1

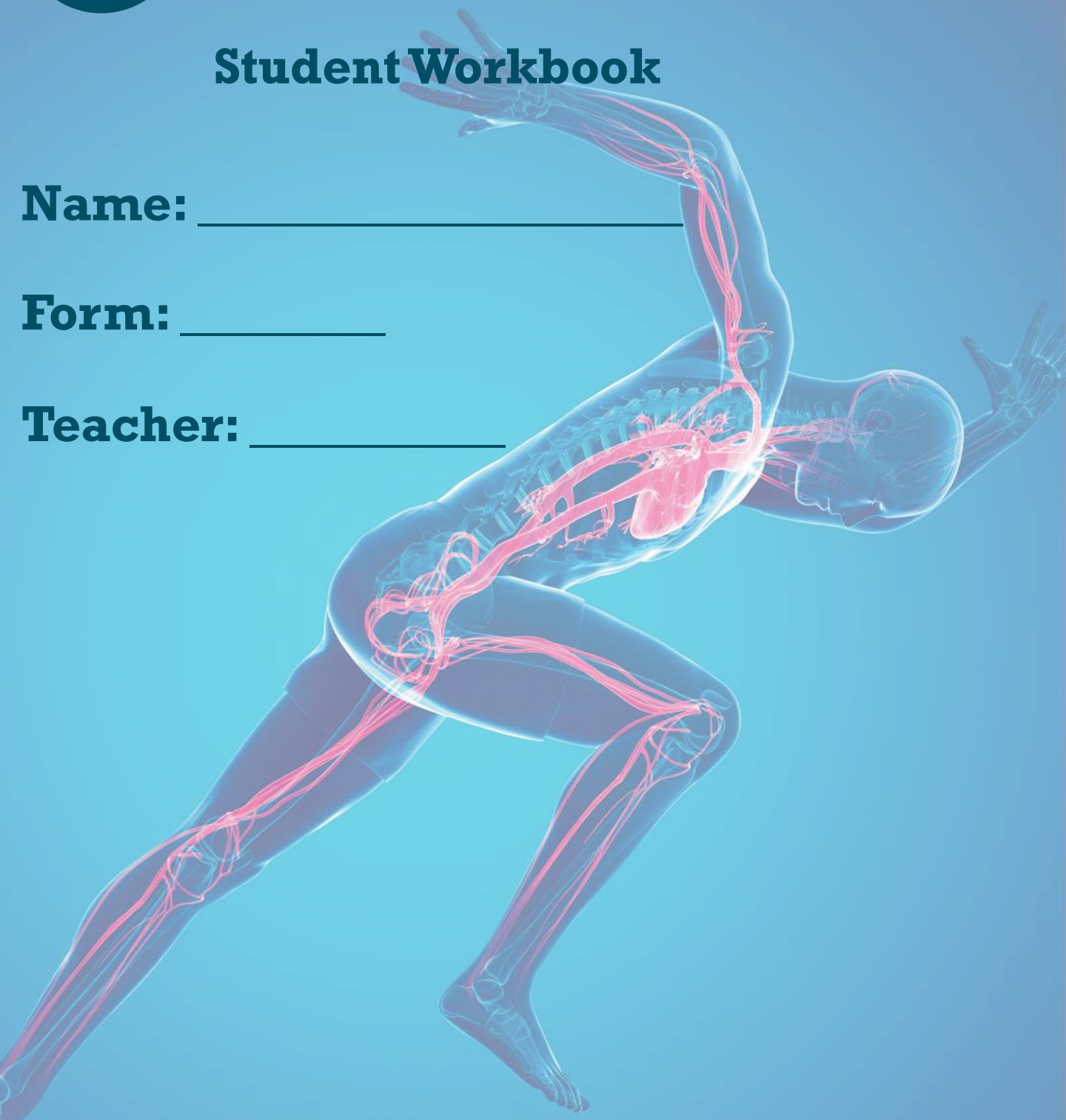
AQA GCSE Physical Education
Applied anatomy and physiology

Student Workbook

Name: _____

Form: _____

Teacher: _____

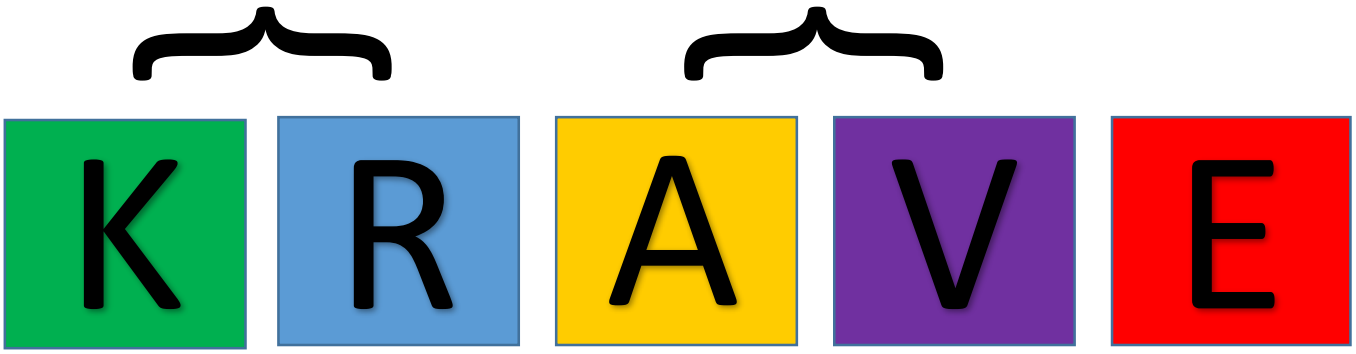


End of unit test

Target Grade: _____

1 Applied anatomy and physiology

Many questions you are asked in GCSE PE will require you to use the **KRAVE** anagram in your answer to enable you to gain maximum marks in your end of topic tests and exams at the end of year 11.



KNOWLEDGE

REPEAT

APPLY

VARIED

EVALUATE

1 Applied anatomy and physiology Contents

1 Applied anatomy and physiology

Key words	
Skeleton	
Musculo-skeletal system	
Articulating bones	
Synovial Joints	
Tendons	
Bursae	
Cartilage	
Synovial Fluid	
Ligaments	
Synovial membrane	
Joint capsule	
Ball and Socket	
Hinge Joint	
Flexion	
Extension	
Plantar flexion	
Dorsiflexion	
Rotation	
Adduction	
Abduction	

1 Applied anatomy and physiology

Prime Mover	
Agonist	
Antagonist	
Antagonistic Pairs	
Concentric Isotonic Contraction	
Eccentric Isotonic Contraction	
Isometric Contraction	
Cardio-respiratory system	
Gaseous Exchange	
Haemoglobin	
Oxyhaemoglobin	
Alveoli	
Capillaries	
Diffusion pathway	
Tidal Volume	
Expiratory Reserve Volume	

1 Applied anatomy and physiology

Inspiratory Reserve Volume	
Residual Volume	
Vital Capacity	
Spirometer Trace	
Deoxygenated blood	
Oxygenated blood	
Heart Rate	
Arteries	
Veins	
Capillaries	
Pulse	
Backflow	
Diastole	
Systole	
Cardiac Cycle	
Blood pressure	
Stroke Volume	
Cardiac Output	

1 Applied anatomy and physiology

Inhalation/ Inspiration	
Exhalation/ Expiration	
Vasoconstriction	
Vasodilation	
Aerobic exercise	
Intensity	
Anaerobic exercise	
Lactic acid	
Excess Post-exercise Oxygen Consumption (EPOC)	
Delayed Onset of Muscle Soreness (DOMS)	
Fatigue	
Hypertrophy	

1.1 The structure & functions of the skeleton

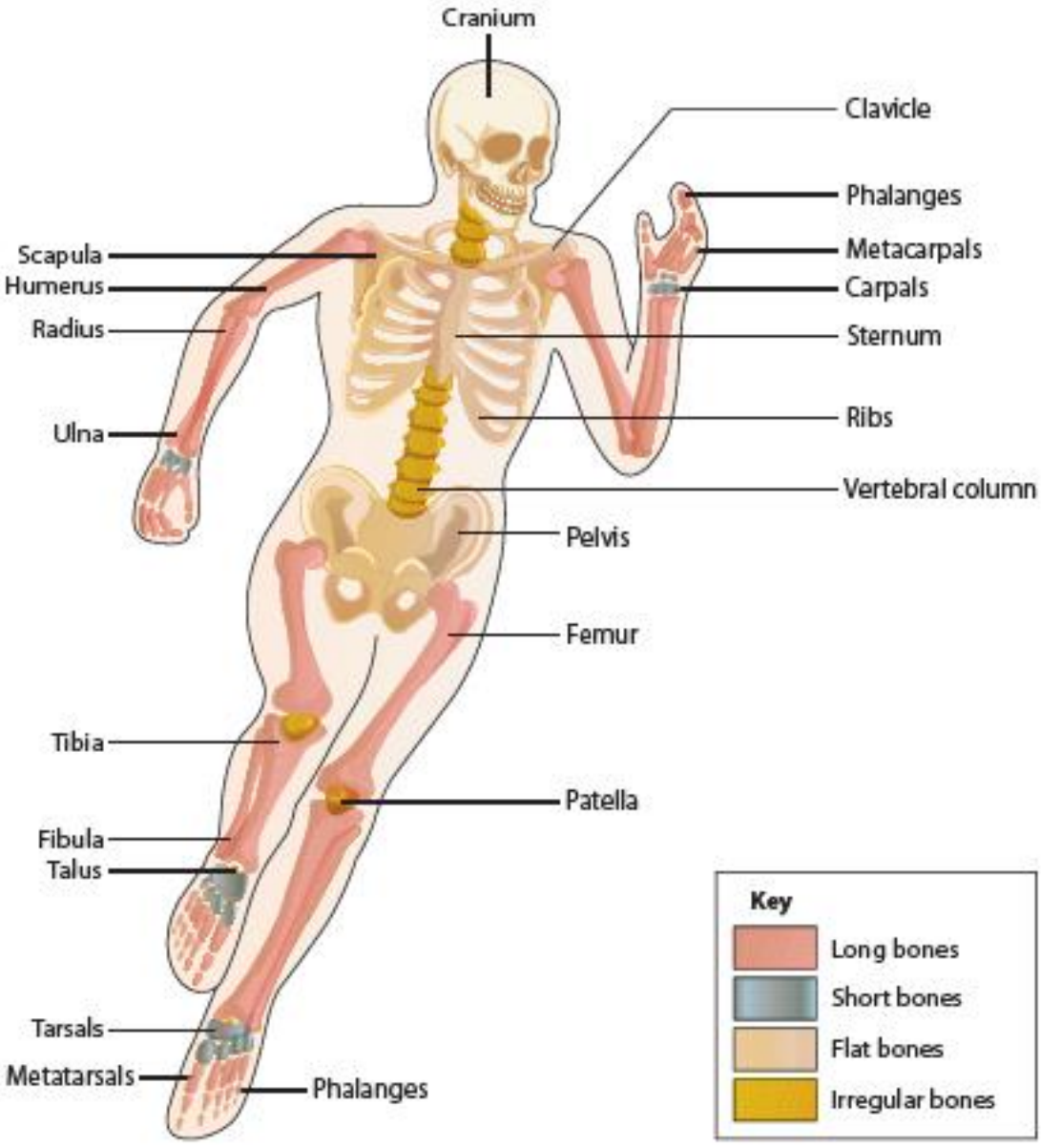
Learning Objectives

- To identify the structure of the skeletal system.
- To describe the functions of the skeletal system.
- To explain the link between the skeletal and muscular systems.

Stating one bone per post it note, can you try and fill your whole table with post it notes and correctly named bones with a partner?

1.1 Bones

K

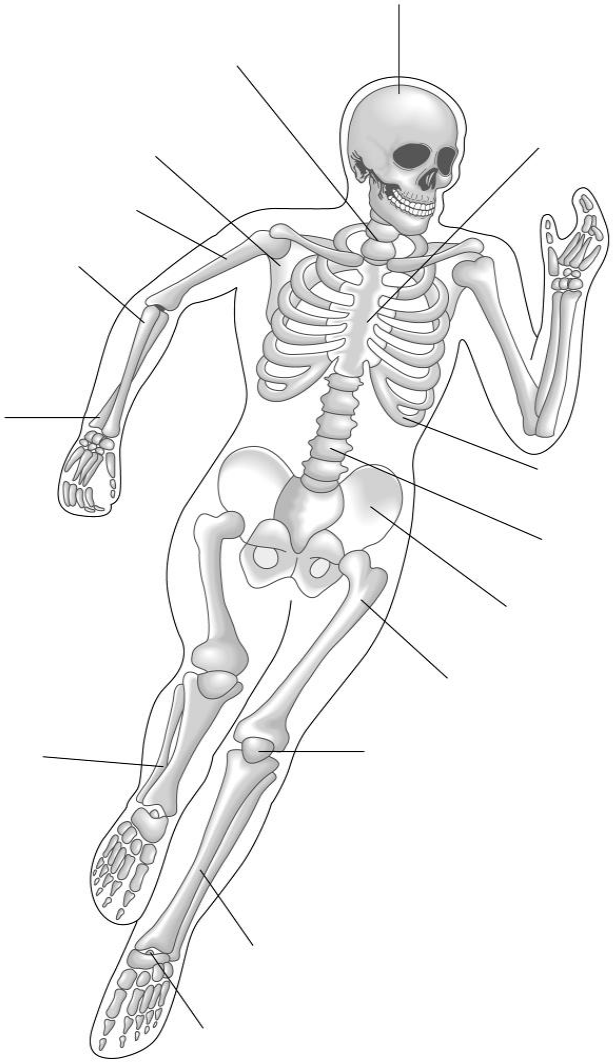

Cranium
Clavicle
Phalanges
Metacarpals
Carpals
Sternum
Ribs
Vertebral column
Pelvis
Femur
Patella
Tibia
Fibula
Talus
Tarsals
Metatarsals
Phalanges
Scapula
Humerus
Radius
Ulna
Key
Long bones
Short bones
Flat bones
Irregular bones

1.1 Bones

See page 6

Label the most common bones in the human body, including the articulating bones that connect at the shoulder, elbow, hip, knee and ankle joints.
Then write down the type of each bone next to its name (flat, long, short or irregular). Next to that, note down how the type of bone influences what the bone does. For each bone, work the information away from the skeleton, like a mind map.
You can also colour the skeleton to show the bone classifications.

R



Key

- Long bones
- Short bones
- Flat bones
- Irregular bones

Key term

Musculoskeletal system:

1.1 Bones

See page 6

A Name the three articulating bones of the elbow.

V Name the articulating bones of the following joints:

Joint	Articulating Bones
Shoulder	***
Elbow	***
Hip	**
Knee	****
Ankle	***

E Look at your completed diagram on the previous page and give examples of bones acting to protect vital organs. Name the bones and what they are protecting and why this is important.

Key term

Articulating bones:

1.1 The structure & functions of the skeleton

Learning Objectives

- **Identify the different type of bone found in the body.**
- **Describe the different types of bone and explain their function.**
- **Explain the functions of the skeletal system and link them to sports performance.**

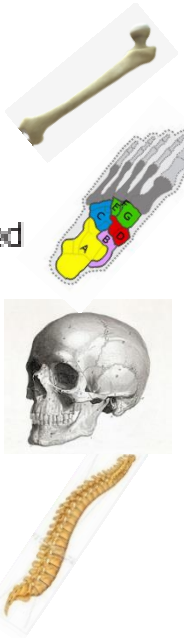
Write down the 4 types of bone found in the body below and next to each record as many bone examples as you can:

1.1 Types of bones

See page 7

K

There are four major **classifications of bone** in the human skeleton.



- Long bones: Bones that are longer than they are wide, like a femur. These play a key part in leverage and movement.
- Short bones: Bones that are box-like in shape, like tarsals. These are designed to be weight bearing.
- Flat bones: Thin, plate bones that act like a shell, such as the cranium. They provide protection and a large surface to which muscles can attach.
- Irregular bones: Unusually shaped bones for a unique purpose, like vertebrae. These also provide protection and a large surface to which muscles can attach.

R

Flat bones

Long bones

Short bones

Irregular bones

1.1 Types of bones

See page 7

A

Name the bone of the upper arm and the bones of the lower leg and identify what type of bone they are.

V

Name the **articulating** bones of the following joints and identify the type of bone of each:

Shoulder:

Elbow:

Wrist:

Hip:

Knee:

Ankle:

E

Using your answer from the above box, explain the function of the bones (i.e. what movements the bones can provide) you identified based on your knowledge of the four different types of bone. Use sporting examples to aid your explanations and evaluate the effectiveness of these bones in relation to the movement they provide.

1.2 The functions of the skeleton

See page 7

K

The functions of the skeleton

The skeletal system has six functions:

- Support, for muscles and vital organs. Without support the body would be a mass of soft tissue that was unable to move
- Protection of vital organs such as the cranium, a flat bone, protecting the brain. During physical activity, protection is crucial for both performance and long-term health. It reduces the chance of injury, which ensures players can continue to train and play
- Movement, which occurs at the joints when muscles contract and pull on the bone. The ability to move is central to all physical activities
- Shape and structure, for maintaining the basic form of our body and providing something for muscles to attach to. Without shape and structure we would not be able to move
- Blood cell production, which takes place in the bone marrow. Red blood cells are especially important in aerobic activities because they carry oxygen to working muscles. White blood cells fight off infections, and platelets help blood to clot following an injury
- Storage of minerals, which are essential for major body functions. Their role in physical activity is, therefore, linked to the general health of an athlete, which clearly affects sporting performance.

Key term
Articulating bones:

1.2 The functions of the skeleton

See page 7

The skeletal system has six functions, which can be recalled using the mnemonic '**S**ometimes **P**ractising **M**oving **S**wiftly **B**rings **S**uccess'.

Write down the key points about each function, remembering to mention how each function is important for physical activity:

S

P

M

S

B

S

Revision technique: mnemonics

A mnemonic is a system designed to help you remember something. It can be particularly helpful to create mnemonics to help you remember lists of things, such as the list of the six functions of the skeletal system.

Do you like this technique? Does it work for you? ☹ 😐 ☺

1.2 The functions of the skeleton

See page 7

A State the functions of the skeleton that are important in gymnastics performance.

