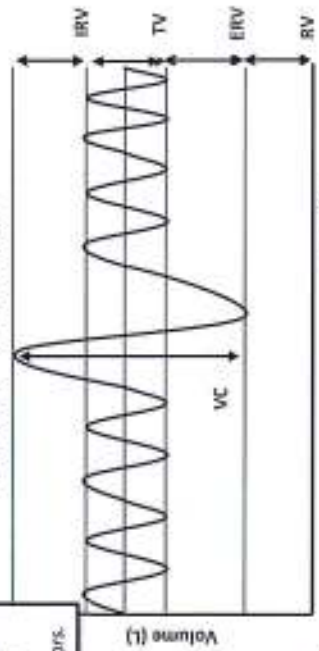
As we exercise, the pectoral and sternocleidomastoid muscles support inspiration by allowing the lungs to expand and take in more oxygen.



Respiratory System During Exercise

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

Spirometer trace at rest



C Identify what happens to the volume of air during exercise and then draw a graph below to show these changes.

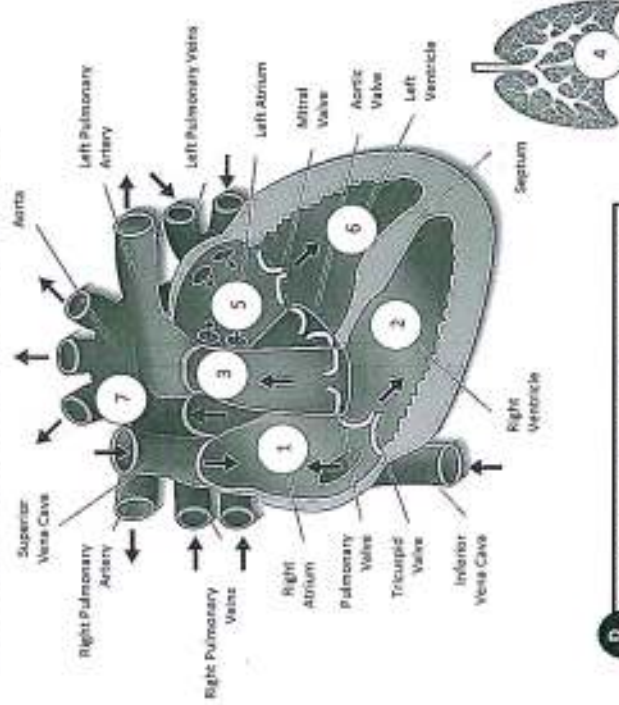
Changes during Exercise:

TV	Tidal Volume: normal amount of air inspired/expired	
ERV	Expiratory Reserve Volume: amount of air forced out after tidal volume	
IRV	Inspiratory Reserve Volume: amount of air forced in after tidal volume	
RV	Residual Volume: the air left in the lungs prior to maximal expiration	
VC	Vital Capacity: largest volume of air that can be forcibly expired following largest inspiration	

Spirometer trace during exercise



The Cardiac Cycle and Pathway of the Blood



B Describe the pathway of the blood around the cardiorespiratory system.

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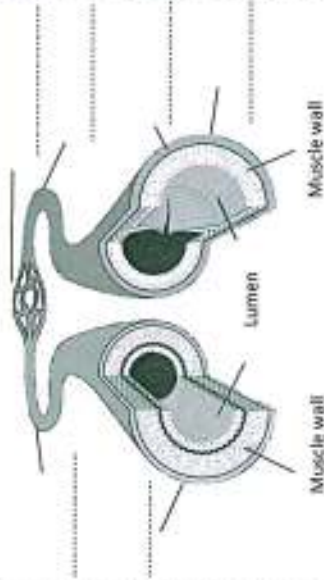
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Cardiac System

Structure of Blood Vessels

A Complete the table to outline the structure of the different blood vessels and then label each on the image.

