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1.2 Analysing Skill & Technique:

(a) Analyse skill and technique from the following perspectives:

I. Biomechanical; planes and axes, levers

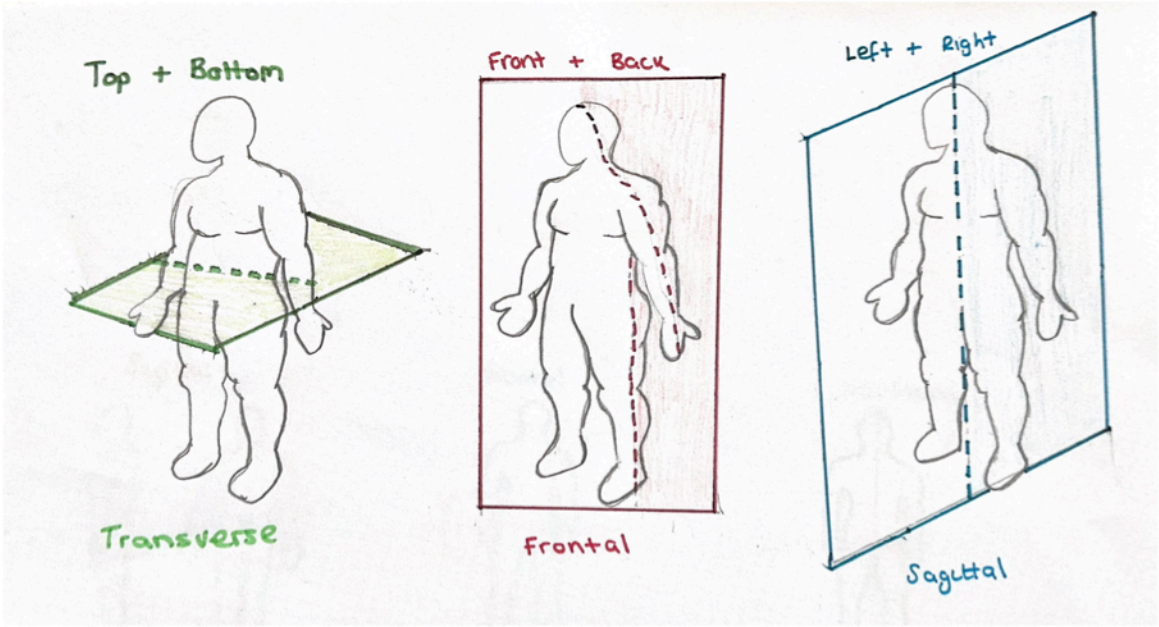
II. Movement, vectors and scalars, Newtons law of motion

III. Quality/effectiveness; economy of movement, creative application of skill

I. Planes and Axes, Levers

Planes are large, imaginary and flat surfaces that dissect the body in half in 3 places >>

- Front & Back
- Left & Right Side
- Top & Bottom



Planes of Movement

Frontal Plane	Sagittal Plane	Transverse Plane
The frontal plane splits the body into **front and back** halves of equal mass It runs **vertically** through the body and is **perpendicular** to the ground	The sagittal plane splits the body into **left and right** halves of equal mass It runs **vertically** through the body and is **perpendicular** to the ground	The transverse plane splits the body into **top and bottom** halves of equal mass It runs **horizontally** through the body and is **parallel** to the ground

Joint movements in this plane move **outward and inwards** from the centre line of the body when standing in the anatomical position	**Joint movements** in this plane move **forwards and backwards** from the centre line of the body when standing in the anatomical position	**Joint movements** in this **pivot or open and close** in relation to the medial line of the body when standing in the anatomical position

Axes: An axis is a line around which the body rotates. Perpendicular to a plane, there is a corresponding axis that the action occurs around.

