Here are just a few sample slides – we hope you love them!
Both teacher and student slides are included (the latter will be supplied as PDF file for photocopying)

OCR Physical Education
AS / A-Level Biomechanics
PowerPoint Summaries

This resource has been written by Ali Woodward for PEfocus and has been designed to support teaching and learning of the 'new' OCR AS and GCE/A-Level PE specification for teaching from September 2016.

All content mirrors the OCR biomechanics specification perfectly.

The resource comprises:

- ✓40 full colour / fully animated teacher slides
- ✓Student slides as PDFs – with gaps to fill (
- ✓Teacher slides as PDFs – with 'answers'

This resource can be used to present new work, for summing up topic areas and for consolidation at the end of the course.

We really hope that you and your learners will find it both engaging and helpful.

Biomechanics – student slides

The aim is for students to build their own bank of biomechanics knowledge that can be used throughout the course as well as at the end for review.

A favoured layout is to print two slides per A3 sheet; this appeals to students who often find the large visual style manageable, engaging and valuable as a supplement to their other notes and resources.

Sets of these student slides (PDFs) can be given to students as they start a topic area. They can work on the set slide by slide as each element of work is completed (e.g. Newton's Laws); or as a whole topic area once it has been 'covered'. This can be done in class or as a homework / private study task

Student slides can be posted on secure areas of centres' intranet/moodle platforms for easy access and further assimilation.

It is highly recommended that students check the accuracy of their work/completed worksheets against a **printed** copy of the teacher slides. **(NB – agreed Terms and Conditions limit access to the full colour animated PowerPoint slides to staff only)**

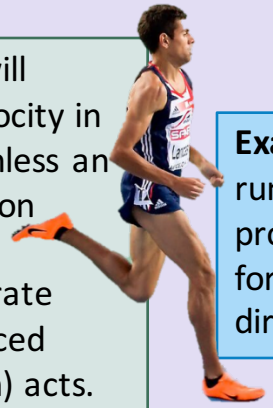
Biomechanical principles: Newton's laws of motion

Newton's first law: Law of inertia

Definition: A body will remain in a state of rest or uniform velocity unless acted upon by an external or unbalanced force.

Example 1: a football will remain at rest on the penalty spot until a force is applied from the players foot.

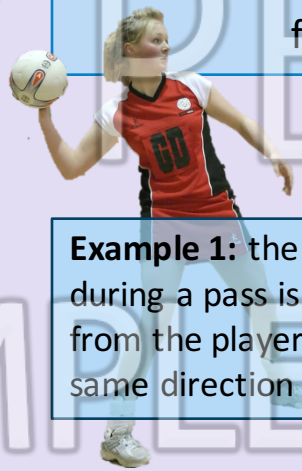
Example 2: A runner will remain at constant velocity in the middle of a race unless an unbalanced force acts on them.
The runner will accelerate forwards if an unbalanced forwards force (friction) acts.



Newton's second law: Law of acceleration

Definition: The acceleration (or rate of change in momentum) of a body is proportional to the size of the force applied and takes place in the direction in which the force acts.

f= ma

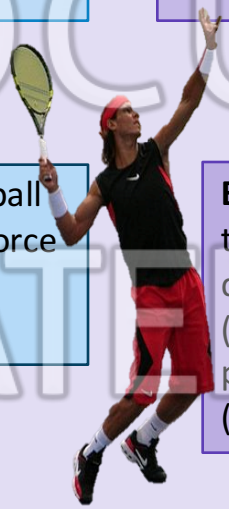


Example 1: the acceleration of a netball during a pass is proportional to the force from the player's hands and is in the same direction as the force.

Example 2: The acceleration of the runner during the sprint finish is proportional to the size of the friction force generated and in the same direction as that force (forwards)

Newton's third law: Law of reaction

Definition: For every action there is an equal and opposite reaction. The reaction force is equal in size and opposite in direction to the action force.



Example 1: when serving , a tennis player pushes downwards on the ground (action force) and the ground pushes upwards on the player (normal reaction force).

Example 2: The runner pushes backwards on the track (action force) and the track pushes forwards on the runner (reaction force, in this case friction)

Biomechanical principles: **Newton's laws of motion**

Newton's first law: Law of ……

Definition: A body will remain in a state of …

Example 1: a football will remain at rest on the penalty spot until …

Example 2: A runner will remain at constant velocity in the middle of a race unless …

The runner will accelerate forwards if …

Newton's second law: Law of ……..

