

---

# Images for BIOMECHANICS



**FELTHAM PRESS**

# Images for BIOMECHANICS

## **Introduction**

This collection contains a variety of images for use in the teaching of Biomechanics. They are designed as focal points for explanations, discussions, and revision. The written content is kept to a minimum, and with a few exceptions they can be used at almost any level at the discretion of the tutor.

# Images for BIOMECHANICS

## Contents List

### Levers

- 1 Different Types of Lever

### Linear Motion

- 2 **The Run** - Resultant ground reaction force.
- 3 **The Run** - Graph showing the vertical ground reaction force and gravitational force acting on a sprinter whilst in contact with the starting blocks.
- 4 **The Run** - Graph showing the net vertical ground reaction force acting on a sprinter whilst in contact with the starting blocks.
- 5 **The Run** - Graph showing the vertical ground reaction force of a single footfall during a 100m race.
- 6 **The Run** - Graph showing the net vertical ground reaction force of a single footfall during a 100m race.
- 7 **The Run** - Graph showing the horizontal ground reaction force acting on a sprinter whilst pushing against the starting blocks.
- 8 **The Run** - Graph showing the horizontal ground reaction force acting on sprinter during one footfall early in a 100m race.

*Contents continued*

- 9 The Run** - Graphs showing the horizontal ground reaction force acting on a sprinter during one footfall in the middle and at the end of a 100m race.
- 10 The Vertical Jump** - Graph showing the changes in position of a performer's centre of gravity during the take-off phase of a vertical jump.
- 11 The Vertical Jump** - Graph showing the vertical velocity during the take-off phase of a vertical jump
- 12 The Vertical Jump** - Graph showing vertical ground reaction force during the take-off phase of a vertical jump.
- 13 The Vertical Jump** - Series of graphs showing the vertical ground reaction force, gravitational force, and net force of a jumper during the take-off phase of a vertical jump (Part A).
- 14 The Vertical Jump** - Series of graphs showing the vertical ground reaction force, gravitational force, and net force of a jumper during the take-off phase of a vertical jump (Part B).
- 15 The Vertical Jump** - Series of graphs showing the vertical ground reaction force, gravitational force, and net force of a jumper during the take-off phase of a vertical jump (Part C).
- 16 The Vertical Jump** - Series of graphs showing the vertical ground reaction force, gravitational force, and net force of a jumper during the take-off phase of a vertical jump (Part D).
- 17 The Vertical Jump** - Graph showing the net force acting on a jumper during the take-off phase of a vertical jump.
- 18 The Vertical Jump** - Graph showing the vertical ground reaction force and gravitational force acting on a jumper during the take-off phase of a vertical jump.
- 19 The Vertical Jump** - Graph showing a representation of the net impulse acting during the take-off phase of a vertical jump.

*Contents continued*

## **Centre of Gravity**

- 20 Net Force and Centre of Gravity** - The handstand
- 21 Net Force and Centre of Gravity** - Withstanding impact from the side.
- 22 Changing position of the Centre of Gravity** - Various body positions.
- 23 High Jump Technique** - The 'scissors' and the 'Fosbury flop'.

## **Angular Motion**

- 24 Rotation** - Weight generating torque force about a supported axis.
- 25 Rotation** - Weight generating torque force about a non-supported axis.
- 26 Rotation** - Weight generating torque force about a point of contact axis.
- 27 Rotation** - Stages of a flick-flak (0.08s intervals).
- 28 Rotation** - Ground reaction force generating torque.
- 29 Rotation** - Graph showing torque force during the take-off phase of a flick-flak.
- 30 Rotation** - Graph showing the relationship between moment of inertia and angular velocity in a standing back somersault (flight phase).
- 31 Angular velocity** - Graphs showing angular position and angular velocity of upper leg during running cycle.
- 32 Angular velocity** - Graphs showing angular position and angular velocity of lower leg during running cycle.

*Contents continued*

### Fluid Forces

- 33 **Bernoulli Effect** - Lamina flow around a slow moving ball and a fast moving ball.
- 34 **Reduced Drag** - Late separation of air flow by travelling above the critical velocity.
- 35 **Swing** - Disturbing the air using the seam on a cricket ball.
- 36 **Magnus Effect** - Lift force created by 'spin'.
- 37 **Magnus Effect** - Lift force lift force at  $90^\circ$  to the direction of travel.
- 38 **Boundary Layer** - Laminar flow around a discus.

