Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9–1)

PHYSICAL EDUCATION

J587
For first teaching in 2016

Movement Analysis

1.1.c. Movement Analysis

Learning Outcomes

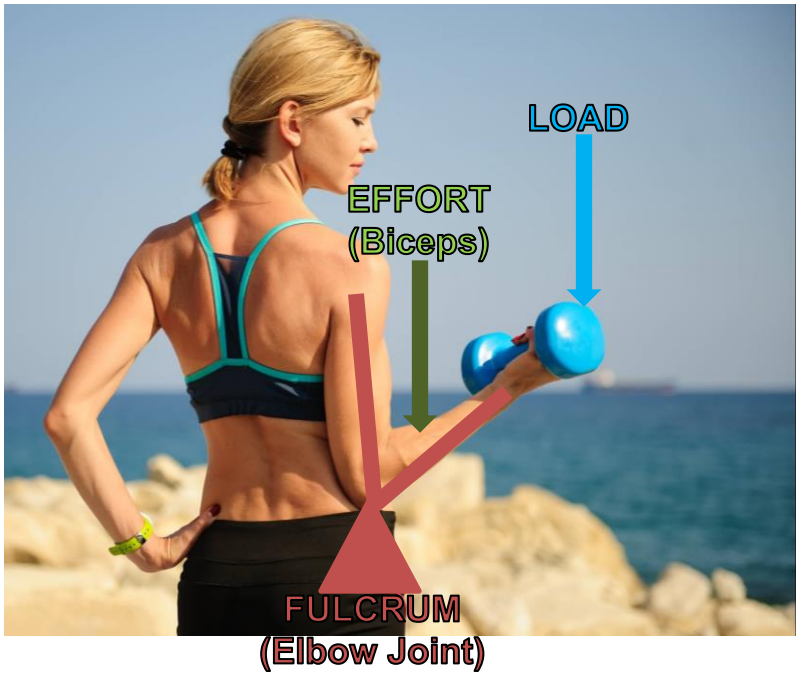
BY THE END OF THIS TOPIC YOU SHOULD ……

- **Know the three classes of lever and their use in physical activity and sport.**
  - ***1st Class: example - Neck***
  - ***2nd Class: example – Ankle***
  - ***3rd Class: example - Elbow***
- **Know the definition of mechanical advantage**
- **Know the location of planes of movement in the body and their application to physical activity and sport:**
  - ***Frontal***
  - ***Transverse***
  - ***Sagittal***
- **Know the location of axes of rotation in the body and their application to physical activity and sport:**
  - ***Frontal***
  - ***Transverse***
  - ***Longitudinal***

Lever Systems

Many bones and muscles work together to form **levers**.
Our bones form a rigid structure that turns about a **fulcrum** (the joint).

Levers are used to make a small amount of force into a much bigger force.
This is known as gaining a **Mechanical Advantage.**