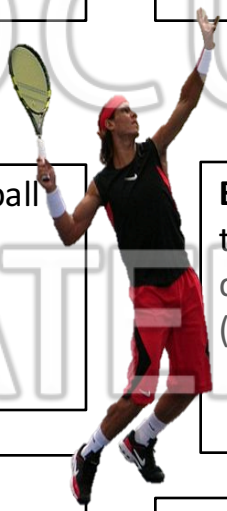
Definition: The acceleration (or rate of change in momentum) of a body is …

Example 1: the acceleration of a netball during a pass is proportional …

Example 2: The acceleration of the runner during the sprint finish is proportional to …

Newton's third law: Law of ……..

Definition: For every action there is …



Example 1: when serving , a tennis player pushes downwards on the ground (action force) and the …

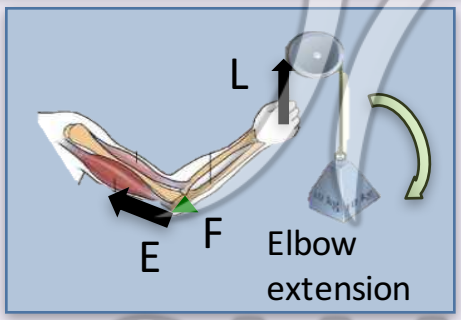
Example 2: The runner pushes backwards on the track (action force) and …

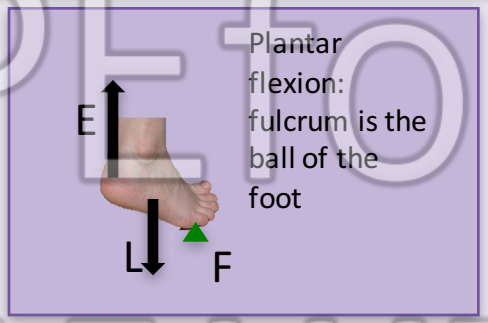
Levers: Classes of lever and mechanical advantage

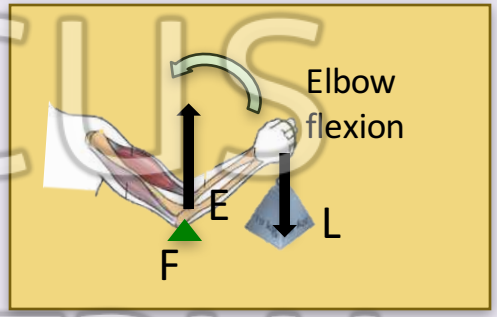
Levers are classified depending on the order of placement of the fulcrum, load and effort in the lever

To identify the class of lever, look at which feature is **between** the other two…
FLE 123

Middle feature: Fulcrum = First class	Middle feature: Load = Second class	Middle feature: Effort = Third class







Mechanical advantage of second class levers

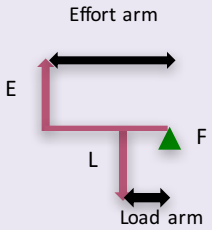
Almost all levers in the human body are third class

The effect of a force within a lever system depends on two factors:

1. The size of the force: greater force = greater effect
2. The distance from the force to the fulcrum: The greater the distance the greater the effect

If the effort is further from the fulcrum than the load, then less effort force is needed to move the load and/or a greater load force can be moved

Effort arm > load arm = mechanical advantage
This applies to second class levers



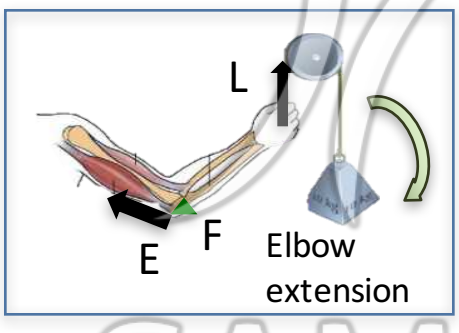
Mechanical advantage of a second class lever explains why the entire body weight can be moved easily by contraction of the gastrocnemius during plantar flexion

Levers: Classes of lever and mechanical advantage

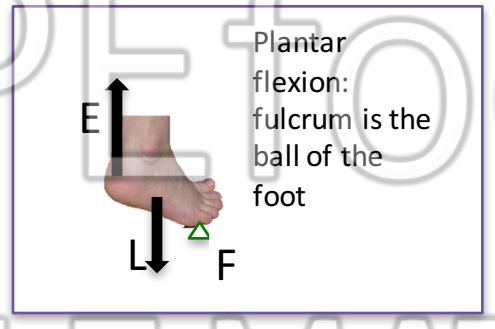
Levers are classified depending on the order of placement of the _____ _____ and _____ in the lever