Vessel	Arteries	Capillaries	Veins
Size/ Diameter			
Wall Thickness			
Valves			



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 occurs by the arteries' smooth muscle layer either:

- contracting (vasoconstriction), or
- widening (vasodilation)

Function of the Heart

The heart needs to supply the muscles with enough oxygen to work. In order to increase the amount of oxygen supplied, they can increase the stroke volume or the heart rate.



C Identify the relationship between the cardiac output, stroke volume and heart rate. Describe each one and identify the unit of measurement for each of them.

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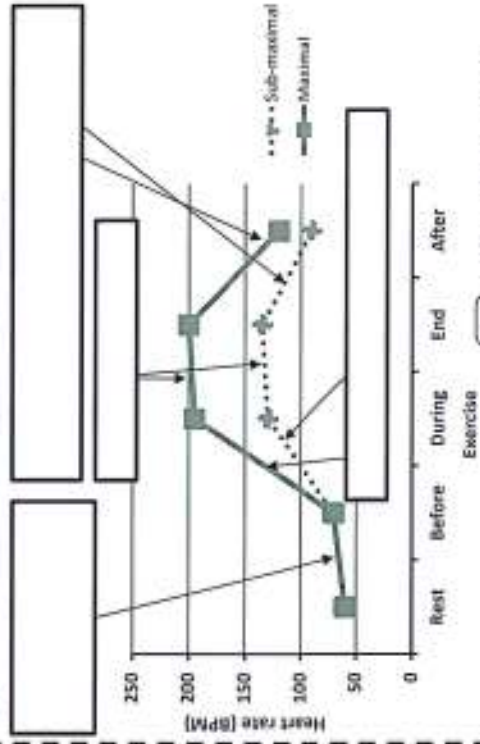
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The relationship facts:

- A long-term effect of exercise is cardiac hypertrophy, which involves an increase in heart size and strength. A stronger heart can pump out more blood per contraction, resulting in a higher stroke volume.
- With more blood being pumped per contraction, the heart does not have to work as hard and is more efficient, meaning long-term exercise results in a lower resting heart rate.
- Exercise increases heart rate, due to the demand for more oxygen by working muscles. This will result in an increased cardiac output during exercise.

Heart Rate during Exercise

D Annotate the graph to briefly explain what is happening.



Aerobic Exercise

Aerobic exercise is any form of exercise which is completed at an intensity that allows a plentiful supply of oxygen to be taken in by the lungs and used by the body.

- A** Provide a summary equation for aerobic exercise and then provide as many sporting examples as you can that demonstrate aerobic exercise.

Anaerobic Exercise

Anaerobic exercise is any form of exercise which involves short periods of high-intensity work which prevents the athlete from taking in enough oxygen to meet the energy demands of the exercise.

- B** Provide a summary equation for anaerobic exercise and then provide as many sporting examples as you can that demonstrate anaerobic exercise.

Aerobic and Anaerobic Exercise

Methods of Recovery

Following exercise it is important that the athlete takes steps to aid their recovery, in order to ensure that they are ready to compete again as quickly as possible.

- C** Outline and explain the three different methods used to recover from exercise and the reason for their use.

Revision Success Tip!

Remember!
You need to be able to justify the relevance of these methods for different sports.



EPOC

- D** Draw a graph which represents EPOC.

- Excessive post-exercise oxygen consumption (EPOC) is the process which ensures that lactic acid is removed from the body by keeping an elevated breathing rate after exercise has stopped.
- EPOC occurs following anaerobic exercise, such as performing a 100 m sprint.