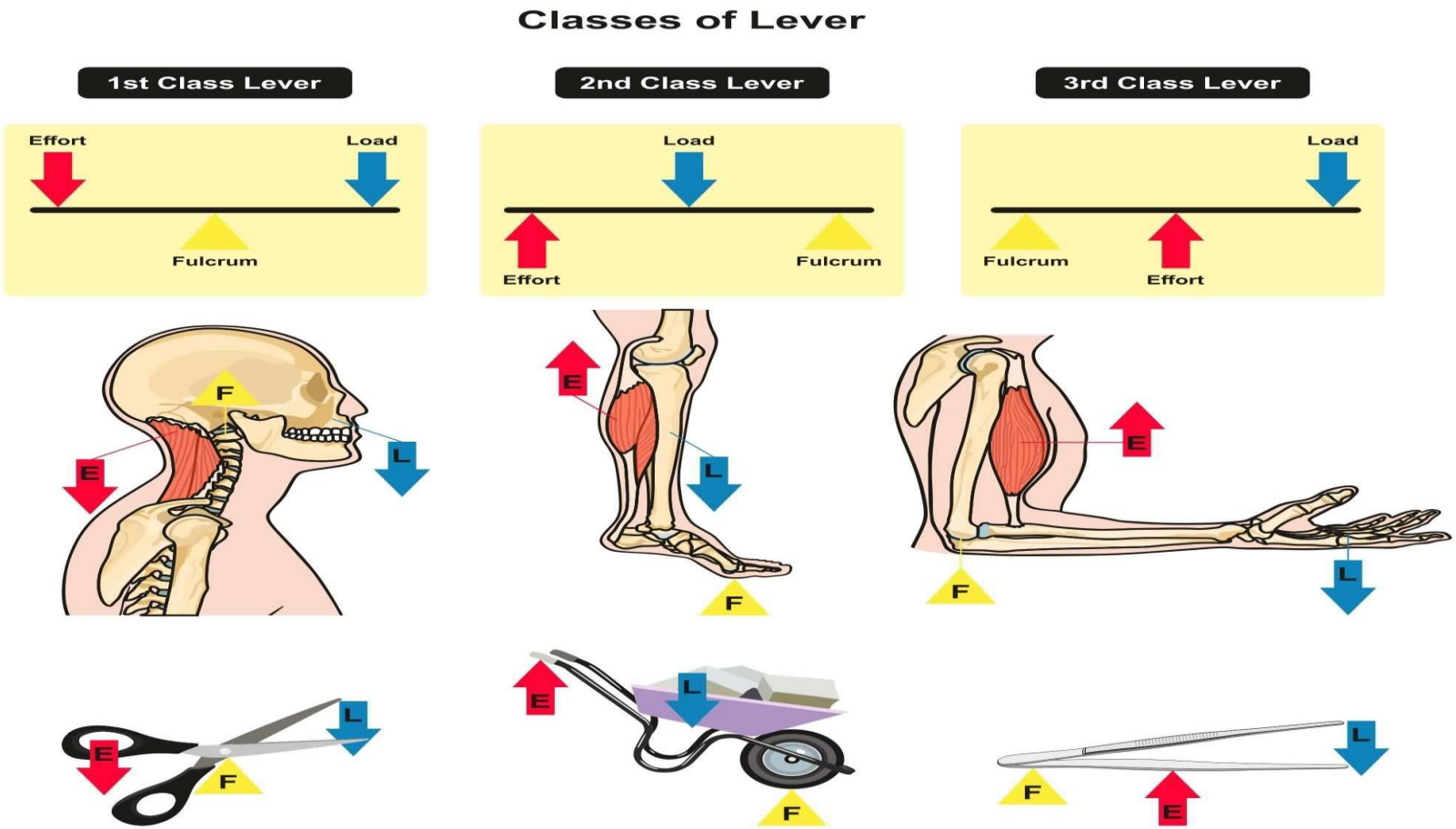


There are 4 parts to a lever:

1. **Lever Arms** (Bones)
2. **FULCRUM** (Joints)
3. **EFFORT** (Muscles provide the effort to move loads e.g. BICEPS)
4. **LOAD** (load forces are often the weight of the body parts that are moved or forces needed to lift, push or pull things like weights, balls, throwing implements etc.)

Lever Systems

Let's Look at the Three Classes of Lever in more detail



REMEMBER!!

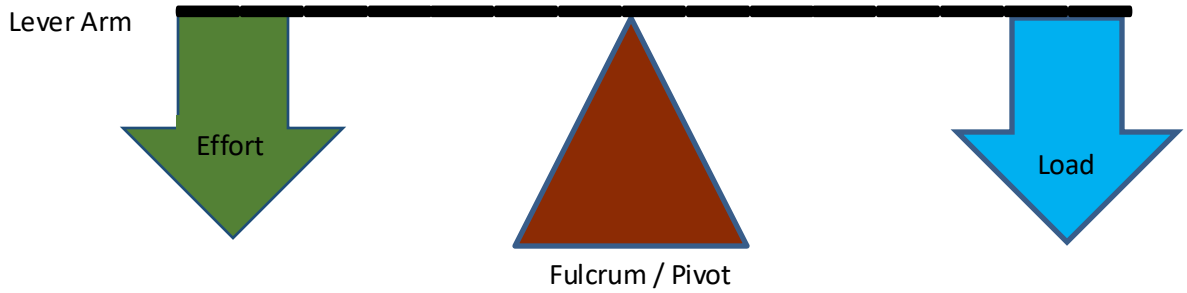
EFL the ELF FELL!

EFL = 1ST CLASS ELF = 2ND CLASS FEL = 3RD CLASS

Lever Systems

Class of lever – First Class (EFL)

This is a lever where the **Fulcrum** (pivot) occurs between the **effort** and **load**.

