

2

AQA GCSE Physical Education Movement analysis

Student Workbook

Name: _____

Form: _____

Teacher: _____

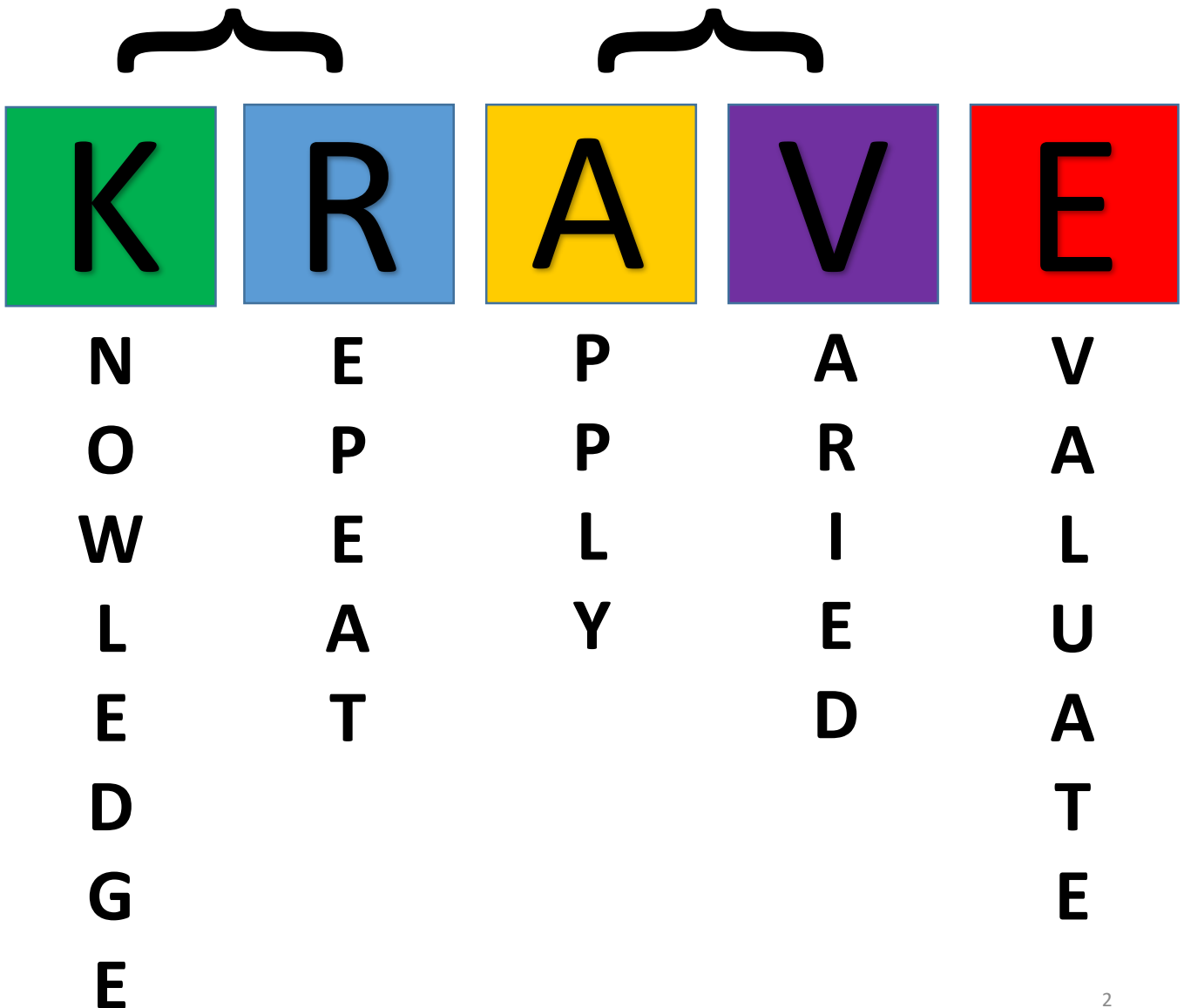
End of unit test

Target Grade: _____

2

Movement analysis

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.



2

Movement analysis contents



2.1	Types of levers	☐	☐	☐
2.2	Mechanical advantage	☐	☐	☐
2.3	Levers concept spiral	☐	☐	☐
2.4	Levers: extended writing answers analysis	☐	☐	☐
2.5	Levers: extended writing planning sheet	☐	☐	☐
2.6	Basic movements	☐	☐	☐
2.7	Planes and axes	☐	☐	☐
2.8	Exam practice: movement analysis	☐	☐	☐

2.1

Planes of movement and axes of rotation

Date: ____/____/____

Learning Objectives



To be able to distinguish between specific sporting skills along planes and axes



To identify at least one sporting movement that takes place along each plane and each axis.



To recall and identify the three planes of movement and the three axes of rotation.

3.1.2 – Movement Analysis	
Start of the lesson	End of the lesson
1. Name the plane that divides the body into front and back?	
2. What movement can occur at a sagittal plane?	
3. Where does the transverse axis run through the body?	
4. Where does the sagittal axis run through the body?	
Start of the lesson: DOWNLOAD BAR Shade in the download bar to show how many questions you could answer 0% 25% 50% 75% 100%  Downloading....	End of the lesson (Actual %): DOWNLOAD BAR Shade in the download bar to show your progress in the lesson 0% 25% 50% 75% 100%  Downloading....

START

Use the descriptions below to cut 3 of your jelly babies in half and place a small piece of card between to show the plane.

Sagittal Plane

Divides the body from the top to the bottom (vertically).

Resulting in a left side and right side.

Frontal Plane

Divides the body from top to bottom (vertically).

Resulting in a front section and back section.

Transverse Plane

Divides the body across the middle (horizontally).

Giving a top section (superior) and bottom section (inferior).



2.1

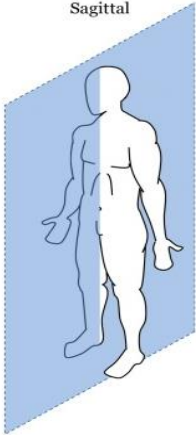
Planes of movement

Planes and axes are technical words to help you describe directions of movement.