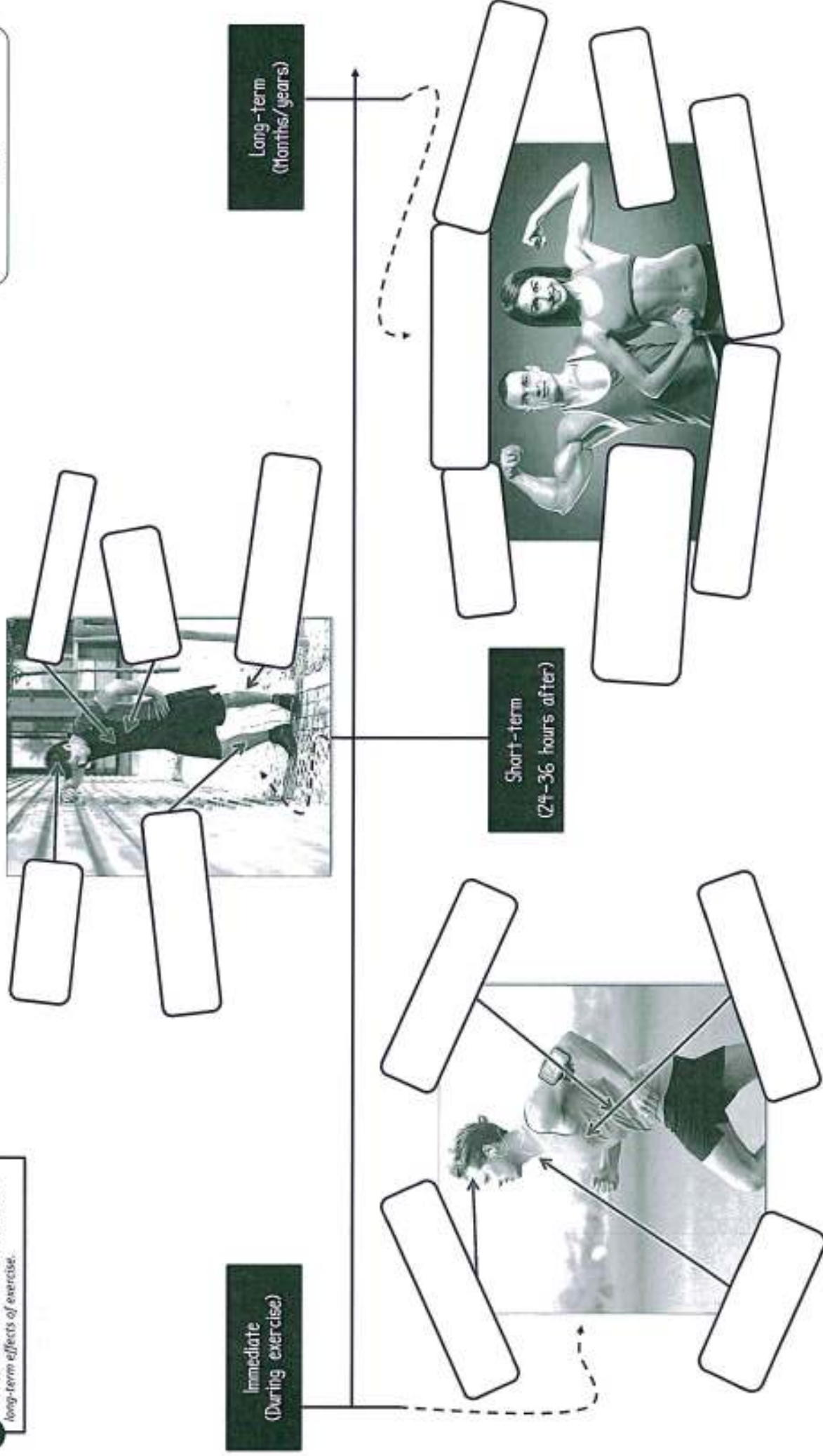
Short- and Long-term Effects of Exercise

Exercise leads to a number of changes to the body. Some of these effects take place during and some take place following exercise. The effects of exercise and the point at which they occur are outlined on the timeline below:

A Identify the immediate, short-term and long-term effects of exercise.

Revision Success Tip!

The long-term effects of exercise are linked to the components of fitness, so make sure you understand the components of fitness as well!



Lever Systems

- Movement at the joints occurs by one of the three classes of levers.
- 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 = Effort arm ÷ Load arm

A Draw a first-, second- and third-class lever system.