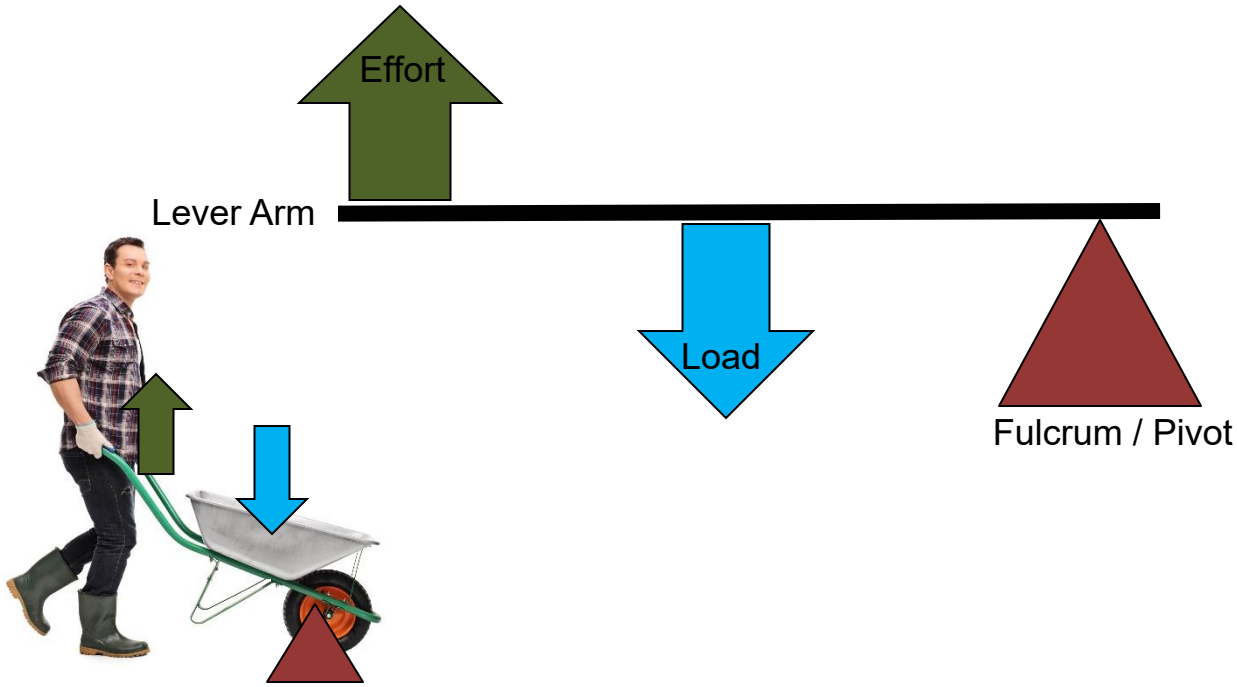


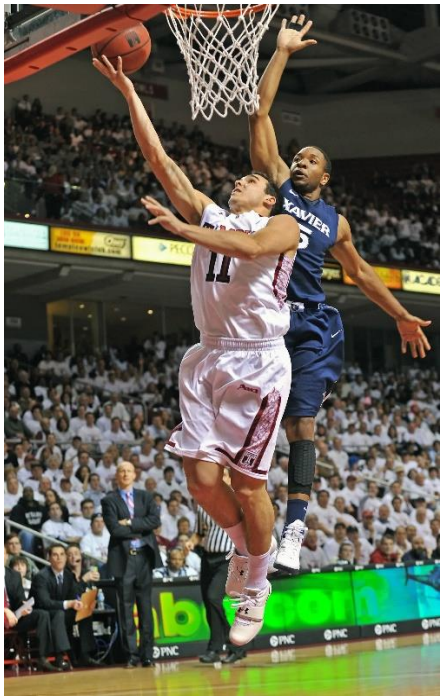
Practical example: **at the neck – heading a ball in football**

Lever Systems

Class of lever – Second Class (ELF)

This lever occurs when the **load** is between the **effort** and the **fulcrum.**



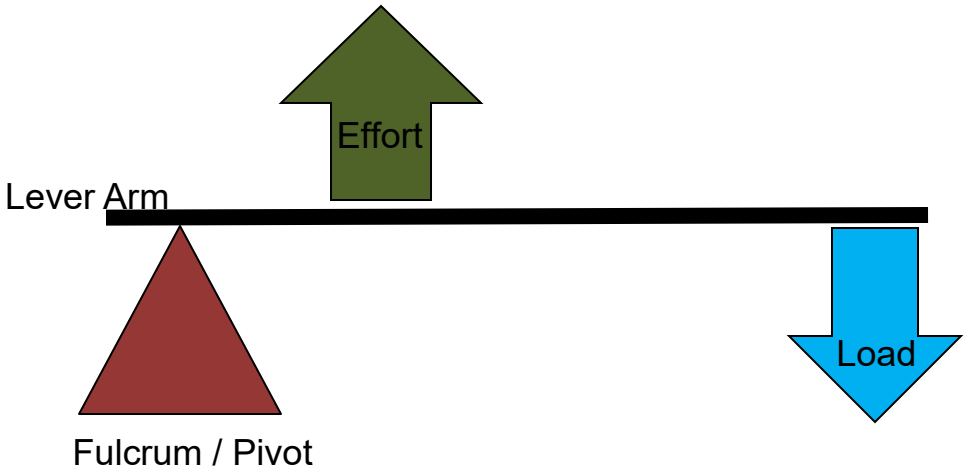


Practical example: **at the ankle – taking off a lay up in basketball**

Lever Systems

Class of lever – Third Class (FEL)

This lever occurs when the **effort** lies between the **fulcrum** and **load**.
This is very common in human movement.



