# HGS GCSE PE

## Applied Anatomy and Physiology 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.
  - 1<sup>st</sup> Class: example Neck
  - 2<sup>nd</sup> Class: example Ankle
  - 3<sup>rd</sup> 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

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.)

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



**Classes of Lever** 

#### GCSE (9-1) PHYSICAL EDUCATION

#### **EFL = 1<sup>ST</sup> CLASS ELF = 2<sup>ND</sup> CLASS FEL = 3RD CLASS**

## **EFL the ELF FELL!**



**REMEMBER!!** 

### 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

#### 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

#### 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

#### **Mechanical Advantage**

Definition:

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



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

### **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'.

#### **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 and axes of movement**

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

#### **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.



### **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



### **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



#### **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 the body

Axes are like invisible skewers running through the body.

All movements rotate around one of the axes.



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

#### Axes of the body



#### Axes of the body

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



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



**Tip to Remember:** Left and right remain left and right

**Practical example: somersault** 

### **Planes & Axes of Rotation**

#### **Planes & Axes of the body combined**

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



**Tip to Remember:** Front and back remain front and back

Practical example: cartwheel

### **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!



### **Extension Task**

### Apply it!



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