V Select two other practical sports and give specific examples as to how each function of the skeleton is important in the sport you have selected.

1. _____

_____

_____

_____

_____

2. _____

_____

_____

_____

_____

E Look at this photograph and explain how the different functions of the skeleton are important in rugby.

_____

_____

_____

_____

_____

_____

_____

_____

1.3 The structure & functions of the skeleton – Part 2

Learning Objectives

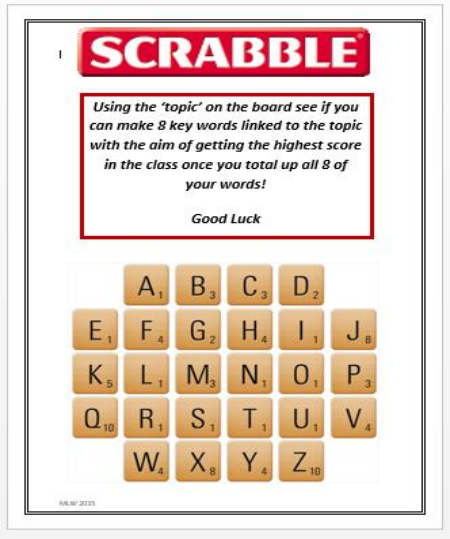
Identify parts of a synovial joint and describe their function.

Describe two different types of synovial joint and give examples of where they are found in the body.

Explain the movements that can take place at these synovial joints.

What is the highest value word you can make from the scrabble card?

The words MUST be to do with the Skeletal System



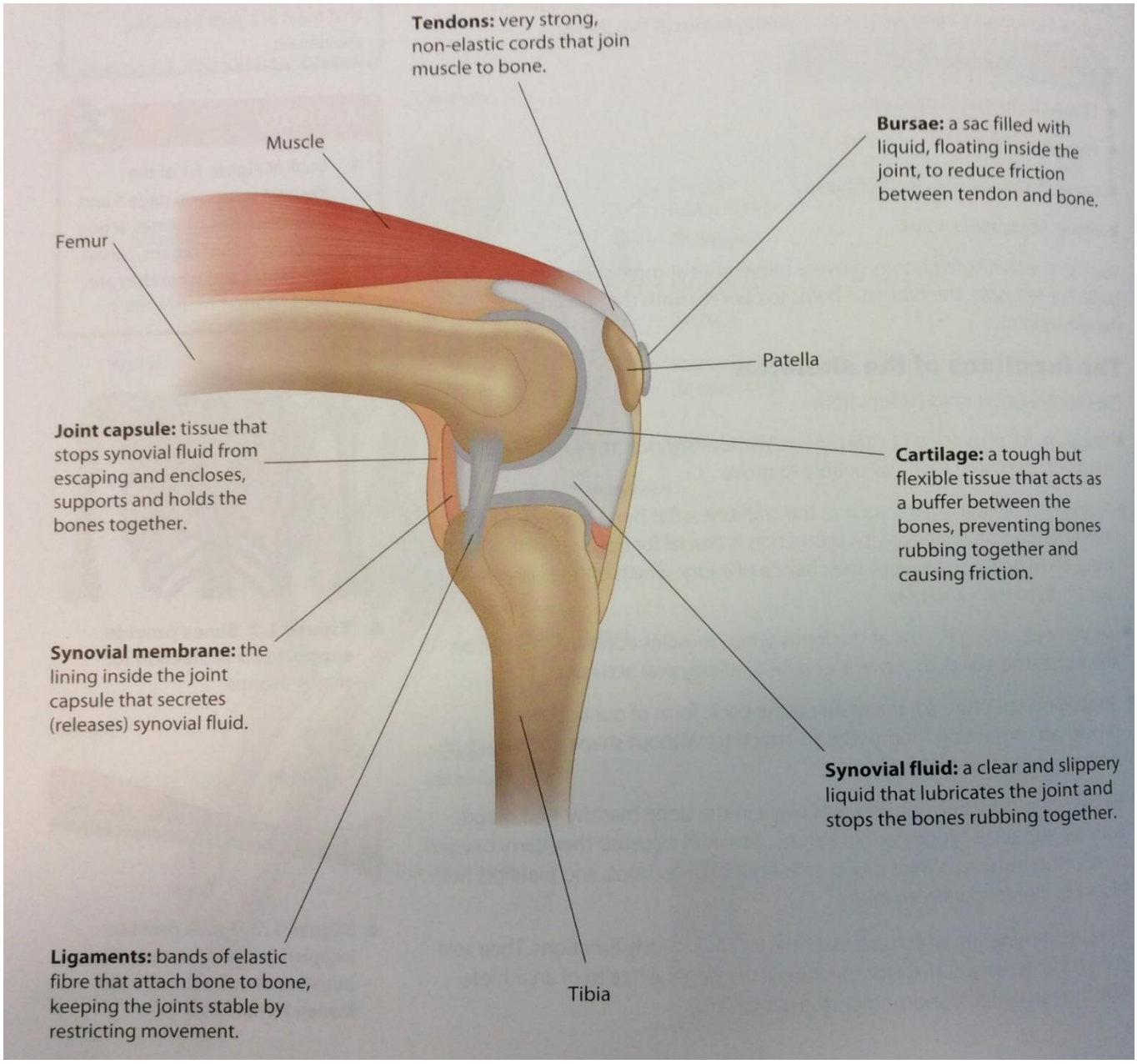
1.3 Synovial joints

See page 8

Synovial joints, or freely moveable joints, are the most common type of joint in the human body. They are found at the shoulder, elbow, hip, knee and ankle.

They are found in areas of the body where two or more articulating bones meet.

K



1.3 Synovial joints

See page 8

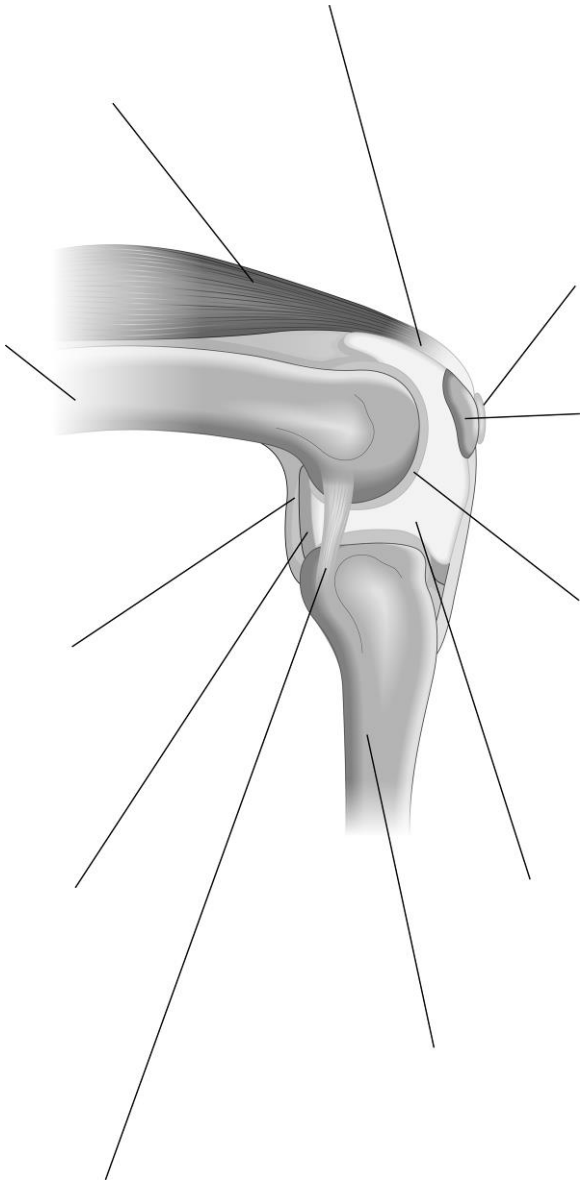
Synovial joints, or freely moveable joints, are the most common type of joint in the human body. They are found at the shoulder, elbow, hip, knee and ankle.

Label the diagram of the synovial joint at the knee, describing how each part of the joint works to prevent injury.

R

Key term

Synovial joint:



1.3 Types of synovial joints

See page 9

K

Ball and Socket Joint

- ✓ Ball of one bone fits into socket of another
- ✓ Allows the most range of motion of any joint in the body
- ✓ Allows movement away and towards the body and also rotation

Examples

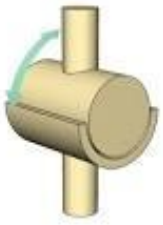
- ✓ Hip joint
- ✓ Shoulder joint

Hinge Joint

- ✓ Can only move in one direction (towards and away from each other).
- ✓ Movement like the movement of a door hinge
- ✓ Only allows flexion and extension movements

Examples

- ✓ Elbow joint
- ✓ Knee joint
- ✓ Ankle joint



1.3 Types of synovial joints

See page 9

R

Ball and Socket Joint

- ✓
- ✓
- ✓

Examples

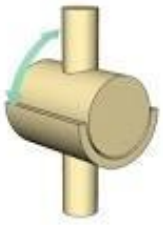
- ✓
- ✓

Hinge Joint

- ✓
- ✓
- ✓

Examples

- ✓
- ✓
- ✓



1.3 Synovial Joints

See page 8

A Describe the difference the functions of cartilage and tendon in a synovial joint.

V Explain the importance of cartilage in a synovial joint for **two** different sports.

1.

2.

E Evaluate and explain how different parts of the shoulder joint help it to move freely during a gymnastics floor routine.

1.4 Movement at synovial joints

See page 9

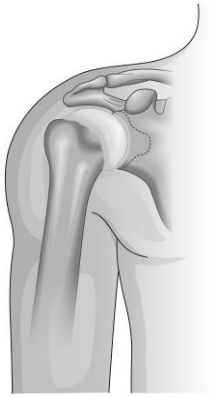
K

For each diagram of a synovial joint below:

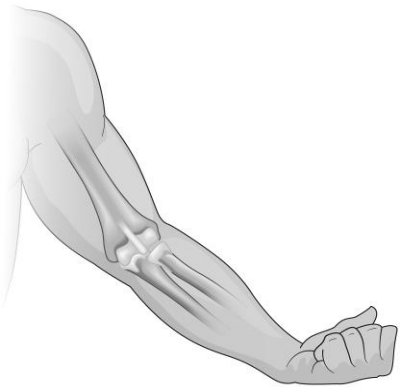
1. Identify the location of the joint
2. Identify the type of joint
3. Identify the movements that take place at the joint.

✓ Exam tip

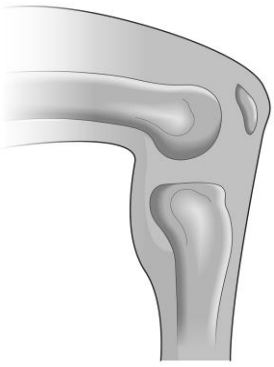
Synovial joints are also known as freely moveable joints. The two terms are used interchangeably.



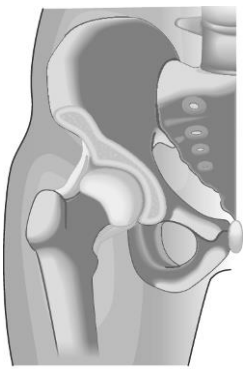
1. Shoulder joint
2. Ball & Socket joint
3. Flexion, extension, abduction, adduction, rotation.



1. Elbow joint
2. Hinge joint
3. Flexion, extension.



1. Knee joint
2. Hinge joint
3. Flexion, extension.



1. Hip joint
2. Ball & Socket joint
3. Flexion, extension, abduction, adduction, rotation.

1. Ankle joint
2. Hinge joint
3. Dorsiflexion, plantarflexion.

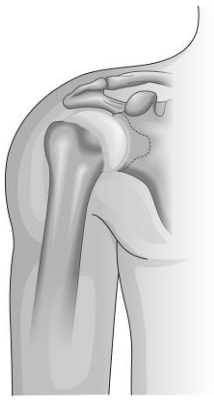
1.4 Movement at synovial joints

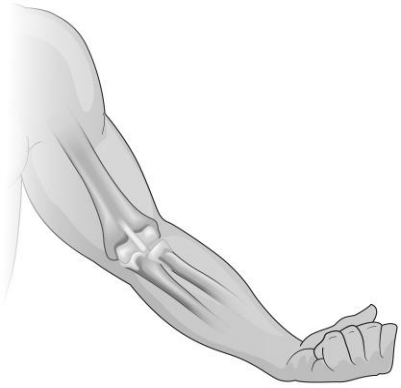
See page 9

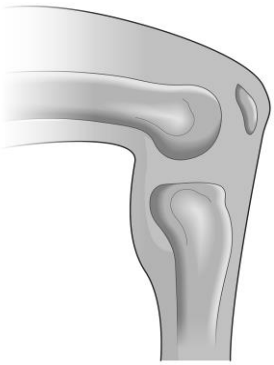
For each diagram of a synovial joint below:

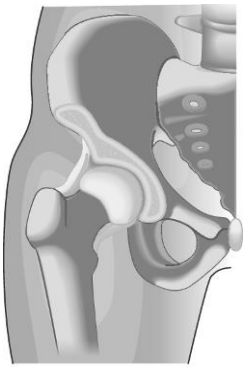
R

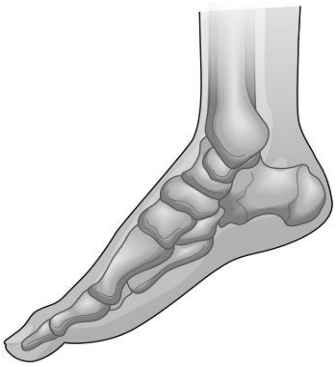
1. Identify the location of the joint
2. Identify the type of joint
3. Identify the movements that take place at the joint.











1.4 The structure & functions of the skeleton – Part 3

Learning Objectives

- Describe different movements that are created by the skeleton
- Identify movements that occur at different hinge and ball and socket joints
- Explain the movements occurring at range of different joints during sports performance

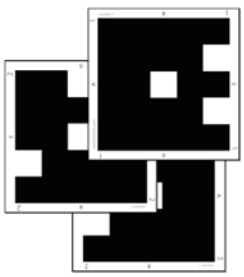
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:



1.4 Joint action and movements

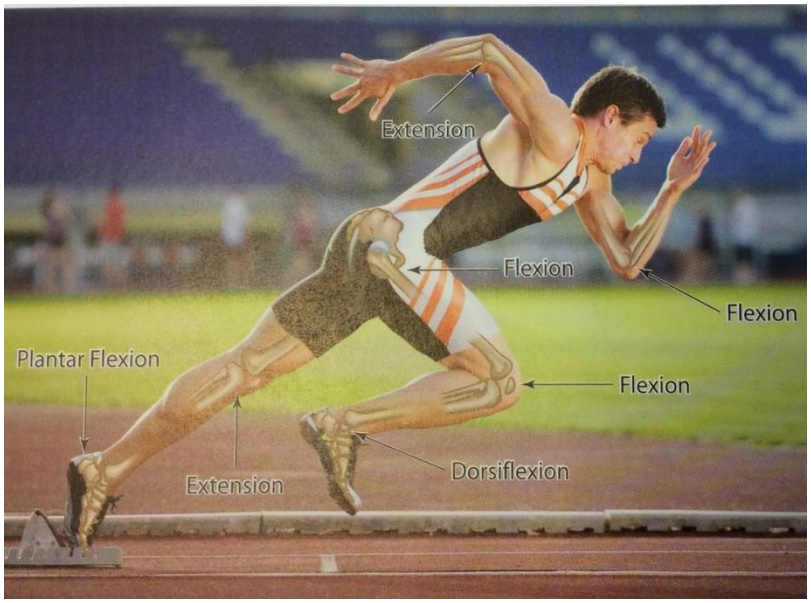
See pages 10-11

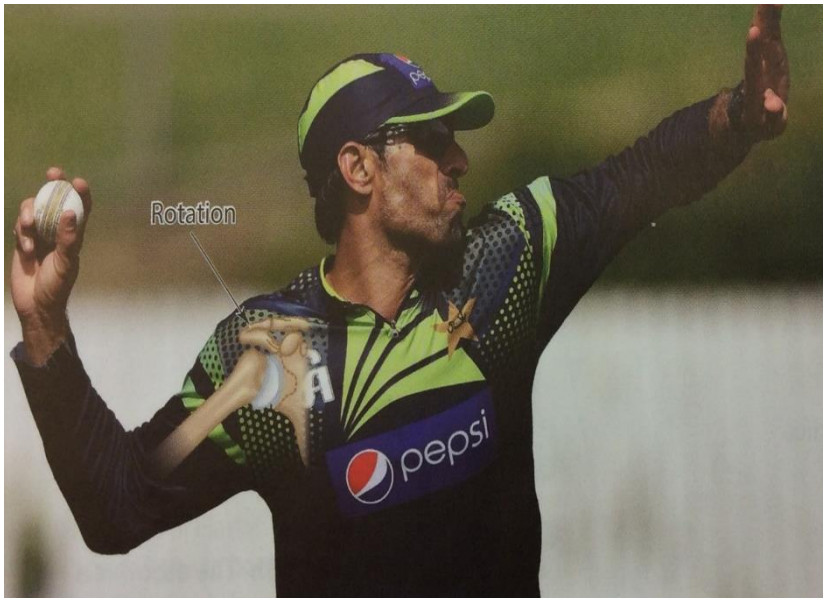
Different joints allow different types of movement. For example:

Hinge joints at the knee and elbow only move in one direction and therefore only produce **flexion** and **extension**.

The hinge joint at the **ankle** enables **plantar flexion** and **dorsiflexion.**

Ball and socket joints of the hip and shoulder enable **rotation, adduction** and **abduction** as well as **flexion** and **extension**





K

Key term

Flexion:

- Decrease in the angle of the bones at a joint
- Bending a joint
- E.g. Flexing the knee when preparing to kick a football is flexion of the knee.

Key term

Extension:

- Increasing in the angle of the bones at a joint
- Straightening a joint
- E.g. straightening the knee when kicking a football is extension of the knee.