Practical example: **the action of the biceps and the triceps at the elbow joint when shooting a basketball**

Lever Systems

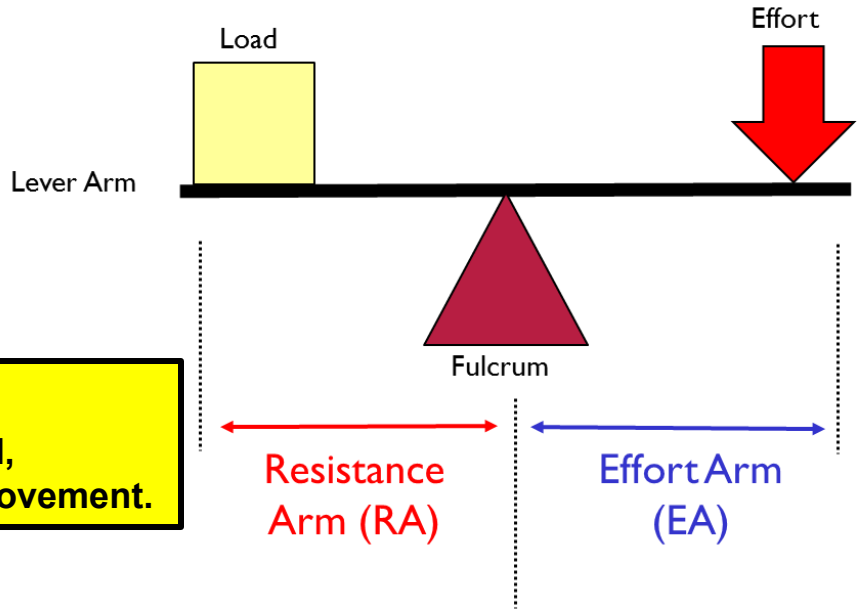
Mechanical Advantage

Definition:

The relative efficiency of each of the lever systems is called the 'mechanical advantage'.

TASK: Use the following equipment to explore how high you can propel the eraser.

RULER
ERASER
PENCIL/PEN



What you should find:

The greater the Effort arm the greater the force produced, however the greater the Resistance Arm the faster the movement.

How can the 1st class lever be adjusted to increase or change how high the load can be propelled?

Lever Systems

Mechanical Advantage

Class 1 and class 2 levers both provide **mechanical advantage**.

This means that they allow you to move a large output load with a small effort.

Definition:
The relative efficiency of each of the lever systems is called the 'mechanical advantage'.

Lever Systems

Mechanical Advantage

The body's levers can be made even more effective by using rackets, oars, paddles, sticks and bats.

These pieces of equipment increase the length of the resistance arm of the lever. This in turn increases the speed at the end of the lever.

Planes of Movement

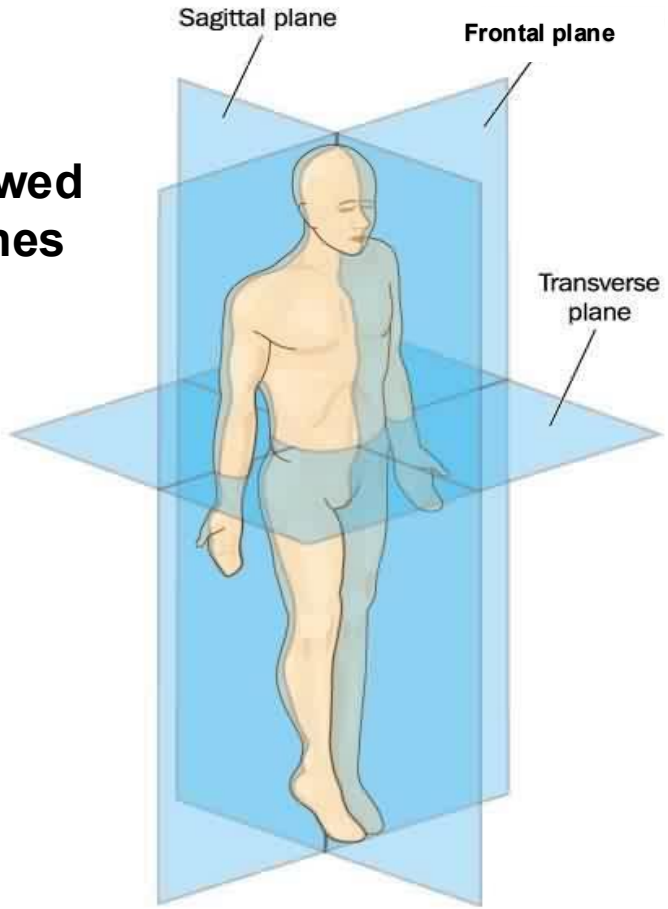
Planes and axes of movement

https://www.youtube.com/watch?v=Z7dFWU9J0EU

Planes of Movement

Planes of movement

To help explain movement, the body can be viewed as having a series of imaginary slices/glass panes running through it.



