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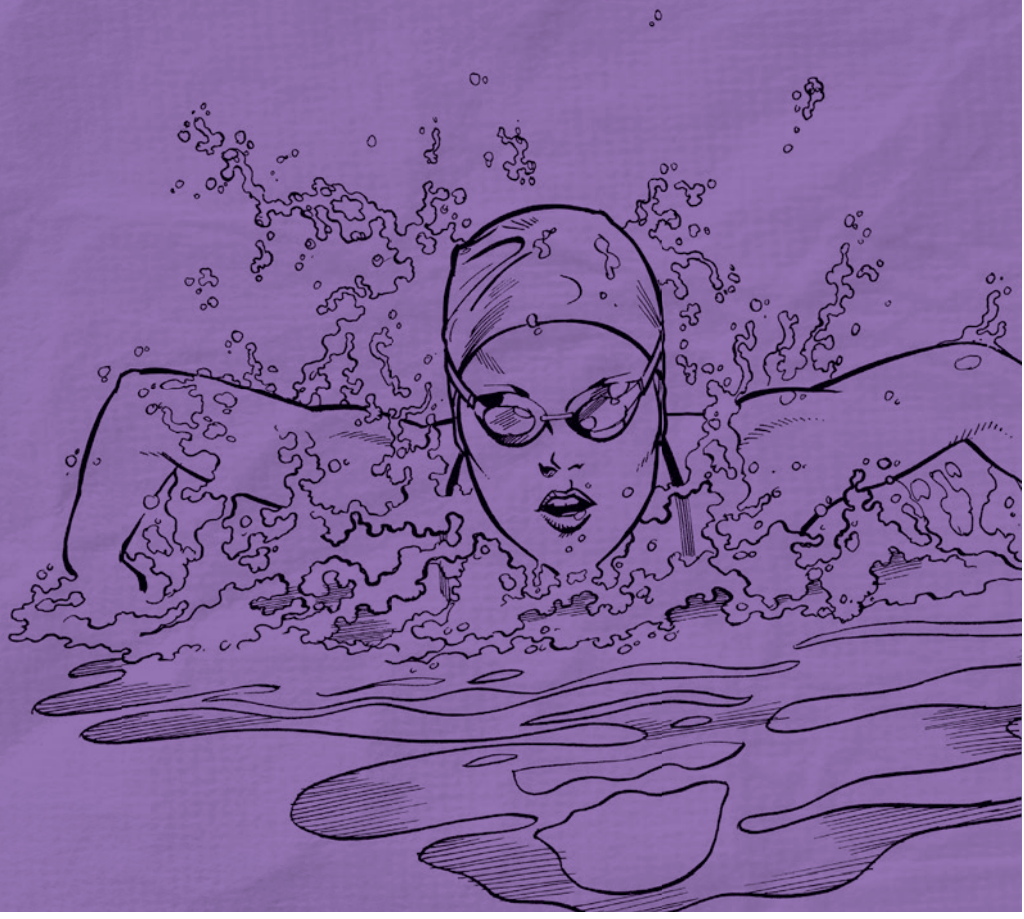
REVISE EDEXCEL GCSE (9–1)

Physical Education

REVISION GUIDE



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REVISE EDEXCEL GCSE (9–1)

Physical Education

Level 1 / Level 2 Full Course (1PE0) & Short Course (3PE0)

REVISION GUIDE

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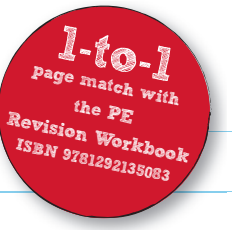
Contents



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A small bit of small print

Edexcel publishes Sample Assessment Material and the Specification on its website. This is the official content and this book should be used in conjunction with it. The questions in 'Now try this' have been written to help you practise every topic in the book. Remember: the real exam questions may not look like this.

Functions of the skeleton

You need to know the functions of the skeleton and how they apply to physical activity and sport.

Key functions

The functions of the skeleton are:

- production of blood cells
- storage of minerals
- protection of vital organs
- muscle attachment
- formation of joints for movement.

You need to be able to explain how the skeleton carries out all of these functions by giving examples of each in relation to physical activity.

Blood cell production

The following types of blood cell are produced in bone marrow. They are all beneficial to physical performance.

- Platelets help clotting if you are cut.
- Red blood cells transport oxygen to working muscles.
- White blood cells help fight infection.

(For examples of benefits, see page 19.)

Mineral storage

Calcium and phosphorus are stored in bones to help strengthen them.

Protection

Your skeleton provides protection for your vital organs, including the heart.

For example, your skull protects your brain if an opponent follows through wildly with their hockey stick and it hits you on the head during a game.

Golden rule

Always use the phrase **vital organs** and try to give an example to show your understanding.

Aid movement

- The bones provide a place for the muscles to **attach** to, so that when the muscles contract they **pull** the bones to cause movement. Movement occurs at the **joints** of the skeleton.
- Bones also act as **levers**. Levers allow the body to increase the force it can generate or increase the speed of the movement. For example, a tennis player with longer levers will generate more force on a serve. (You can read more about levers on pages 27 and 28.)

Worked example

Which of the following options is correct to complete the sentence below?

The skeletal system protects: **(1 mark)**

- ☐ **A** Vital organs, for example, bones, muscles, tendons
- ☒ **B** By providing a hard structure over the organ needing protection
- ☐ **C** By providing a structure for support
- ☐ **D** By producing red blood cells which fight disease

Now try this

The skeletal system has several functions. Describe how the skeleton aids movement. **(2 marks)**

Classification of bones

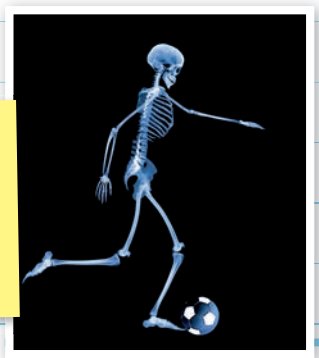
We classify bones by their shape. Each bone type or classification has a particular function. You need to know the classification type of each bone and its function, and be able to explain the use of each in physical activity.

Long bones

Long bones aid movement by working as levers.

Examples of long bones:

- the humerus
- the femur.



Long bones work as a lever to increase the pace of the ball when kicked.

Short bones

Short bones are weight bearing and provide support.

Examples of short bones:

- the carpals
- the tarsals.

Example of use:

- supporting body weight in a handstand.

Flat bones

Flat bones provide protection and a broad surface for muscles to attach to.

Examples of flat bones:

- the cranium
- the ribs
- the scapula.

