

## 2.1. Lever Systems

## 2.2 Planes and Axes of Movement

Name \_\_\_\_\_

Class \_\_\_\_\_



Topic	Description from Specification	Pupil comments – How confident do you feel on this topic?
2.1.1	First, second and third class levers and their use in physical activity and sport	
2.1.2	Mechanical advantage and disadvantage (in relation to loads, efforts and range of movement) of the body's lever systems and the impact on sporting performance	
2.2.1	Movement patterns using body planes and axes: sagittal, frontal and transverse plane and frontal, sagittal, vertical axes applied to physical activities and sporting actions	
2.2.2	Movement in the sagittal plane about the frontal axis when performing front and back tucked or piked somersaults	
2.2.3	Movement in the frontal plane about the sagittal axis when performing cartwheels	
2.2.4	Movement in the transverse plane about the vertical axis when performing a full twist jump in trampolining	

What do you think of when you hear the word 'lever'?

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How do you think parts of your body can be referred to as levers?

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Every lever has 3 components. Use the words below to fill in the gaps.

A **fulcrum** – The \_\_\_\_\_ around which the lever \_\_\_\_\_

A **load** – The \_\_\_\_\_ of the thing that you want to \_\_\_\_\_

An **effort** – The \_\_\_\_\_ that is applied by the user of the \_\_\_\_\_ system

force    axis    move    force    lever    rotates

Think about a darts player throwing a dart. What would be the....