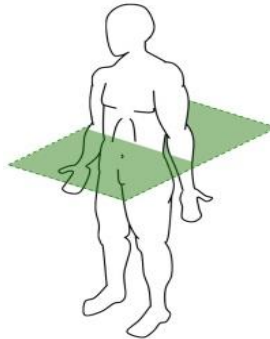
K

Think of a plane as a line drawn through the body dividing it into two parts. A movement occurs in a plane. There are three planes referred to in movement analysis: the **sagittal plane**, the **transverse plane** and the **frontal plane**.

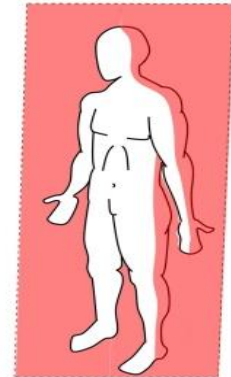
Sagittal



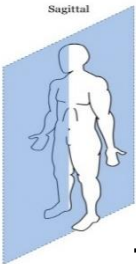
Transverse



Frontal



Sagittal



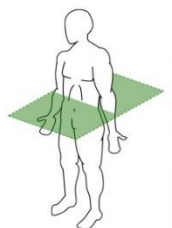
- The **Sagittal plane** runs **forwards and backwards** and divides the body into **left and right** halves.
- **Flexion and extension** movements occur in the sagittal plane.



Sagittal plane – cuts the body into left and right (**SIDES**)

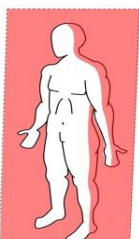
- The **Transverse plane** divides the body in half **horizontally**, creating an **upper and lower half**.
- **Rotation of the body** (in an upright position) occurs in the transverse plane.

Transverse



Transverse plane – cuts the body into upper and lower body (**TUMMY**)

Frontal



- The **Frontal plane** runs **left to right** and divides the body into **front and back** halves.
- **Abduction and adduction** movements occur in the frontal plane.



Frontal plane – cuts the body into **FRONT** and back.

2.1

Planes of movement

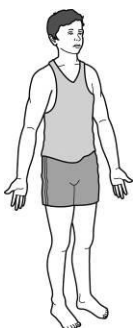
R Planes and axes can be used when describing movement patterns. Explain what a plane is:

Plane:

.....

Using the human outlines below, draw on the planes and shade them in.

Sagittal plane



Transverse plane



Frontal plane



A

Use your own knowledge of **planes** to place the sporting examples from the **amber box** into the correct row.

PLANE	MOTION	SPORTING EXAMPLE
SAGITTAL	Flexion/extension	
FRONTAL	Abduction/adduction	
TRANSVERSE	Rotations	

Walking,
Bicep curls,
Cartwheel,
Star jump,
Hammer throws,
360 degree
twist,
Discus,
Running,
Front
somersault,
Ice-skating spin,
Leg extensions,
Squats,

2.1

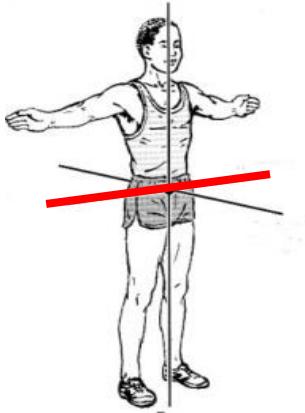
Axes of rotation

Planes and axes are technical words to help you describe directions of movement.

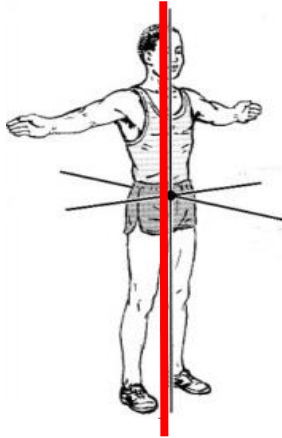
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An axis is an imaginary straight line around which the body rotates. There are three different axes of rotation in movement analysis: the transverse axis, the longitudinal axis and the sagittal axis.

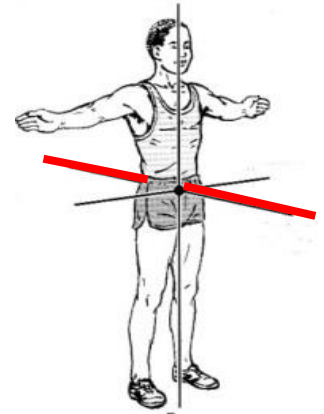
Transverse axis



Longitudinal axis

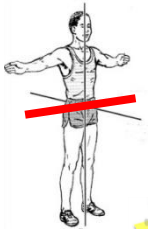


Sagittal axis

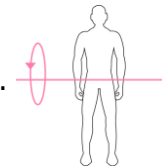


✓ Exam tip

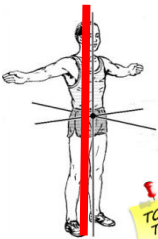
You should refer to one 'axis' and multiple 'axes'. In other words, 'axes' is the plural of 'axis'.



The **Transverse axis** passes **horizontally** from **left to right**. A **somersault** in **diving or gymnastics** is a rotation through the transverse axis.

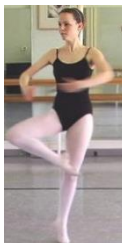


Transverse axis – is like the same axis for a **table** footballer.

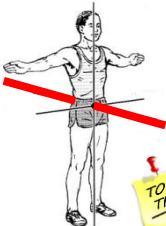


The **Longitudinal axis** passes **vertically** from the **top to the bottom** of your body.

When a **dancer** performs a **pirouette/ 360 degree turn**, they're rotating around the longitudinal axis.

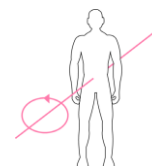


Longitudinal axis – is the **LONG**est axis, running from the head to the feet.



The **Sagittal axis** runs **horizontally** from the **front to back** of your body.

When a **gymnast** performs a **cartwheel** they have rotated around the sagittal axis.