Example of use:

- the cranium protects the brain if hit by a cricket ball.

Irregular bones

Irregular bones provide protection and a place for muscle attachment.

Example of irregular bones:

- the vertebrae.

Example of use:

- muscles attached to the vertebrae allow a hockey player to bend their back low to dribble a ball.

Vertebrae are irregular bones.

Worked example

Which **type** of bone is the ulna? **(1 mark)**

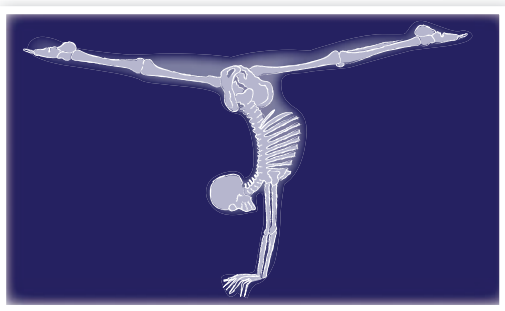
- ☐ **A** Flat bone
- ☒ **B** Long bone
- ☐ **C** Irregular bone
- ☐ **D** Short bone

If you are not sure, think about where the ulna is. Then think: does it look similar to any bones you know the classification of? Remember that bones are classified by shape; so if it is the same shape as a bone you **do** know, go for that option.

Now try this

Explain how the bone type at the wrist allows the gymnast to perform the position shown. **(3 marks)**

Make sure you identify the bone type you are explaining.



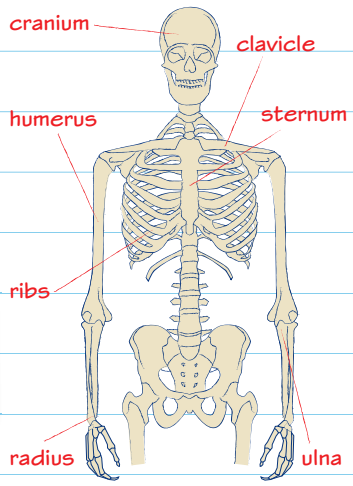
Structure of the skeleton

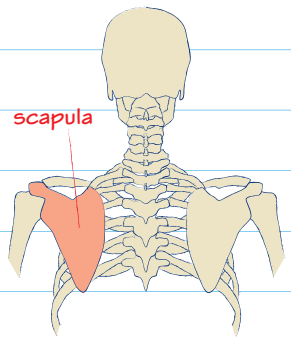
The skeleton is made up of many bones. Make sure you know the names and locations of the bones below and that you can recognise them on a variety of different diagrams.

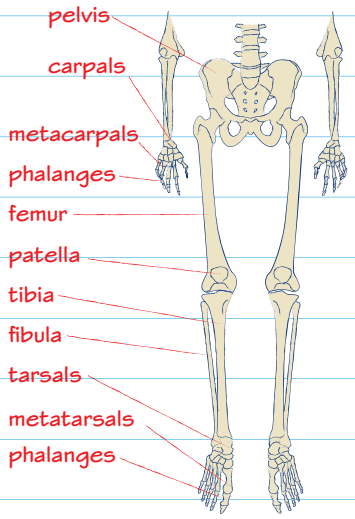
Identifying bones

The skeleton provides a framework for muscle attachment, to enable movement for physical activity.

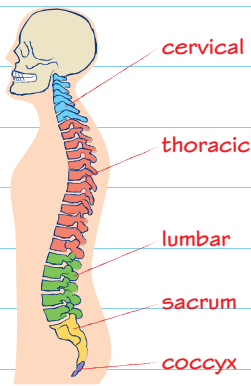
Remember to look at the shape of the bone to help identify what type it is.







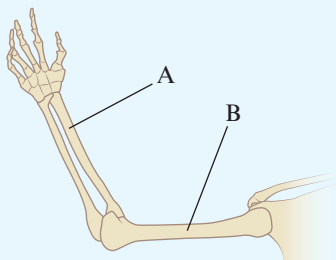
The vertebral column has five regions.



Golden rule

A good way to remember the names and locations of the bones is to practise by labelling blank diagrams of the skeleton.

Worked example



Identify the bones at A and B. **(2 marks)**

A: Radius

B: Humerus

Sometimes it is hard to remember which bone is the radius and which is the ulna. Remember: the radius is the bone that is near the thumb.

Now try this

The rugby player in the image is holding the ball.

State **two** bones located in the hand that help him hold the ball. **(2 marks)**

Classification of joints

You need to know the names of the bones that form each joint and the range of movement that each joint can do during physical activity.

About joints

- A joint is the place where two or more bones meet. It is where movement can occur.
- Although there are many joints in the human body, you only need to know the joints on this page.
- You should be able to see the similarities between the same types of joints.
- You should be able to give sporting examples of the use of each joint.

Hinge joints

Located at the:

- knee
- elbow
- ankle.


Knee

Movement at hinge joints:

- flexion
- extension.

Golden rule

Remember it is the formation of the joint that dictates the type of movement that can occur there.

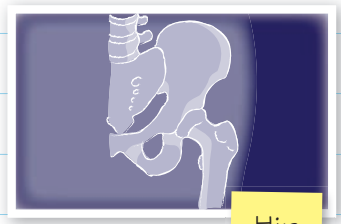
Ball and socket joints

Located at the:

- hip
- shoulder.

Movement at ball and socket joints:

- flexion
- extension
- rotation
- circumduction
- abduction
- adduction.


Hip

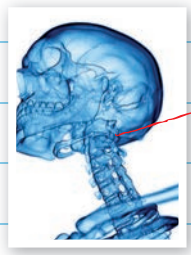
Pivot joints

Located at the:

- neck (atlas and axis).

Movement at **this** pivot joint:

- rotation.


atlas and axis at the neck

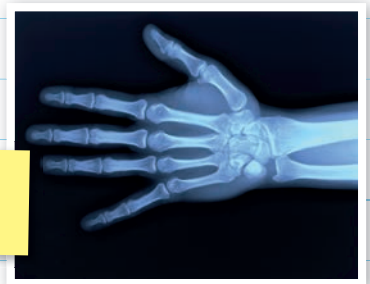
Condyloid joint

Located at the:

- wrist.

Movement at condyloid joints:

- flexion
- extension
- circumduction.


Condyloid joint at the wrist.

Worked example

Which of the following is a movement associated with the pivot joint at the atlas and axis? **(1 mark)**

- ☐ **A** Adduction
- ☒ **B** Rotation
- ☐ **C** Flexion
- ☐ **D** Extension

Make sure you read the question carefully. This question states 'is associated with' rather than 'is not …'.