Sagittal Axis	Frontal Axis	Vertical Axis
This axis runs through the body from **front to back** Actions occurring around the sagittal axis **move out to the side of the body**, and then **back in** towards the medial line (middle of the body) At the point of the **belly button**, the whole body would turn to the left or right side, just like a **cartwheel** in gymnastics At the point of the **hip joint,** the leg would **abduct** out to the side, and then **adduct** in towards the medial line	This axis runs through the body from **left to right** Actions occurring around the frontal axis move **forwards and backwards** from the anatomical position At the point of the **hips**, the whole body would turn **spin forwards or backwards**, like a somersault At the point of the **knee,** the **flexion** would bring the lower leg up behind the performer, and **extension** would straighten it back out	This axis runs through the body from **top to bottom** Actions occurring around the vertical axis **rotate outwards and inwards** in anatomical position Running down through the **top of the head**, the whole body would **turn on the spot** When running down **through the lower arm** from the elbow joint out through the fingers**, supination and pronation** occurs around the vertical axis

COMMON QUESTION >> DESCRIBING PLANES AND AXES FROM A BIOMECHANICAL PERSPECTIVE

ANSWER:

1. Where it splits the body (a) **vertically or horizontally**, (b) **perpendicular or parallel** to the ground and (c) **left & right, front & back or top & bottom**
2. The movements along the plane >> **abduction & adduction, flexion & extension or rotation and pivot**
3. Sporting/ exercise example >> **cartwheel, forward roll, Russian twist**

4. If Axes is asked as well >> Where does it intersect the body >> **front to back, left to right or top to bottom**

SAMPLE ANSWER:

The frontal plane splits the body into **front and back** halves of equal mass. It runs **vertically** through the body and is **perpendicular** to the ground.

The sagittal axis is **perpendicular** to the frontal plane and goes from the **front to the back of the body. Adduction and abduction** occur in this plane and axis, **for example a Jumping Jack**

Levers

Levers in our body allow a range of **different movements to be completed.** The bodies **Joints, Muscles and Bones** all work together in different ways to perform everyday tasks **using Levers**

In the human body, LEVERS are formed from BONES, JOINTS & MUSCLES. The JOINTS act as the FULCRUM (Fixed Point), EFFORT comes from our MUSCLE contractions and the LOAD is the BODY PART being moved plus any additional OBJECTS

Classifying Levers (Most Common Question)

The lever is classified based on what component is in the middle of the lever. We can use FLE 123 to help us classify a level

- If the FULCRUM is in the middle = 1st Class Lever
- If the LOAD is in the middle = 2nd Class Lever
- If the EFFORT is in the middle = 3rd Class Lever

1st Class Levers:

In a first class lever, **the Fulcrum is between the Load and Effort**

Within the body a first class lever can be found in **the neck. The neck acts as the fulcrum, gravity pulling the head down is the load and the neck muscles act as the effort.**

2nd Class Levers:

In a second class lever, the **Load** is in the middle of the **Fulcrum** and the **Effort**

Within the body a second class lever can be found in **the ankle**. In plantar flexion (toe pointed down) and when performing a **calf raise**. The **foot acts as the fulcrum,** the **body as the load** and the **effort come from the calf muscle**.

3rd Class Levers:

In a third class lever, the **Effort is placed** in the middle of the **Fulcrum** and the **Load**

Within the body, **flexion at the elbow** is an example of a third class lever. **The Effort, which is the attachment of the biceps to the radius,** occurs between the **elbow joint (fulcrum)** and the **hand (load)**