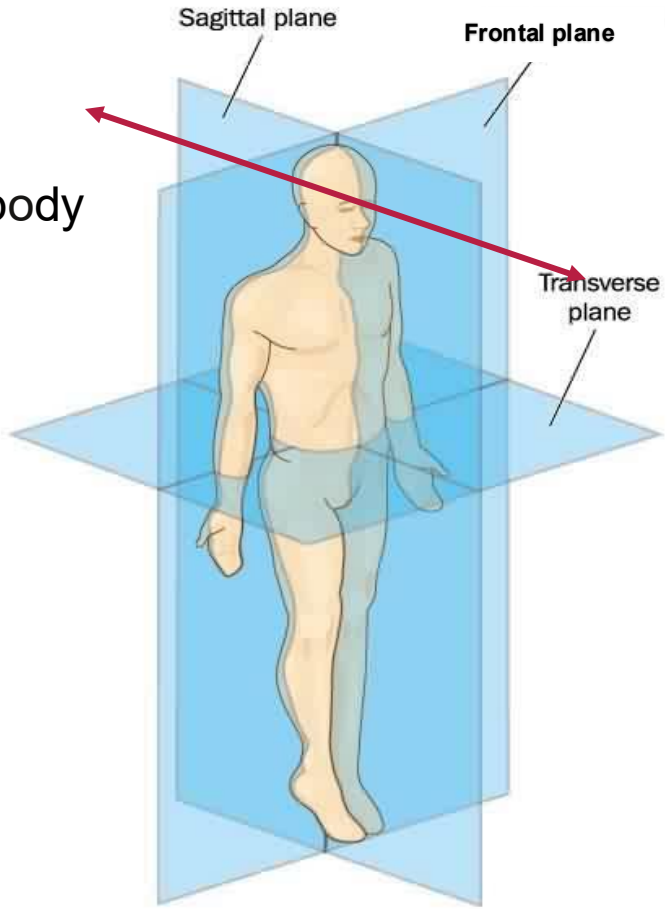
TASK

In groups using the play-doh and card.
Firstly, make 3 human bodies using the play-doh.
Then, use the card to show each of the 3 planes of movement.

Planes of Movement

SAGITTAL Plane

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



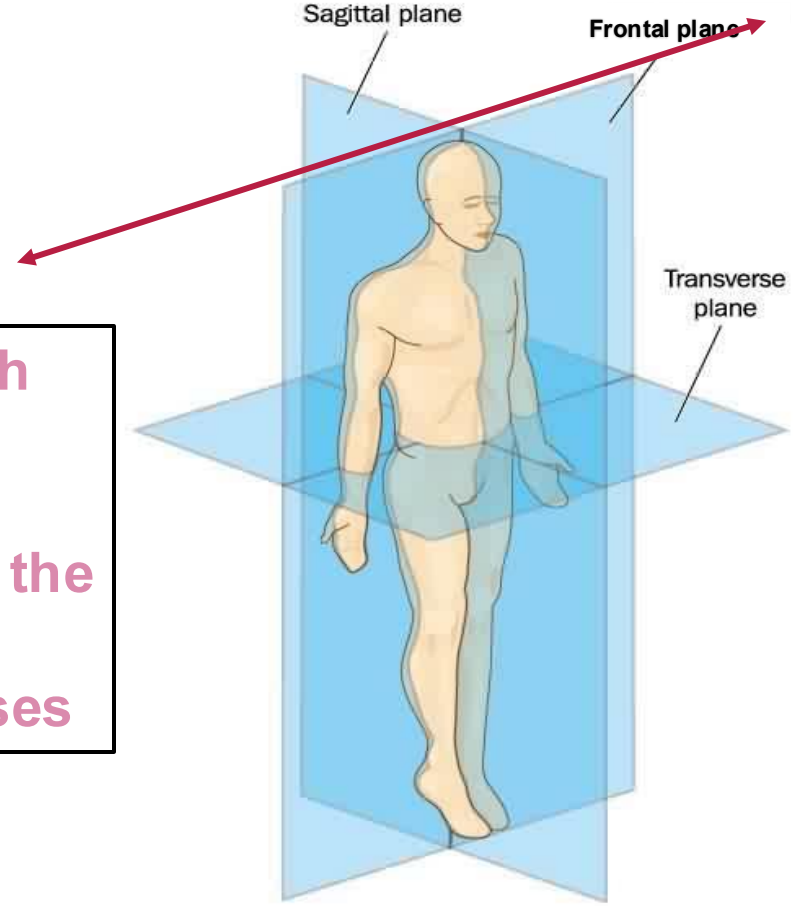
Practical example of movement through the sagittal plane