Now try this

What type of joint is formed at the shoulder? **(1 mark)**

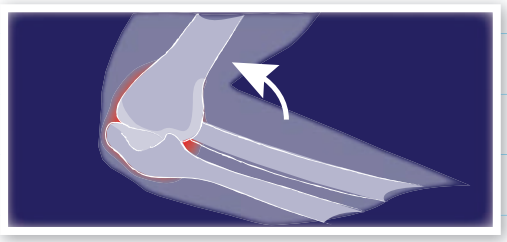
- ☐ **A** Ball and socket
- ☐ **B** Ball joint
- ☐ **C** Dovetail
- ☐ **D** Hinge

Movement at joints 1

You need to know the **range of movement** that can be achieved at each of the joints. Flexion and extension can occur at: ball and socket, hinge and condyloid joints.

Joint action: flexion

Flexion is the term given when the angle at a joint **decreases**.



This happens when the bones forming the joint move closer together.

Joint type and application

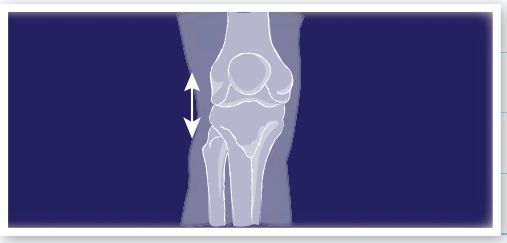
Flexion occurs at hinge, ball and socket, and condyloid joints.

For example, at the knee when the player is preparing to kick a football.

The lower part of your leg gets closer to the upper part of your leg as the angle at the joint decreases.

Joint action: extension

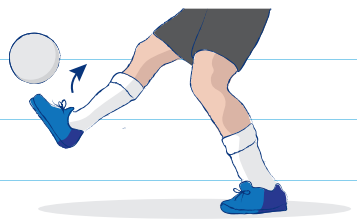
Extension is the term given when the angle at a joint **increases**.



This happens when the bones forming the joint move away from each other.

Joint type and application

Extension occurs at hinge, ball and socket, and condyloid joints.



For example, at the knee when following through after kicking a football.

The lower part of your leg gets further away from the upper part of your leg as the angle at the joint increases.

Worked example

What is the main range of movement possible at the knee joint? **(1 mark)**

The range of movement at the knee joint is flexion to extension.

Flexion and extension could be written in any order but you do need to include both. If a question asks for the range of movement at a joint, you need to put down both parts because the range is the whole movement covered.

Now try this

Identify the joint action necessary to bend the batting (right) arm at the elbow to move into the position shown in the image. **(1 mark)**

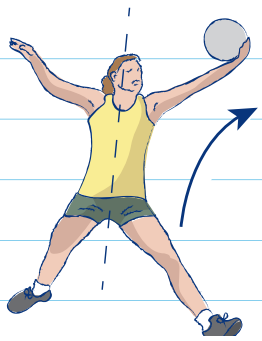
This question asks for the joint action. Watch out for the different terms and make sure you are not confusing joint action with joint type or muscle action.

Movement at joints 2

This page covers the joint actions of abduction, adduction and rotation. These movements occur at ball and socket joints.

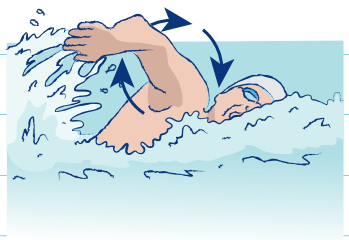
Joint actions

Abduction = the movement of a limb **away** from the midline of the body.



Adduction = the movement of a limb **towards** the midline of the body.

Rotation = when the bone at a joint moves around its own axis, so making a circular movement.



Rotation allows for the biggest range of movement.

Joint type and application

Abduction occurs at ball and socket joints (hip and shoulder).

For example, at the shoulder when reaching out sideways to intercept a netball. There is abduction at the shoulder.

To help you remember:
If something is 'abducted', it is taken away.

Adduction occurs at ball and socket joints (hip and shoulder).

For example, at the hip in the cross-over leg action when throwing a javelin. The leg comes back towards the midline of the body.

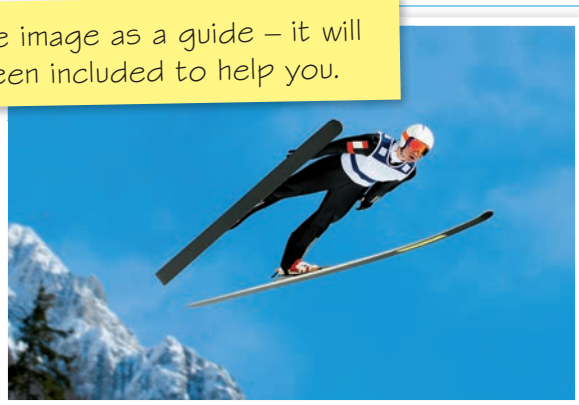
To help you remember:
Adduction starts with 'add', so it is when a limb is added to the midline of the body.

Rotation occurs at ball and socket joints (hip and shoulder).

For example, at the shoulder when swimming front crawl. The arm rotates around in a circular motion.

Worked example

Use the image as a guide – it will have been included to help you.



Which of the following is the correct term for the joint action that occurs when the ski jumper takes the skis away from the midline of the body to achieve the position shown in the image? **(1 mark)**

- ☒ **A** Abduction
- ☐ **B** Adduction
- ☐ **C** Flexion
- ☐ **D** Extension

Now try this

Identify the range of movement at the shoulder during a star jump. **(1 mark)**

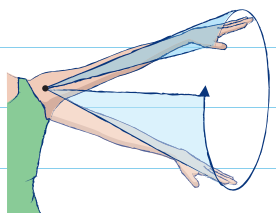
The word 'range' means you need to include both the start and finish movement for the action identified.

Movement at joints 3

In addition to the joint actions on pages 5 and 6, there are three other joint actions you need to know: circumduction, plantar-flexion and dorsi-flexion.

Joint action: circumduction

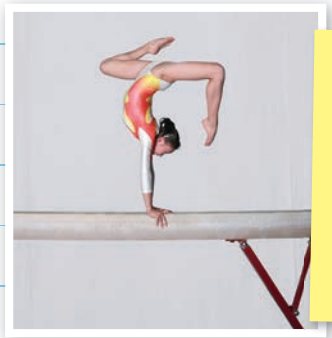
- Movement in the shape of a cone (conical).
- Allows 360° of movement.
- Occurs at ball and socket joints.
- For example, the shoulder action when swimming butterfly.



Circumduction at the shoulder.