Sagittal- goes through the **stomach**.

2.1

Axes of rotation

R

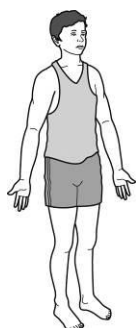
Planes and axes can be used when describing movement patterns. Explain what an axis is:

Axis:

.....

Using the human outlines below, draw on the axes.

Transverse axis



Longitudinal axis



Sagittal axis



A

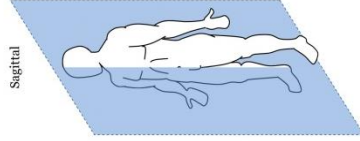
Use your own knowledge of **axes** to place the sporting examples from the **amber box** into the correct row.

AXIS	MOTION	SPORTING EXAMPLE
TRANSVERSE	Flexion/extension	
SAGITTAL	Abduction/adduction	
LONGITUDINAL	Rotations	

Walking,
Bicep curls,
Cartwheel,
Star jump,
Hammer throws,
360 degree
twist,
Discus,
Running,
Front
somersault,
Ice-skating spin,
Leg extensions,
Squats,

SAGITTAL PLANE

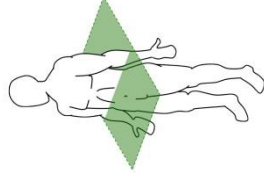
Sagittal



The sagittal plane is a vertical plane that divides the body into right and left sides.

TRANSVERSE PLANE

Transverse



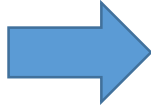
The transverse plane is a horizontal plane that divides the body into upper and lower halves

FRONTAL PLANE

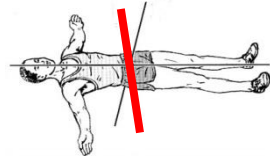
Frontal



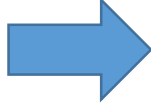
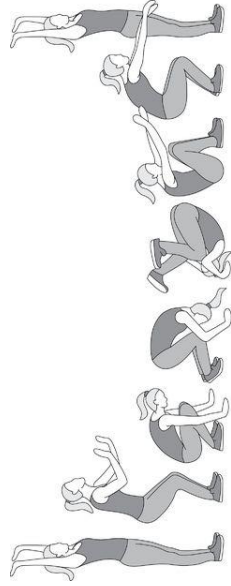
The frontal plane is also a vertical plane but this divides the body into front and back.



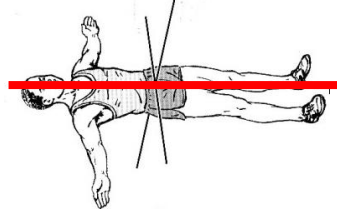
TRANSVERSE AXIS



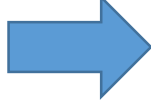
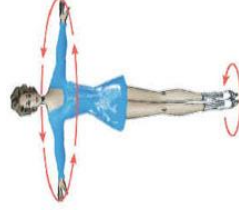
Transverse axis runs through the body horizontally from the left to right



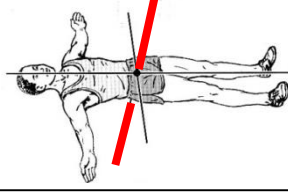
LONGITUDINAL AXIS



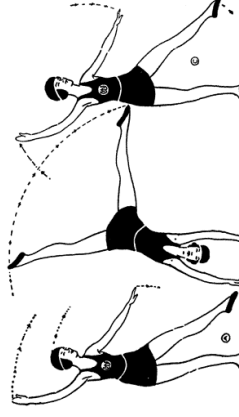
Longitudinal axis runs through the body vertically from the top to bottom.



SAGITTAL AXIS



Sagittal axis runs through the body horizontally from the back to front.



Planes of movement and axes of rotation



See pages 40-41

2.1

V

There are three very well known examples of whole body movements that use planes and axes.

- | | | |
|--------------|------------------|-------------------|
| • Cartwheel | frontal plane | sagittal axis |
| • 360° twist | transverse plane | longitudinal axis |
| • Somersault | sagittal plane | transverse axis |



Construct a mnemonic for each example to help you link the information and allow you to remember the plane, axis and example together. For example, 'Cats Fall Safely' will help you remember that the **C**artwheel takes places in the **F**rontal plane and around the **S**agittal axis. Add another example of each movement in the space provided.

C _____ F _____ S _____

T _____ T _____ L _____

S _____ S _____ T _____

Another example:

Another example:

Another example:

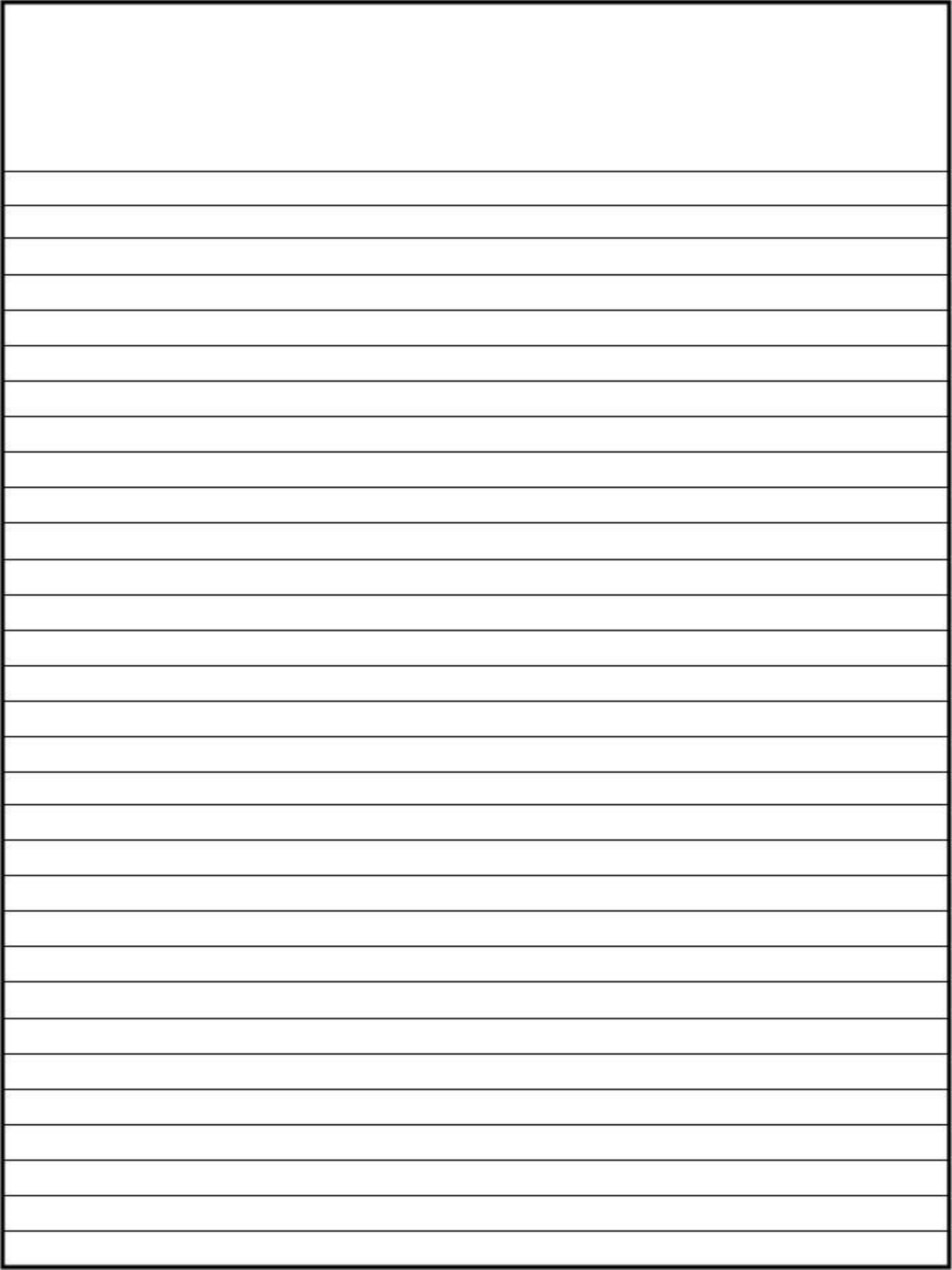
E

1. When a javelin thrower performs their throw, in which plane and in which axis does their movement occur?

(2 marks)

2. As part of a training programme a performer completes star jumps. In which plane and in which what axis are these movements performed?

(2 marks)



2.2

Basic movements

Date: ____/____/____

Learning Objectives



To be able to explain the basic movements created around different joints in at least one sports activity



To identify at least one sporting movement that takes place using each basic movement pattern



To recall and identify the six basic movement patterns

3.1.2 – Movement Analysis

Start of the lesson

End of the lesson

1. What movement is occurring when bending the knee joint to kick a football?

2. This is movement of the ankle where the foot flexes downwards.

3. Describe the difference between abduction and adduction movements

4. Give a sporting example of rotation including, specifically which joint(s) used

Start of the lesson:

DOWNLOAD BAR

Shade in the download bar to show how many questions you could answer

0% 25% 50% 75% 100%



Downloading....

End of the lesson (Actual %):

DOWNLOAD BAR

Shade in the download bar to show your progress in the lesson

0% 25% 50% 75% 100%



Downloading....



Record your success for the 3 Plickers questions:



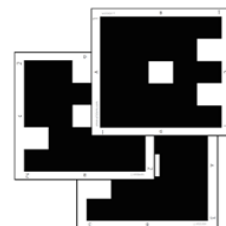
Q1:



Q2:



Q3:



2.2

Basic movements

K

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**



Key term

Flexion:

-
-
- E.g.



Key term

Extension:

-
-
- E.g.

Key term

Rotation:

-
-
- E.g.



2.2

Basic movements

Key term

Abduction:

-

E.g.

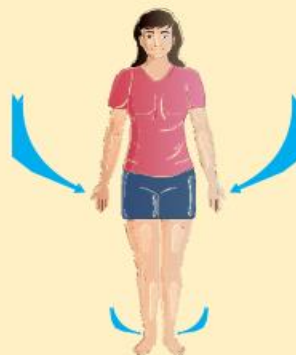


Key term

ADDuction:

-

E.g.



Dorsiflexion

Plantarflexion

Key term

Plantarflexion:

-

E.g.

Key term

Dorsiflexion:

-

E.g.



2.2

Basic movements

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.



A

Identify the movement produced in Usain Bolt's **elbows and left knee** in this image.