1st Class

Usually Mechanical Advantage

2nd Class

Mechanical Advantage










3rd Class

Mechanical Advantage

Movement Analysis (Including Planes and Axes)

Analysis of Movement

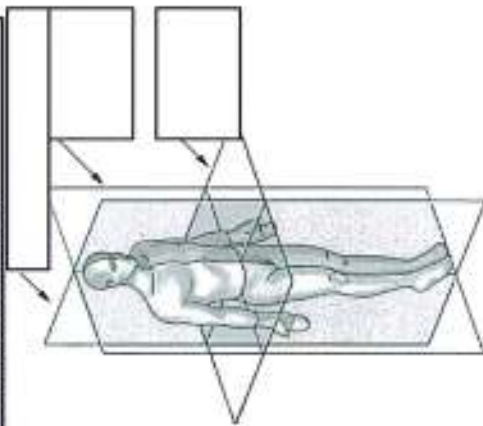
B Identify the types of movement and the lever system that occurs during each phase of the five movements shown.

<p>Push up</p> <p>Movement at the elbow:</p> <p>Downwards:</p> <p>Upwards:</p> <p>Lever system:</p> 	<p>Cricket bowling</p> <p>Movement at the shoulder:</p> <p>Lever system:</p> 
<p>Jumping</p> <p>Movement at the ankle:</p> <p>Take-off:</p> <p>Landing:</p> <p>Movement at the hip:</p> <p>Take-off:</p> <p>Landing:</p> <p>Lever system at the ankle:</p> 	<p>Running</p> <p>Movement at the knee:</p> <p>Backwards:</p> <p>Forwards:</p> <p>Lever system:</p> 
<p>Front somersault</p> <p>Plane:</p> <p>Axes:</p> 	<p>Tennis forehand</p> <p>Movement at the shoulder:</p> <p>Backswing:</p> <p>Follow-through:</p> <p>Lever system:</p> 
<p>Cartwheel</p> <p>Plane:</p> <p>Axis:</p> 	<p>Discus throw</p> <p>Plane:</p> <p>Axis:</p> 
<p>Cycling</p> <p>Plane:</p> <p>Axis:</p> 	

Planes of Movement

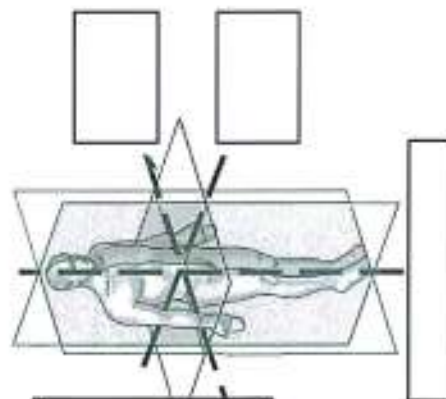
Any movement at a joint occurs in one of the planes outlined below.

C Identify the three planes of movement and the three axes of rotation. (Below.)



Axes of Rotation

Any time the body rotates, it does so around one of the three axes shown below.



D Identify the plane of the movement and the axis of rotation in each of the four movements shown.