**Fulcrum:** \_\_\_\_\_

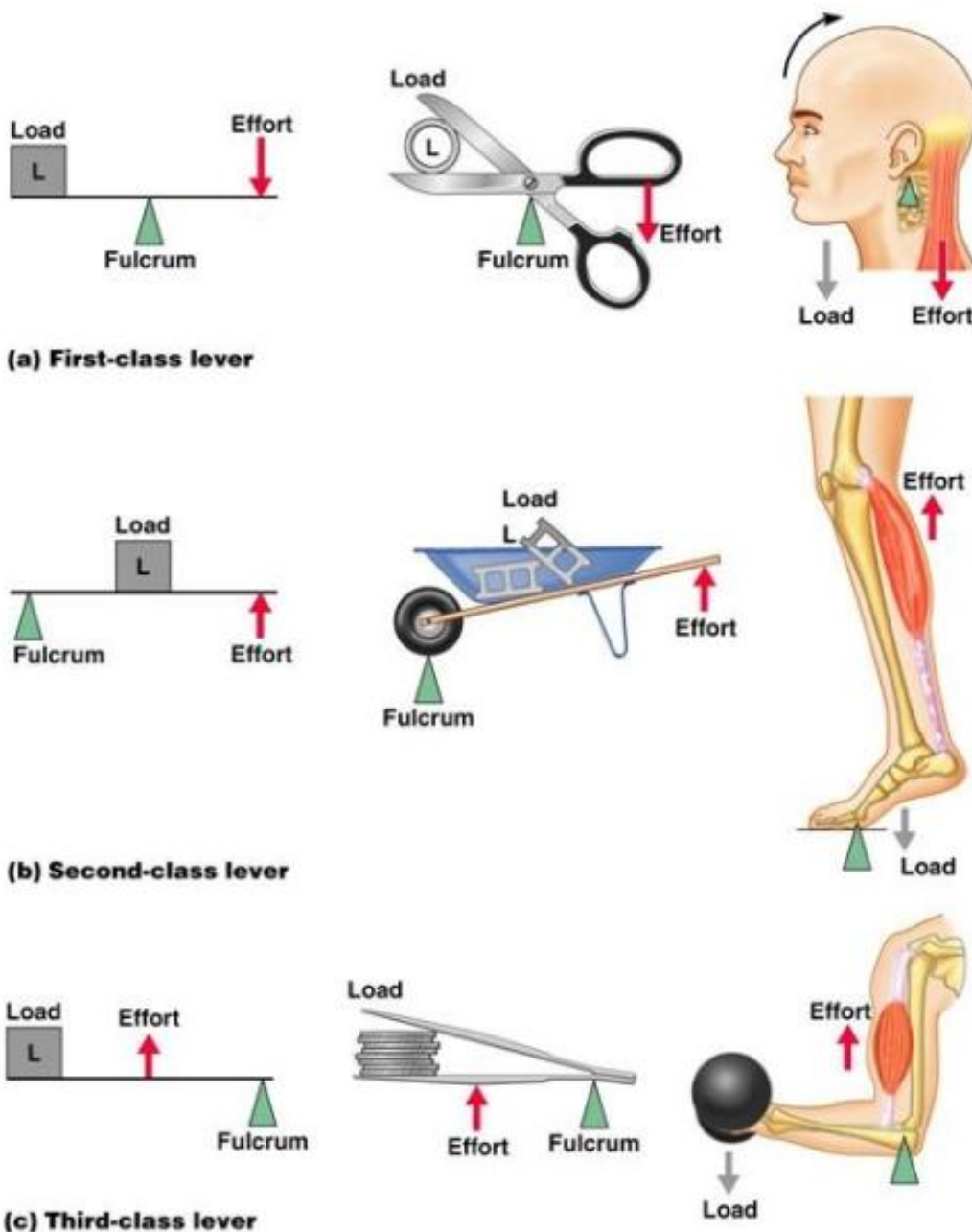
**Load:** \_\_\_\_\_

**Effort:** \_\_\_\_\_



## Different Classes of Lever:

Levers are classified as either **First Class**, **Second Class** or **Third Class** according to the placement of the fulcrum, load and effort.



1<sup>st</sup> Class = **Fulcrum** in the middle

2<sup>nd</sup> Class = **Load** in the middle

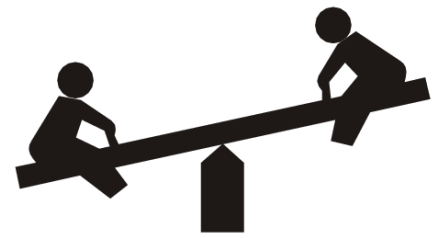
3<sup>rd</sup> Class = **Effort** in the middle

To remember what is in the middle you simply need to think FLE. Think 'FLY LITTLE ELF' to remember this.

**First Class Levers: Load – Fulcrum - Effort**

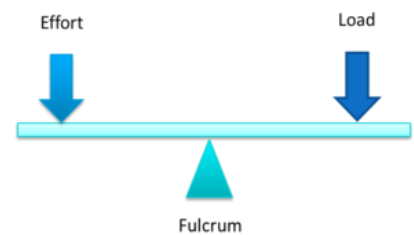
In this lever system the fulcrum sits in the middle, between the load and the effort.

For the pictures shown, fill in the table below.



Exercise/Activity	Load	Fulcrum	Effort

Can you think of any other first class lever systems?



## Second Class Levers: Fulcrum – Load - Effort

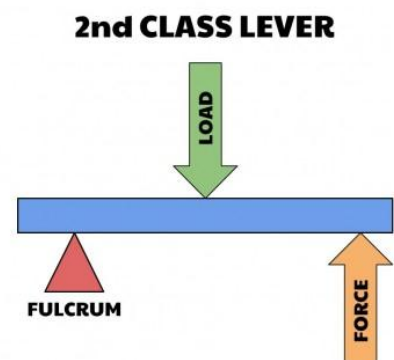
In this lever system, the load sits between the fulcrum and the effort

For the pictures shown, fill in the table below.



Exercise/Activity	Fulcrum	Load	Effort

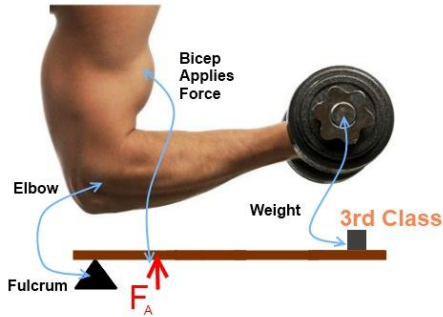
Can you think of any other second class lever systems?