2.2

Basic movements

V

E

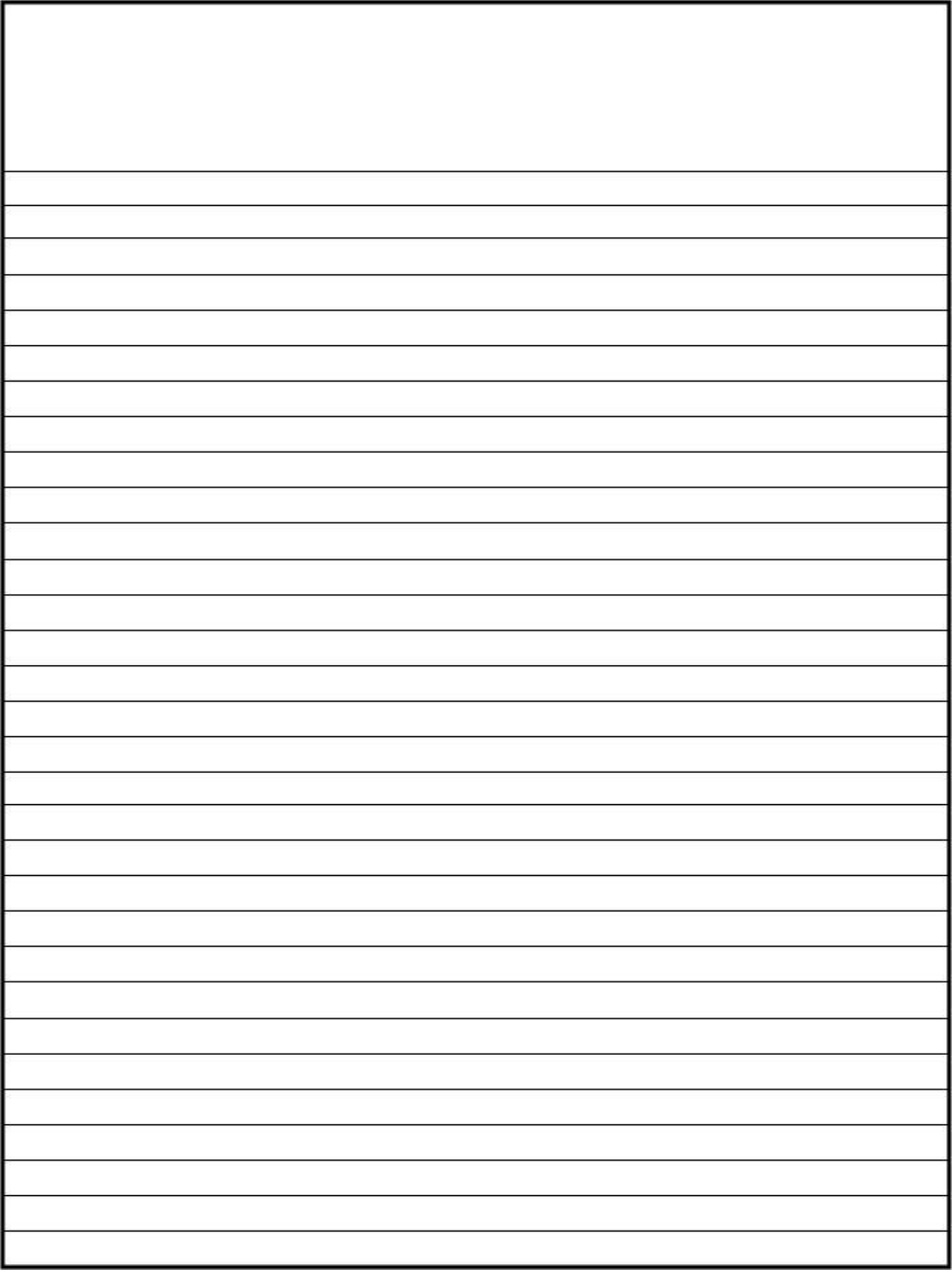
Identify the movements produced in the **shoulder, elbow and knee** joints of the performers pictured.



1. _____

2. _____





2.3

Types of levers

Date: ____/____/____

Learning Objectives



Describe the components of first, second and third class levers



To draw and explain the structure of the levers



To apply each lever movement to specific sporting examples

3.1.2 – Movement Analysis	
Start of the lesson	End of the lesson
1. Describe a first class lever	
2. What is a fulcrum?	
3. Describe a second class lever	
4. What is mechanical advantage?	
Start of the lesson: DOWNLOAD BAR Shade in the download bar to show how many questions you could answer 0%25%50%75%100% Downloading.....	End of the lesson (Actual %): DOWNLOAD BAR Shade in the download bar to show your progress in the lesson 0%25%50%75%100% Downloading.....

When do we use levers in everyday life?

2.3

Types of lever

K

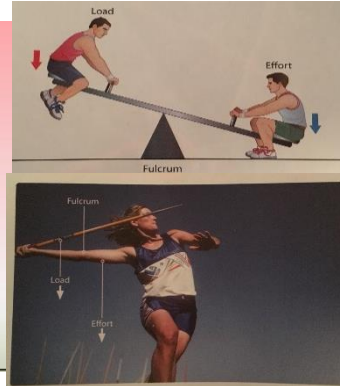
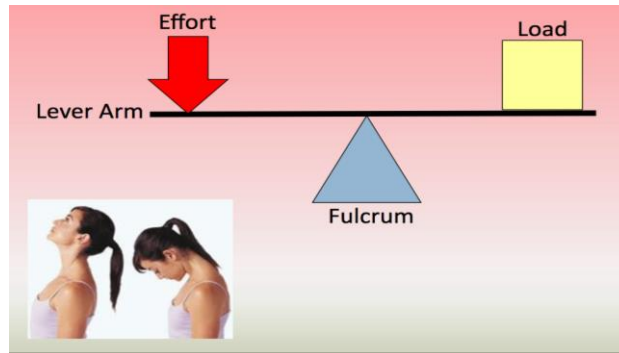
All movements made by the body are produced by a series of levers working together. Without levers we would not be able to throw or kick a ball, run or jump. A lever is a rigid bar that turns about an axis to create movement.

There are three types of levers – first class levers, second class levers and third class levers. They all make use of a fulcrum, load and effort.

1st class lever

First class levers have the fulcrum midway between the effort and the load.

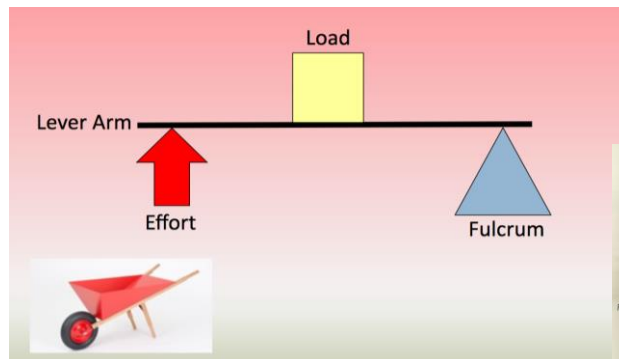
Also, the fulcrum is usually quite close to the effort and the load



2nd class lever

Second class levers have the load between the fulcrum and the effort.