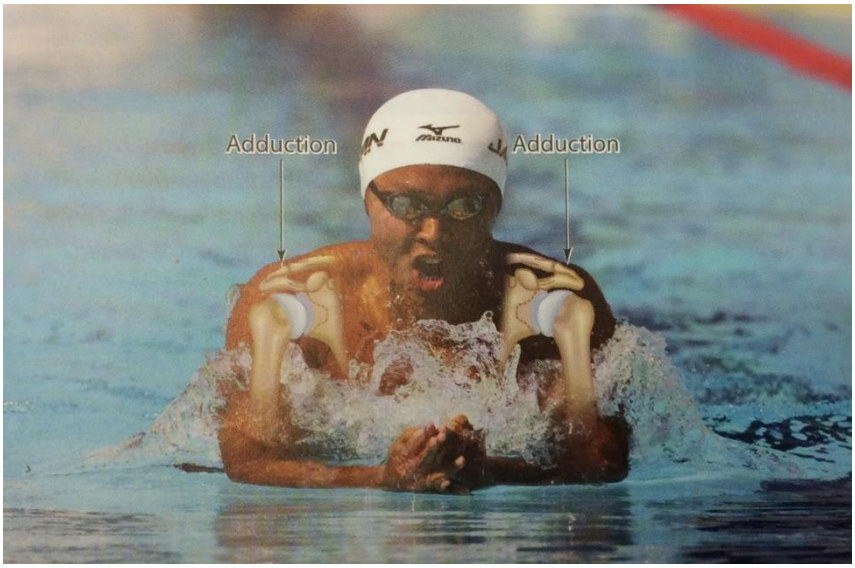
Key term

Rotation:

- A circular movement around a joint
- Can also be known as movement around an axis
- E.g. An overarm throw is rotation at the shoulder joint.

1.4 Joint action and movements

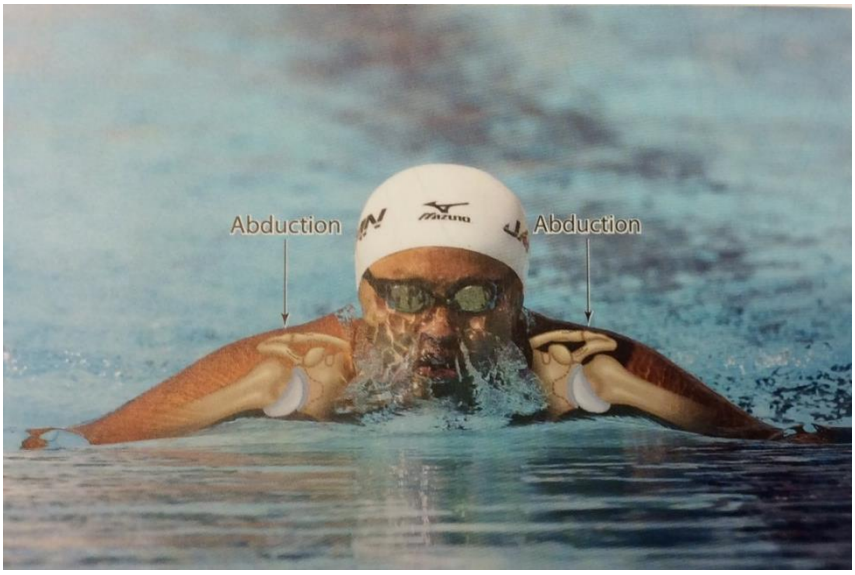
See pages 10-11



Key term

Abduction:

- Movement of a bone or limb **AWAY** from the **MIDLINE** of the body.
- E.g. When performing the crucifix position on the rings in gymnastics, abduction of the shoulder occurs.



Key term

ADDuction:

- Movement of a bone or limb **TOWARDS** the **MIDLINE** of the body.
- E.g. When performing breast stroke in swimming and bringing your arms and hands in front of the body adduction of the shoulder occurs.

Key term

Plantarflexion:

- Movement at the ankle joint that points the toes downwards and increases the angle at the joint.
- E.g. A gymnast will produce plantarflexion of the ankle when standing up on their toes.

Key term

Dorsiflexion:

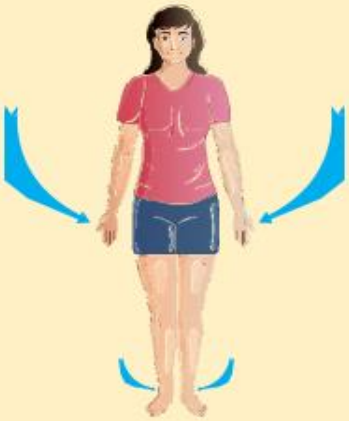
- Movement at the ankle joint that points the toes upwards and decreases the angle at the joint.
- E.g. A footballer keeping the ball up will produce dorsiflexion at the ankle.

1.4 Joint action and movements

See pages 10-11

Identify the movements produced in the images and provide a sporting example.

R



1.4 Joint action and movements

See pages 10-11

Each of the sporting actions in the photos below relies on a specific classification of joint. For each sporting action, name the type of joint and describe what it is about the design of the joint that makes it capable of performing the action.

i

ii

iii

iv

v

vi

1.4 Joint action and movements

See pages 10-11

A Identify the movement produced in Wayne Rooney's **shoulder joints, right knee** and **left knee** in this image.

V Identify the movements produced in the **shoulder, elbow and knee** joints of the performers pictured.

1.

2.

1.4 Joint action and movements

See pages 10-11

E Identify which joint and articulating bones are at each location identified **(1).** Then identify what type of joint it is **(2)** before identifying the type of movement which is taking place at that joint **(3).**

1. _____
2. _____
3. _____

1. _____
2. _____
3. _____

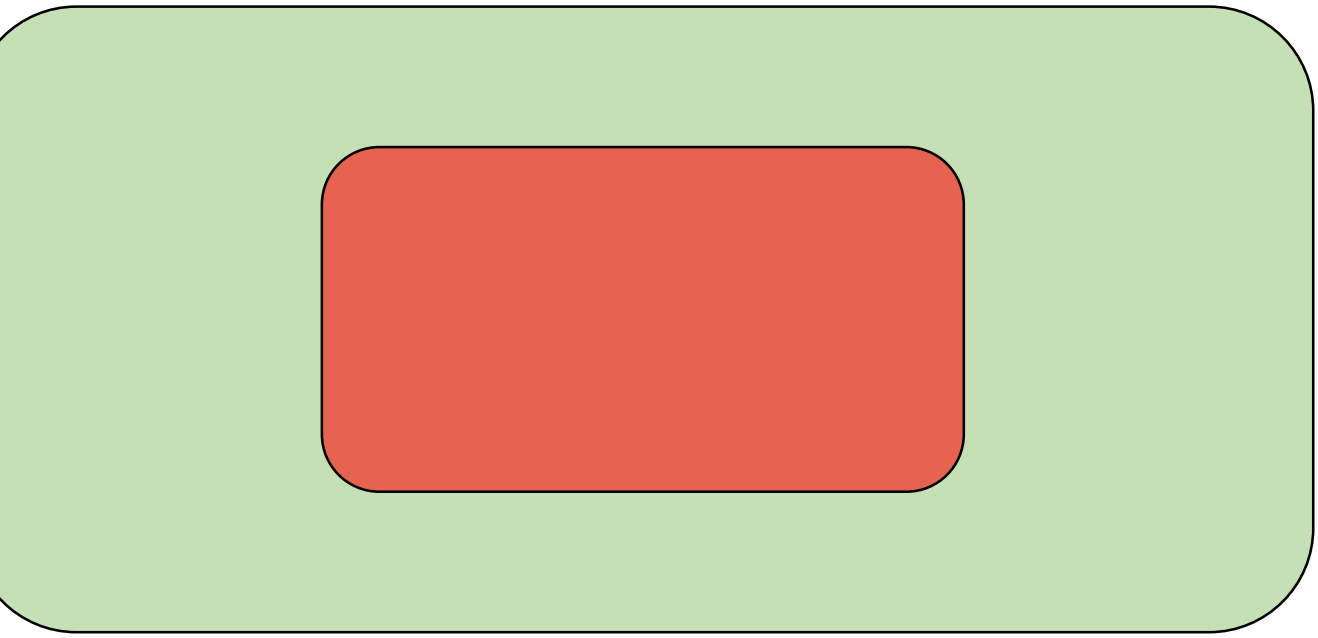
1. _____
2. _____
3. _____

1. _____
2. _____
3. _____

1.5 The structure & functions of the muscular system

Learning Objectives

- **Identify the major muscles and locate their position on the body.**
- Describe how muscles work in pairs and the bones they act upon.
- **Explain how muscles work together as antagonistic pairs and how they work to produce movement around certain joints**



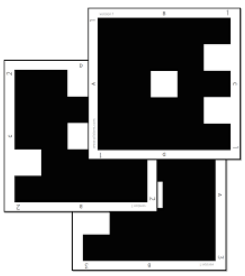
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:



1.5 Muscles

K

Muscles are attached to the skeleton by **tendons** and movement occurs when the muscles contract and pull the bone causing movement at a joint.

Key term

Tendon:
Connective tissue that attaches muscle to bone. It's role is to transfer the effort created by a contracting muscle to the bone, resulting in the movement of that bone.

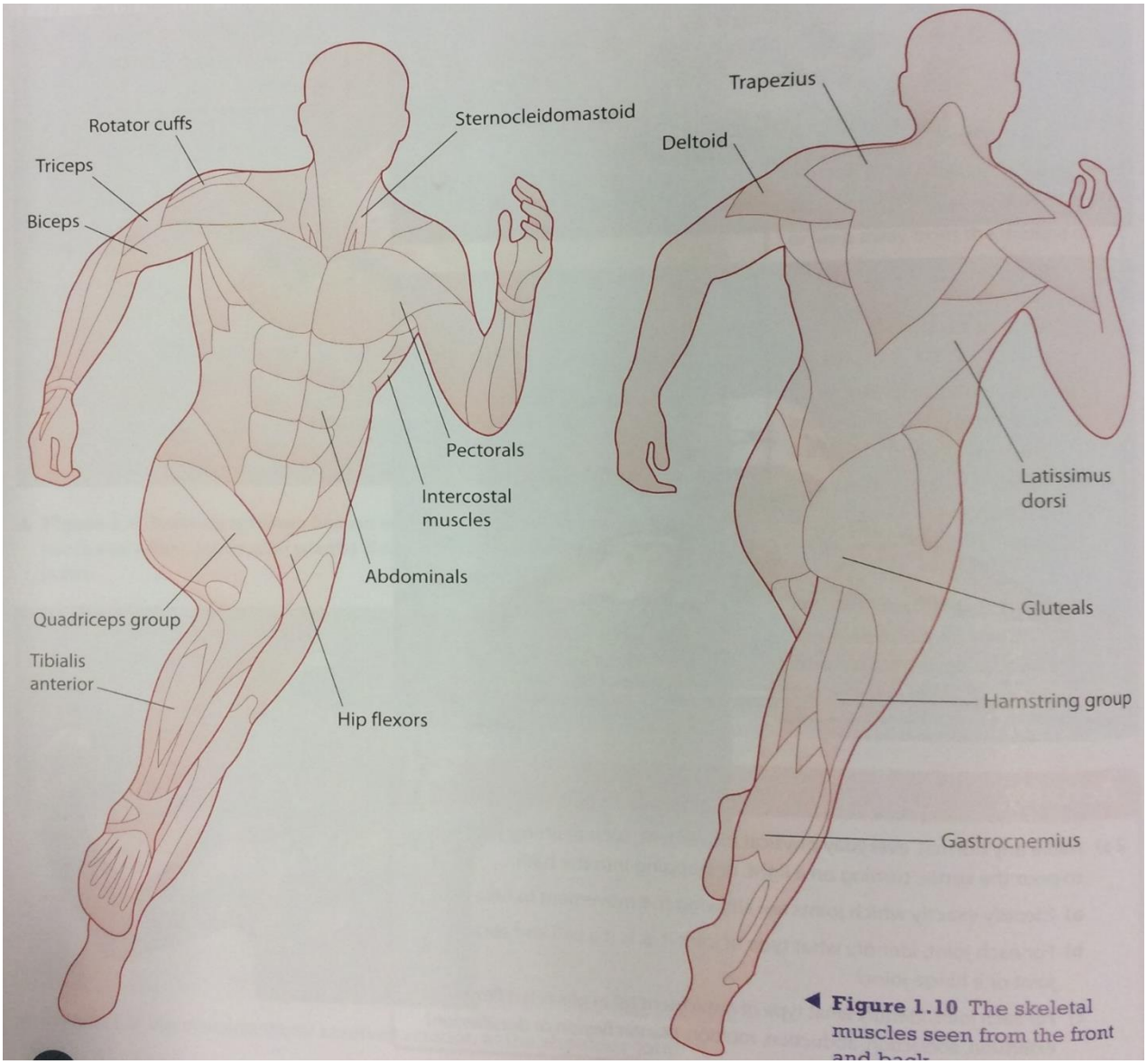


Figure 1.10 The skeletal muscles seen from the front and back

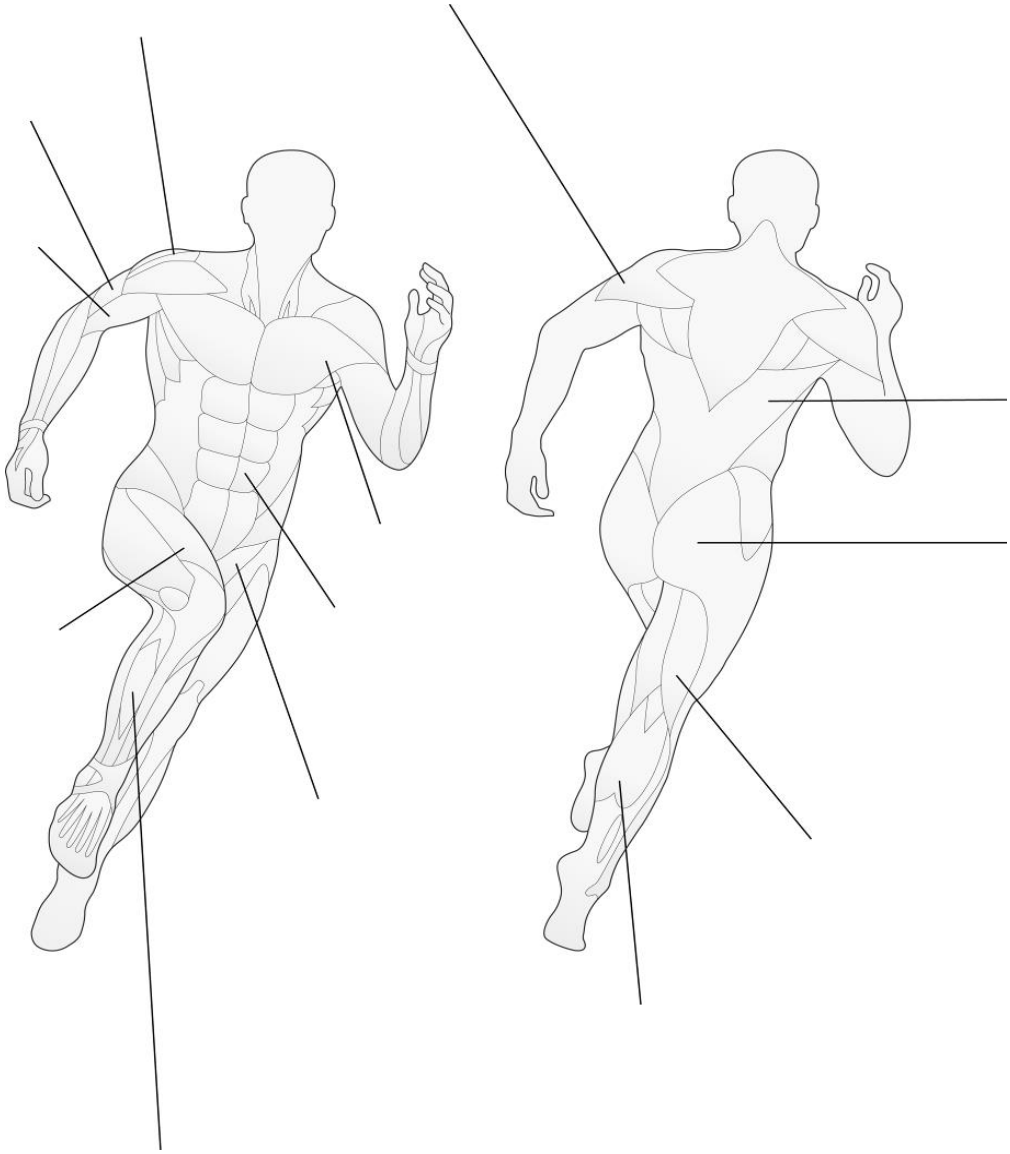
1.5 Muscles

See page 12

Muscles are attached to the skeleton by tendons. Label the names of the major muscles and muscle groups in the human body. Then colour the antagonistic pairs that work at the shoulder, elbow, knee and ankle joints. Use a different colour for each antagonistic pair so you can easily match them.

R

Key term
Tendon:



1.5 Muscles

See page 12

A

Name the two muscle groups acting around the knee joint to produce movement at the knee.

1.

2.

V **E**

Name the major muscle groups that act around the following joints:

Joint	Major muscle groups
Shoulder	*******
Elbow	**
Hip	**
Knee	**
Ankle	**

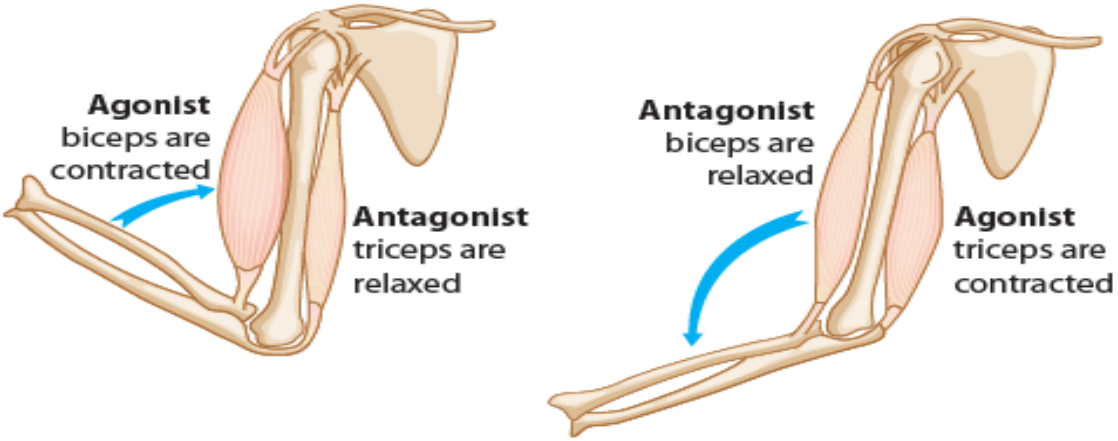
1.6 Antagonistic pairs

See page 13

K

Because muscles can only pull and are not capable of pushing, they are arranged in pairs on either side of joints. Movement is produced when one muscle contracts and pulls on a bone, while the opposite muscle relaxes and allows the bone to be pulled. The same process happens in the other direction when the other muscle contracts.