### Parabolas

- 39 **Symmetry** - The symmetrical parabola.
- 40 **Range** - Optimum release angle for height for maximum range.
- 41 **Air Resistance** - Asymmetric parabolic flight path due to air resistance.
- 42 **Velocity Vector** - Resultant of vertical velocity component and horizontal velocity component.
- 43 **Velocity Vector** - Parabolic flight path showing horizontal component only.
- 44 **Velocity Vector** - Parabolic flight path showing vertical component only.
- 45 **Velocity Vector** - Changes in the vertical velocity component of the parabolic flight path of a projectile (shot put) with the landing point lower than the release point.
- 46 **Velocity Vector** - Long jump vertical and horizontal velocity components of a long jump flight parabola.
- 47 **Jumps** - Centre of gravity parabola of 'Fosbury flop'.
- 48 **Jumps** - Altering the position of the body in relation to the centre of gravity in a jump to 'Hang in the Air'.

**Images for Biomechanics**

---

# Images for BIOMECHANICS

## Levers



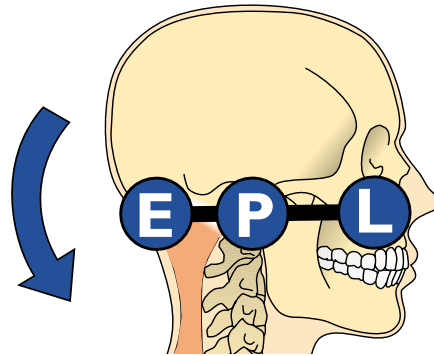
1 2 3 = P L E

**1st Order Lever**

Pivot (*fulcrum*) between effort and load

**E - P - L**

eg: atlas vertebrae to skull joint

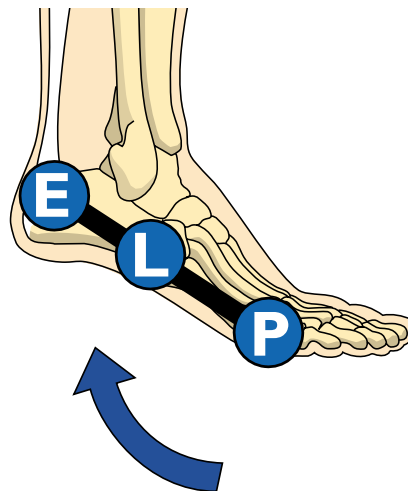


**2nd Order Lever**

Load between Effort and Pivot

**E - L - P**

eg: ankle joint

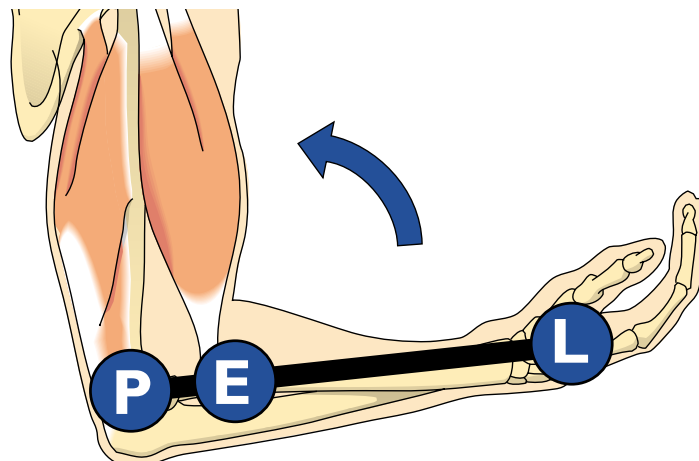


**3rd Order Lever**

Effort between Load and Pivot

**P - E - L**

eg: elbow joint





Images for Biomechanics

---

# Images for BIOMECHANICS

## Linear Motion

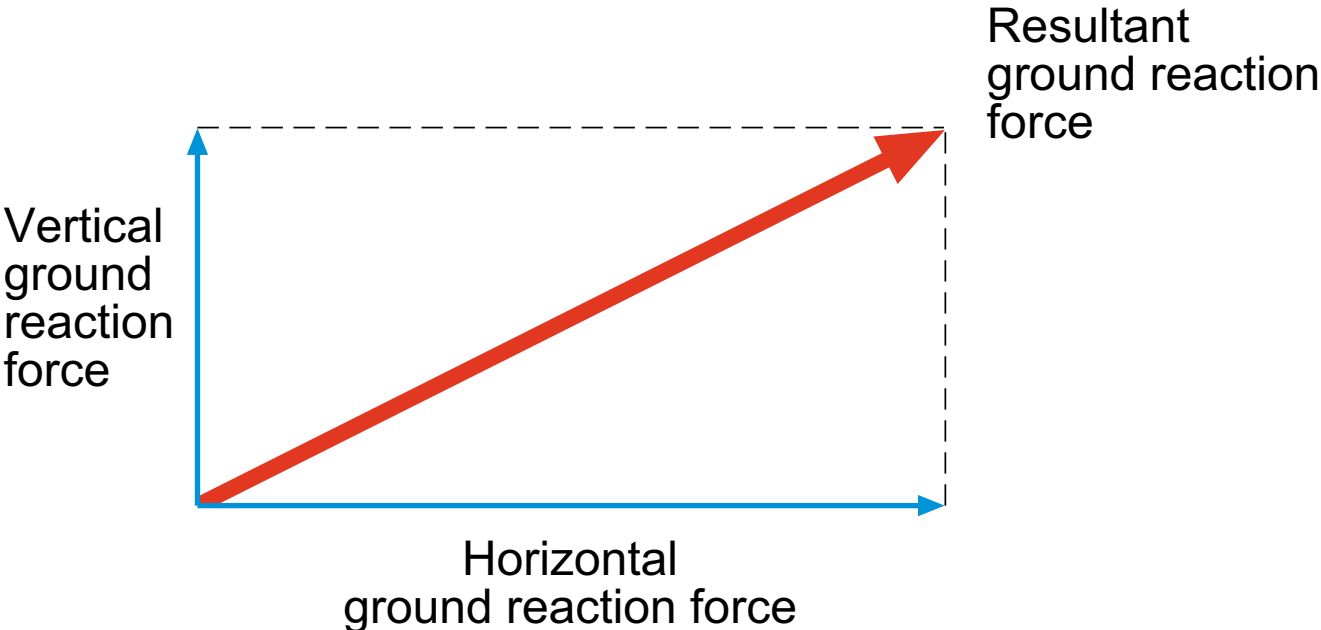
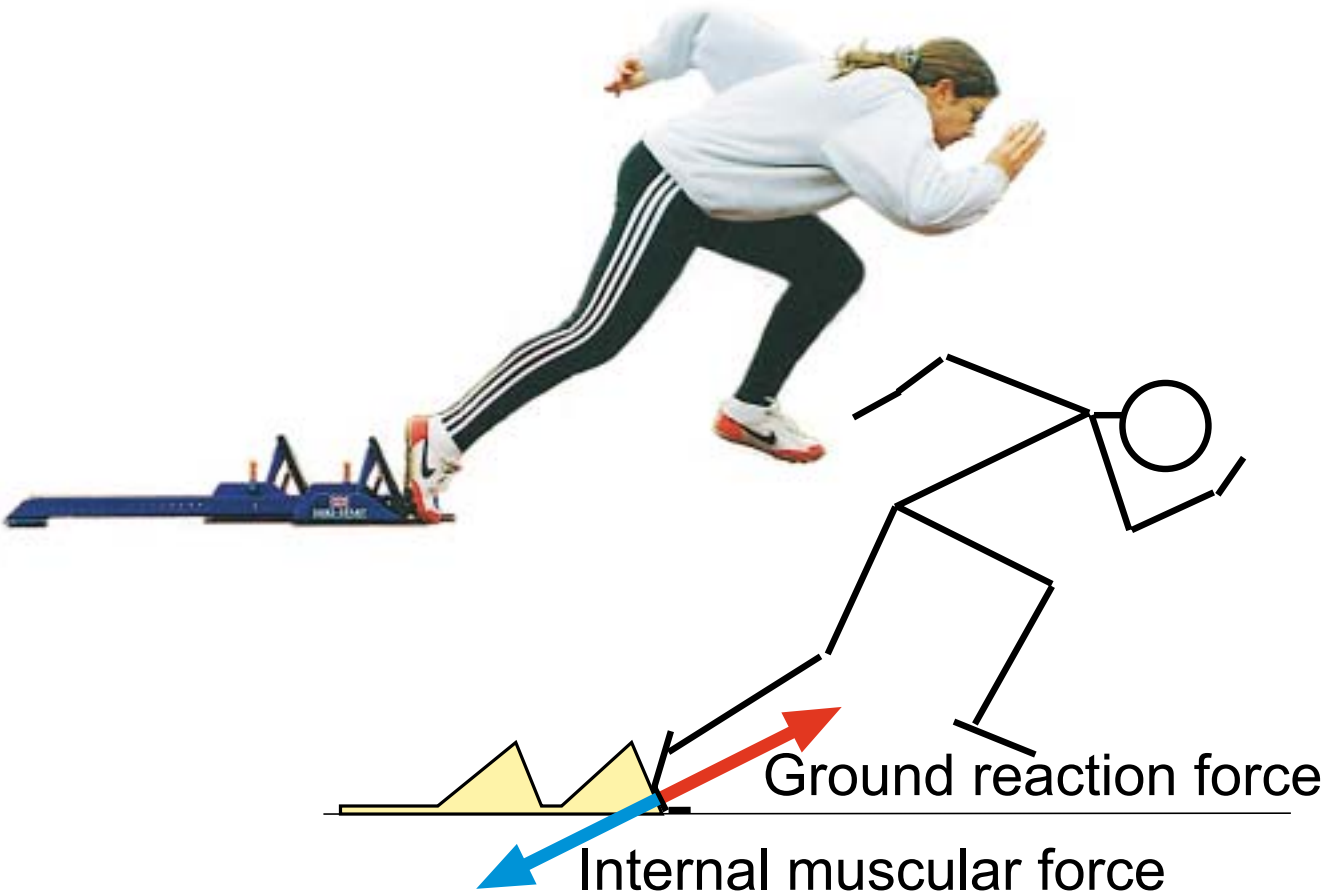