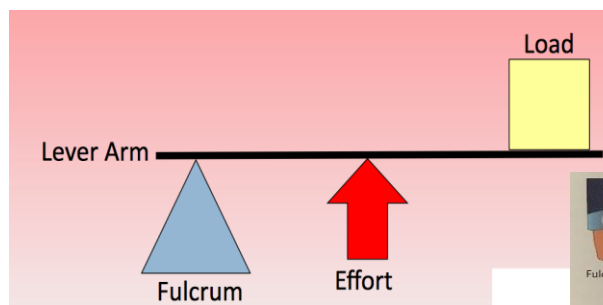
This means that a large load can be moved with relatively low effort



3rd class lever

Third class levers have the effort placed between the fulcrum and the load.

This means they can produce a large movement with relatively low effort



2.3

Types of levers



See page 32

R

Key term

Lever:

Key term

Fulcrum:

Key term

Load:

Key term

Effort:

First class lever

Example from the human body:

**R****Second class lever**

Example from the human body:

Third class lever

Example from the human body:

2.3

Types of levers



See page 33

A

V

E

Look at movements and identify where the FULCRUM (pivot), EFFORT (force) and RESISTANCE (load) are.



Lever _____



Lever _____



Lever _____



Lever _____

2.3

Types of levers



See page 33

A

V

E



Lever _____



Lever _____



Lever _____



R

Mechanical advantage measures the efficiency of a lever. It is calculated as follows:

Mechanical advantage = _____

The benefit of a lever is linked to whether it operates at high mechanical advantage or low mechanical advantage. This is determined by the length of the load arm compared to the length of the effort arm.

Complete the flow diagram to outline the link between levers and mechanical advantage.

LEVERS	
	
Load arm longer than effort arm	Effort arm longer than load arm
Does this have high or low mechanical advantage?	Does this have high or low mechanical advantage?
Which lever class/classes give this?	Which lever class/classes give this?
What benefit does this bring?	What benefit does this bring?

2.3

Types of levers



See page 33

A

Exam questions

1. Which one of the following describes a second class lever system? (1)

V

- A The resistance is at the right-hand end of the lever
- B The fulcrum is in the middle of the lever
- C The resistance is in the middle of the lever
- D The resistance and the fulcrum are at the same point on the lever

E

2. Label the lever system below (4)

Lever class = _____







3. Figure 4 shows a basketball player jumping to execute a shot. Draw the lever system which operates at the ankle joint in the space below. Label the fulcrum, effort and resistance. (3)



2.3

Types of levers



See page 33

A

V

E

4. Analyse how the following parts of the lever system allow the weight trainer in **Figure 5** to lift the weight.



(i) Fulcrum (2)

(ii) Effort (2)

**E**

Let's have a look at an extended writing question for levers.

Read the high-level answer provided below and:

- 1)** Highlight the key terms and important information.
- 2)** Add annotations around the outside to define key terms, add any extra detail and comment on things you like about the style of the answer. Imagine you are peer-marking this person's answer for them.
- 3)** Use the next page to reverse plan an answer. Transfer the key information from the answer into the planning sheet. This will help you think about how you might approach answering a similar question in a structured way.

Discuss whether second or third class levers are more important to the performance of a sprinter.

[6 marks]

Second class levers operate with high mechanical advantage, which means that they can move heavy loads with relatively low effort.

This is because the effort arm is longer than the load arm.

Third class levers operate with low mechanical advantage, which means that they cannot move as heavy loads with the same effort as second class levers. The benefit of these levers is that they produce a greater range of movement and, therefore, can increase distance moved and speed at the end of the lever.

There is a second class lever created as the foot contacts the floor when sprinting, with the fulcrum found at the ball of the foot as a person leaves the ground. The effort for this lever comes from the gastrocnemius muscle with the load being the person's body weight. As the sprinter leaves the ground, the load (weight) is between the effort and the fulcrum, which makes it a second class lever and brings high mechanical advantage. This is key in driving the weight of the sprinter off the ground.

There are third class levers at most other joints in the body. At the shoulders and elbows, third class levers allow large arm movements to take place, which adds momentum. Even more crucially, at the hips and the knees, the third class levers allow a large range of movement and greater speed to be created as the legs move forwards and backwards during the sprint.

Both these levers are very important to the performance of the sprinter. Without the third class levers, the arms and legs would not be able to move as quickly and would not be able to create the same momentum. The second class lever, with its high mechanical advantage, allows the sprinter to drive off the ground and power forward. It is the combination of both levers in the body that allow a sprinter to run fast.

2.3

Types of levers



See pages
32- 35

E

It is almost certain that AO1 (knowledge and understanding), AO2 (application) and AO3 (analysing and evaluating) will all be tested in an extended writing question. To make sure that you can access all six marks, you should consider how you tackle each Assessment Objective in your answer.