To identify the class of lever, look at which feature is **between** the other two…***FLE 123***

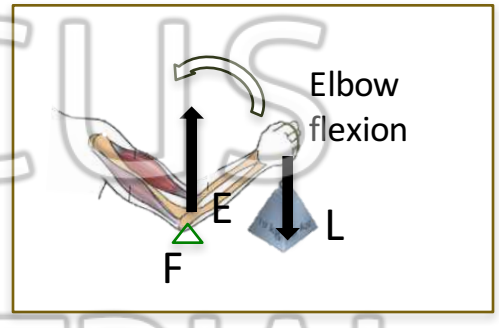
Middle feature:
Fulcrum = _____



Middle feature:
Load =_____ class



Middle feature:
Effort =_____class



Almost all levers in the human body are _____

Mechanical advantage of second class levers

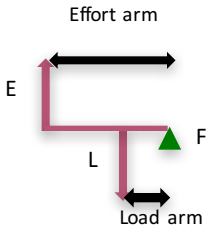
The effect of a force within a lever system depends on two factors:

1.

2.

If the effort is further from the fulcrum than the load …

Effort arm > load arm =

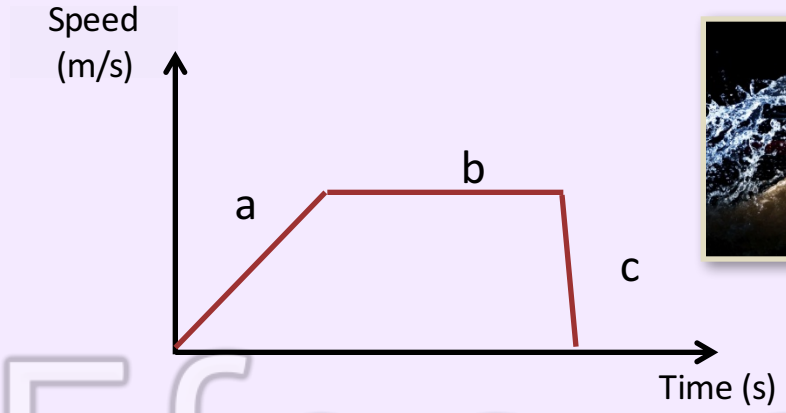


Mechanical advantage of a second class lever explains why the entire body weight can be moved easily by contraction of the gastrocnemius during plantar flexion

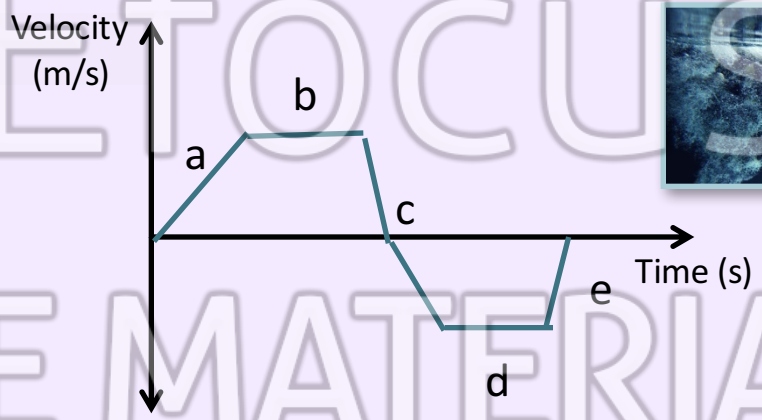
*GCE/A-level only

4.5 Linear motion: Examples of speed/time and velocity/time graphs

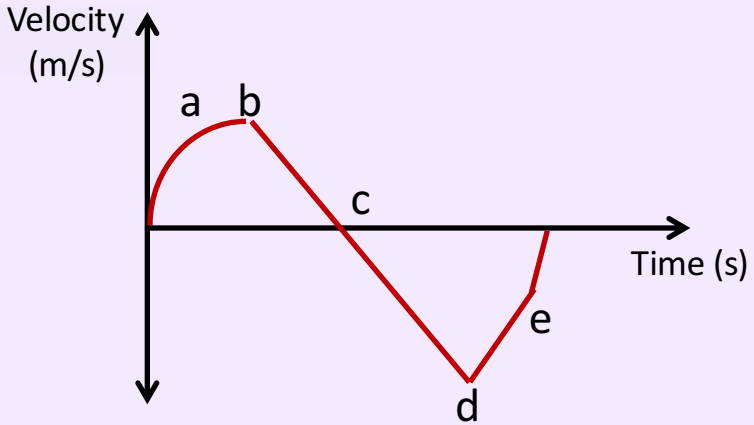
A **speed / time** graph showing
a)Swimmer accelerating from the start
b) Sprinting at top speed
c) Stopping at wall