2

Linear Motion

# The Run

## Resultant ground reaction force

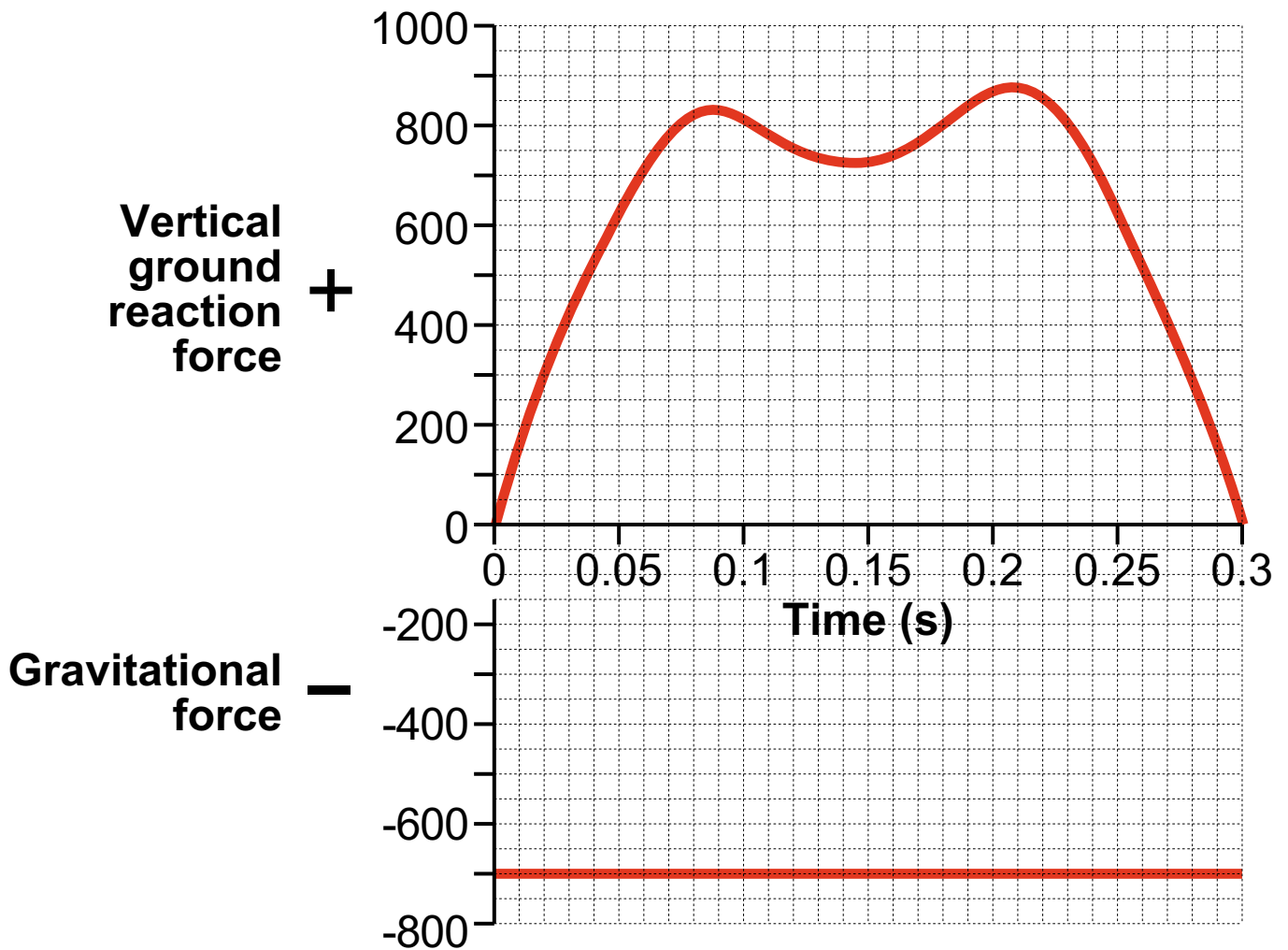


3

Linear Motion

The Run

Graph showing the vertical ground reaction force and gravitational force acting on a sprinter, whilst in contact with the starting blocks.