running / sit ups / bicep curl / somersault

Planes of Movement

FRONTAL Plane

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



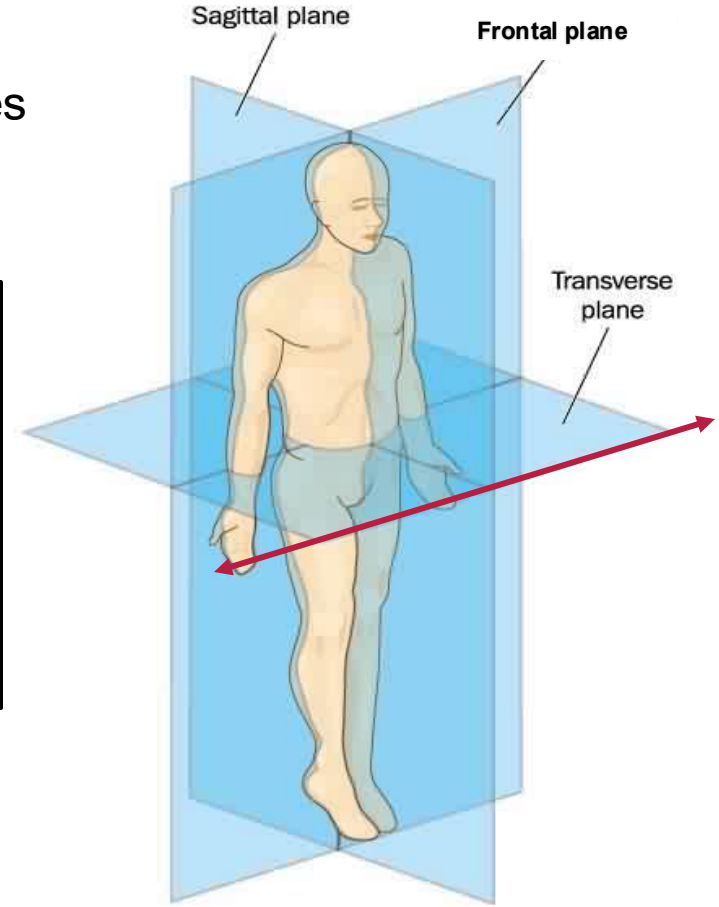
Practical example of movement through the frontal plane

abduction and adduction of the legs at the hip joint
e.g. performing star jumps type exercises

Planes of Movement

TRANSVERSE Plane

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



Practical example of movement through the transverse plane

Arm action (circumduction) when bowling in cricket with rotation at the shoulder

Axes of Rotation

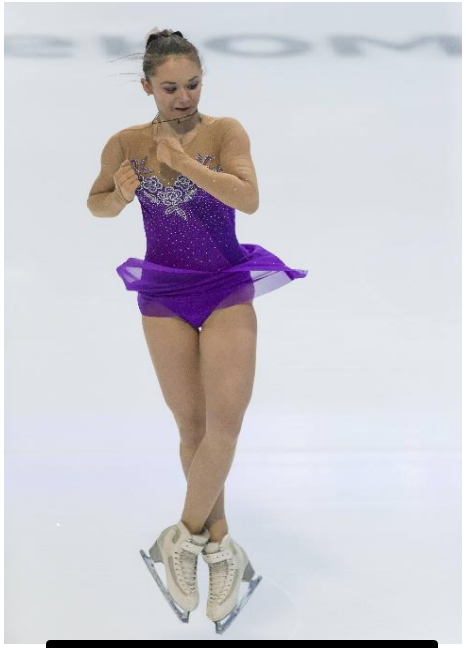
Axes of the body

Axes are like invisible skewers running through the body.

All movements rotate around one of the axes.

Transverse axis

Frontal axis

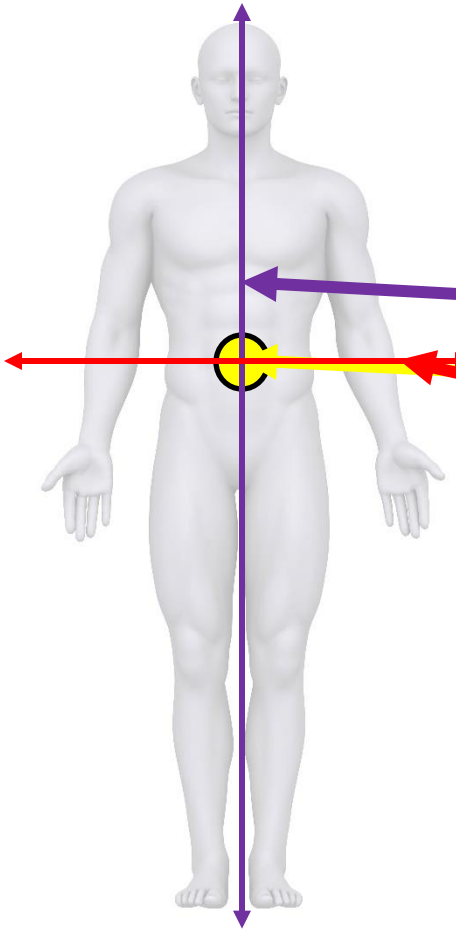


Longitudinal axis

Practical example: gymnasts will use multiple axes to perform their routines

Axes of Rotation

Axes of the body



TASK 1: in groups use the play-doh and cocktail sticks in front of you to show the following….