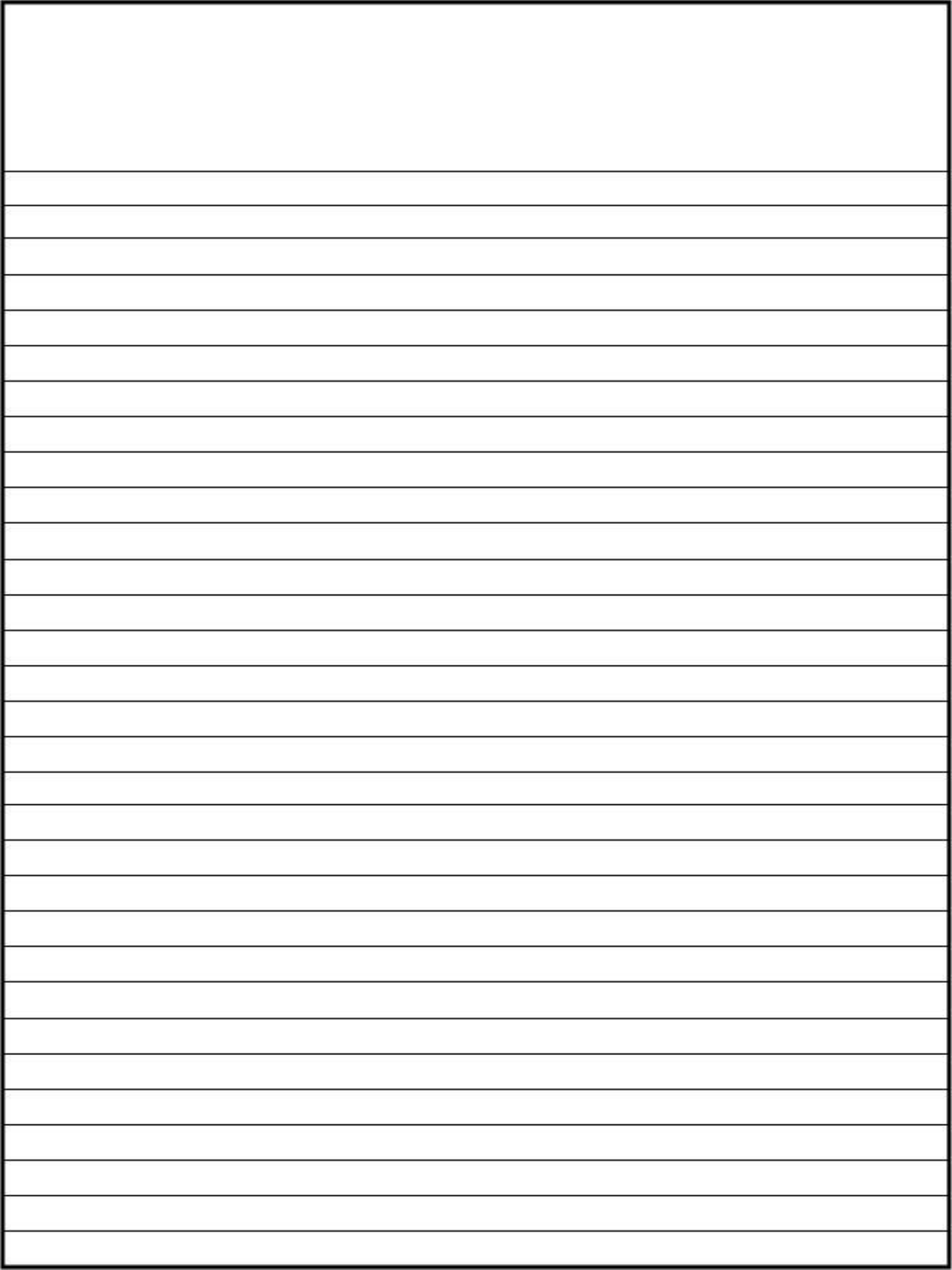
To practice this, transfer the key information from the answer on '2.4 Levers: extended writing answer analysis' into the planning boxes below in bullet point format.

QUESTION

Discuss whether second or third class levers are more important to the performance of a sprinter.

[6 marks]

AO1: Knowledge and understanding of the raw content	Discussion of levers in general terms	
AO2: Apply knowledge to sporting examples	Application of levers knowledge to sprinting example	
AO3: Analyse, evaluate and conclude	Conclusion evaluating importance of each type of lever in the performance of a sprinter	



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.

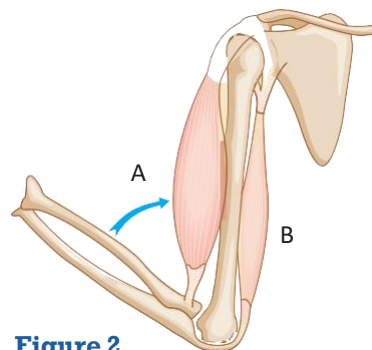


Figure 2

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)

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

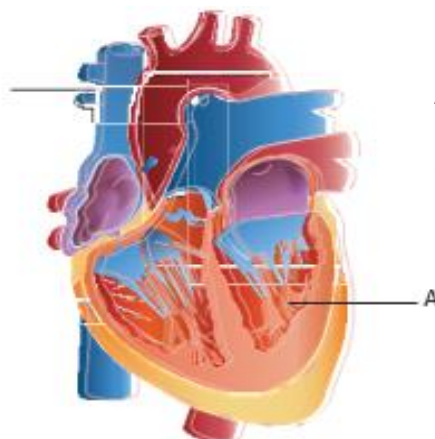
18 Which **one** of the following describes the alveoli? (1)

- 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

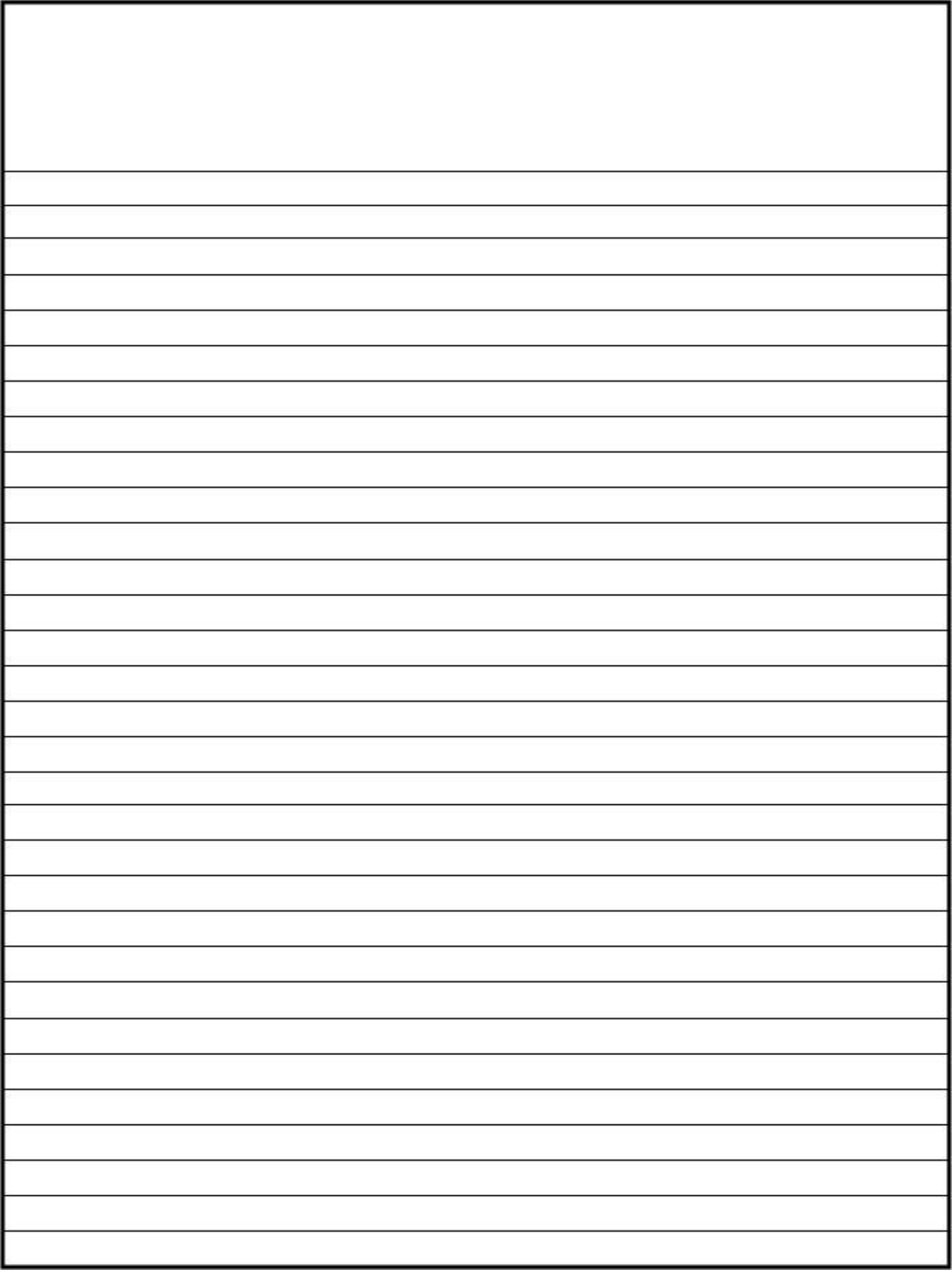
19 Which **one** of the following describes an isometric contraction? (1)