Mechanical Advantage VS Mechanical Disadvantage

Effort Arm = How far away the effort is from the fulcrum

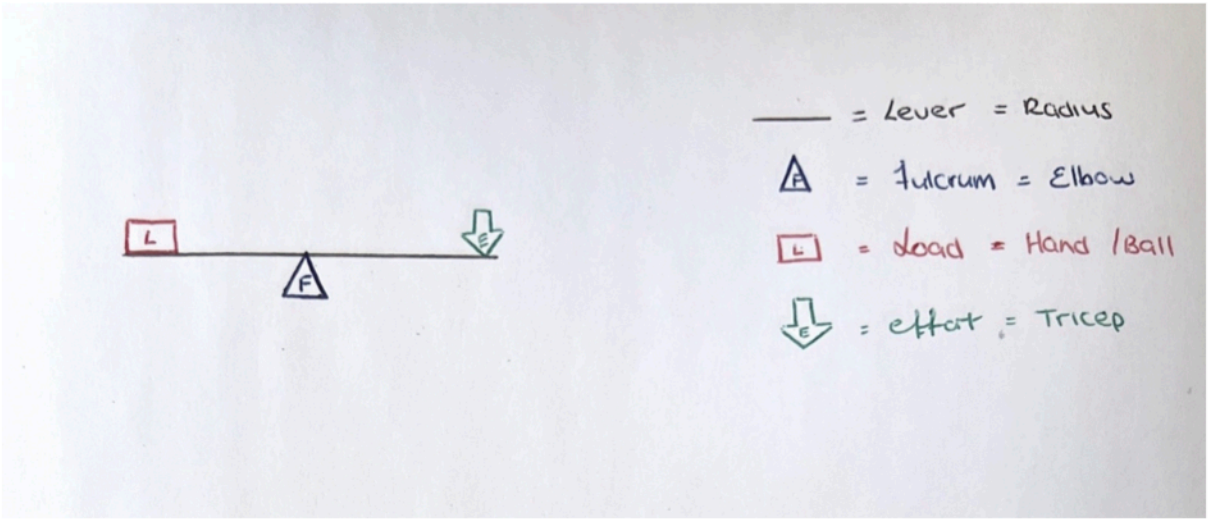
Resistance/Load Arm = How far away the resistance/load is from the fulcrum

Certain levers are said to have a **Mechanical Advantage** as they can **move higher loads with less force. When the effort arm is bigger than the load arm, the lever is adopting a mechanical advantage.** Mechanical advantage is a **key feature to how second class levers work**, as the **effort arm is always longer than the load arm**

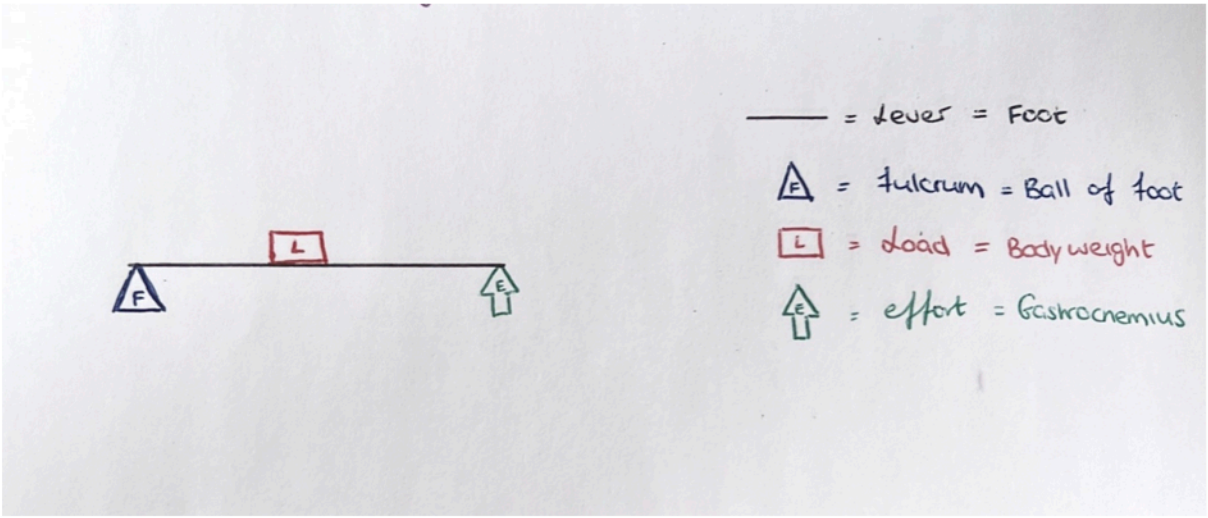
When the **load arm is bigger than the effort arm**, the lever is said to have **Mechanical Disadvantage.** This is where a **larger force needs to be applied to overcome the load in order to move it. Mechanical disadvantage helps to move a load further and faster >> It is not a bad thing! Third class levers work with mechanical disadvantage**. Some people will have more disadvantages than others depending on the length of their bones (levers)

COMMON QUESTION: Drawing Levers:

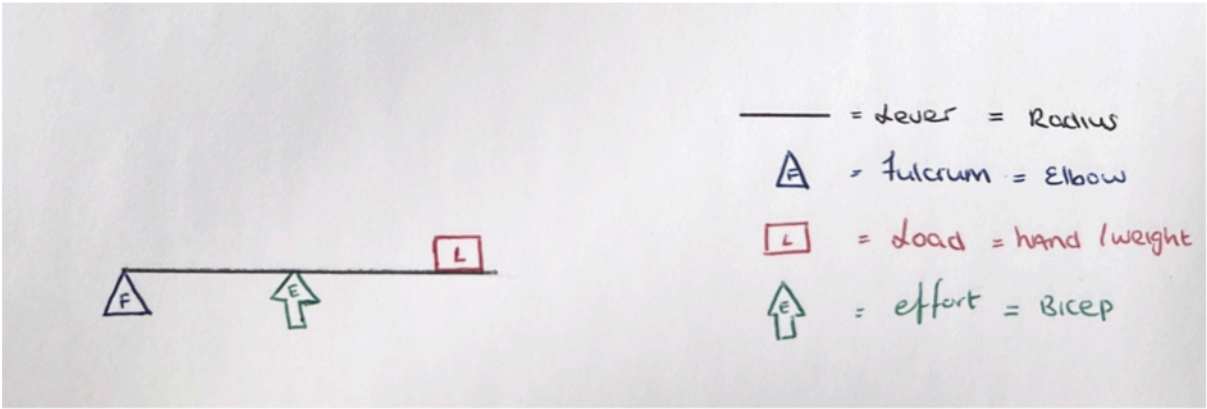
1st Class Lever - Free throw in basketball



2nd Class Level - Sprint start



3rd Class Lever - Bicep Curl



II. Movement, vectors and scalars, Newton's law of motion

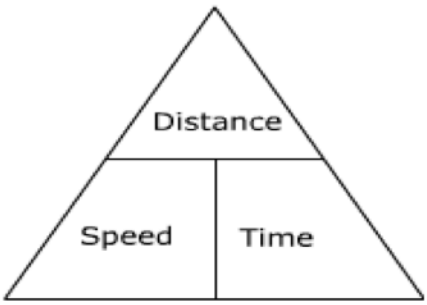
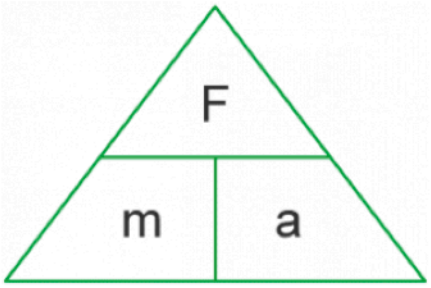
Vectors & Scalars

COMMON QUESTION >> VECTORS VS SCALARS

ANSWER: A Scalar is a quantity that is fully described by **magnitude** (size) only. A scalar has **NO direction** and is described by a single number **Example = The ball travelled 10m. = Distance**. A vector is a quantity that has both **Magnitude** (size) **AND Direction**.

Example = The ball travelled 10m to the right = Displacement

MUST KNOW DEFINITIONS BELOW WITH EXAMPLES IN SPORT

Term	Definition	Formula
Magnitude	The size of something **>> Size 4 Football**	
Time	The amount of seconds and minutes - The time something takes to happen **>> 5 Minutes to run 1km**	
Speed	Speed is the maximal rate at which a person can cover a distance or perform a movement in a period of time **>> Sprinter ran at 9m/s**	
Distance	The length of space between two points **>> The race is 100m long**	
Volume	The amount of space that an object occupies	Length x width x height
Acceleration and Deceleration	The rate of change of a body's velocity Acceleration = Faster Deceleration = Slower	
Force	Strength or energy as an attribute to physical movement	
Mass	Amount of matter a body possesses	
Velocity	Speed of something in a given direction	displacement/time
Displacement	An object moving from its starting position to another position. A measure of motion 'as the crow flies' >> Distance in a certain direction	

Newton's Law of Motion

These 3 laws help explain **how and why objects, items and bodies move** the way they do in different sporting contexts

If a coach or performer can understand how the laws apply to their sport , they can begin to **adjust technique** so they abide by the laws or perhaps work in their favour

1. The Law of Inertia

DEFINITION >> "A body will remain in a constant state of motion unless acted upon by an external force"

A body can mean our physical body or an object/ piece of equipment like a ball or racket.