Joint action: plantar-flexion

- Occurs at the ankle joint.
- Movement of the foot downwards when you point your toes.



Plantar-flexion of the ankle occurs as the gymnast points her toes to make the shape more aesthetically pleasing.

Joint action: dorsi-flexion

- Occurs at the ankle joint.
- Movement of the foot upwards towards the shin (decreasing the angle at the joint).

Dorsi-flexion occurs at the ankle of the leading leg as the athlete jumps the hurdle.

Worked example

State the name of the joint type where circumduction takes place and give an example of its use. **(2 marks)**

Ball and socket joint. Circling the leg at the hip during a warm up.

Make sure you read the question carefully. This question is asking for the name of a **joint type**, not the name of a **joint**.

Golden rule

Always try to apply your answers to examples in physical activity.

Now try this

Briefly explain how the joint action at the ankle in the image shown assists the volleyball player in their sport. **(2 marks)**

The joint action has not been named, so it would be a good idea to name it and then explain how it might help.

Ligaments, tendons and muscle types

Although bones and muscles are essential for movement, they need help from other structures. These structures work with the bones and muscles to ensure that the body functions well in physical activity.

Ligaments

The role of the ligaments is to join **bone to bone**. Ligaments are formed of tough connective tissue that holds the bones together to form the joint.

Ligaments are relevant to sport and physical activity because they:

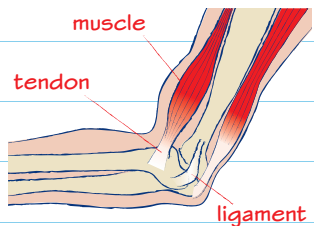
- help keep joints stable
- prevent unwanted movement that might cause an injury, such as a dislocation when playing sport.

Tendons

The role of the tendons is to join (skeletal) **muscle to bone**. Tendons are formed of a tough connective tissue.

Tendons are relevant to sport and physical activity because they:

- hold the muscle to the bone, so that when the muscle contracts the muscle can pull on the bone and cause movement at joints.



Tendons join muscle to bone and ligaments join bone to bone.

Muscle types

There are three types of muscle. Each muscle type has a different classification based on its characteristics.

Cardiac muscle

- Location: cardiac muscle forms the heart.
- Cardiac muscle is unconsciously controlled – we do not have to think to make it contract.
- For example, cardiac muscle in the heart contracts to pump blood around the body.

Involuntary muscles

- Location: involuntary muscles are found in blood vessels (and the stomach and intestines).
- They contract slowly and rhythmically and are unconsciously controlled – they contract automatically when required to by the body.
- For example, the involuntary muscles in the blood vessels help regulate blood flow for vascular shunting.

Voluntary muscles

- Location: voluntary muscles are the skeletal muscles that attach via tendons to the skeleton to allow movement.
- Voluntary muscles are under conscious control – that is, we move them when we want to; we consciously decide when they should work.
- For example, the biceps contract to flex the arm at the elbow when we perform bicep curls.

Worked example

Which of the following is an example of a voluntary muscle? **(1 mark)**

- ☒ **A** Deltoid
- ☐ **B** Heart
- ☐ **C** Blood vessel
- ☐ **D** Tendon

Now try this

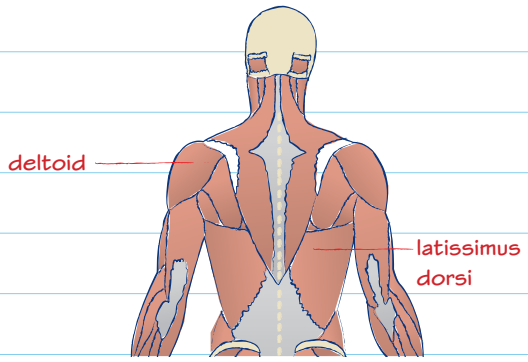
Notice the word **analyse**. This means you need to really look at each characteristic and see how it links to the particular role of that muscle type.

Analyse how the characteristics of voluntary and cardiac muscle types support their function. **(4 marks)**

Muscles

You need to know the names, location and specific functions of the main muscles that work with the skeleton to produce movement and be able to give examples of their use in sport.

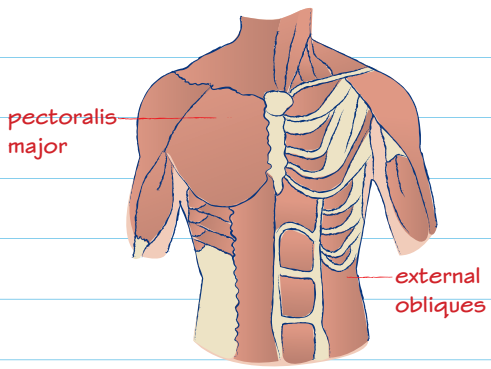
Name: **Deltoid**
Location: Top of the shoulder
Role: Abducts the arm at the shoulder
Example: Lifting your arms above your head to block the ball in volleyball



Name: **Latissimus dorsi**
Location: Side of back
Role: Adducts the upper arm at the shoulder / rotates the humerus
Example: Bringing arms back to side during a straight jump in trampolining

Different types of joint movement plus words to describe the different types of movement at joints, for example, flexion, extension and abduction, are explained on pages 5, 6 and 7.

Name: **Pectoralis major**
Location: Front of upper chest
Role: Adducts the arm at the shoulder
Example: Follow-through from a forehand drive in tennis



Name: **External obliques**
Location: Between lower ribs and abdomen
Role: Rotates the trunk and helps pull chest down
Example: Rotating trunk while throwing the javelin

Worked example

Which one of the following muscles is contracting to allow the tennis player in the image to adduct his arm at the shoulder?
(1 mark)

- ☐ **A** Triceps
- ☐ **B** Latissimus dorsi
- ☐ **C** Abdominals
- ☒ **D** Pectoralis major

If you are not sure, you can move your own body to help you work out which muscles are contracting.

Now try this

Name the movement that occurs when the deltoids contract **and** give an example of its use in a physical activity of your choice. **(2 marks)**

Antagonistic muscle pairs: biceps and triceps

Antagonistic pairs of muscles create opposing movement at joints. You need to know the **four** different pairs covered on the following pages and relate them to sporting techniques.

Antagonistic pairs

Skeletal muscles work together to provide movement of the joints.

While one muscle **contracts**, another **relaxes** to create movement.

Muscles working together like this are called **antagonistic pairs**.

The muscle contracting is the **agonist** (prime mover).