Health, Fitness and Fitness Components

Relationship between Health and Fitness

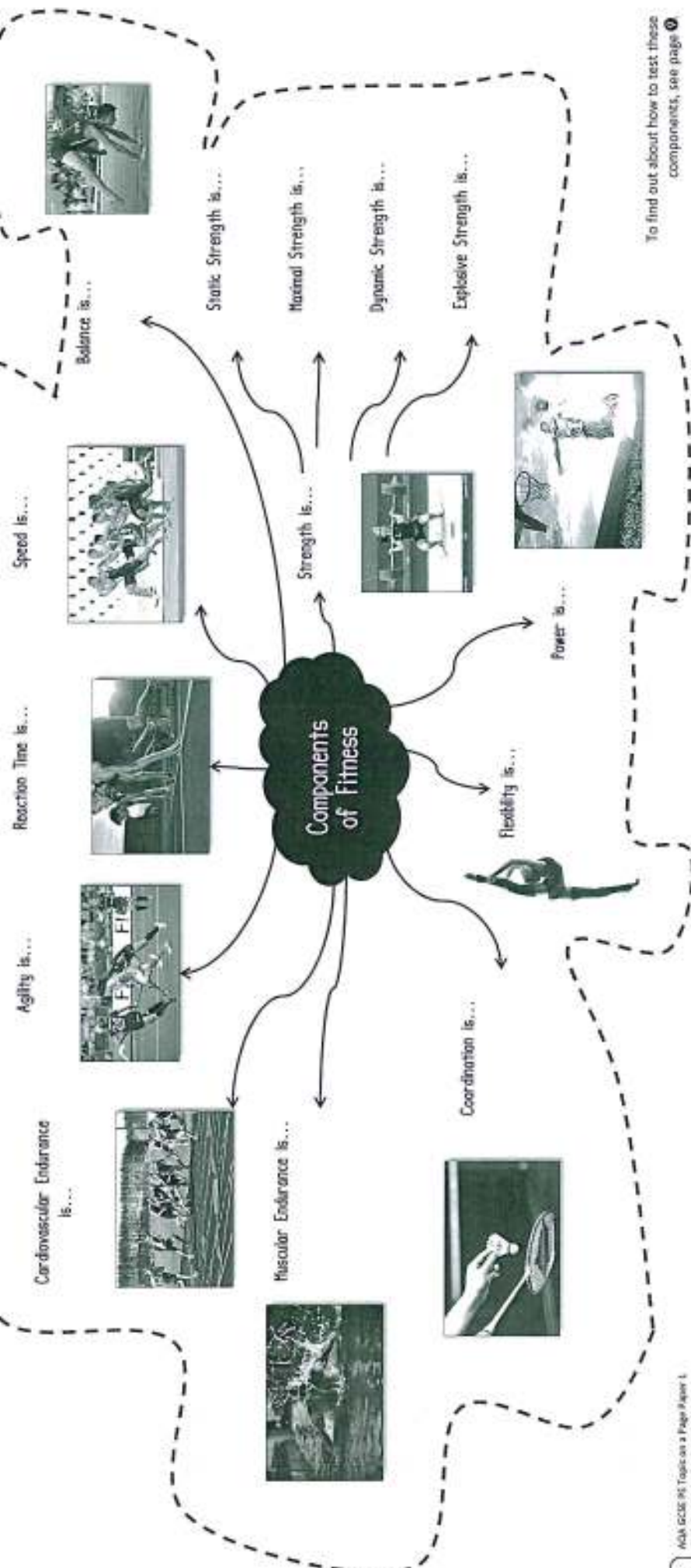
A Define 'health' and 'fitness' and describe the relationship between them.



Components of Fitness and Physical Activity

Different sports require different components to perform different skills.

B Define each of the components of fitness.



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

Fitness Testing

There is a range of different fitness tests which can be used to evaluate the different components of fitness. These are outlined below and the advantages and limitations of fitness testing are provided to the side.



B Identify the reasons against fitness testing.

-
-
-
-
-

C Briefly describe each of the fitness tests on the cards provided.

Agility → Winds agility test

Balance → Stark Balance

Power → Vertical Jump Test

Flexibility → Sit and Reach Test

Maximal Strength → One Rep Max Test

Cardiovascular Endurance → Multistage Fitness Test

Coordination → Wall Toss Test

Speed → 30 m Sprint Test

Strength → Handgrip Dynamometer

Fitness Data Collection

There are two types of data that can be collected from fitness testing: 'qualitative' and 'quantitative'.



Handwritten notes area with horizontal lines for text.

Muscular Endurance → Sit-up Bleep Test

Reaction Time → Ruler Drop Test

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 four 'SPOKRY' principles of training.