If the body is at rest, it will remain at rest **unless acted upon by an external force**

If the body is rolling on a surface, it will roll indefinitely **unless acted upon by an external force**

If the body is flying, it will fly **indefinitely unless acted upon by an external force**

2. The Law of Acceleration

DEFINITION >> 'When an external force acts upon a body, the resultant change in velocity is proportionate to the magnitude and direction of the external force applied to it"

The acceleration depends on the magnitude applied to it – How powerful/ forceful was the external force

The bigger the force, the bigger the rate of acceleration. Whatever direction the force is applied in will result in the body moving in that direction

3. The Law of Reaction

DEFINITION >> "Every action (force) has an equal and opposite reaction force."

In sport, performers are required to generate a force in one direction against a surface, so that the surface responds with a force in equal magnitude and opposite direction, producing the movement the performer intended.

SAMPLE ANSWER: You must use Newton's law within an example. See below:

Newton's Law Applied >> Rowing

1. Law of Inertia >> A Body will remain in a constant state of motion unless acted upon by an external force.

(a) The boat will **remain still** until acted upon by an external force which could be the current, wind or the rower pulling on the oars.
(b) The boat will **remain in a constant state of motion** until acted upon by an external force which could be the current, wind or the rower pulling on the oars to stop the boat

2. Law of Acceleration >> When an external force acts upon a body, the resultant change in velocity is proportionate to the magnitude and direction of the external force applied to it

(a) When the rower pulls on the oar it acts upon the body which is the boat. The change in velocity is proportionate to the force the rower applies to the oar in the water, allowing the boat to accelerate backward as the rower pulls forward.

3. Law of Reaction >> Every action has an equal and opposite reaction

(a) When the rower pulls on the oar (action) the oar goes forward and pushes the boat backwards (in the opposite direction) with an equal reaction force.

III. Quality/effectiveness; economy of movement, creative application of skill

Movement Economy:

The economy of one's movement refers to **how efficient or energy-sparing an athlete is when they're in motion.** Economy of movement can be examined from an **Energy Expenditure** and **Technique Execution** perspective

Energy Expenditure: The less energy that an athlete uses when executing a skill, the more economical (efficient) their movement is. Highly trained athletes will **use oxygen more sparingly** and are able to move and **sustain efforts for longer periods** than athletes who do not have economical movement

Activities that call for high endurance capacities, such as long distance running, **will require athletes to have well-trained aerobic systems** to enable them to **use their energy sparingly** throughout an event

Technical Execution: If an athlete can consistently execute skills without energy wastage, they can sustain efforts for longer periods without tiring

Athletes will also look to **develop perfect technique** so that they can apply all the forces they can produce in the **correct manner.** For example, in the long jump. An athlete develops **speed and power as they approach the take off board,** so they can apply a large force to the board, enabling them to **jump further** (Newton's 3rd Law). The athletes **technique at the take-off will need to be extremely accurate** in order to allow optimum flight time and jumping distance

If your body uses energy that does not result in effective movement for your goal, this energy is wasted and the athlete has displayed poor movement economy

Creative Application of Skill:

The creative application of skill is the ability to perform a skill in a new or unique way.

These skills are high risk, high reward and very aesthetically pleasing. There are athletes who demonstrate excellent levels of brilliant and creative skill application.

Examples of Creative Skill in Sport:

Soccer	Gaelic Football	Camogie
A backheel >> To pass the ball behind you quickly	**A chipped pick-up >>** To pick up the ball at speed/ on the run	**Kicking the ball >>** When taking a shot on goal in a tight space
A stepover >> to fool an opponent and send them the wrong way	**A dummy solo >>** To create more space to take a shot (because you send the defender the wrong way)	**Sideline cut >>** When trying to get height on a sideline ball
A nutmeg >> to beat a player (putting ball between their legs)	**A fake hand-pass >>** To send your opponent the wrong direction	**A dummy hand-pass >>** To confuse your opponents, opening up space