A pair of muscles is called an **antagonistic pair**. The muscle contracting is known as the **agonist**, while the opposite muscle, which is relaxing, is known as the **antagonist**.



Key terms

Prime mover (or 'agonist'): The muscle or group of muscles that contract to create movement. The prime mover works in an antagonistic pair with the antagonist.

Antagonist: The muscle or group of muscles that relax to allow movement to take place. The antagonist works in an antagonistic pair with the agonist.

The following muscles make up obvious antagonistic pairs:

- biceps and triceps, acting at the elbow to create flexion and extension
- hip flexor and gluteus maximus, acting at the hip to create flexion and extension
- quadriceps and hamstrings, acting at the knee to create extension and flexion
- tibialis anterior and gastrocnemius, acting at the ankle to create dorsi-flexion and plantar-flexion.

During sporting situations, antagonistic pairs will swap roles continuously. A muscle acts as both an agonist and an antagonist depending on the movement required.

1.6 Antagonistic pairs

See page 13

R Add labels and notes to the diagrams below to explain how an antagonistic pair of muscles work together to cause movement at a joint.

Key terms

Prime mover (or 'agonist'):

Antagonist:

Fig 1.

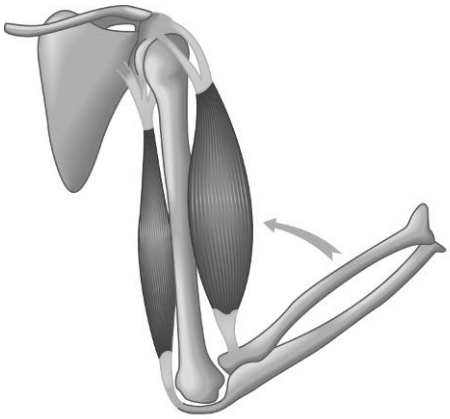
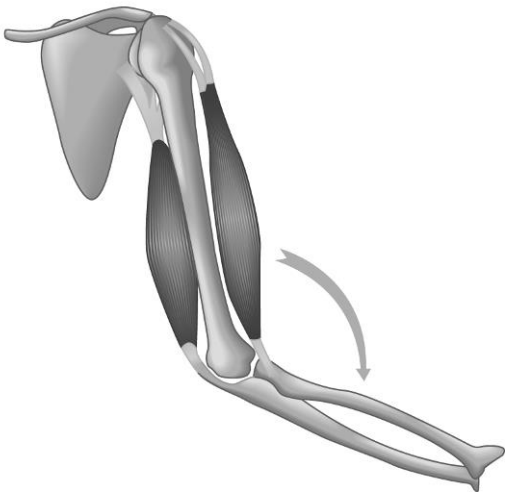


Fig 2.



✓ Exam tip

You will need to remember which muscles work in antagonistic pairs to enable certain movements, so when you're learning the major muscles, try remembering them in pairs.

List the four most obvious antagonistic pairs in the human body:

The antagonistic pair acting at the elbow joint: .....

The antagonistic pair acting at the hip joint: .....

The antagonistic pair acting at the knee joint: .....

The antagonistic pair acting at the ankle joint: .....

1.6 Antagonistic pairs

See page 13

A

Using **figure 1** on the previous page:

Name and describe the role of the muscle acting as the prime mover/ agonist:

Name and describe the role of the muscle acting as the antagonist:

V

Using **figure 2** on the previous page:

Name and describe the role of the muscle acting as the prime mover/ agonist:

Name and describe the role of the muscle acting as the antagonist:

E

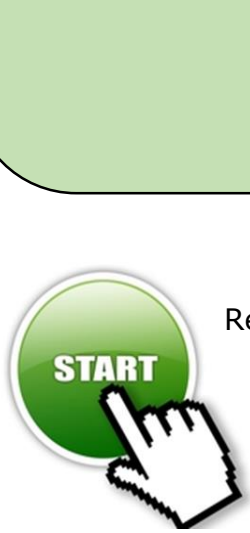
Identify the muscles working as agonist and antagonist to create flexion of the knee and explain how these muscle groups create this movement.

Key term
Ligament:

1.7 Muscular contractions

Learning Objectives

- **Describe the types of muscular contraction that muscles produce.**
- **Identify the type of muscle contraction occurring during certain movements.**
- **Evaluate the muscular contractions taking place in muscle pairs during sporting movements.**



Record your success for the 3 Plickers questions:

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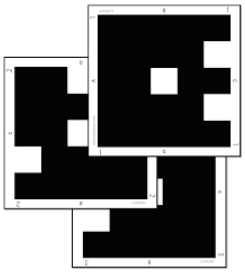
clickers, simplified

Q1:

Q2:

Q3:



1.7 Muscular contractions

See page 14

K

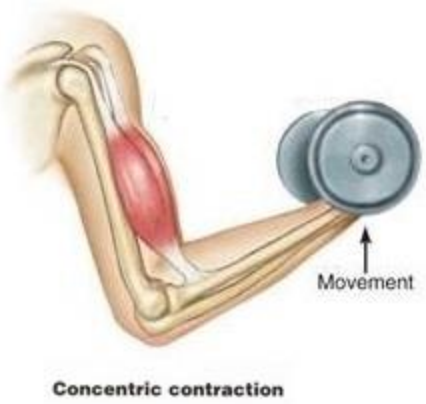
Muscles contract in two different ways: **isotonically** and **isometrically**. Isotonic muscle contractions can occur by concentric or eccentric contractions.

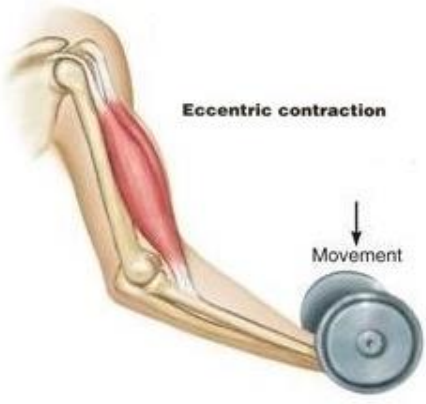
Isometric contractions: These occur when the muscle **stays the same length.** There is **no actual movement** of the limb or the joint because the muscles are working to keep the joint stationary.

Isotonic contractions: These occur when the muscle **changes length** when it contracts and they result in limb movement. Isotonic contractions can be concentric or eccentric.

Concentric contraction: where the muscle **contracts and shortens** to produce movement at a joint.

Eccentric contraction: where the muscle **contracts and lengthens**, usually in the downward phase of movement. The muscle acts as a brake against gravity.





1.7 Muscular contractions

See page 14

R

Use the template below to create your own fact sheet on the different ways in which muscles contract. Describe each type of muscular contraction and add images of sporting examples in the spaces provided.

ISOMETRIC CONTRACTIONS

Types of muscular contractions

ISOTONIC CONTRACTIONS

CONCENTRIC ISOTONIC CONTRACTIONS

ECCENTRIC ISOTONIC CONTRACTIONS

1.7 Muscular contractions

See page 14

A

Explain the difference between concentric and eccentric muscle contractions.

V

Identify which muscular contraction is taking place and in which muscles it is occurring.

E

For each of the images below, identify which muscular contraction is taking place and in which muscle(s) (Remember that muscles always work in pairs to produce movement).

1.8 The structure & functions of the cardio-respiratory system

Learning Objectives

- **Describe the term 'cardio-respiratory system'.**
- **Identify the parts of the cardio-respiratory system and describe the function of each.**
- **Explain the pathway of oxygen and carbon dioxide through the respiratory system.**

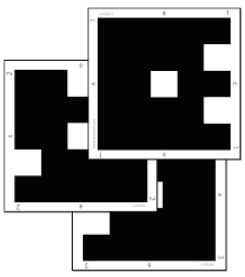
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:

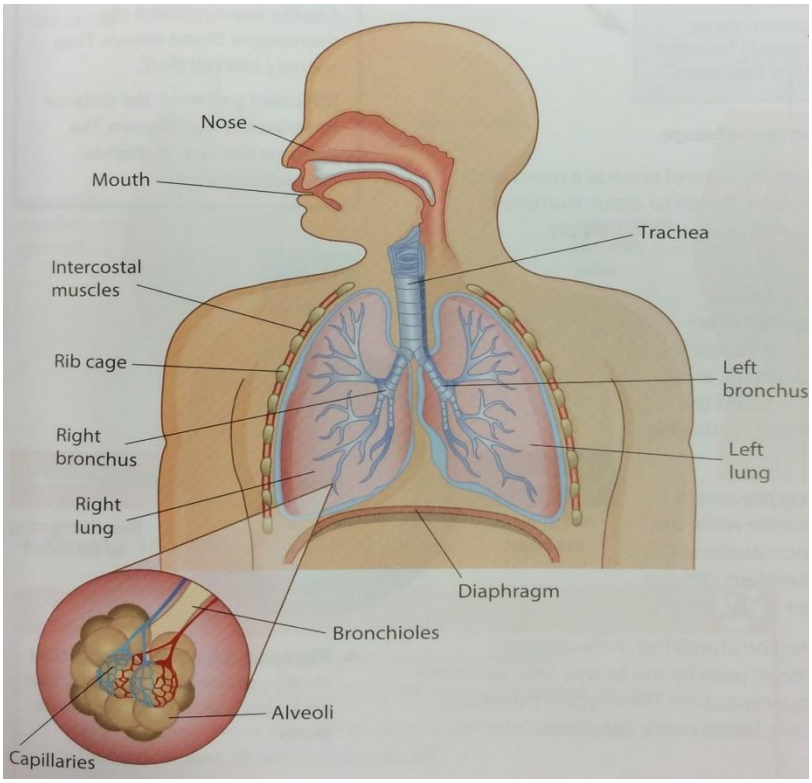


1.8 The structure & function of the respiratory system

See page 15

K

The **cardio-respiratory system** is made up of the **circulatory system** (the heart, blood vessels and blood) and the **respiratory system** (the lungs and airways). It's main function is to enable the body to breathe, pumping blood and oxygen around the body. During physical activity, the system works harder to supply blood and oxygen to the muscles.



When we breathe in, air moves through the mouth and nose and then travels into the trachea. The trachea carries air from the throat to the lungs.

The inner surface of the trachea is covered in tiny hair called cilia, which catch particles of dust, which are then removed when coughing. The trachea is kept open by rings of cartilage.

Near the lungs, the trachea divides into two tubes called bronchi., one entering the left and the other entering the right lung. Once inside the lung the bronchi split several ways, forming smaller bronchi called bronchioles.

Bronchioles are very narrow tubes less than 1 millimetre in diameter. There is no cartilage within their walls. At the end of each bronchiole are openings to the alveoli. There are usually several alveoli coming from one bronchiole, forming a small clump that resembles a cluster of grapes.

The function of alveoli is to exchange gases. It exchanges oxygen in the lungs into the blood stream and carbon dioxide from the blood stream into the lungs.

1.8 The structure & function of the respiratory system

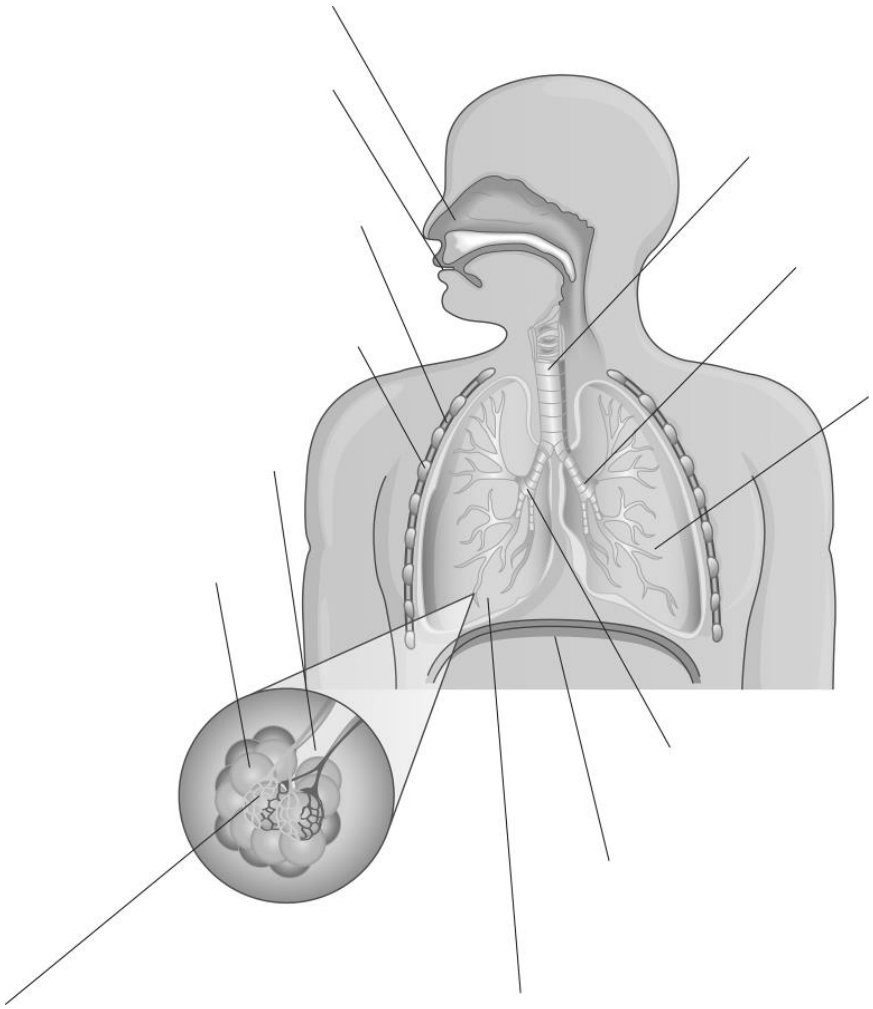
See page 15

R

Key term

Cardio-respiratory system:

Label the diagram of the respiratory system below. In the space around the outside of the diagram, add details about what each item you've labelled does.



Key term

Respiratory system:

1.8 The structure & function of the respiratory system

See page 15

A

Describe the role of the nose and mouth within the respiratory system.

V

What is the difference between bronchi and bronchioles?

What is the function of cilia?

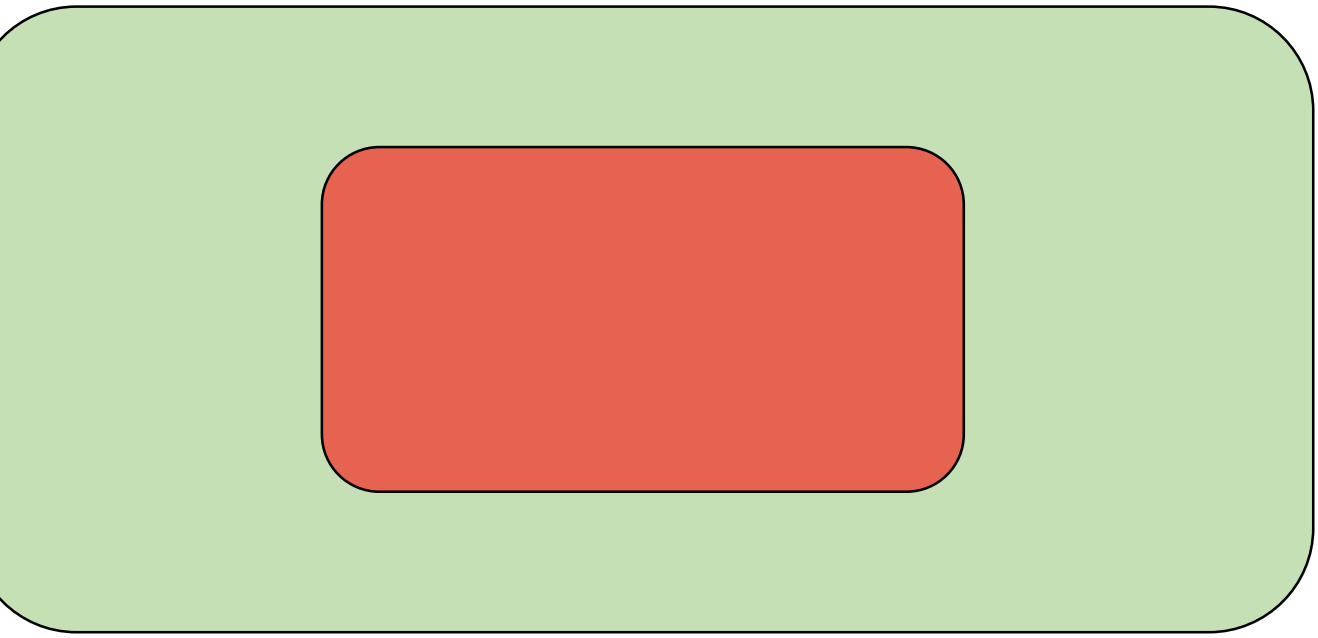
E

Describe the pathway of oxygen and carbon dioxide through the respiratory system.