A **velocity/ time** graph showing
a)A swimmer accelerating from the start
b) Sprinting at top speed
c) Turning at wall
d) Sprinting a second length
e)Stopping at the wall



A **velocity/ time** graph showing
a) A diver pushing against the board
b) Point of take off from board
c) Reaching maximum height in the air
d) Entry to water
e) Deceleration to bottom of pool



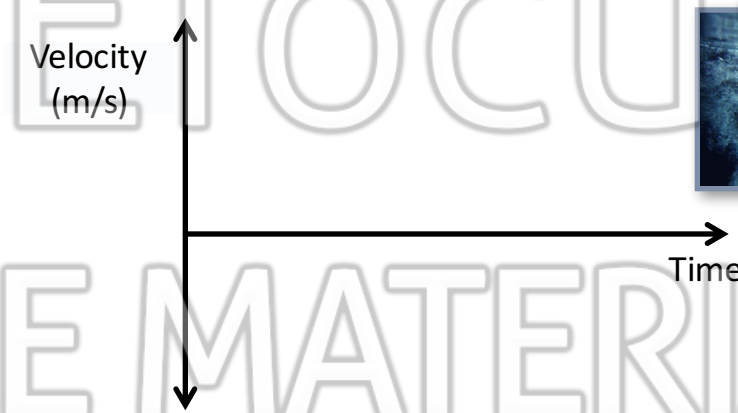
*GCE/A-level only

4.5 **Linear motion:** Examples of speed/time and velocity/time graphs

For each of the following examples of linear motion, draw the graph on the axes and label points a, b and c .

A **speed / time** graph showing
a)Swimmer accelerating from the start
b) Sprinting at top speed
c) Stopping at wall

A **velocity/ time** graph showing
a)A swimmer accelerating from the start
b) Sprinting at top speed
c) Turning at wall
d) Sprinting a second length
e)Stopping at the wall



A **velocity/ time** graph showing
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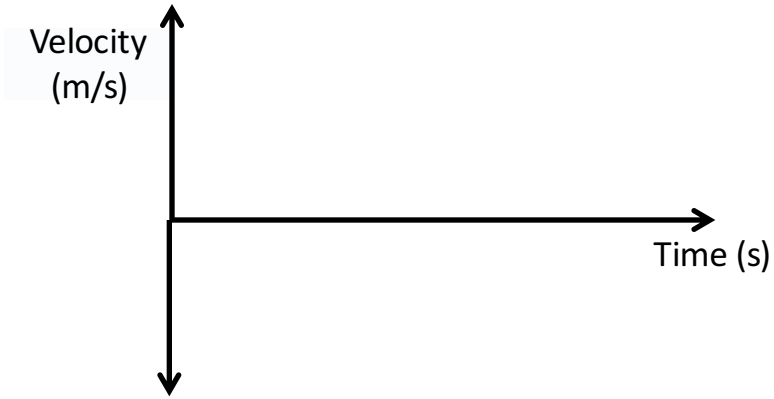