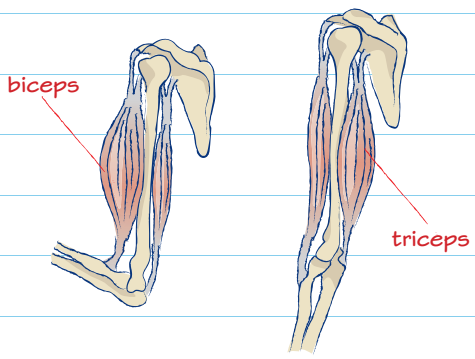
The muscle relaxing is the **antagonist**.

Remember, muscles are connected to bones via tendons. When the muscles contract, they pull on the tendon which pulls on the bone. This creates the movement.

Biceps and triceps

These two muscles are an example of an antagonistic muscle pair.

Name:	**Biceps**
Location:	Front of upper arm
Role:	Flexion of the arm at the elbow
Example:	Upwards phase of a biceps curl



Name:	**Triceps**
Location:	Back of upper arm
Role:	Extension of the arm at the elbow
Example:	Straightening the arms in a chest press

During this part of the movement, the triceps is the antagonist – it is relaxing to allow the biceps to contract.

During this movement, the biceps is the antagonist – it is relaxing to allow the triceps to contract.

Worked example

Explain the term 'antagonistic pair' in relation to muscle movement. **(1 mark)**

One muscle contracts while the other relaxes to bring about movement.

EXAM ALERT!

Explain the role of **each** muscle in the antagonistic pair.

Now try this

Complete the blanks by identifying the muscles involved in the movement described. **(2 marks)**

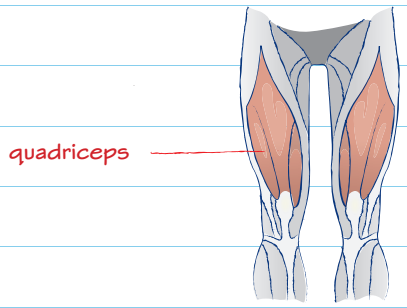
The ..... is the agonist when the goalkeeper extends his arm at the elbow and the ..... is the antagonist.

Antagonistic muscle pairs: quadriceps and hamstrings

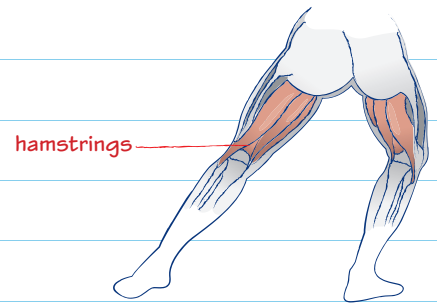
You need to know which muscles work together to bring about movement and use this knowledge to analyse sporting actions.

The quadriceps and hamstrings are an antagonistic muscle pair.

Name:	**Quadriceps**	Name:	**Hamstrings**
Location:	Front of upper leg	Location:	Back of upper leg
Role:	Extension of the leg at the knee	Role:	Flexion of the leg at the knee
Example:	Straightening the leading leg going over a hurdle	Example:	Bending the trailing leg going over a hurdle



During this part of the movement the hamstrings act as the antagonist. It is relaxing to allow the quadriceps to contract.



During this part of the movement the quadriceps is the antagonist. It is relaxing to allow the hamstrings to contract.

The quadriceps and hamstrings work together so the performer can clear the hurdle.

Golden rules

- If you are not sure of the correct spelling of muscle names, write them like they sound.
- Always write the name in full, for example, quadriceps, not quads.

Worked example

Which one of the following muscles is contracting to allow the cyclist in the image to flex her leg at the knee? **(1 mark)**

- ☐ **A** Latissimus dorsi
- ☒ **B** Hamstrings
- ☐ **C** Gastrocnemius
- ☐ **D** Quadriceps

EXAM ALERT!

Make sure you know the actions of the muscles. Questions often have a picture to help you visualise the movement.

Now try this

Name the antagonist that is relaxing to allow the cyclist in the image above to flex her leg at the knee. **(1 mark)**

Antagonistic muscle pairs: gastrocnemius and tibialis anterior

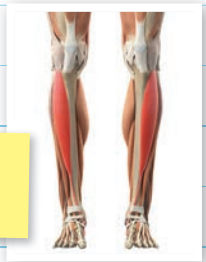
Make sure you know the names and locations of these muscles and can give an example of their use.

Name: **Gastrocnemius**
Location: Back of lower leg
Role: Plantar-flexion at the ankle

The **gastrocnemius** muscles are highlighted.

Example: Pointing the toes when performing a pike jump in trampolining

Name: **Tibialis anterior**
Location: Front of lower leg
Role: Dorsi-flexion at the ankle



The **tibialis anterior** muscles are highlighted.

Example: Bringing the toes up towards the shins when extending the legs in the long jump

Golden rule

Always use the correct name for the gastrocnemius, not the calf. Also remember it has a 'C' sound in it (gast-ro-C-nemius).

Which action is plantar-flexion?

To help you recall which action is plantar-flexion, remember:

Pointing toes starts with the letter **P** and so does the action **p**lantar-flexion.

Where is the tibialis anterior?

To help you recall where the tibialis anterior muscle is located, remember:

- the word 'anterior' means front
- the word 'tibialis' starts with the name of the bone – the tibia
- the muscle is located on the front of the tibia.

Worked example

What term is being described below?

When two muscles work together, one muscle starts to contract to pull the bone, the other starts to relax to aid the movement. **(1 mark)**

Antagonistic pair

Golden rule

When asked to give an example, always use the most obvious example to make sure it is correct, rather than giving a more obscure answer.

Now try this

Name the antagonist supporting the agonist to allow the gymnast to point his toes. **(1 mark)**

Double check if a question is asking for the agonist or the antagonist.

Antagonistic muscle pairs: hip flexors and gluteus maximus

Make sure you know the names and locations of these muscles and can give an example of their use.

Name: **Hip flexors**
Location: Very top of front of upper leg
Role: Flexion of leg at the hip

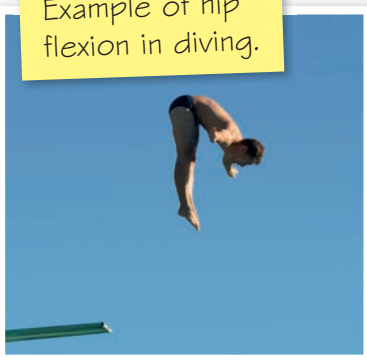
The **hip flexor** muscles are highlighted.

Example: Bringing the legs up in a seat-drop in trampolining

Name: **Gluteus maximus**
Location: Buttocks
Role: Extension of the leg at the hip

The **gluteus maximus** muscles are highlighted.