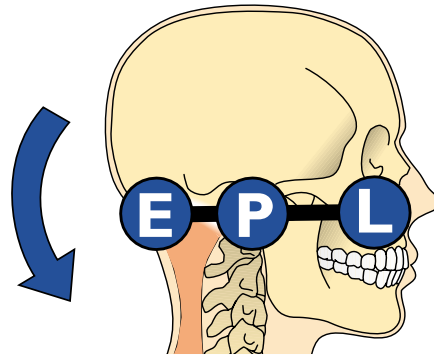
1 2 3 = P L E

**1st Order Lever**

Pivot (*fulcrum*) between effort and load

**E - P - L**

eg: atlas vertebrae to skull joint

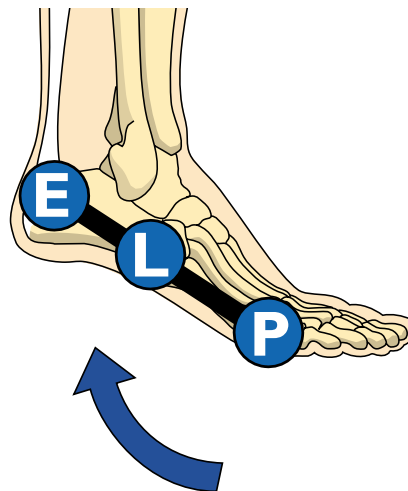


**2nd Order Lever**

Load between Effort and Pivot