1.9 Gaseous exchange

Learning Objectives

- **Describe the process of gaseous exchange.**
- **Explain the role capillaries, red blood cells and alveoli play in gaseous exchange.**
- **Explain why gaseous exchange occurs using knowledge of diffusion pathway.**



Record your success for the 3 Plickers questions:

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Q1:

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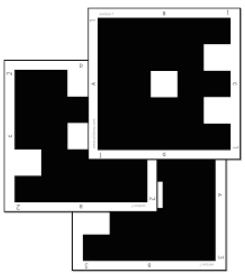
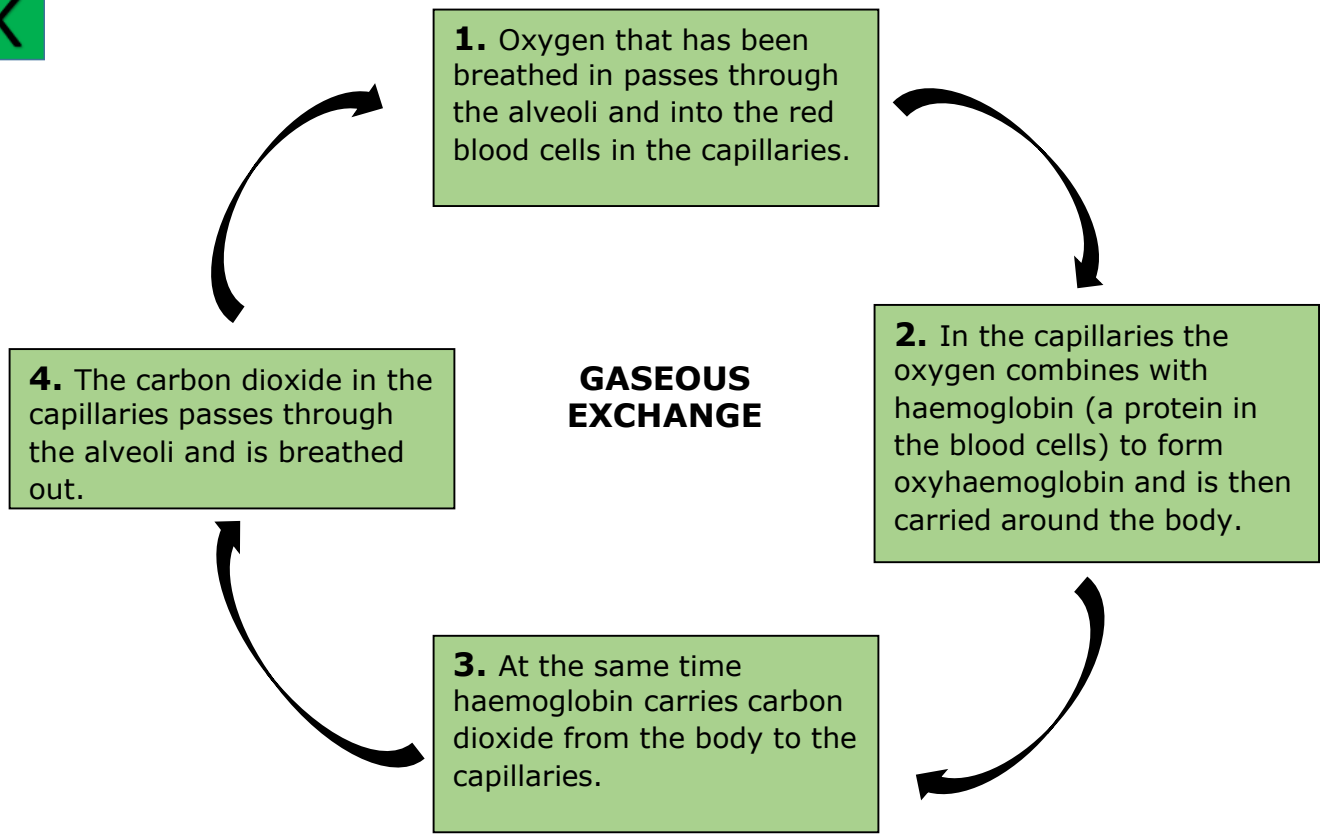


1.9 Gaseous exchange

See page 16

K



The **alveoli** are very thin – only one cell thick – and provide a moist and extremely large surface area for gaseous exchange to occur. Numerous **capillaries** run across the alveoli, ensuring a large blood supply to the area.

All gases, including oxygen and carbon dioxide, more from an area of higher concentration to an area of low concentration. This process is called **diffusion** and the distance that the molecules travel is called **diffusion pathway**. The diffusion pathway is short in gaseous exchange.

The blood in the capillaries surrounding the alveoli has a high concentration of carbon dioxide while the air in the alveoli has a much lower concentration of carbon dioxide. The carbon dioxide, therefore, diffuses from the blood in the capillaries into the air in the alveoli.

1.9 Gaseous exchange

See page 16

R

Using the key terms and phrases given, describe the process of gaseous exchange in as much detail as you can.

oxygen	air	alveoli	red blood cells	capillaries
haemoglobin	oxyhaemoglobin	carbon dioxide	gas	lungs

Complete these sentences to explain how the structure of the alveoli and the capillaries assist in gaseous exchange.

The alveoli are .....

The walls of the alveoli are .....

They provide a large ..... for gaseous exchange to take place.

The capillaries are .....

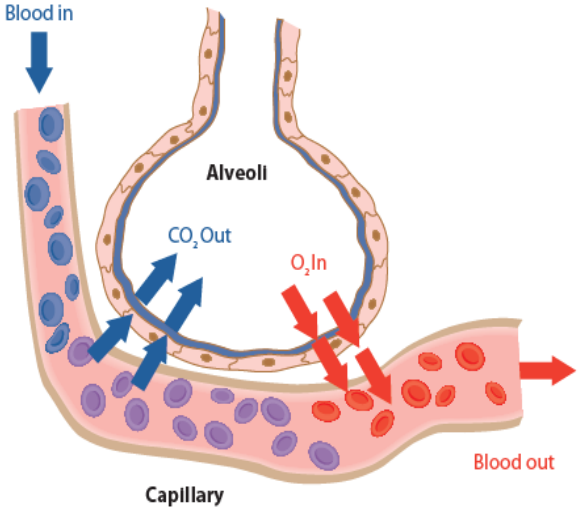
Lots of capillaries run across the alveoli ensuring .....

Key terms

Gaseous exchange:

Haemoglobin:

Oxyhaemoglobin:



1.9 Gaseous exchange

See page 16

R

Using the key terms and phrases given, describe diffusion and the diffusion pathway in as much detail as you can.

high concentration	diffusion	distance
diffusion pathway	short	low concentration

Key term	Key term	Key term
Alveoli:	Capillaries:	Diffusion pathway:

1.9 Gaseous exchange

See page 16

A

Describe how the structure of alveoli allow them to meet their function in the process of diffusion.

V

What is the function of haemoglobin?

How does oxyhaemoglobin differ to haemoglobin?

E

Explain why oxygen diffuses into the blood and carbon dioxide diffuses out of the blood.

1.10 The mechanics of breathing

Learning Objectives

- **Describe the process of inhalation and exhalation when at rest.**
- **Apply knowledge of how inhalation and exhalation changes during exercise.**
- **Evaluate, using data, the difference in the air composition that we inhale to the air we exhale.**

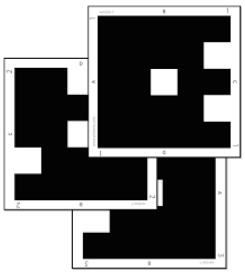
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

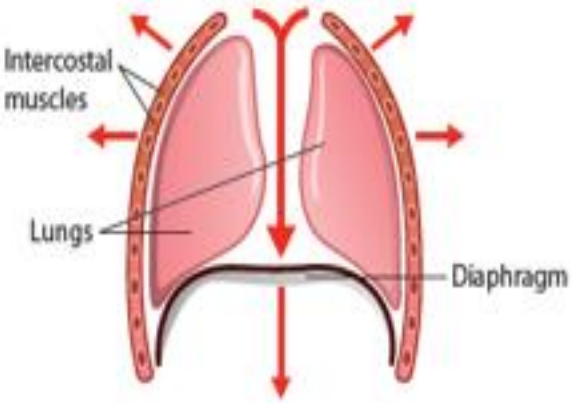
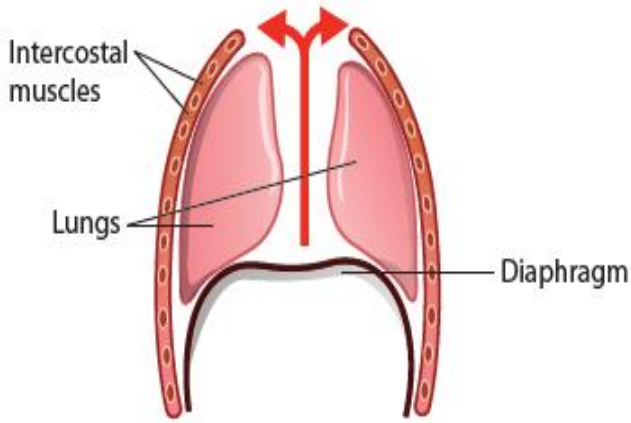
Q3:



1.10 The mechanics of breathing

See page 17

K

Inhalation (also known as inspiration)	Exhalation (also known as expiration)
	
1. The diaphragm contracts. It flattens and moves downwards. 2. The intercostal muscles contract, raising the ribs and pushing out the sternum, making the chest cavity larger. 3. The lungs increase in size and the air pressure inside the lungs is reduced. 4. The air pressure outside the body is now higher than the air pressure inside the body. Air travels from areas of high pressure to areas of low pressure, so air is pulled into the lungs.	1. The diaphragm relaxes. It moves back up into a dome shape. 2. The intercostal muscles relax, lowering the ribs and dropping the sternum, making the chest cavity smaller. 3. The lungs reduce in size and the air pressure inside the lungs is increased. 4. The air pressure outside the body is now lower than the air pressure inside the body. Air travels from areas of high pressure to areas of low pressure, so air leaves the lungs.

The lungs expand and contract much more when you breathe during exercise, as more air is inhaled to supply more oxygen to the working muscles and more air is exhaled to remove the increased amount of carbon dioxide produced by the working muscles.

More muscles are involved in breathing when you exercise. The pectorals and sternocleidomastoid, paired muscles in the side of the neck, assist in raising the sternum when you inspire. The abdominals pull the rib cage down more quickly, forcing air out quickly when you expire.

1.10 The mechanics of breathing

See page 17

R Using the information provided to help you, draw two diagrams in the space below to show what happens when you inhale and exhale.

Inhalation (also known as inspiration)	**Exhalation (also known as expiration)**
1. The diaphragm contracts. It flattens and moves downwards. 2. 3. 4. The air pressure outside the body is now higher than the air pressure inside the body. Air travels from areas of high pressure to areas of low pressure, so air is pulled into the lungs.	1. 2. The intercostal muscles relax, lowering the ribs and dropping the sternum, making the chest cavity smaller. 3. The lungs reduce in size and the air pressure inside the lungs is increased. 4.

Now explain how this process changes when a person begins to exercise.

1.10 The mechanics of breathing

See page 17

A

Name the breathing muscles used to inspire air during rest.

Name the breathing muscles used to inspire air during exercise.

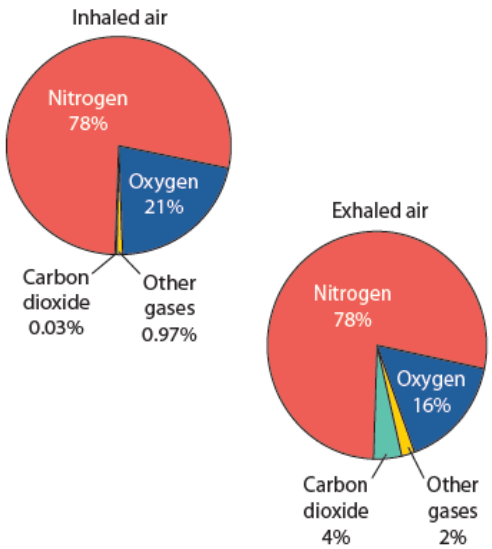
Name the breathing muscles used to expire air during exercise.

V

Describe the mechanics of inhalation at rest.

E

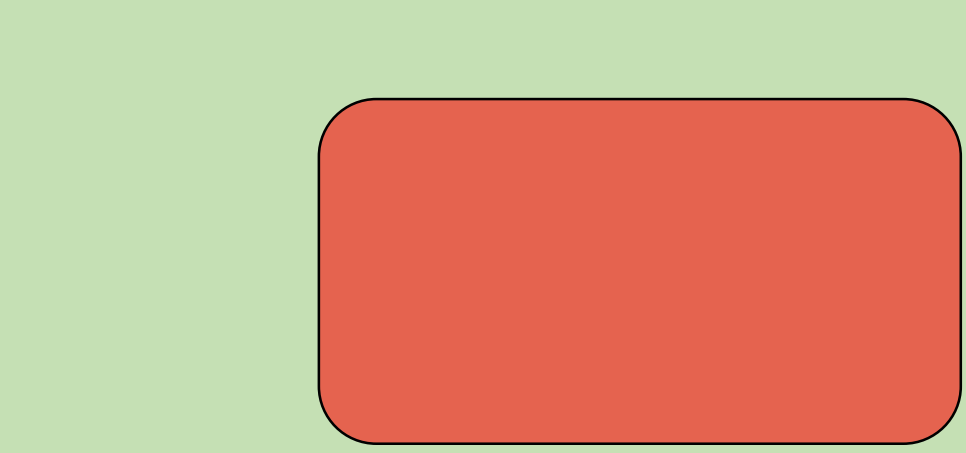
Look at the pie charts showing the composition of air in the lungs. Can you explain why there is a difference in the composition of air we inhale and the composition of air that we exhale?



1.11 Spirometer trace

Learning Objectives

- **Identify and describe the five lung volumes associated with the lungs.**
- **Complete a spirometer trace and label it with the lung volumes.**
- **Evaluate and explain how lung volumes change from rest to exercise.**



Record your success for the 3 Plickers questions:

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Q1:

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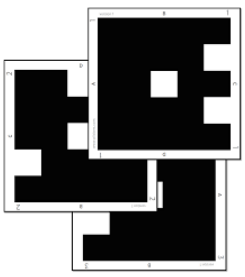


1.11 Spirometer trace

See page 18

K

A spirometer measures the five volumes associated with the lungs. Explain each volume in your own words.

Tidal volume: The normal amount of air inhaled or exhaled per breath. Tidal volume increases with exercise.

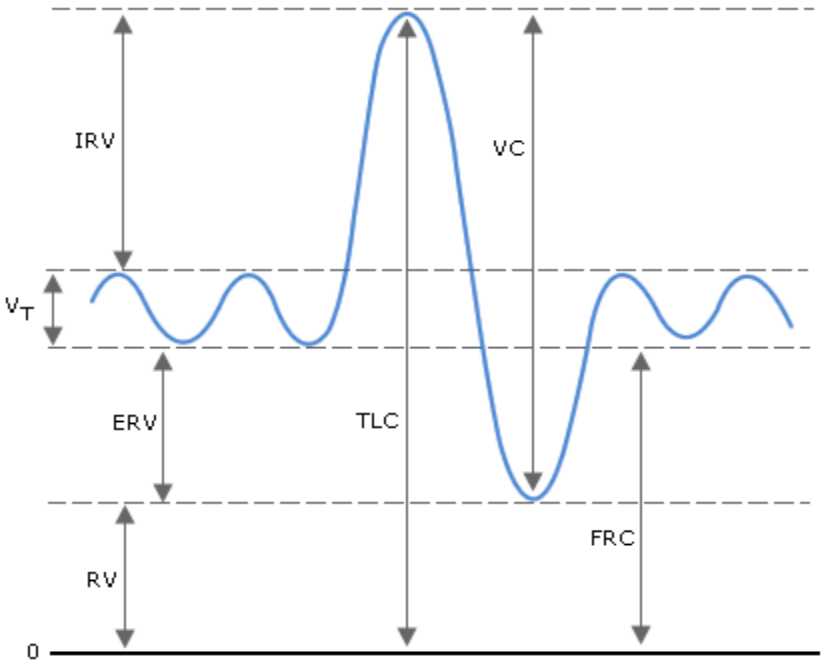
Expiratory reserve volume: The amount of air that can be forced out after tidal volume (after a normal expiration). Expiratory reserve volume decreases during exercise.

Inspiratory reserve volume: The amount of air that can be forced in after tidal volume (after a normal inspiration). Inspiratory reserve volume decreases during exercise.

Residual volume: The amount of air that remains in the lungs after maximal expiration. There is no change in residual volume during exercise.

Vital capacity: The largest volume of air that can be forcibly expired after the deepest possible inspiration.

A spirometer trace is a way of recording and drawing the volumes listed above. The pattern of the trace will change as the amount of air you inspire and expire changes as a result of exercise. The lines moving upwards show inhalation and the lines moving downwards show exhalation.



1.11 Spirometer trace

See page 18

R

A spirometer measures the five volumes associated with the lungs. Explain each volume in your own words.

Tidal volume:

Expiratory reserve volume:

Inspiratory reserve volume:

Residual volume:

Vital capacity:

A spirometer trace records these volumes. Complete this spirometer trace by:

1. Continuing the spirometer trace to show how the respiratory volumes change during exercise.
2. Labelling the five volumes on the spirometer trace.

1.11 Spirometer trace

See page 18

A

What is tidal volume?

_____

_____

_____

_____

V

Which lung volume is used to increase the amount of air breathed in?

_____

What is the name of the amount of air left in the lungs after a full expiration?

_____

E

While running, a performer will experience changes in lung volumes. Complete the table below to show how the tidal volume, inspiratory reserve volume and expiratory reserve volume change during exercise.