Example: Lifting the leg back at the hip when running

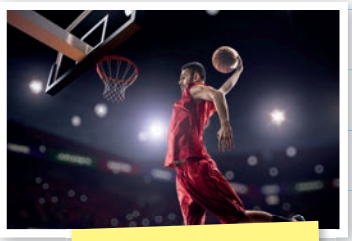


Example of hip flexion in diving.

Golden rules

Notice the words **flexion** and **extension** are used for the action at the hip as well as the knee. The same rules apply.

- Flexion occurs when the angle at the joint gets smaller.
- Extension occurs when the angle at the joint gets bigger.



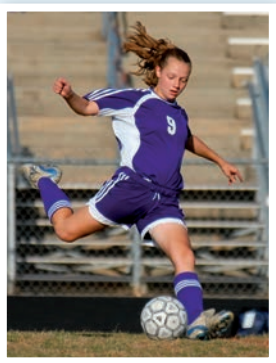
Example of hip extension in basketball.

Worked example

Which **one** of the following muscles is contracting to allow the footballer in the image to extend her leg at the hip? **(1 mark)**

- ☒ **A** Gluteus maximus
- ☐ **B** Hamstrings
- ☐ **C** Abdominals
- ☐ **D** Quadriceps

Note that the question refers to the hip, not the knee, and asks about extension rather than flexion.



Now try this

Name the agonist that brings the knees up to the chest in a tuck jump and identify the joint action occurring at the hip. **(2 marks)**

Muscle fibre types

Muscle fibres types fall into three main categories. You need to know the differences between the types of muscle fibre and how each is used in performance.

Types of skeletal muscle

Skeletal muscles are made up of different muscle fibres. Muscle fibres are either **fast twitch** or **slow twitch**.

There is one type of slow twitch fibre: type I.
There are two types of fast twitch fibre: type IIa and type IIx.

The different types of muscle fibre have different capabilities and are recruited depending on the task required.
Each type has its advantages (👍) and disadvantages (👎).

Slow twitch type I

- Produce low force.
- Slow speed of contraction.
- High endurance.

👍 Good in endurance activities to keep going without tiring – for example, leg muscles in a cross-country race.

👎 Do not produce much power.

Fast twitch type IIa

- Produce high force.
- Moderate speed of contraction.
- Medium endurance.

👍 More resistant to fatigue than type IIx – for example, in a 400-metre sprint.

👎 Not as powerful as type IIx or as resistant to fatigue as type I.

Golden rule

You should always be clear if you are referring to type IIa or type IIx fast twitch fibres.

Fast twitch type IIx

- Produce very high force.
- Fast contracting.
- Low endurance.

👍 Good for short, explosive actions requiring power, strength and speed – for example, a sprint start or a 100-metre sprint.

👎 Only provide power for a very short time before becoming fatigued.

Summary of characteristics

	Slow twitch type 1	Fast twitch type IIa	Fast twitch type IIx
Force of contraction	low	high	very high
Speed of concentration	slow	medium	fast
Resistance to fatigue	high	moderate	low
Aerobic or anaerobic	aerobic	aerobic and anaerobic	anaerobic
Myoglobin	high	medium	low
Mitochondria	high	medium	low
Capillary network	good	moderate	low

Worked example

Name the muscle fibre type that is predominantly used when constantly running throughout a game to mark your opponent in football. **(1 mark)**

Slow twitch type I

Look for the key words 'constantly' and 'throughout' in the question help to show that it is an endurance requirement.

Now try this

Describe a characteristic of type IIx muscle fibres and how it is an advantage to a basketball performer. **(2 marks)**

Remember: 'characteristic' means a quality or feature that specifically belongs to the item.

Cardiovascular system 1

You need to know the **functions** of the cardiovascular system, what it does and how this is relevant to physical performance.

The cardiovascular system

The cardiovascular system consists of:

- **the blood** – the medium that the gases, blood cells and nutrients are transported in
- **the blood vessels** – the structures that carry the blood
- **the heart** – which circulates blood around the body by squeezing blood out to the blood vessels each time it beats.

Transport of oxygen

The cardiovascular system transports **oxygen** around the body in the blood. It carries oxygen **to** the muscles and vital organs. Oxygen is needed in energy production for physical activity.

Transport of carbon dioxide

Carbon dioxide is produced as a by-product during energy production. The cardiovascular system takes carbon dioxide **away** from the muscles to get rid of it from the body.

Transport of nutrients

Nutrients are broken down from the food we eat and transported to the body in the blood.

Athletes need macro- and micronutrients in order to perform well. (These are covered on pages 91 and 92.)

Clotting of open wounds

Platelets that are transported in the blood help to clot wounds by gathering at the site and forming a plug to prevent blood loss.

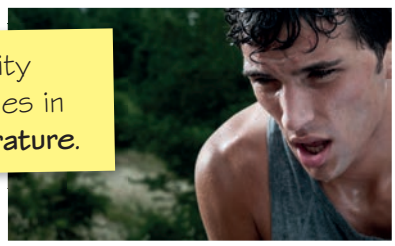
Clotting of blood is needed, for example, if a performer falls and grazes their knee, so that they can stay on the field of play.

Regulation of body temperature

We get hot when we do physical activity because heat is a by-product of energy production.

We can also get cold doing physical activity outside in low temperatures.

The body attempts to keep a constant temperature.



Physical activity causes changes in body temperature.

When the body temperature rises:

- the blood vessels under the skin increase in diameter (**vasodilation**) to increase blood flow to the capillaries under the surface of the skin so heat can radiate from the skin.

When body temperature drops:

- the blood vessels under the skin decrease in diameter (**vasoconstriction**) to decrease blood flow to the capillaries under the surface of the skin so less heat is lost by radiation.

Worked example

Which of the following is a function of the cardiovascular system? **(1 mark)**

- ☐ **A** Breathing in air containing oxygen
- ☒ **B** Regulating body temperature
- ☐ **C** Protection and muscle attachment
- ☐ **D** Breathing out air containing carbon dioxide

Note the question refers to the cardiovascular system and **not** the respiratory system.