- **Longitudinal axis**
- **Frontal axis**
- **Transverse axis**

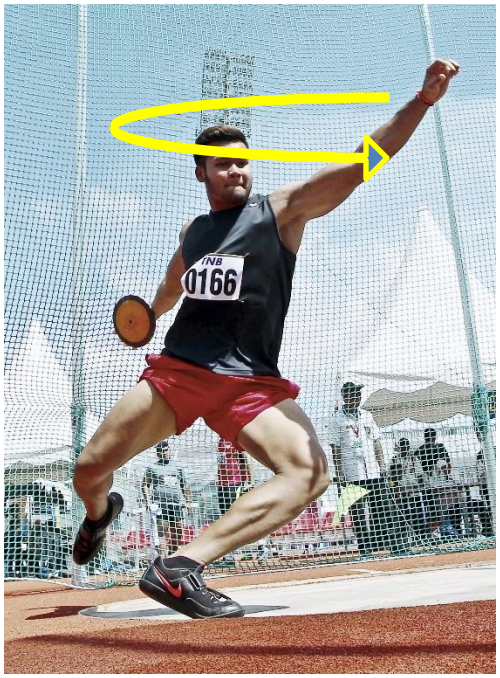
All movements rotate around one of the axes.

Axes of Rotation

Axes of the body

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

TASK:
Move your Play-Doh Figure using the Longitudinal Axis



Practical example: an axel jump in ice skating or a discus throw rotation

Axes of Rotation

Axes of the body

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

TASK: Move your Play-Doh Figure using the Transverse Axis

Practical example: somersault in diving or gymnastics

Axes of Rotation

Axes of the body

Frontal axis runs through the body horizontally from the **back** to **front**.

TASK: Move your Play-Doh Figure using the Frontal Axis

Practical example: cartwheel in gymnastics

Planes & Axes of Rotation

Planes & Axes of the body combined

Movement in the **sagittal plane** about the **transverse axis** allows for front somersaults/forward roll.

Practical example: somersault

Tip to Remember:
Left and right remain left and right

Planes & Axes of Rotation

Planes & Axes of the body combined

Movement in the **frontal plane** about the **frontal axis** allows for cartwheels.

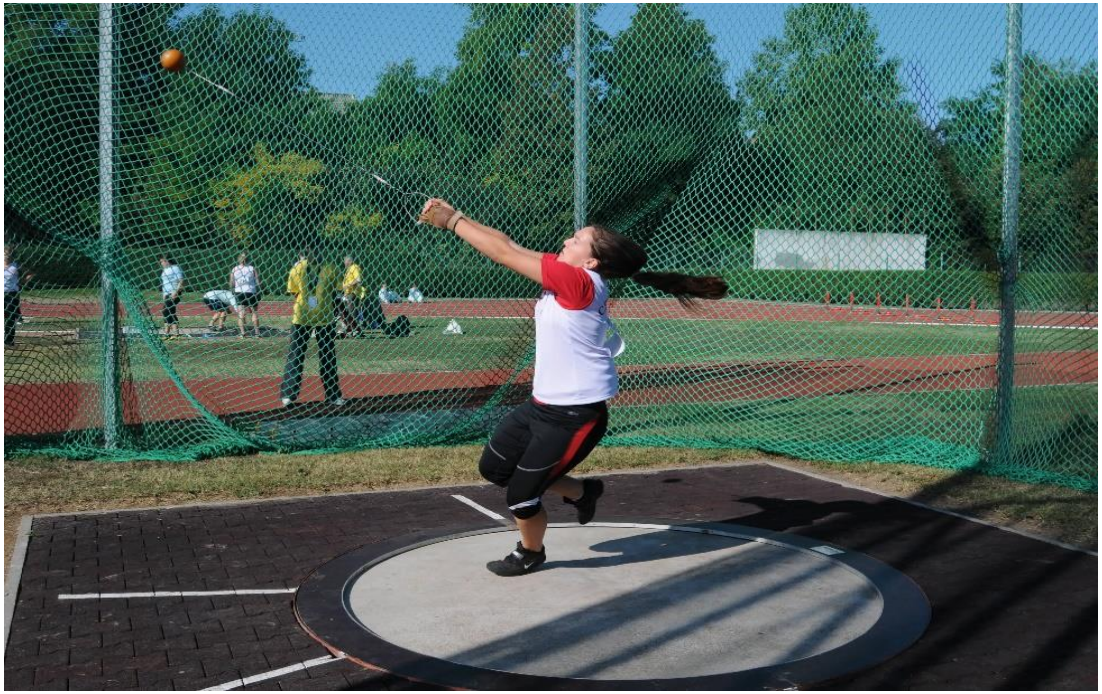
Practical example: cartwheel

Tip to Remember:
Front and back remain front and back

Planes & Axes of Rotation

Planes & Axes of the body combined

Movement in the **transverse plane** about the **longitudinal axis** allows for a 360 degree turn.