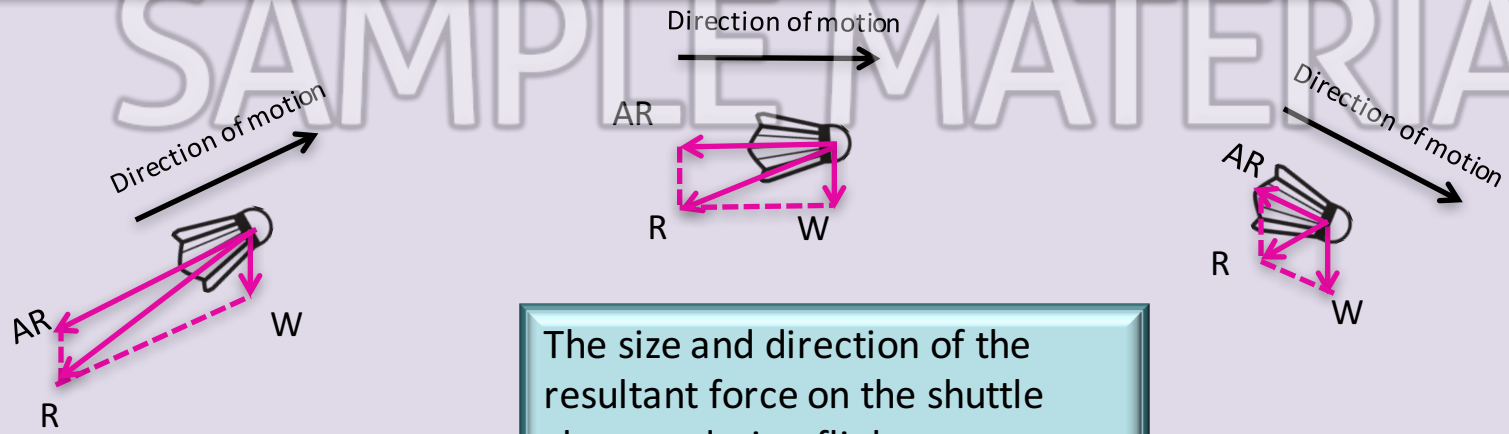
*GCE/A-level only

7.4

Projectile motion: patterns of flight paths (ii)

If weight is small, and air resistance is large then the flight path shape is non-parabolic or asymmetric. Eg: Badminton shuttle

- This is because the force of air resistance is able to overcome the inertia (small mass) of the body, and decrease its velocity.
- Decreasing velocity causes decreasing air resistance.
- As the flight continues the body becomes increasingly under the influence of its weight, rather than air resistance.
- The parallelogram of forces shows that the size of the resultant force decreases, and the direction it acts in becomes further from the direction of AR. (Increasing angle between AR and R)
- This gives a non- parabolic flight shape.



The size and direction of the resultant force on the shuttle changes during flight = asymmetric, non-parabolic flight path.

*GCE/A-level only

7.4

Projectile motion: patterns of flight paths (ii)

If weight is small, and air resistance is large then the flight path shape is …

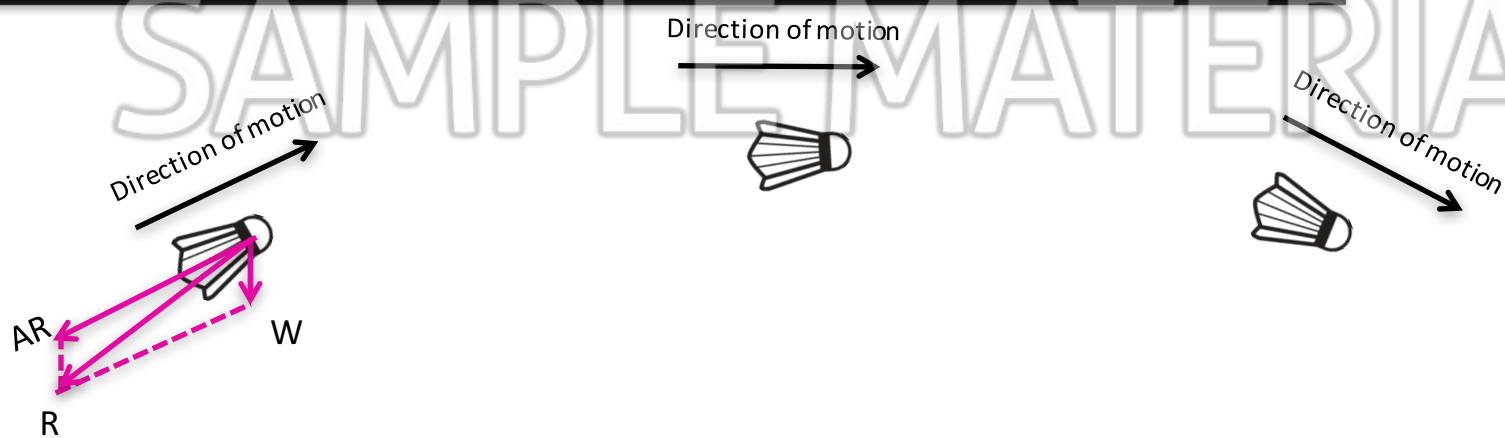
Eg: Badminton shuttle

- This is because the force of air resistance is able to overcome the inertia (small mass) of the body, and decrease its velocity.
- Decreasing velocity causes decreasing air resistance
- As the flight continues the body becomes increasingly under the influence of its...
- The parallelogram of forces shows that the resultant force changes in:

a) size:

b) direction:

- This makes the flight shape …



Draw the force arrows and complete the parallelogram on the diagrams of the shuttlecock in mid and late flight