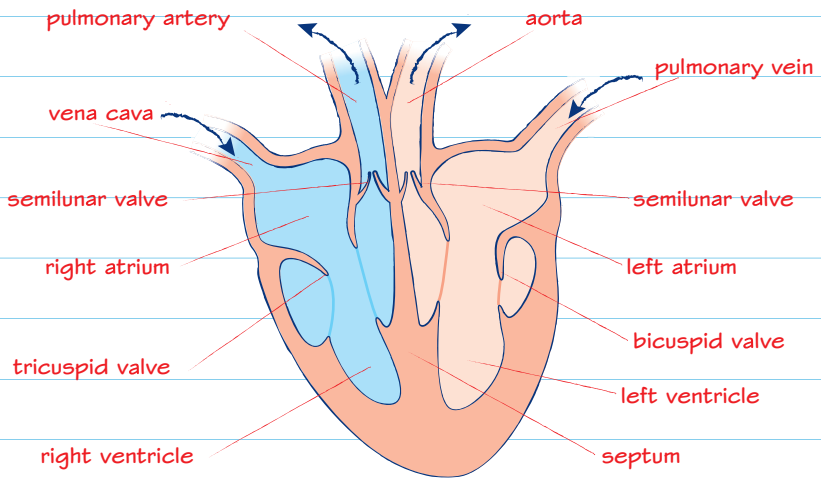
Now try this

Explain how the cardiovascular system helps regulate body temperature when the skier starts to get cold.

(2 marks)

Cardiovascular system 2

You need to know the structure of the cardiovascular system. Make sure you know the names and location of the components and their role in maintaining blood circulation during physical activity.



Golden rule

When looking at a diagram of the heart remember that it is a cross-section, viewed from the front. This is why the right-hand side is actually on the left of the diagram! Imagine your heart to check the sides.

- **Tricuspid valve** is on the **right** side of the heart between the right atrium and the right ventricle.
- **Bicuspid valve** is on the **left** side of the heart between the left atrium and left ventricle.
- **Semilunar valves** are between the ventricles and the pulmonary artery and vein.

Valves help keep the blood moving forward by shutting behind blood that has passed through, to prevent it from flowing back the way it came.

- **Vena cava** is the main **vein** bringing deoxygenated blood back **to** the heart so it can be pumped to the lungs to collect oxygen.
- **Aorta** is the main **artery** and carries oxygenated blood **away** from the left ventricle to take oxygen to the working muscles.
- **Pulmonary artery** receives deoxygenated blood from the right ventricle to take to the lungs to receive oxygen.
- **Pulmonary vein** brings oxygenated blood from the lungs to the left atrium.

- **Right atrium** receives deoxygenated blood from the body via the vena cava.
- **Left atrium** receives oxygenated blood from the lungs via the pulmonary vein.
- **Right ventricle** receives deoxygenated blood from the **right** atrium via the tricuspid value.
- **Left ventricle** receives oxygenated blood from the **left** atrium via the bicuspid valve.
- **Septum** is the wall that separates the left and right sides of the heart.

Worked example

Explain the function of the pulmonary artery. **(2 marks)**

The pulmonary artery carries deoxygenated blood from the heart to the lungs **so** the blood can get oxygen, which is eventually pumped to the working muscles.

Knowledge – say what you know.
Application – apply it. Use linking words such as 'so', 'meaning that' and 'therefore' so the knowledge leads on to the application.

Now try this

Complete the diagram to show the missing components assisting the flow of deoxygenated blood to the lungs. **(2 marks)**

Vena cava	→		→	Tricuspid valve	→	Right ventricle	→		→	Pulmonary artery

Blood vessels

You need to know both the structure and function of the blood vessels and how this is relevant in terms of blood pressure, oxygenated blood, deoxygenated blood and response to physical exercise.

Arteries

Structure

- Thick muscular and elastic walls.
- Small internal diameter (lumen).

Functions

- Carry blood at high pressure **away** from the heart.
- Mainly carry oxygenated blood (exception: pulmonary artery carries deoxygenated blood to lungs from heart).

Relevance

Blood pressure increases during exercise as the working muscles demand more oxygen, increasing blood flow. The muscles in the artery walls contract and relax automatically. When the muscle relaxes, the arteries dilate so there is more room for the blood to travel through, helping regulate blood pressure.

Capillaries

Structure

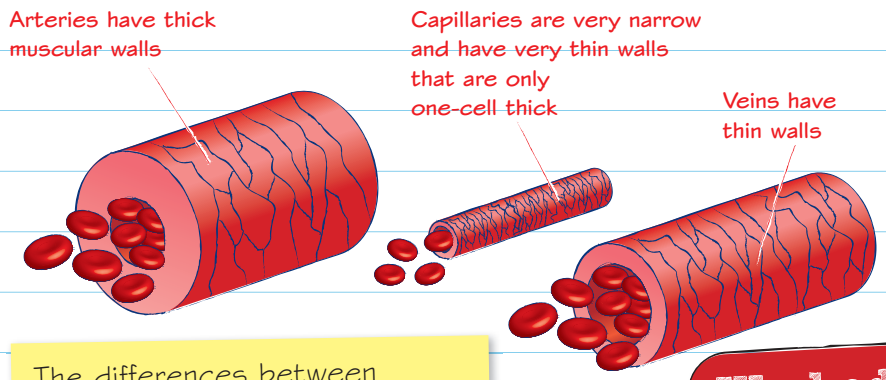
- Very thin walls (only one-cell thick).
- Small internal diameter.

Functions

- Link smaller arteries with smaller veins.
- Carry blood at very low pressure.

Relevance

Allow **gaseous exchange**. Walls are very thin to allow gases and nutrients to pass through them, therefore getting oxygen to the muscles and removing carbon dioxide.



The differences between arteries, capillaries and veins.

Golden rule

Remember: All arteries carry blood **away** from the heart and all veins carry blood **towards** the heart.

Veins

Structure

- Thin walls.
- Contain valves.
- Large internal diameter.

Functions

- Carry blood at low pressure towards heart.
- Mainly carry deoxygenated blood (exception: pulmonary vein carries oxygenated blood from lungs to heart).

Relevance

Veins carry deoxygenated blood from the muscles. The wide internal diameter allows blood to pass through more easily and the valves help return the blood to the heart by preventing backflow due to low pressure.

Worked example

Which one of the following is a characteristic of capillaries? **(1 mark)**

- ☐ **A** Has valves
- ☐ **B** Thick muscular wall
- ☒ **C** One-cell thick
- ☐ **D** Carries blood under high pressure

Think about the function of capillaries. The capillaries need to be thin to allow the gases to move in and out of them easily.

Now try this

State the type of blood vessel that holds blood at high pressure. **(1 mark)**

Vascular shunting

You need to be able to explain the redistribution of blood flow (**vascular shunting**) during exercise compared to at rest.