**E - L - P**

eg: ankle joint

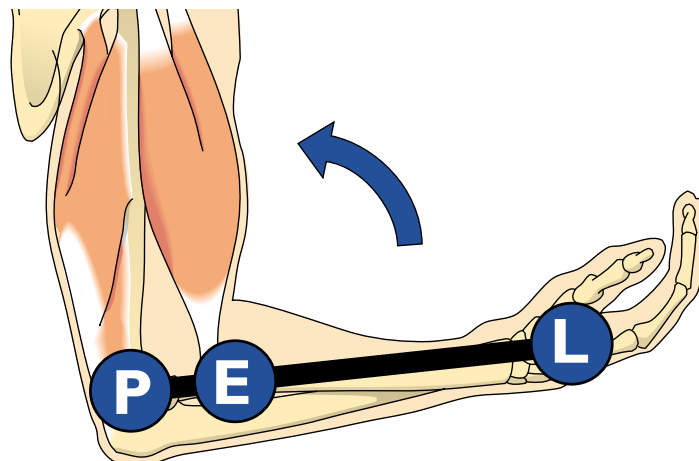


**3rd Order Lever**

Effort between Load and Pivot

**P - E - L**

eg: elbow joint

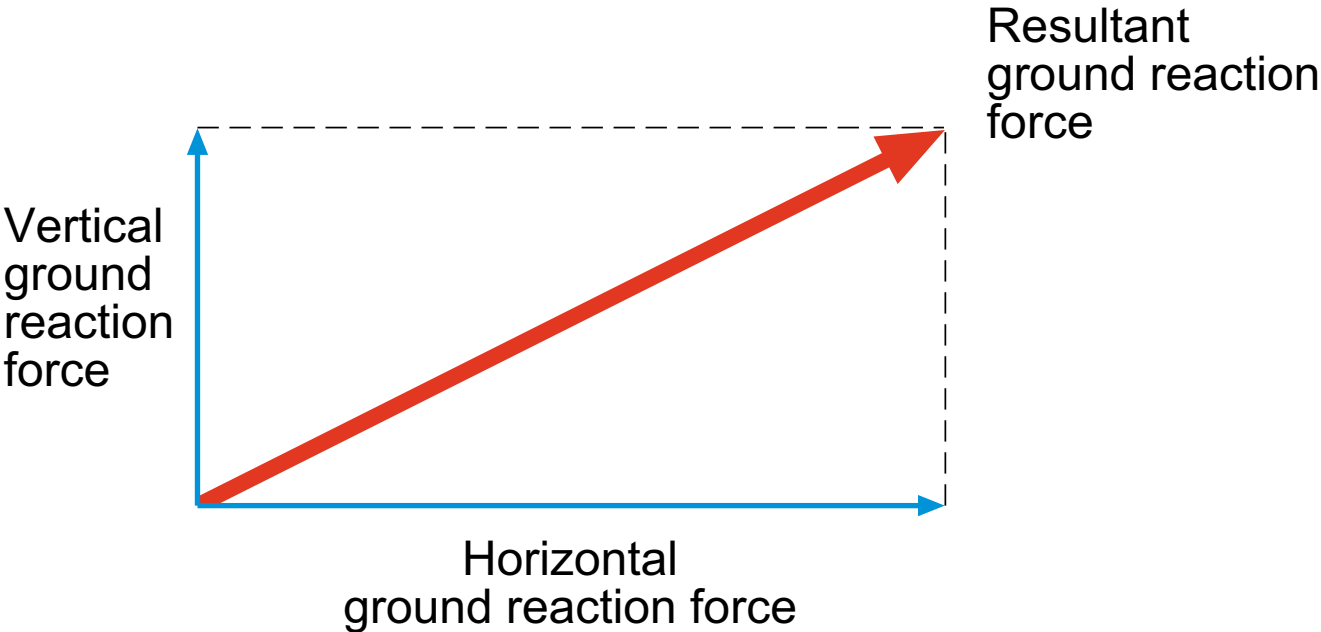
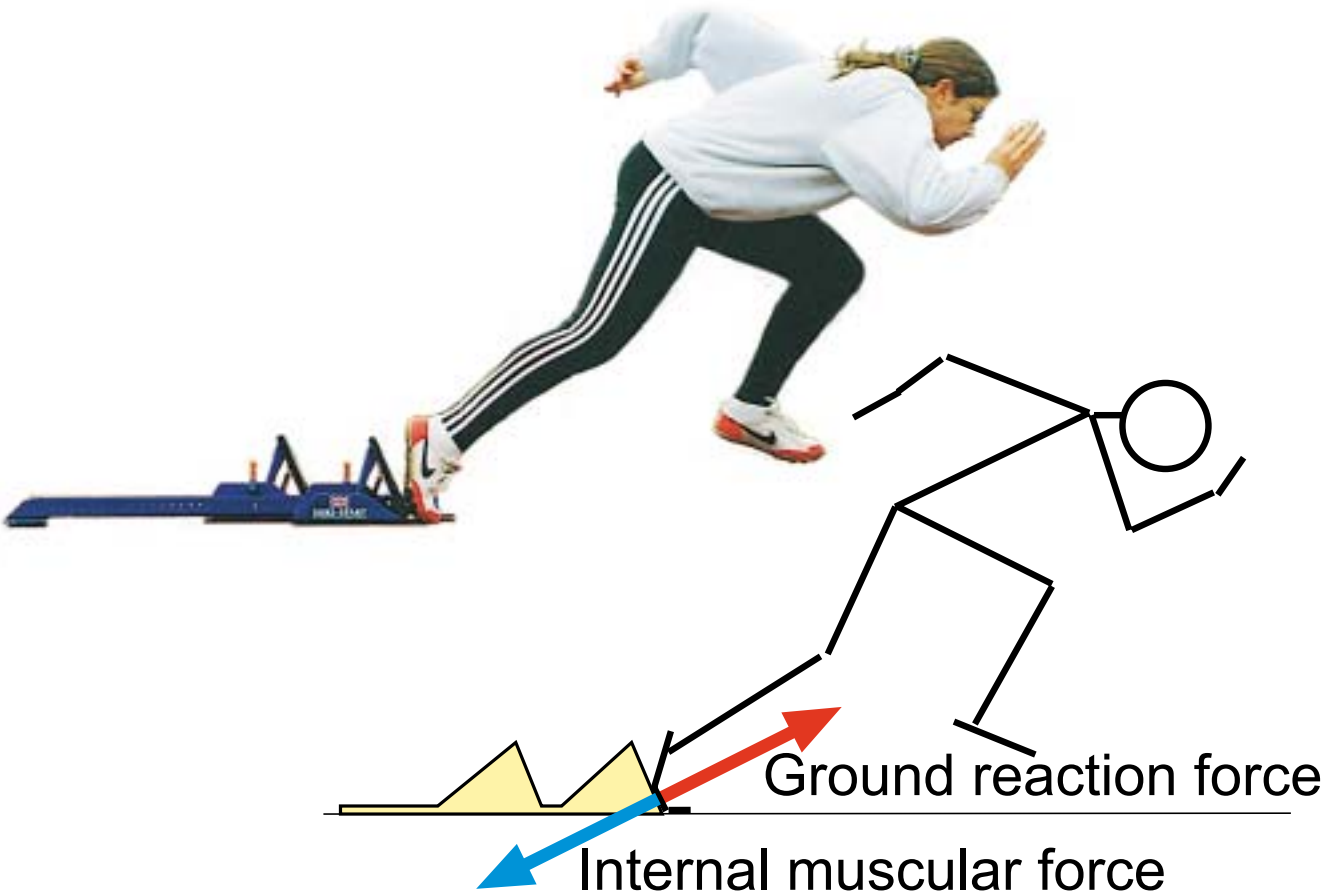