Volume name	Value at rest	Change during exercise
Breathing rate	16 breaths/min	Increases
Tidal volume	500 cm3	
Inspiratory reserve volume	3100 cm3	
Expiratory reserve volume	1200 cm3	
Residual volume	1100 cm3	No change

The cardiovascular system

Learning Objectives

- **Describe the role of the heart in the cardiovascular system.**
- **Identify the components of the heart and describe their functions.**
- **Explain the cardiac cycle including the passage of blood through the heart.**

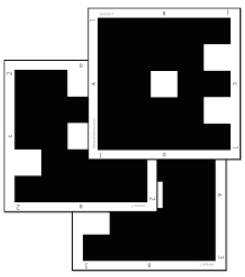
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:

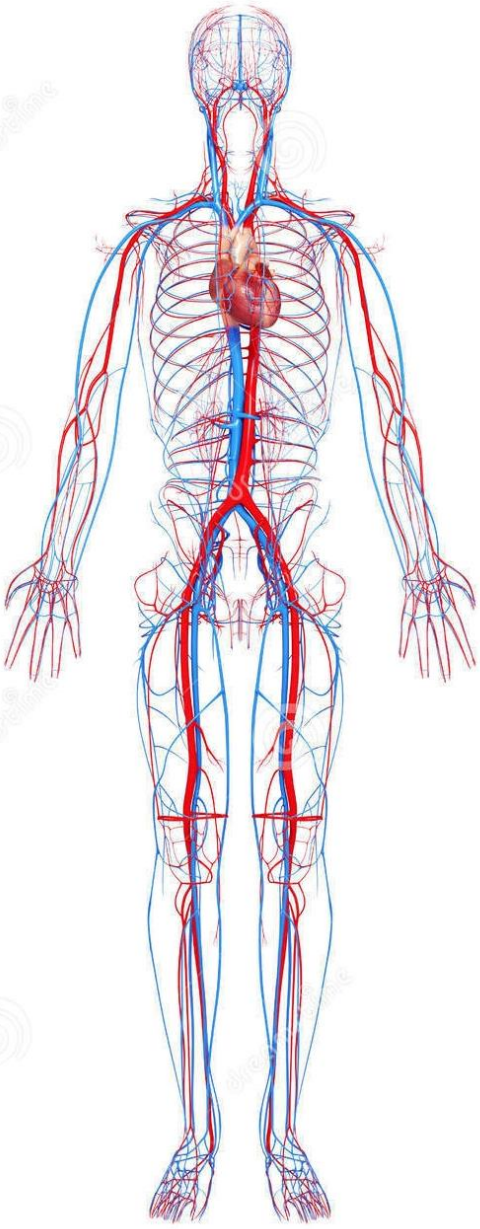


The cardiovascular system

See page 19

K

The cardiovascular system carries blood around the body. Blood is the body's fuel supply. It contains both nutrients (e.g. oxygen) and waste products (e.g. carbon dioxide). The cardiovascular system is made up of the **blood**, the **heart** and a series of **arteries, veins** and **capillaries** to transport the blood.



Key term

Deoxygenated blood:

Key term

Oxygenated blood:

1.12 The Heart

See page 19-20

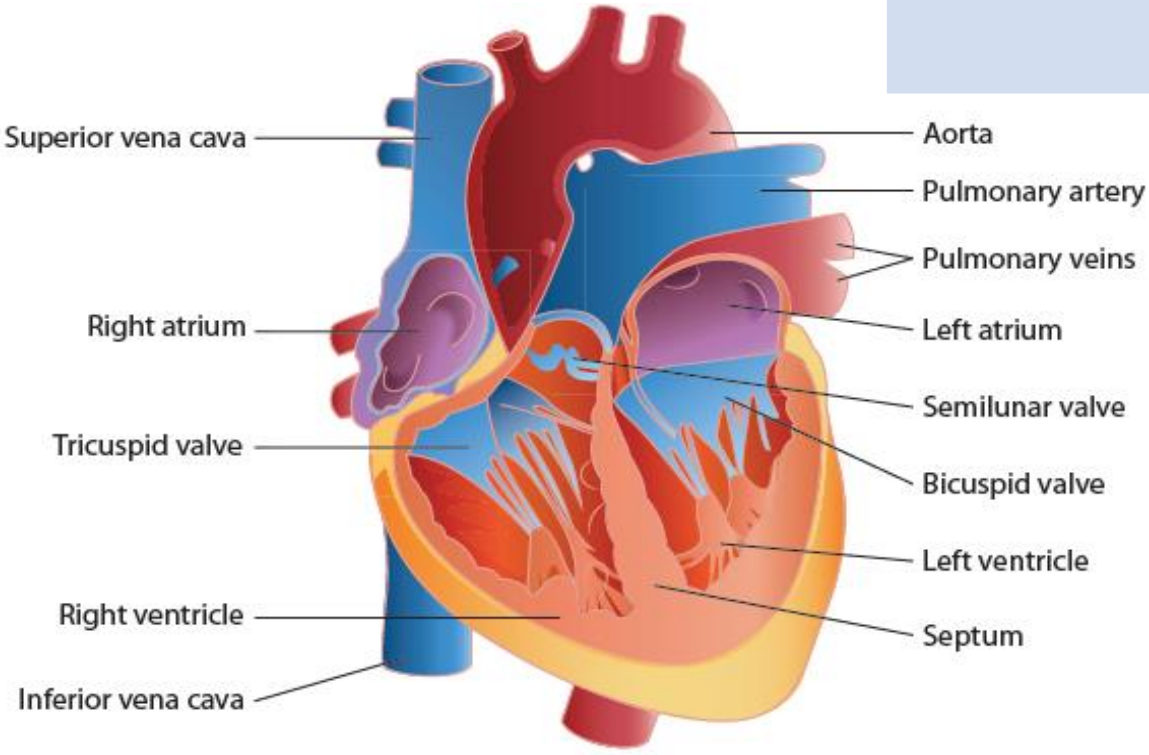
K

The heart is an efficient pump and, like any other muscle, it contracts and relaxes. One contraction and relaxation is called a heartbeat, and your heart rate – the number of times your heart beats in one minute, measured in beats per minutes (bpm). The heart of an adult at rest beats at an average of 72 beats per minute and your heart rate will increase when you exercise.

This is because the heart is required to supply more oxygen to the working muscles and, therefore, has to work harder. Your heart rate has to increase quite considerably to cope with strenuous exercise.

Key term

Heart rate:

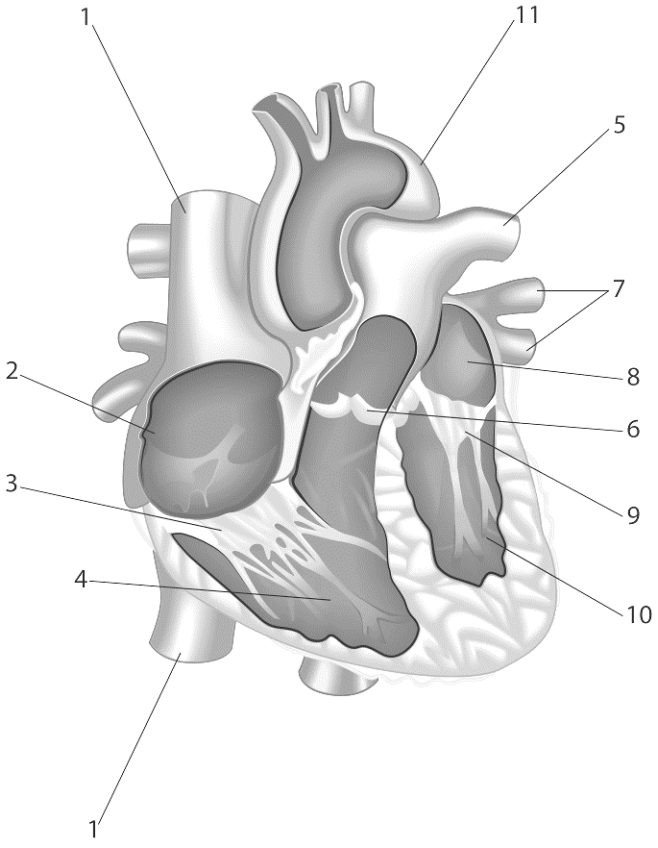


1.13 The cardiac cycle and pathway of blood

See page 21

R

Write a commentary around the outside of this diagram to describe what is happening at each stage of the blood's journey through the heart. Start your journey at '1'. Use completed activity 1.12 to help you.



Colour the heart to show oxygenated and deoxygenated blood flow and highlight your commentary to show the diastole and systole phases of the cardiac cycle.

Key term

Pulse:

Revision technique: linking information to a diagram

Often people, especially visual learners, find pictures and diagrams easier to remember than blocks of text. By linking information to a diagram, you'll have something to visualise in your exam, which will help you recall key information.

Do you like this technique? Does it work for you? ☹ 😐 ☺

1.13 The cardiac cycle and pathway of blood

See page 21

Key terms

Backflow:

Diastole:

Systole:

Cardiac cycle:

Blood pressure:

A What is the function of the pulmonary artery?

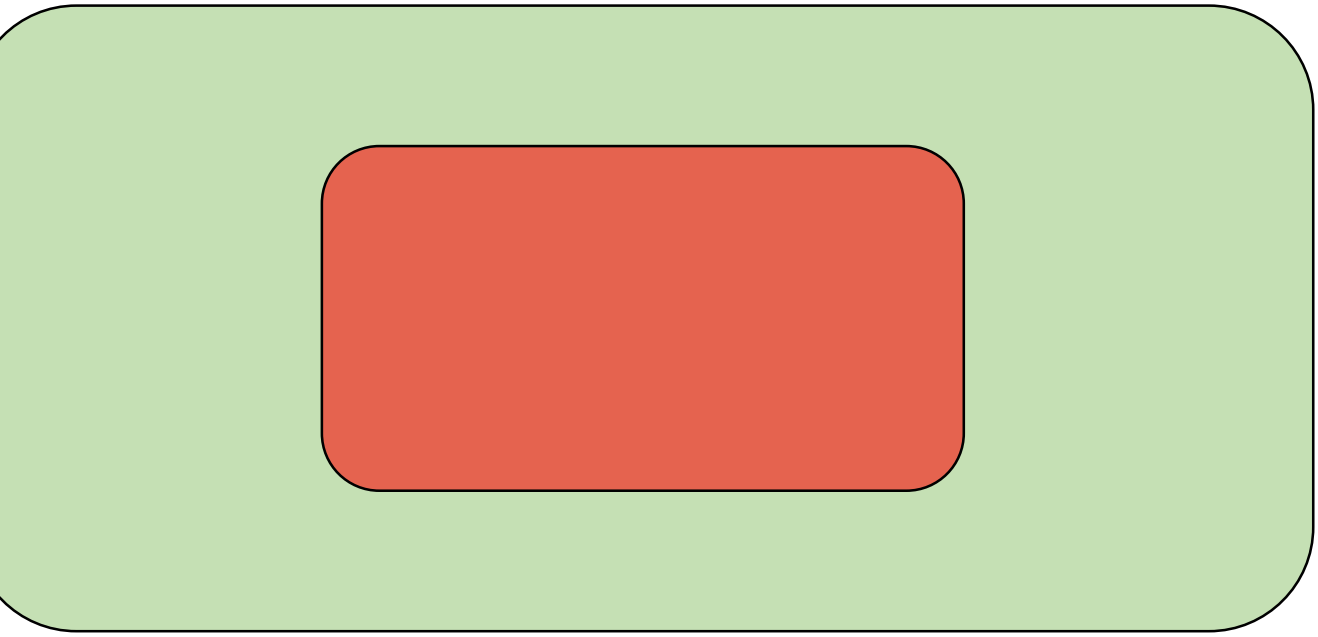
V Describe the passage of blood from the right atrium to the lungs.

E Describe the passage of blood from it leaving the right atria to it eventually reaching the left ventricle.

1.14 Blood vessels

Learning Objectives

- **Identify the key structures of the major blood vessels in the body.**
- **Describe how the structures of blood vessels help them to meet their function.**
- **Explain how and why blood is redistributed during exercise.**



Record your success for the 3 Plickers questions:

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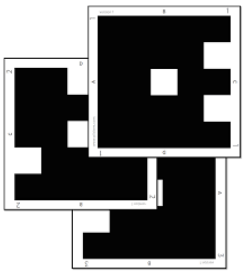
clickers, simplified

Q1:

Q2:

Q3:



1.14 Blood vessels

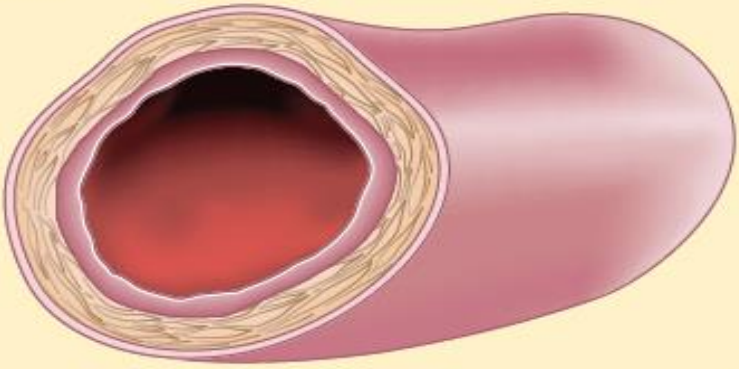
See page 21

Blood flows through the body via three types o blood vessels:

K

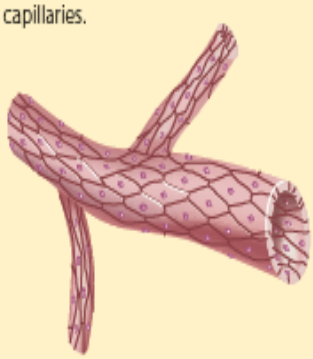
Arteries

- **Arteries** carry blood away from the heart.
- Arteries carry oxygenated blood. The exception is the pulmonary artery, which carries deoxygenated blood.
- Blood pressure is high in the arteries and gets higher when exercise takes place.
- The blood travels at high speed in the arteries.
- The arteries have thick muscular walls and small lumens.
- The involuntary muscle in the walls of arteries is always under slight tension.
- When blood moves through arteries, it makes them pulse. As they retract to their normal diameter, blood is pushed along.
- During exercise, the arteries to active muscles dilate. This means that they increase in diameter, allowing more oxygenated blood to be carried to working muscles.
- During exercise, the arteries to inactive muscles and organs constrict. This means that they reduce in diameter and less blood is carried to inactive areas of the body.



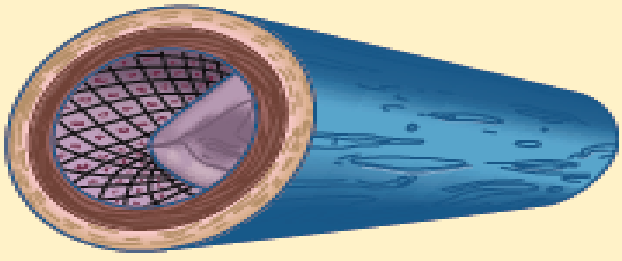
Capillaries

- **Capillaries** look like a mesh wrapped around muscles and organs.
- There are lots of capillaries in every mesh.
- Each single capillary is very narrow. Blood cells have to travel through one at a time. This slows blood down.
- Each capillary has walls that are only one cell thick.
- Gases can diffuse through the walls of capillaries. Oxygen diffuses into muscles and organs through the capillaries. Carbon dioxide also diffuses into the blood through the capillaries. (See page xx for more about diffusion.)
- Blood becomes deoxygenated at the capillaries.
- Capillaries are key during physical activity because they allow oxygen to enter the muscles through diffusion. Deoxygenated blood becomes oxygenated at the capillaries.



Veins

- **Veins** carry blood back to the heart.
- Veins carry deoxygenated blood. The exception is the pulmonary vein, which carries oxygenated blood.
- Blood pressure is low in the veins.
- Blood travels at a fairly low speed in the veins.
- To prevent blood going in the wrong direction, veins have many one-way pocket valves.
- Veins have thinner walls than arteries.
- Veins have a larger **lumen** than arteries.



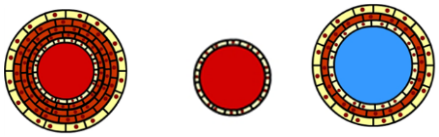
1.14 Blood vessels

See page 21

R

The cardiovascular system carries blood around the body. Blood is the body's fuel supply. It contains both nutrients (e.g. oxygen) and waste products (e.g. carbon dioxide). The cardiovascular system comprises the heart, the blood and a series of blood vessels to transport the blood.

Identify which vessel or vessels each statement is about:



	Arteries	Capillaries	Veins
1. These carry blood away from the heart.			
2. These run across the alveoli.			
3. These pulse as blood moves through them.			
4. These carry deoxygenated blood.			
5. Gases can diffuse through the walls of these vessels.			
6. These have thick muscular walls.			
7. Blood becomes oxygenated in these vessels.			
8. Carbon dioxide diffuses into the air in the lungs through these vessels.			
9. These carry blood back to the heart.			
10. Blood pressure is high in these vessels.			
11. These have valves, which open due to the pressure of the blood flow and then close to prevent backflow.			
12. The walls of these vessels are very thin.			
13. These carry oxygenated blood.			
14. Blood pressure is at its lowest in these vessels.			
15. These have small internal diameter.			
16. These are microscopic.			
17. These do not have valves.			
18. These have large internal diameter.			
19. These can vasodilate and vasoconstrict.			

1.14 Blood vessels

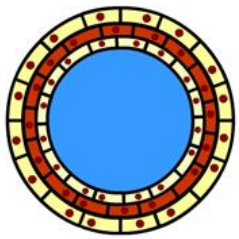
See page 21

R

Complete the bullet points for each type of blood vessel, explaining its role in the body and what it is about its structure that allows it to fulfil its role.

Arteries:

Capillaries:



Veins:

1.15 Redistribution of blood during exercise

See page 22

K

When exercise begins, the body alters it's priorities. While at rest, a high proportion of blood is directed towards the organs, but during exercise the majority of blood is directed towards the voluntary muscles. For example, blood is directed away from the digestive system in favour of supplying the quadriceps and hamstring muscles when running 800m. This ensures that the voluntary muscles are able to work aerobically, which is the most efficient way for them to work.

Redistributing blood when exercise begins is achieved by vasodilation and vasoconstriction, which involves changes in the internal diameter of the arteries that supply the body with blood.

Vasoconstriction

Vasoconstriction is the **narrowing** of the internal diameter of a blood vessel to **restrict** the volume of blood travelling through it. The arteries constrict during exercise so that **less blood** is delivered to inactive areas.

Normal vascular tone

Vasodilation

Vasoconstriction is the **widening** of the internal diameter of a blood vessel to **increase** the volume of blood travelling through it. The arteries dilate during exercise so that **more blood** is delivered to active areas, increasing their oxygen supply.