S	Frequency: The number of training sessions undertaken each week.	e.g. a cyclist should perform most of their training on a bike
P	Intensity: The amount of work undertaken during each training session.	e.g. once bench-pressing 50 kg becomes easier, the load should be increased to 52.5 kg
O	Time: The amount of time spent training during each session.	e.g. It is important for an athlete to undertake some form of training during a post-season break, to prevent fitness loss
T	Type: The method of training undertaken during each session.	e.g. football players could play netball to practise moving into a space

B Provide an example of how each of the 'FIT' principles of overload can be used during the training programme of a cyclist.

F	Frequency: The number of training sessions undertaken each week.	<p>Remember! It is important that training intensity and rest periods are appropriate for the training goals that an athlete has; for example, an athlete who wants to increase their muscular endurance should not be weight training with high weights and low repetitions.</p>
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.	

Types of Training

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.



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

Circuit Training	Continuous Training	Interval Training	High-intensity Training	Static Stretching	Weight Training	Plyometrics
<p>What? A number of activities at different sessions; the athletes move between each station with little or no rest</p> <p>Components All components</p> <p>Advantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <p>Disadvantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Useful for</p>	<p>What? Physical activity which involves prolonged periods of aerobic exercise, such as running or cycling</p> <p>Components Cardiovascular and muscular endurance</p> <p>Advantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Disadvantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Useful for</p>	<p>What? Continuous exercise performed on different terrains, at different speeds or with different periods of work and rest</p> <p>Components Cardiovascular and muscular endurance</p> <p>Advantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <p>Disadvantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Useful for</p>	<p>What? Intermittent periods of high-intensity exercise with periods of recovery or low-intensity exercise</p> <p>Components Power, cardiovascular and muscular endurance</p> <p>Advantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Disadvantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Useful for</p>	<p>What? A range of isometric stretches are performed for 30 seconds and then repeated</p> <p>Components Flexibility</p> <p>Advantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Disadvantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <p>Useful for</p>	<p>What? Weights are lifted in a series of movements which target different muscle groups</p> <p>Components Strength, power and muscular endurance</p> <p>Advantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <p>Disadvantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> <p>Useful for</p>	<p>What? An eccentric contraction is performed and followed by a larger, concentric contraction</p> <p>Components Power</p> <p>Advantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <p>Disadvantages</p> <ul style="list-style-type: none"> <input type="checkbox"/> <p>Useful for</p>

Optimising Training and Preventing Injury

Training Intensities

The intensity of training can be altered in order to train different components of fitness.

Calculations

Anaerobic/Aerobic

Anaerobic and aerobic training thresholds are determined by your heart rate during exercise and indicate which energy systems you are using.

B Describe the training thresholds that are required in order to train aerobic, anaerobic, strength and muscular endurance fitness components.

Max heart rate:
 $220 - \text{age (years)}$



Training zone:
 Aerobic
 Anaerobic

Strength / power training:

Muscular endurance:

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

D Identify the steps an athlete can take to reduce the risk of injury.



Training Seasons

There are three distinct phases of a season and each phase involves different types of training.

C Complete the table by describing what happens during each training season.

Season	What Happens
Pre-season	
Competition	
Post-season	

Revision Success Tip!
 Remember! You will need to be able to apply these seasons to different sports.

High-altitude Training

High altitude training is used by endurance athletes and involves training for several weeks at high altitude (approximately 2400m above sea level) in order to experience physical adaptations.

How it is carried out:

1. Athletes carry out their normal aerobic training at high altitude.
2. Due to the lack of oxygen, the oxygen-carrying capacity of the blood is reduced at high altitude.
3. Therefore, more red blood cells are produced in order to provide the muscles with oxygen.

Limitations

Benefits



Effective Use of a Warm-up and Cool-down

Warm-up

It is important that a warm-up is performed prior to exercise in order to prepare the body for physical activity. A warm-up is designed to reduce the risk of injury and improve performance.

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

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Cool-down

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

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

Benefits of Warming Up

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-

Benefits of Cooling Down

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-
-