2

Linear Motion

# The Run

## Resultant ground reaction force



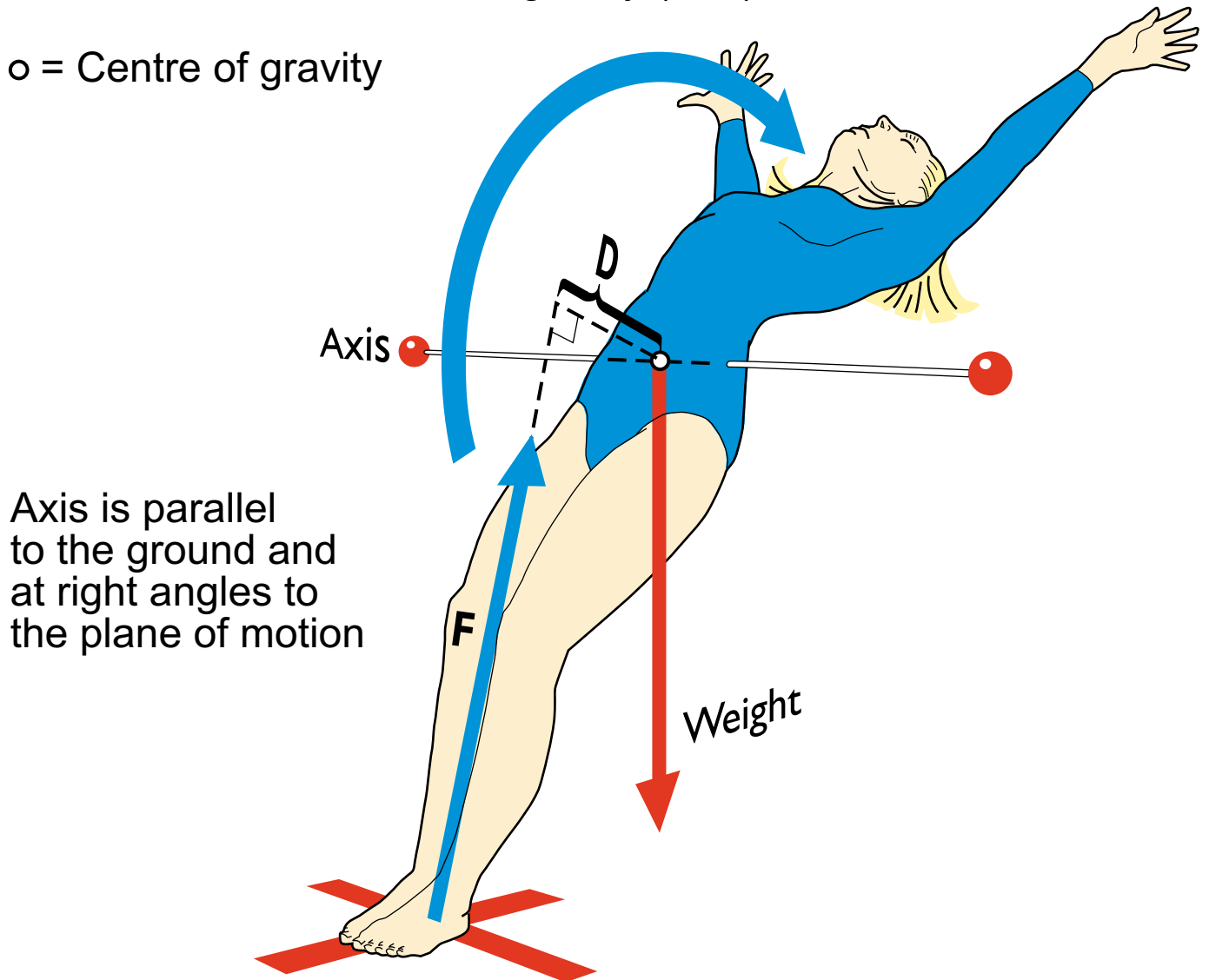
# Rotation

Ground reaction force  
generating torque

F = Ground reaction force

D = Perpendicular distance between  
line of action of the ground reaction  