1.15 Redistribution of blood during exercise

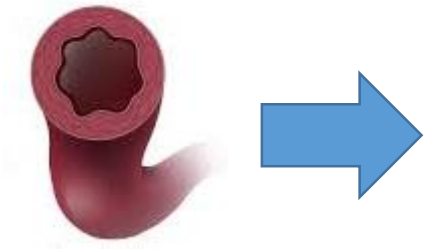
See page 22

R

When exercise begins, the body alters it's priorities. While at rest, a _____ proportion of blood is _____ towards the organs, but during exercise the majority of _____ is directed towards the _____ _____. For example, blood is directed away from the _____ _____ in favour of supplying the _____ and _____ muscles when running 800m. This ensures that the voluntary muscles are able to work aerobically, which is the most efficient way for them to work.

Redistributing blood when exercise begins is achieved by _____ and _____, which involves changes in the internal diameter of the arteries that supply the body with blood.

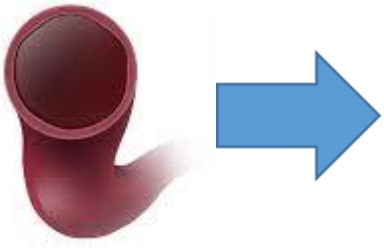
voluntary muscles	quadriceps	vasodilation	hamstring
digestive system	blood	high	vasoconstriction	directed



Key term

Vasoconstriction:

Normal vascular tone



Key term

Vasodilation:

1.15 Blood vessels & Redistribution of blood

See pages 21/22

A

Which type of blood vessel contains valves? What is the function of these valves in the blood vessel?

V

Why do capillaries have thin walls?

What is the function of elastic tissue in the walls of arteries?

E

A student has written the following answer to a question. It is on the right lines but it is lacking some important key terms and could be written more precisely. **Read** and **annotate** the answer and then write an improved version of your own on the next page.

Explain how blood is redistributed during exercise.

Blood is redistributed when a person exercises. When resting, a high amount of blood is sent to organs. When a person exercises, this needs to change. By opening up vessels going to muscles, more blood can go there. At the same time, the vessels to organs are shut, which stops blood going there. This process gets more blood to muscles so they can work.

1.15 Blood vessels & Redistribution of blood

See page 21/ 22

E

Now, explain how blood is redistributed during exercise then annotate your own answer to define each key term you used.

1.16 Cardiac output, stroke volume & heart rate

Learning Objectives

- **Describe cardiac output, stroke volume and heart rate.**
- **Explain the relationship between cardiac output, stroke volume and heart rate.**
- **Evaluate the change to cardiac output, stroke volume and heart rate before, during and after exercise.**

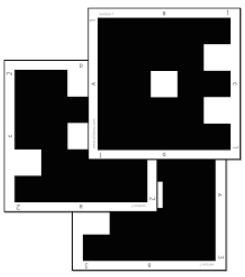
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:



1.16 Cardiac output, stroke volume & heart rate

See page 23

K

Cardiac output is the volume of blood that the heart is able to pump out. It is usually measured in litres per minute.

The cardiac output represents the volume of oxygenated blood that is delivered to the body.

There are two major factors from cardiac output:

1. Heart rate, which is the number of times the heart beats each minute
2. Stroke volume, which is the volume of blood that leaves the heart during each contraction.

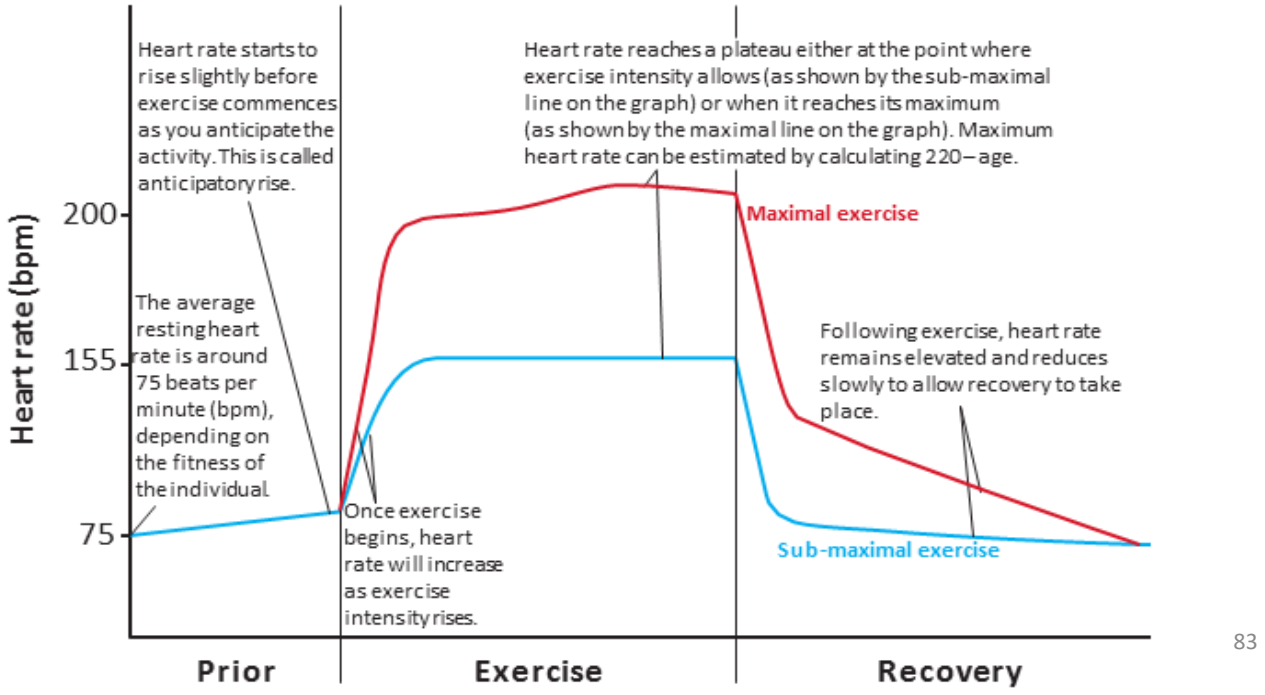
Increasing the heart rate increases the cardiac output by increasing the number of volumes of blood released into the system.

The heart rate increases usually before activity because of the expectation of exercise. This slight increase in heart rate before exercise is called anticipatory rise.

The stroke volume can be increased by the heart contracting with more force and so pushing more blood out with each beat.

Cardiac output, heart rate and stroke volume are related such that:

cardiac output (Q) = stroke volume (SV) × heart rate (HR)



1.16 Cardiac output, stroke volume & heart rate

See page 23

R

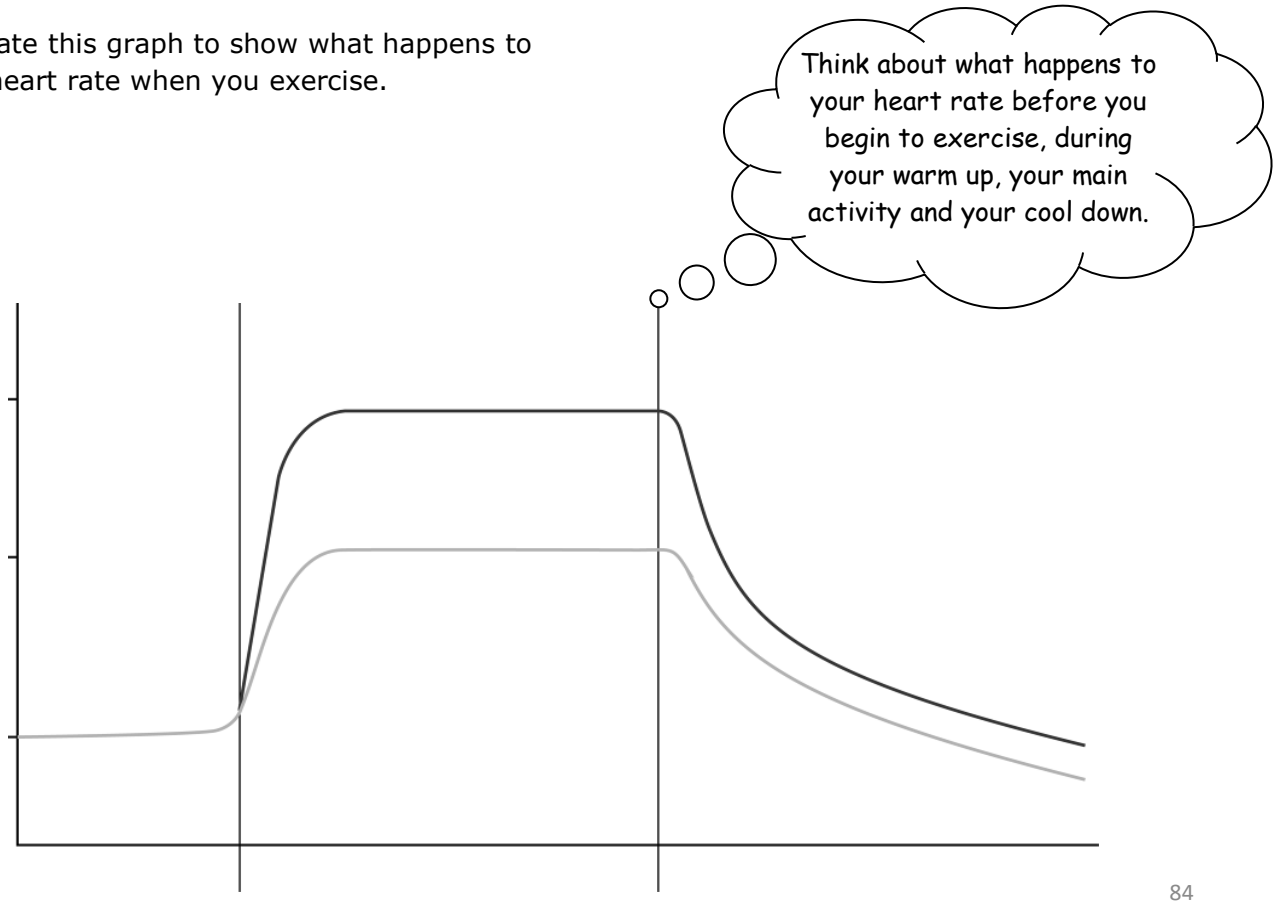
Annotate the equation below to define each value:

cardiac output (Q) = stroke volume (SV) × heart rate (HR)

Key term	Key term	Key term
Cardiac output (Q):	Stroke volume (SV):	Heart rate (HR):

Cardiac output _____ when you exercise. This is because

Annotate this graph to show what happens to your heart rate when you exercise.



1.16 Cardiac output, stroke volume & heart rate

See pages 23

A

Which is cardiac output?

V

What is the relationship between stroke volume, heart rate and cardiac output?

What is stroke volume?

E

What is the cardiac output of a performer who has a stroke volume of 70 mls and a heart rate of 70 beats per minute?

1.17 Aerobic exercise

Learning Objectives

- Define the term ‘aerobic exercise’ and provide examples from different sports.
- Apply knowledge to explain the link between intensity and aerobic exercise.
- Identify aerobic sports/ activities and explain why they are aerobic exercises.

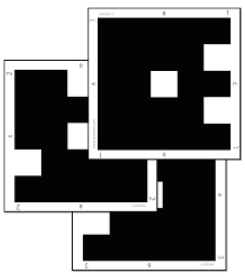
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:



1.17 Aerobic exercise

See page 24

K

Aerobic exercise takes place in the presence of oxygen. When exercise is over a long period of time, not too fast and is steady, the heart can supply all the oxygen the working muscles need.

When working aerobically, the energy needed by the working muscles comes from carbohydrates., which are converted into glucose, and oxygen. When this energy is being used, it creates by-products in the form of carbon dioxide and water. When you sweat the water is released. The carbon dioxide makes its way back to the lungs and is exhaled. The process can be summarised using the following equation:

glucose + oxygen → energy + carbon dioxide + water

Producing energy aerobically is the body's preferred way of working because lots of energy can be produced this way and there are few harmful by-products created. Consequently, people working aerobically can work for a long period of time at a low to moderate intensity.

Intensity is the amount of energy needed to complete an activity. Working at a low to moderate intensity requires less energy than working at high intensity.

Examples of aerobic exercise include long-distance running, endurance cycling and long-distance swimming

✓ **Exam tip**

Think of aerobics when you're trying to remember what aerobic exercise is. Aerobics is a form of continuous exercise, where participants work at a moderate intensity for a relatively long time.

1.17 Aerobic exercise

See page 24

R

Aerobic exercise relies on energy produced in the presence of .....

Aerobic exercise is different to anaerobic exercise because…

.....

.....

.....

Annotate the aerobic exercise equation to explain what each item in the equation is.

glucose + oxygen → energy + carbon dioxide + water

Key term
Aerobic exercise:

Key term
Intensity:

✓ **Exam tip**

Think of aerobics when you're trying to remember what aerobic exercise is. Aerobics is a form of continuous exercise, where participants work at a moderate intensity for a relatively long time.

1.17 Aerobic exercise

See page 24

Give two examples of sports or physical activities that use aerobic energy production and describe what makes them aerobic activities.

1.

2.

1.17 Aerobic exercise

See pages 24

A

Is the marathon an aerobic or anaerobic event? Explain your answer.

V E

Select the aerobic sports/ activities from the following list and explain why they are aerobic. Be specific when explaining times of aerobic activity in each sport/ activity

Netball, Pole vault, Marathon, Trampolining, Cricket, Triathlon

1.18 Anaerobic exercise

Learning Objectives

- Define the term ‘anaerobic exercise’ and provide examples from different sports.
- Apply knowledge to explain the link between intensity and anaerobic exercise
- Identify anaerobic sports/ activities and explain why they are anaerobic exercises

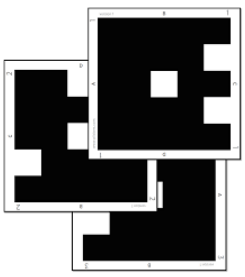
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:



1.18 Anaerobic exercise

See page 24

K

Anaerobic exercise takes place in the **absence of enough oxygen**. When exercise is **short in duration** and at **high intensity**, the heart and lungs cannot supply enough blood and, therefore, oxygen to the working muscles. Glucose is converted into energy without the presence of oxygen:

glucose → energy + lactic acid

When working anaerobically, the muscles produce a waste product called lactic acid. As lactic acid builds up in the muscles, they become painful, fatigued and unable to continue working effectively. As a result, the body can only work anaerobically for short periods of time, for a maximum of approximately 60 seconds:

Excess Post-exercise Oxygen Consumption (EPOC), refers to the amount of oxygen needed to recover after anaerobic exercise. It is characterised by an increased breathing rate and deeper breathing. EPOC replenishes the body with oxygen and enables the body to convert the lactic acid produced during anaerobic exercise into glucose, carbon dioxide and water.

Examples of Anaerobic exercise include sprinting, e.g. 100 metres or 200 metres, or activities that require fast, powerful muscular contractions, such as the triple jump or a tennis serve.

✓ **Exam tip**

EPOC is sometimes referred to as 'oxygen debt' but this is an outdated term.

1.18 Anaerobic exercise

See page 25

R

Anaerobic exercise relies on energy produced *without* the presence of .....

Anaerobic exercise is different to aerobic exercise because .....

.....

.....

.....

Annotate the anaerobic exercise equation to explain what each item in the equation is.

glucose → energy + lactic acid

Give two examples of sports or physical activities that use anaerobic energy production and describe what makes them anaerobic activities.

1. .....

.....

.....

.....

.....

.....

2. .....

.....

.....

.....

.....

.....

1.18 Anaerobic exercise

See page 25

Give two examples of sports or physical activities that use aerobic energy production and describe what makes them aerobic activities.

1.

2.

Key term

Anaerobic exercise:

Key term

Lactic acid:

Key term

Excess Post-exercise oxygen consumption (EPOC):

✓ Exam tip

EPOC is sometimes referred to as 'oxygen debt' but this is an outdated term

Excess Post-exercise Oxygen Consumption (EPOC), refers to the amount of oxygen needed to

It is characterised by

It replenishes the body with and enables the body to convert

1.18 Anaerobic exercise

See pages 25

A

Is the Javelin an aerobic or anaerobic event? Explain your answer.

V E

Select the anaerobic sports/ activities from the following list and explain why they are anaerobic. Be specific when explaining times of anaerobic activity in each sport/ activity. **Netball, Pole vault, Marathon, Trampolining, Cricket, Triathlon**

1.19 The recovery process

Learning Objectives

- **Describe processes of recovery following vigorous exercise.**
- **Explain how recovery processes help to prevent DOMS after vigorous exercise**
- **Evaluate recovery processes and suggest which would be more beneficial to certain sports performers.**

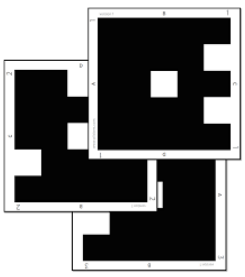
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:



1.19 The recovery process

See page 26

K

It is important to ensure that the body recovers from vigorous exercise. The methods of recovery include cooling down, manipulating or controlling diet, and ice baths or massage.

Cool down

Rather than just stopping at the end of a physical activity session, you should end the session gradually by doing 5 to 10 minutes of walking or jogging to help decrease body temperature and remove waste products such as lactic acid from the working muscles. This should be followed by 5 to 10 minutes of stretching to help the muscles relax.

An appropriate cool down has the following benefits:

- Aids in the clearing of waste products – including lactic acid
- Reduces the potential for DOMS
- Reduces the chances of dizziness or fainting caused by the pooling of blood in the extremities
- Allows breathing and heart rate to slowly return to their resting rates and so prevent sudden changes to heart rhythm, which could be dangerous.

Manipulation of diet

Drinking water to **rehydrate** is essential to help your body recover and replace the fluids lost during exercise, so you are ready to train again. Exactly how much water you need to ensure you are fully hydrated depends on the intensity and duration of the exercise. Air temperature, humidity, altitude and your body composition also affect how much water you need.

Endurance athletes, such as marathon runners, use a strategy called **carbohydrate loading** to boost their performance and limit the length and severity of their recovery period. Carbohydrate loading involves increasing the amount of complex carbohydrates eaten a few days before an event in order to maximise the amount of glucose in the body so it can better meet the demands of performance.

The timing of **protein intake** is particularly important for power athletes, who are training to increase their strength and speed. A lot of small tears appear in the muscle during training and, because of a process called '**hypertrophy**', the muscles increase in size and become stronger when these tears heal. Consuming protein after training provides the body with the nutrients it needs to heal the tears quickly and build muscle.

