

# Force, Energy and Momentum

## 1 Scalars and Vectors

**Scalar** - Magnitude

**Vector** - Magnitude and Direction

## 2 Moments

### 2.1 Moment

$\text{Force} \times \text{Perpendicular distance from the point to the line of action of the force}$

### 2.2 Couple

A pair of equal and opposite coplanar forces

### 2.3 Moment of a couple

$\text{Force} \times \text{Perpendicular distance between the lines of action of the forces}$

### 2.4 Principle of moments

For an object in equilibrium, **Clockwise Moments=Anticlockwise Moments**

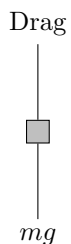
## 3 Graphs with respect to time

Type of Graph	Gradient	Area Under Graph
Distance Time	Velocity	-
Velocity time	Acceleration	Displacement
Acceleration time	-	Change in velocity

## 4 Projectile motion

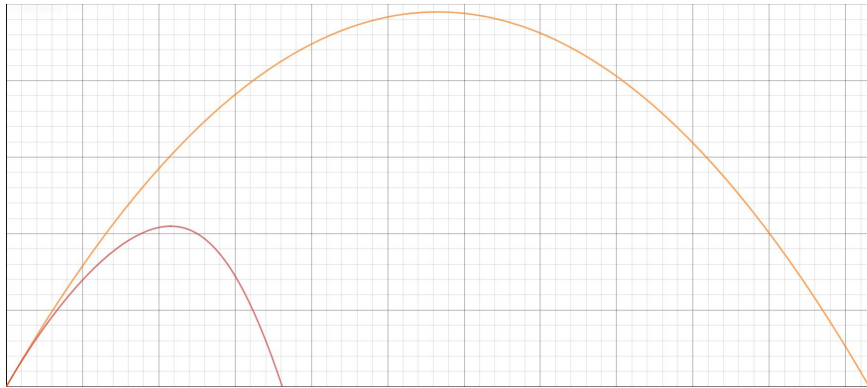
For a falling object with no air resistance there is no horizontal acceleration or deceleration

### 4.1 Terminal Velocity



As an object accelerates speed increases so drag increases, when **Drag=mg** the object has reached **terminal velocity** meaning that it now travels at a **constant velocity**

## 4.2 The effect of air resistance



No Air Resistance

Air resistance

- Steeper descent
- Peak Further Left
- Smaller Range

### 4.2.1 Factors that affect air resistance

- Surface area
- Air Pressure/Density
- Speed
- Roughness of shape

## 5 Newton's laws of motion

**First Law** - Objects either stay at rest or move with a constant velocity unless acted on by a resultant force

**Second law** - For an object with constant mass its acceleration will be directly proportional to the resultant force

$$F = ma$$

**Third law** - Every action has an equal and opposite reaction

## 6 Momentum

Momentum = Mass  $\times$  Velocity

In a collision **Momentum is conserved**

**Impulse** = Change in momentum

The area under a force time graph is the impulse

**Elastic collision** - A collision with no loss of kinetic energy

**Inelastic collision** - A collision with a loss of kinetic energy

## 7 Work, energy and power

Rate of doing work = Rate of energy transfer

The area under a force displacement graph is the **work done**

## 8 Conservation of energy

**Principle of conservation of energy** - In an isolated system the total energy remains constant