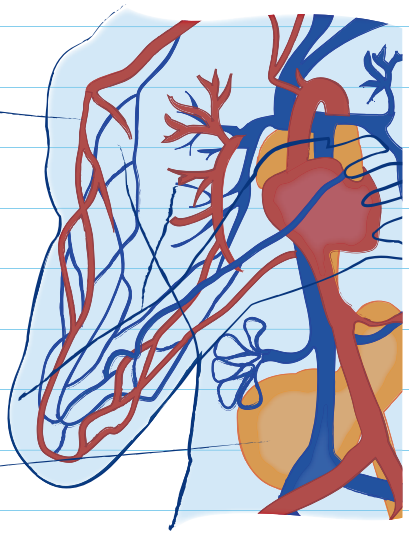
Vascular shunting

When you exercise your working muscles need more oxygen. Oxygen is attached to the red blood cells in the blood and carried to your active muscles.

Your heart rate and stroke volume (see page 26) increase so more blood is circulating every minute.

Blood is diverted away from inactive areas to the working muscles. This is called **vascular shunting**.

Blood can be shunted away from the stomach. This is why it is important that digestion is complete before exercise begins.



Vasoconstriction

- Vasoconstriction means that the blood vessels are constricted (squeezed) to make them smaller.
- When you start to exercise, chemical changes trigger signals from your nervous system.
- These signals cause the blood vessels that supply the **inactive** areas (for example, the digestive system) to **constrict**, reducing blood flow to these areas.

Vasodilation

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

Worked example

You could use alternative words to 'greater' and 'lower', such as 'more' or 'less', but always re-read your answer to make sure the meaning is clear.

Using the words in the table below, complete the following statements about blood flow whilst at rest and during physical activity.

unchanged	equal
lower	greater

Blood flow to the digestive system is .....greater..... at rest than when exercising. **(1 mark)**

Blood flow to the muscular system is .....lower..... at rest than when exercising. **(1 mark)**

Now try this

Using the words in the table below, complete the statements that follow.

vascular shunting	digestion
cardiac output	increased blood flow

Reduced blood flow to specific areas of the body is achieved through .....

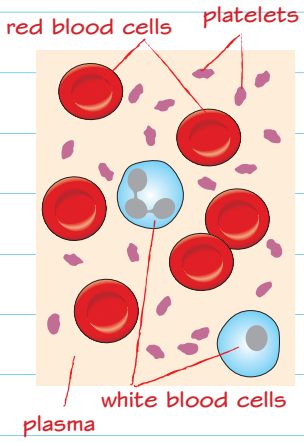
There is a need for ..... to the muscles during exercise. **(2 marks)**

Plasma, platelets and blood cells

You need to know the function and importance of red and white blood cells, platelets and plasma for physical activity and sport.

The four main components of blood

The four main components of the blood each play a role in enabling physical activity to take place.



Plasma

Plasma transports the blood cells, platelets and nutrients to the different parts of the body.

Plasma is the liquid part of blood.

Red blood cells

Red blood cells carry oxygen and remove carbon dioxide.

- Oxygen is diffused into the bloodstream from the alveoli in the lungs.
- The oxygen then binds (joins) with the haemoglobin in the red blood cells and is transported (by the plasma) to the working muscles where it is needed for any aerobic activity.
- Some of the carbon dioxide produced in the tissue is transported away from the muscles. It can be either attached to red blood cells or just carried in the plasma.

Platelets

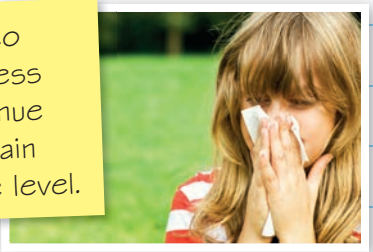
Platelets help prevent bleeding as they can stick to each other and to the walls of the blood vessels. If a performer gets cut while playing, the platelets flowing in the plasma stick together and form a plug to prevent further blood loss.

If cut, a performer is not allowed to continue playing until the bleeding has stopped.

White blood cells

White blood cells help fight infection. They travel around the body in the plasma and fight any infections or diseases that may be there.

Performers need to stay free from illness so they can continue to train and maintain their performance level.



Golden rule

Always try to apply the topic to physical activity.

Worked example

Explain why plasma is so important to sports performance. **(3 marks)**

Plasma is the liquid component of the blood.

Because it is liquid it flows through the blood vessels, allowing transportation of anything within it.

Therefore plasma can carry red blood cells within it, supplying oxygen to the working muscles for physical activity.

Generally when answering 'explain' questions you need to **show your knowledge** and either **apply or justify** the point you are making. Remember, if the question asks you to **explain** you need to include a **justification** or **reason** to support the initial point too.

Knowledge (what is it?)
Application (what is the impact?)
Justification (why is it important?)

Now try this

State the component of blood responsible for fighting infection. **(1 mark)**

Composition of air

You need to know the composition of inhaled and exhaled air and the impact of physical activity and sport on this composition.

Inhaled air

Inhaled air is the air we breathe **in** to the lungs.

The percentages of the gases in inhaled air are shown in the table below.

Nitrogen	78%
Oxygen	21%
Carbon dioxide	0.04%

Exhaled air

Exhaled air is the air we breathe **out** of the lungs.

The percentages of the gases in exhaled air are shown in the table below.

Nitrogen	78%
Oxygen	16%
Carbon dioxide	4%

The differences between inhaled and exhaled air

How do the percentages of the different gases vary between inhaled and exhaled air?

- Nitrogen has remained the same.
- Oxygen levels have gone down.
- Carbon dioxide levels have risen.

You need to be able to account for these changes.

Remember: the reason these three gases do not add up to 100% is due to the rest of the air being made up of tiny percentages of other gases. You do not need to know these other gases for your exam.

Nitrogen

- The largest percentage of gas.
- The same amount is breathed out as is breathed in.
- Does not go down as the body does not use it during physical activity.
- Does not go up as the body does not produce it during physical activity.

Oxygen

- Levels decrease as oxygen is used in energy production for activity or for recovery, so there is less oxygen to breathe out.

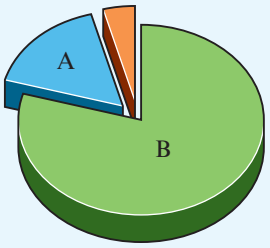
Carbon dioxide

- Levels increase as carbon dioxide is produced as a by-product of energy production.

Worked example

The chart below represents the three main gases found in exhaled air.

Identify the gases labelled A and B. **(2 marks)**



A = oxygen
B = nitrogen

Use of data

Use of data

Think about the percentages of the gases and relate them to the pie chart. Which gas forms the highest percentage of air?

In this example it does not make a difference that the question refers to exhaled air, as the changes do not affect the proportions of the gases.

Now try this

State **two** reasons why the level of nitrogen remains the same in inhaled and exhaled air. **(2 marks)**