1.19 The recovery process

See page 26

K

Ice baths or massage

Ice baths and massages immediately after intense exercise are very popular with elite performers as they help to prevent **Delayed Onset Muscle Soreness (DOMS),** the muscle soreness that you feel in your muscles the day after intense exercise.

Massage increases blood flow to the sore area, speeding up the healing process and reducing pain.

Ice baths help the body flush lactic acid from the working muscles. The cold causes the blood vessels to constrict, forcing lactic acid out. Then, when you get out of the ice bath, you blood vessels dilate and bring oxygenated blood in.

Key term
DOMS is:

1.19 The recovery process

See page 26

R

Using the template below, create a flashcard summarising the key information about recovering from vigorous exercise.

Think carefully about what you will be assessed on, so that you only include the information that you absolutely must know about how a cool down, manipulation of diet, and ice baths or massages can help you recover from vigorous exercise. And remember to use sporting examples.

Revision technique: flashcards

Summarising one topic on one flashcard helps you condense all the information you have been given into a format that you can then memorise. The process of choosing which information to include and which information to leave out is also the first step in memorising it.

Do you like this technique? Does it work for you? ☹ 😐 ☺

Recovering from vigorous exercise

Cool down

Manipulation of diet

Ice baths or massage

1.19 The recovery process

See page 26

A What is Excess Post-exercise Oxygen Consumption?

V Explain the importance of a cool down after a game for a Premiership footballer.

E Andy Murray has an ice bath after each training session and match. Explain the benefits to his body using this recovery technique. Evaluate this process and compare it to sports massage used for recovery.

✓ **Exam tip**

Remember to avoid abbreviations such as DOMS or EPOC unless you have first written the term out in full.

1.20 The effects of exercise

Learning Objectives

- Describe the difference between immediate, short-term and long-term effects of exercise.
- Recall the immediate, short-term and long-term effects of exercise on the body.
- Explain the effects of exercise on the body and fitness levels.

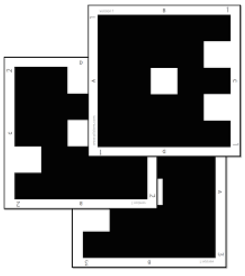
Record your success for the 3 Plickers questions:

plickers
clickers, simplified

Q1:

Q2:

Q3:



1.20 The immediate effects of exercise

See page 27

K

The effects of exercise can be categorised in three ways: immediate, short-term and long-term effects.

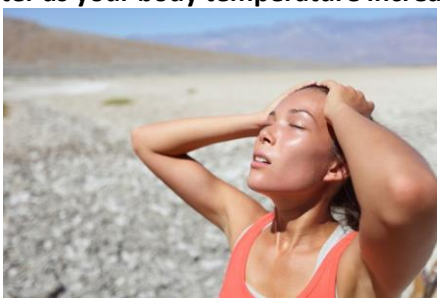
As soon as you start to exercise, and while you continue exercising, you will experience the immediate effects of exercise. These are:

Your heart rate will increase, as your heart works harder to deliver oxygen to the working muscles.

✓ **Exam tip**

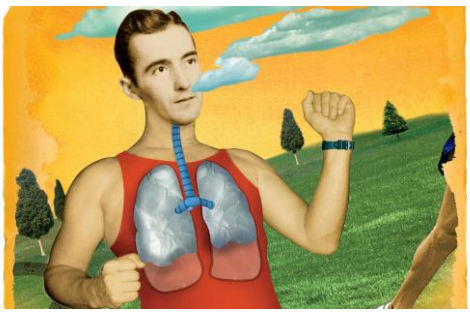
There is a link between the respiratory volumes discussed earlier & the immediate effects of exercise. When you breathe more deeply and more frequently during exercise your respiratory volumes change.

You will feel hotter as your body temperature increases



You will sweat and your skin will redden, especially on your face. This occurs as part of the body's temperature control system.

You will breathe more deeply and more frequently, as your body delivers more oxygen to the working muscles.



1.20 The immediate effects of exercise

See page 27

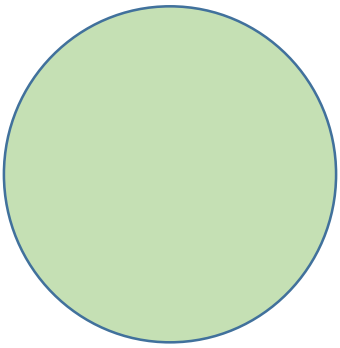
Revision technique: mind maps

Invented by Tony Buzan, mind mapping is a technique for capturing information. It has been shown to improve your memory and creativity. Find out more about mind mapping at imindmap.com/how-to-mind-map.

Do you like this technique?

Does it work for you? ☹ 😐 ☺

R Create a mind map to capture everything you know about the immediate effects of exercise.



1.20 The short-term effects of exercise

See page 28

K

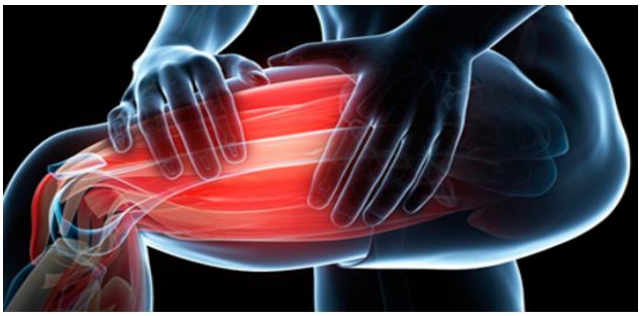
The short term effects of exercise occur any time between 24 to 36 hours after you finish exercising.

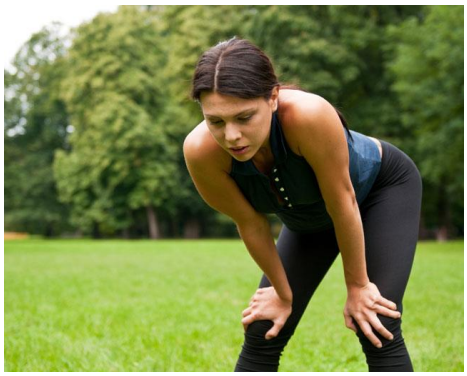
The short term effects of exercise are:

You will feel tired, possibly very fatigued.

You may feel light headed.

You may feel nauseous.





Your muscles will ache a little.

You may experience DOMS if your exercise was of high intensity.

You may experience muscle cramps.

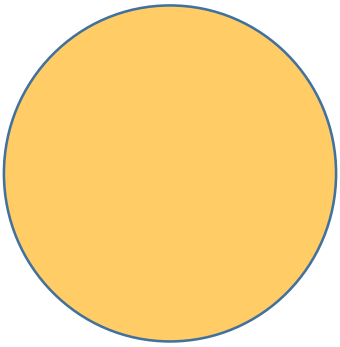
Some of the negative short-term effects of exercise – such as feeling very fatigued, light-headed and nauseous – are quite common until you establish a regular exercise routine, when they are likely to reduce or disappear altogether. Applying the principles of training to your exercise programme will help you avoid the negative effects of exercising.

1.20 The short-term effects of exercise

See page 28

R

Create a mind map to capture everything you know about the short-term effects of exercise.



Key term

Fatigue:

1.20 The long-term effects of exercise

See page 29

K

The long-term effects of exercise occur after months and even years of training. They result in adaptations to the body. Adaptations are positive changes that result in improved performance.

The long term effects of exercise are:

Your body will change shape, almost certainly for the better because exercise helps keep body weight down.

Your resting heart rate will be lower. Bradycardia is the name given to a slow resting heart rate. A resting heart rate of under 60 beats per minute in adults is considered bradycardic.

Your stamina – your ability to exercise for longer – will improve.

You will see improvements in specific components of fitness, including an increase in strength, muscular endurance and cardiovascular endurance, and an improvement in speed and flexibility. Exactly which components of fitness improve will depend on the exercise you do.

You heart will increase in size. This is called cardiac hypertrophy and it means your cardiac output increases. Your heart is able to deliver more blood and, therefore, more oxygen to your working muscles, and remove more carbon dioxide and other waste products such as lactic acid.

Your muscles will increase in size and produce greater strength. When a muscle is trained, small tears are created. As they heal, they become thicker. This process is called hypertrophy.

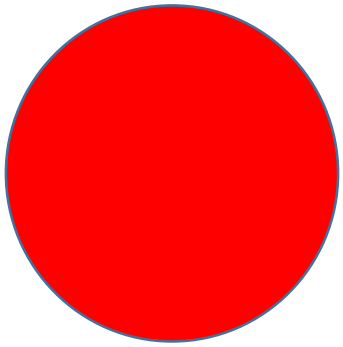
Key term
Hypertrophy:

1.20 The long-term effects of exercise

See page 29

R

Create a mind map to capture everything you know about the long-term effects of exercise.



✓ **Exam tip**

When you learn about the components of fitness in Chapter 3, be sure to link components of fitness back to these long term effects of exercise.

1.20 The effects of exercise

See page 29

A

Why might body shape change following repeated long-term exercise?

As an immediate effect of exercise, why will you breathe more deeply and more frequently?

V

Fatigue is a short-term effects of exercise. Define **fatigue** and describe why is occurs.

Hypertrophy is a long-term effect of exercise. Define **hypertrophy** and describe how is occurs.

1.20 The effects of exercise

See page 29

E

Explain the effects of long-term exercise on the heart.

In what ways does long-term exercise benefit fitness?

1.21 Exam-style questions

1. Which one of the following are examples of short bones? (1)

A. Carpals
B. Phalanges
C. Ribs
D. Vertebrae

2. Which one of the following movements is possible at a hinge joint? (1)

A Elevation
B Extension
C Rotation
D Circumduction

3. Muscles work with the skeleton to bring about specific movements.

Complete **Table 1** by:

a) stating the function of each muscle
b) giving an example of a specific sporting movement that uses each muscle.

Table 1

Muscle	a) Function	b) Specific sporting movement
Pectoralis major	(1)	(1)
Gastrocnemius	(1)	(1)

4. What are the main functions of ligaments? (1)

5. What is the main function of cartilage? (1)

6. Explain the difference between plantar flexion and dorsiflexion (2)

7. Describe one function of the cardio-respiratory system. (3)

8 **Figure 2** shows an antagonistic pair of muscles being used to lift a weight.

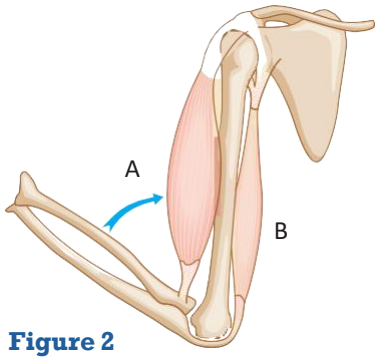


Figure 2

Explain the role of the muscles marked in making this movement possible.

A: (2)
B: (2)

9 Describe gaseous exchange and evaluate the extent to which it is important during a 100 m sprint, and during a marathon. (9)

10 Describe the mechanics of breathing change during exercise (2)

11 Which one of the following is a feature of an artery? (1)

A. Blood is carried at low pressure
B. One cell thick
C. Valves to prevent backflow
D. Thick muscular wall

12 Briefly explain the terms 'cardiac output' and 'stroke volume' and the relationship between them (3)

1.21 Exam-style questions

13 Is the marathon an aerobic or anaerobic event? Explain your answer (3)

14 Which **one** of the following is **not** an articulating bone at the shoulder? (1)

A. Fibula
B. Humerus
C. Scapula
D. Tibia

15 (a) Movement occurs when the skeletal and muscular systems combine.
Identify which joints enable the action of kicking a football. (3)

(b) Identify the two muscles that allow the movement to take place at one of the joints you identified in 15(a). (2)

16 Identify **two** types of movement that can occur at a ball and socket joint. (2)

17 **Table 1** shows the tidal volume recorded by a performer as the intensity of the exercise they were taking part in increased.

Plot the information in **Table 1** on graph paper to show how exercise intensity affects tidal volume. Label the axis and join up the points to make a line graph. (4)

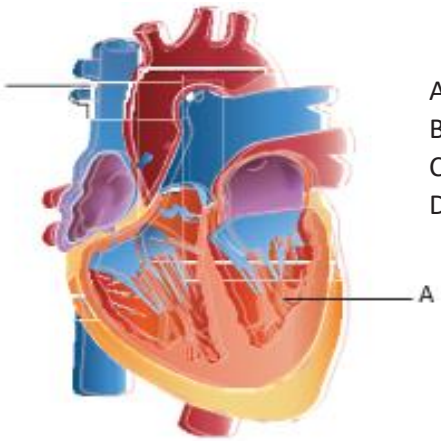
18 Which **one** of the following describes the alveoli? (1)

A. Tiny tubes that spread across the surface of the lungs
B. A network of very fine blood vessels
C. Small air sacs in the lungs where gaseous exchange takes place
D. The muscles between the ribs

19 Which **one** of the following describes an isometric contraction? (1)

A. The muscle lengthens when it contacts
B. The muscle shortens when it contracts
C. The muscle stays the same length
D. The muscle contracts

20 Identify the structure labelled A below. (1)



A. Aorta
B. Left ventricle
C. Left atrium
D. Right ventricle

Table 1

Exercise (w)	0	50	100	150	200	250
Tidal volume (l)	0.5	1.2	1.8	2.1	2.5	2.7

1 Revision checklist

GCSE PHYSICAL EDUCATION

ASSESSMENT:

Assessed as part of paper 1 at the end of Y11.

MARKS: Paper 1 = 78 marks

% : Paper 1 = 30% of GCSE

ARE YOU ON TRACK? **TARGET GRADE** →

Topic:	Score out of…	Percentage:	Grade:

TOPIC LIST	CURRENT KNOWLEDGE	TIPS TO IMPROVE
UNIT 1 – THE STRUCTURE AND FUCTIONS OF THE MUSCULOSKELETAL SYSTEM		
Bones: ⇒ head/neck – cranium and vertebrae ⇒ shoulder – scapula and humerus ⇒ chest – ribs and sternum ⇒ elbow – humerus, radius and ulna ⇒ hip – pelvis and femur ⇒ knee – femur and tibia		
The structure of the skeleton: ⇒ Movement at a joint ⇒ Shape and type of bones ⇒ Movement at different joint types ⇒ Interaction of the skeleton & muscles to provide movement		

GCSE PHYSICAL EDUCATION PAPER 1 CONTENT

TOPIC LIST		TIPS TO IMPROVE
Functions of the skeleton: ⇒ Support ⇒ Protection ⇒ Movement ⇒ Structural shape and points for attachment ⇒ Mineral storage ⇒ Blood cell production.		
Muscles of the body: ⇒ Latissimus dorsi ⇒ Deltoid ⇒ Rotator cuffs ⇒ Pectorals ⇒ Biceps ⇒ Triceps ⇒ Abdominals ⇒ Hip flexors ⇒ Gluteals ⇒ Hamstring group ⇒ Quadriceps group ⇒ Gastrocnemius ⇒ Tibialis anterior		
Structure of a synovial joint: ⇒ Synovial membrane ⇒ Synovial fluid ⇒ Joint capsule ⇒ Bursae ⇒ Cartilage ⇒ Ligaments.		
Identification of joint types: ⇒ Hinge joints (elbow, knee & ankle) ⇒ Ball & socket joints (hip & shoulder)		

GCSE PHYSICAL EDUCATION PAPER 1 CONTENT

TOPIC LIST		TIPS TO IMPROVE
Movement at different joints & application to sporting actions: ⇒ Flexion/extension ⇒ Abduction/adduction ⇒ Rotation ⇒ Plantarflexion/dorsiflexion		
The following details of specific joints (shoulder, elbow, hip, knee & ankle): ⇒ Major muscle groups & how these muscle groups work ⇒ Agonists & antagonists ⇒ Bones Plus the difference between concentric & eccentric muscle contractions.		
UNIT 2 – THE STRUCTURE AND FUCTIONS OF THE CARDIO-RESPIRATORY SYSTEM		
The pathway of air: ⇒ Mouth/nose ⇒ Trachea ⇒ Bronchi ⇒ Bronchioles ⇒ Lungs ⇒ Alveoli		
Gas exchange at the alveoli & features that assist in this process: ⇒ Surface area of alveoli ⇒ Moist thin walls ⇒ Short distance for diffusion ⇒ Lots of capillaries ⇒ Large blood supply ⇒ Movement from high concentration to low Haemoglobin & oxyhaemoglobin		

GCSE PHYSICAL EDUCATION PAPER 1 CONTENT

TOPIC LIST		TIPS TO IMPROVE
Structure of the blood vessels: ⇒ Arteries, capillaries & veins ⇒ How the structure of the vessels above relate to their function (carrying oxygenated & deoxygenated blood to/from the heart, gas exchange, blood pressure, redistribution of blood during exercise and vasoconstriction & vasodilation) ⇒ Names of the arteries & veins the transport blood to and from the heart.		
Structure of the heart: ⇒ Atria & ventricles		
Cardiac output, stroke volume & heart rate, and the relationship between them.		
Mechanics of breathing (inhaling & exhaling) with reference to: ⇒ Intercostal muscles ⇒ Rib cage ⇒ Diaphragm ⇒ Changes in air pressure		
Interpretation of a spirometer traces at rest & exercise: ⇒ Tidal volume ⇒ Expiratory reserve volume ⇒ Inspiratory reserve volume ⇒ Residual volume		
UNIT 3 – ANAEROBIC & AEROBIC EXERCISE		
Definition & understanding of the terms: ⇒ Aerobic exercise ⇒ Anaerobic exercise Plus summaries of the exercise equations & practical examples of aerobic & anaerobic exercise.		
Excess post-exercise oxygen consumption: ⇒ Definition of the term EPOC ⇒ Basic understanding of the term EPOC		

GCSE PHYSICAL EDUCATION PAPER 1 CONTENT

TOPIC LIST		TIPS TO IMPROVE
The following methods to recover from exercise, and reasons to use method: ⇒ Cooldown ⇒ Diet manipulation ⇒ Ice baths/massage		
UNIT 4—THE SHORT & LONG TERM EFFECTS OF EXERCISE		
⇒ Immediate effects of exercise (during exercise) ⇒ Short-term effects of exercise (24-36 hours after exercise) ⇒ Long-term effects of exercise (months & years)		