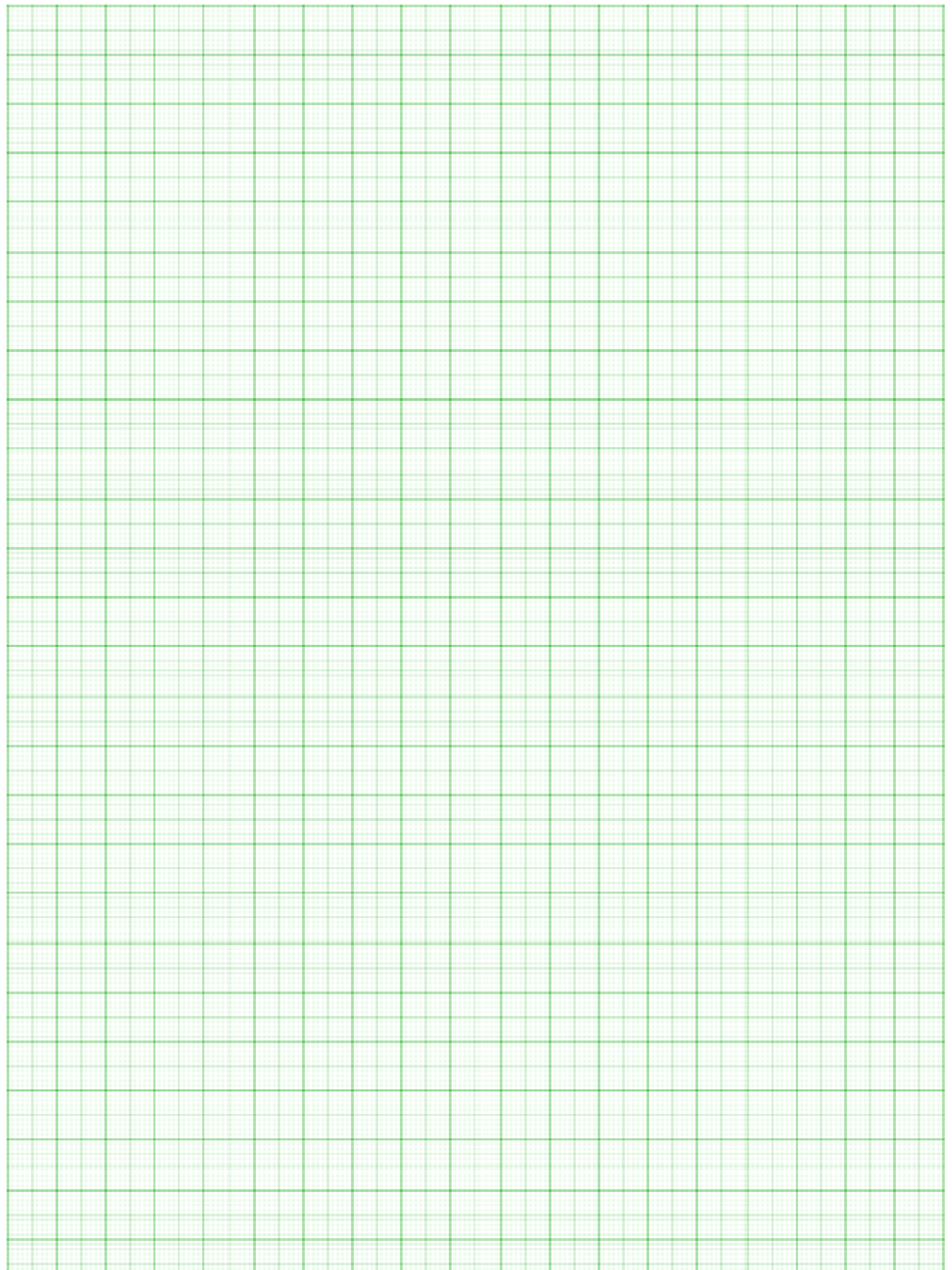
- A. The muscle lengthens when it contracts
- B. The muscle shortens when it contracts
- C. The muscle stays the same length
- D. The muscle contracts

20 Identify the structure labelled A below. (1)



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







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