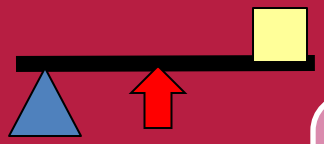
Practical example: hammer throw rotation

Tip to Remember:
Top and bottom remain top and bottom

Extension Task

Apply it!

Label the following levers components.



Describe the 3 levers in the body (use diagrams to help illustrate your answer)

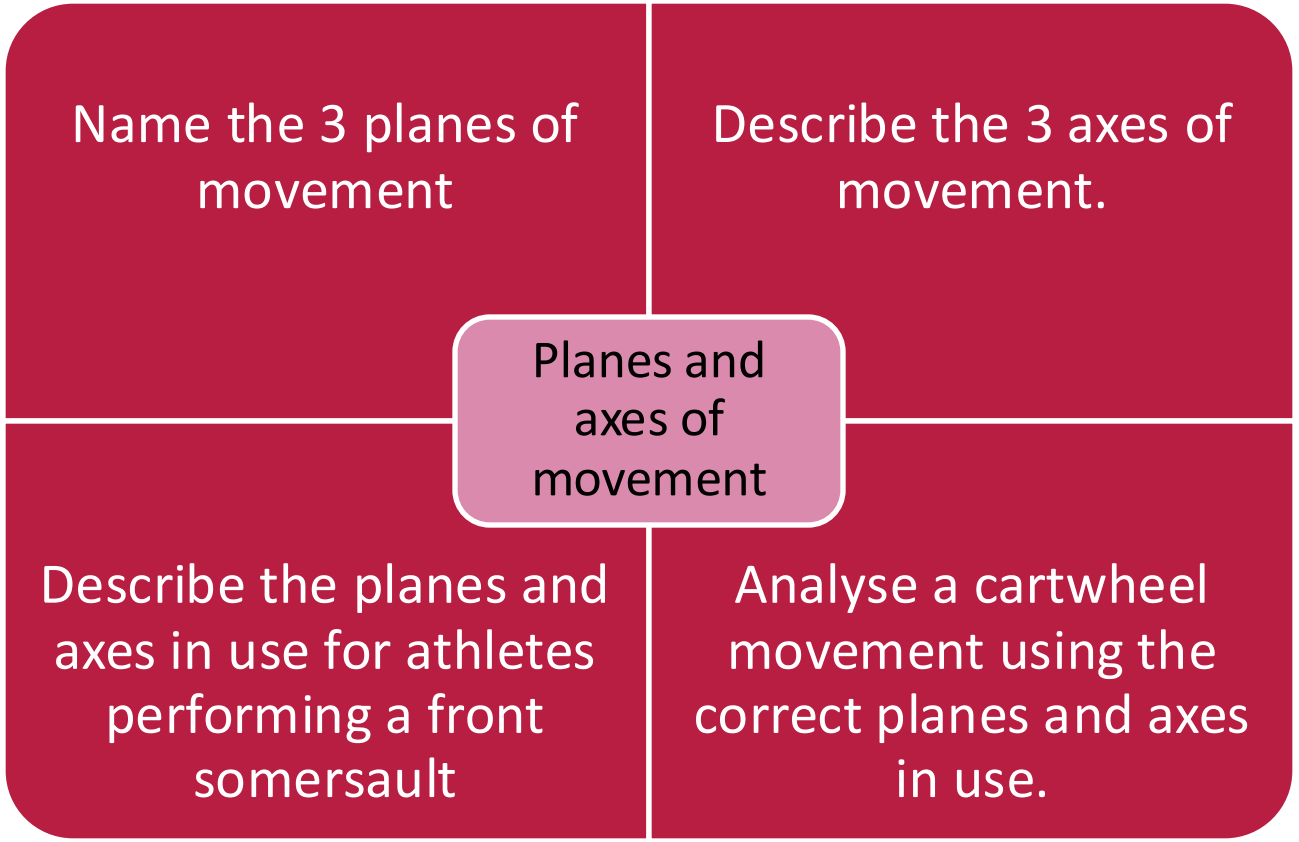
Levers and mechanical advantage

Explain the term ‘mechanical advantage’

Which class of lever always has a mechanical disadvantage?

Extension Task

Apply it!



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