### Third Class Levers: Fulcrum – Effort - Load

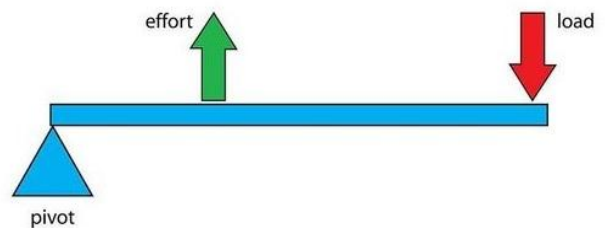
In this lever system, the effort is applied between the fulcrum and the load.

For the pictures shown, fill in the table below.



Exercise/Activity	Fulcrum	Effort	Load

Can you think of any other third class lever systems?



Hint - you must know the difference between each lever system and the location of the fulcrum, effort and load

Advantages/Disadvantages of lever systems:

Class of lever	Advantage	Disadvantage
First Class	<b>Mechanical Advantage</b> – A large load can be lifted with relatively little effort, <b>due to the effort ‘arm’ being long</b>	Slower Movement Limited Flexibility
Second Class	<b>Mechanical Advantage</b> – A large load can be lifted with relatively little effort, <b>due to the effort ‘arm’ being long</b>	Slower Movement Limited Flexibility
Third Class	Fast Movement Large Range of Motion	<b>Mechanical Disadvantage</b> – Cannot lift as heavy a load with the same amount of effort, <b>due to the effort ‘arm’ being short</b>

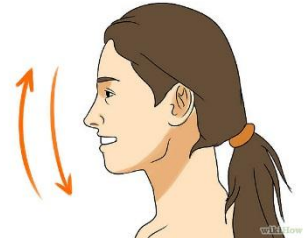
Why is your head an example of a first class lever system? (3)

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Analyse the first class lever system used at your head. (3)

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Think about the word 'analyse' and what this question is asking



Rowing is an example of which lever system? (1)

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Analyse the role of this lever system in affecting a rowers' performance?

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A bicep curl is an example of which type of lever system? (1)

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Give one advantage and one disadvantage of the lever system used when performing a bicep curl (2)

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## Planes & Axes of Movements:

Different sports often require different types of movement and positioning. For the following sports, in your own words describe the positioning of the body.

Tennis \_\_\_\_\_

Swimming \_\_\_\_\_

Trampolining \_\_\_\_\_

## **Planes:**

Planes are theoretical divisions that divide the body into sections. There are three planes of motion in the body.

### **1. The Sagittal Plane:**

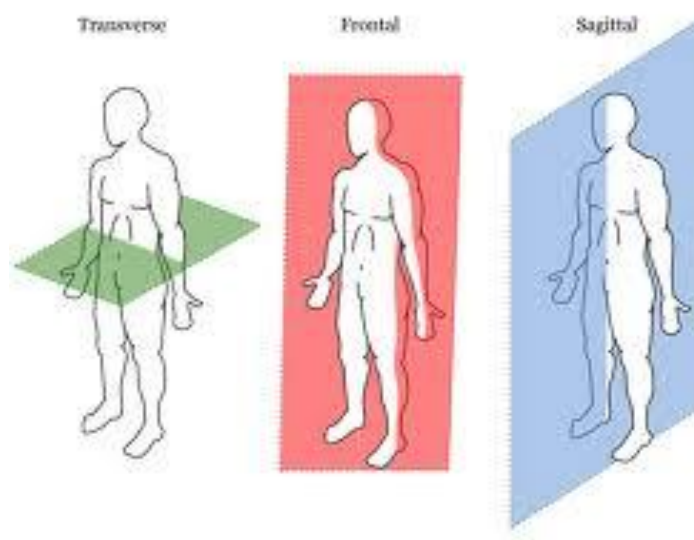
Splits the body down the middle resulting in a \_\_\_\_\_ side and a \_\_\_\_\_ side.

