

Newton's Laws

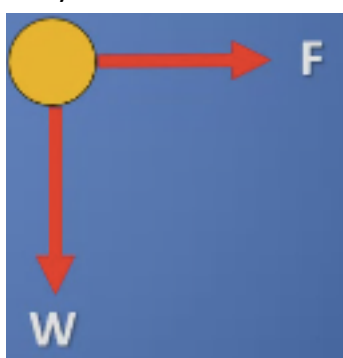
Forces and Gait

- Newton realised that force causes motion
- Kinetics is the analysis of force
- The unit of force is measured in Newtons (N)
- Most forces can be separated into contact and non-contact forces

Non-contact forces	Contact forces
Gravity	Ground reaction forces
	Joint reaction forces
	Muscle forces
	Fluid forces
	Elastic forces

Horizontal vs Vertical Motion

- Gravity does not affect "horizontal" motion



Gravity

Gravity is expressed as an acceleration

$$g = 9.81\text{ms}^{-2}$$

All objects accelerate this quickly, irrelevant of their mass

Newton's Laws

- As Newton correctly observed when an external force is applied, motion is caused
- We need to be careful when differentiating between internal and external forces on an object
- When an athlete lifts a weight, there are lots of forces generated within the body
 - Internal – muscular forces, forces on bones, forces at joints
 - External – between the athletes' hands and the bar, and between the athlete's feet and floor
 - Consider only the relevant forces during analysis

Law of inertia

Every body will remain in a state of rest or constant motion (velocity) in a straight line unless acted on by an external force that changes that state

A body cannot be made to change its speed or direction (i.e. velocity) unless acted upon by a force(s)

Difficult to demonstrate on earth due to the presence of friction and air resistance e.g. pushing a boat from a pier

Law of acceleration

A force (F) applied to a body causes an acceleration (a) of that body which has a magnitude proportional to the force, and takes place in the direction in which the force acts

Vitaly important in sport as it forms the link between force and motion: Force = mass x acceleration

Assuming mass remains constant, the greater the force, the greater the acceleration

Acceleration is inversely proportional to mass

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