force and the centre of gravity (axis)

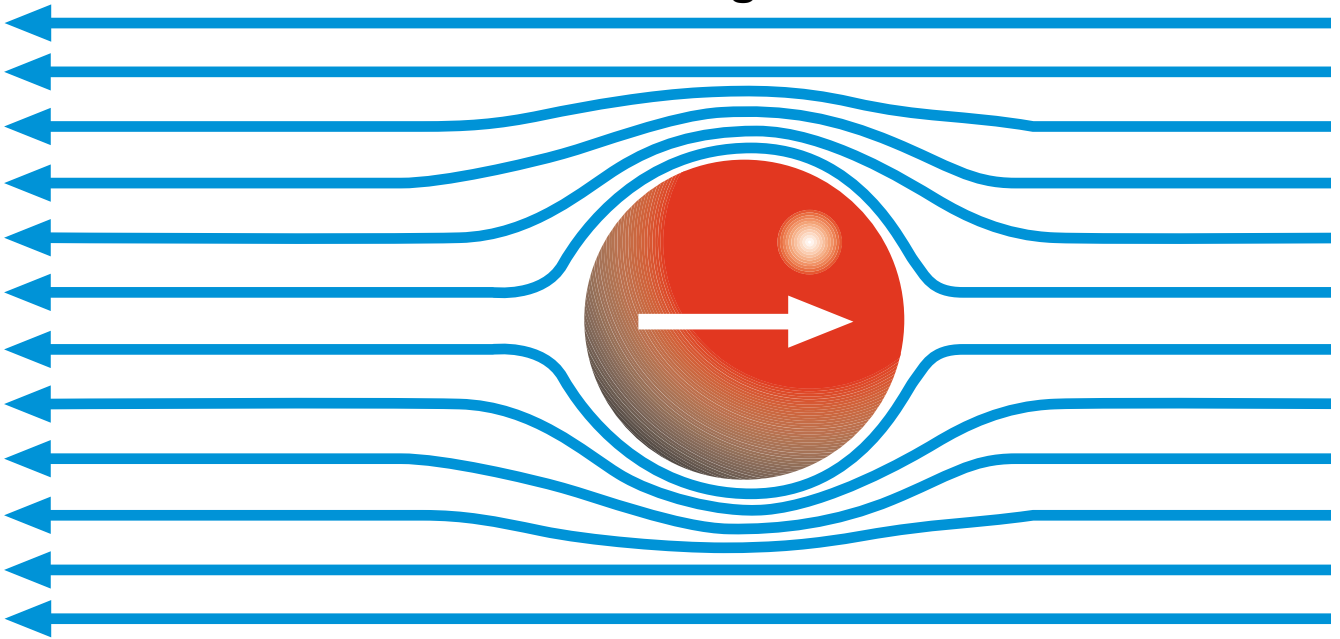
o = Centre of gravity



# Bernoulli Effect

Laminar flow around a slow moving ball  
and a fast moving ball

Slow moving ball



Fast moving ball

s = separation point