### **2. The Frontal Plane:**

Divides the body so that there are \_\_\_\_\_ and \_\_\_\_\_ sections.

### **3. The Transverse Plane (AKA Horizontal Plane):**

Divides the body across the middle (horizontally), giving a \_\_\_\_\_ section and a \_\_\_\_\_ section.



Underneath each of the pictures shown above, write down one of the following phrases to describe the movement possible within the plane. Think about how the person could move and **still keep the plane intact**:

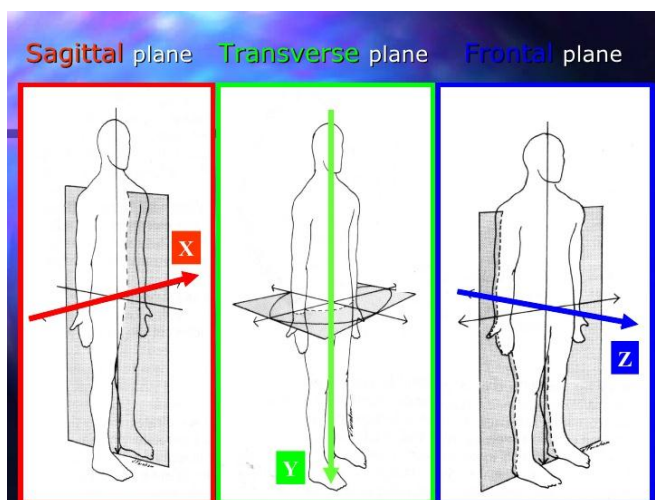
- Forward or backward
- Side to side
- Rotational

Use the table below to select the plane of movement for each exercise/sporting action:

Exercise/Action	Plane
Walking	
Side Bends	
Side Stepping	
Jogging	
360 degree twist	

### Axes:

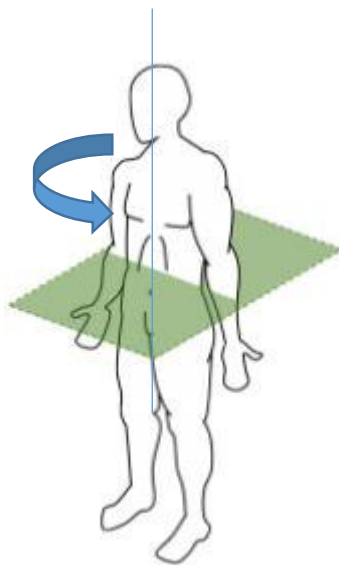
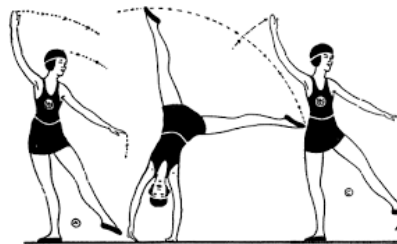
The joints in our bodies rotate around one of three different axes. These axes allow rotation to take place in one of the planes. There are three different axes:



1. **The Frontal Axis:**  
From hip to hip
2. **The Vertical Axis:**  
Vertical line - top to bottom
3. **The Sagittal Axis:**  
Stabs through the body

Use the table below to state the plane and axes present during each movement/action.

Movement/Action	Plane	Axes
Forward Roll		
Cartwheel		
Somersault		
Twist Jump		



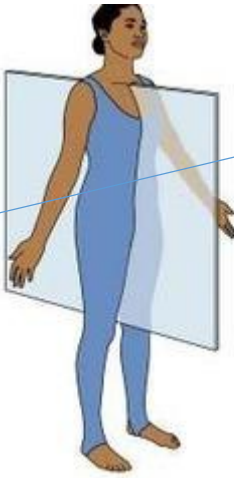
**Sample exam questions:**

Identify the plane and axis shown in the figure on the left (1)

\_\_\_\_\_

Give an example of a sporting action used at this plane and axis?

\_\_\_\_\_



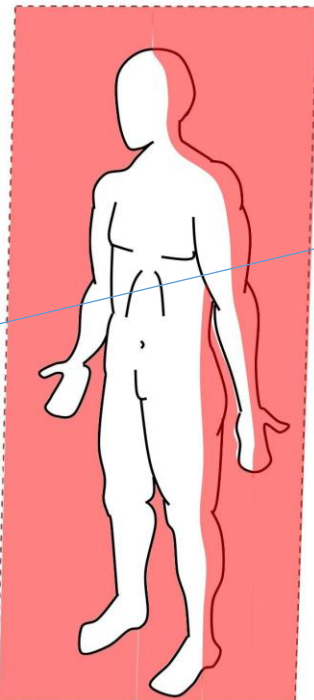
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**Sample exam questions:**

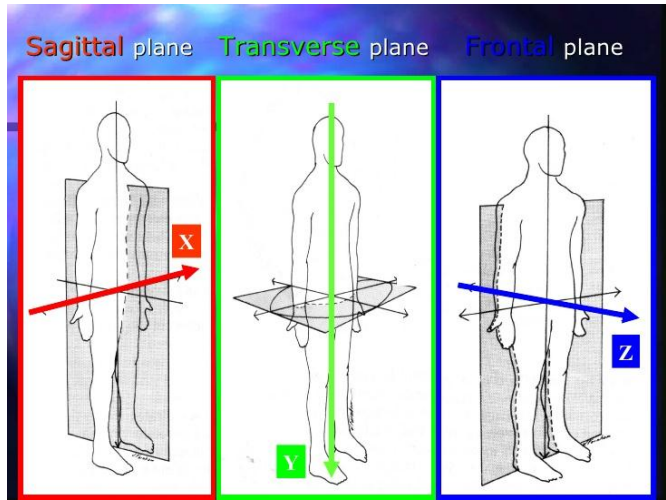
Identify the plane and axis shown in the figure on the left (1)

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Give an example of a sporting action used at this plane and axis?

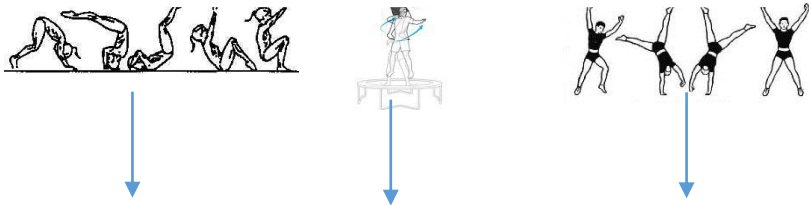
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# Revision



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**Frontal Axis**      **Vertical Axis**      **Sagittal Axis**



## Planes:

Sagittal = **Split** down the middle

Transverse = **Top** and bottom

Frontal = **Front** and back

## Axes:

Frontal = **From** hip to hip

Vertical = **Vertical** line

Sagittal = **Stab** through the body

Sagittal Plane and Frontal Axis = **Forward Roll**

Transverse Plane and Vertical Axis = **Twist**

Frontal Plane and Sagittal Axis = **Cartwheel**

<p><b><u>Planes</u></b></p>	<p>Sagittal (<b>Split</b> down the middle)</p>	<p>Transverse (<b>Top</b> and bottom)</p>	<p>Frontal (<b>Front</b> and back)</p>
<p><b><u>Axes</u></b></p>	<p>Frontal (<b>From</b> hip to hip)</p>	<p>Vertical (<b>Vertical</b> line)</p>	<p>Sagittal (<b>Stab</b> through the middle)</p>
<p><b><u>Sporting Action</u></b></p>	<p>Forward Roll/Somersault</p>	<p>Twist Jump</p>	<p>Cartwheel</p>

**Key Terms:**

**Fulcrum** – The point around which the lever rotates

**Load** – The force of the thing that you want to move

**Effort** – The force that is applied by the user of the lever system

**Mechanical Advantage** – A large load can be lifted with relatively little effort

**Mechanical Disadvantage** – Cannot lift as heavy a load with the same amount of effort

**Plane** – An imaginary line dividing the body vertically into left and right sides

**Axis** - An imaginary line dividing the body vertically from front to back