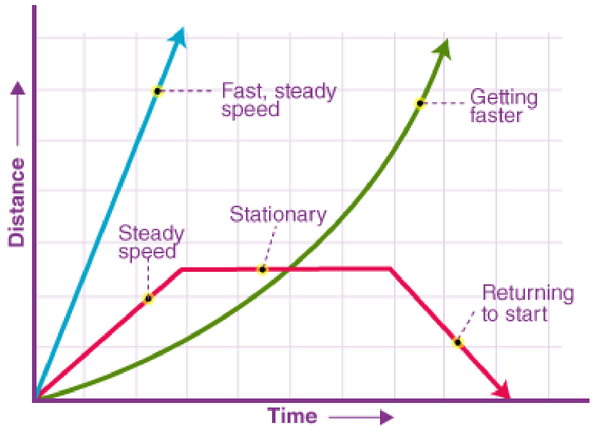
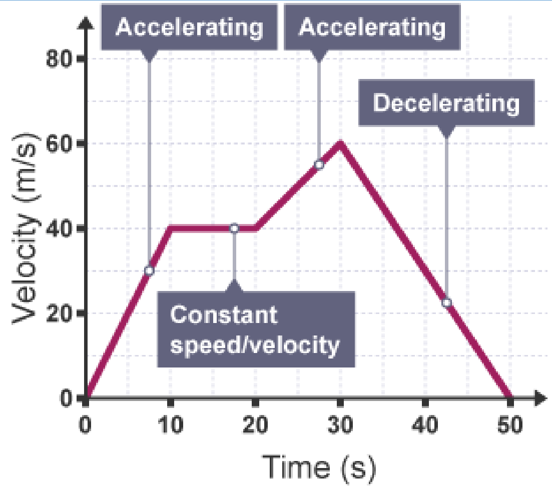
AQA Physics GCSE Knowledge organiser

Yr11 Forces Part 1

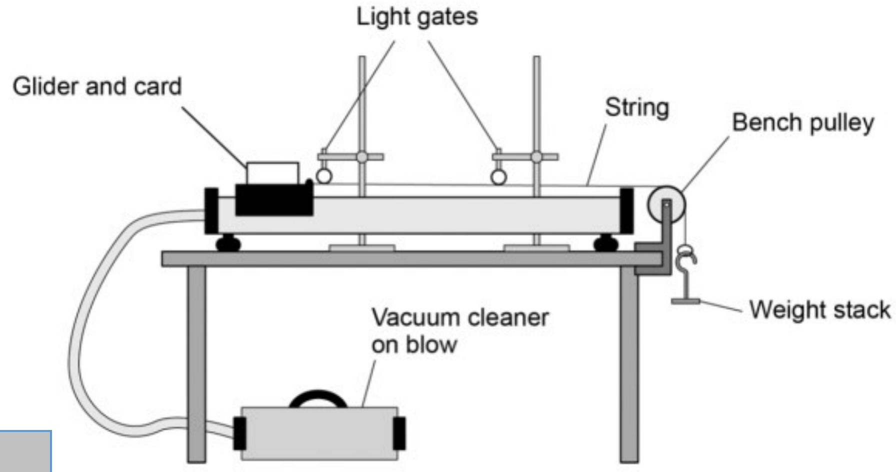
Distance– time graphs



Velocity– time graphs



$$v^2 = u^2 + 2as$$



$$\text{SPEED (m/s)} = \frac{\text{DISTANCE (m)}}{\text{TIME (s)}}$$

$$a = \frac{\Delta v}{\Delta t}$$

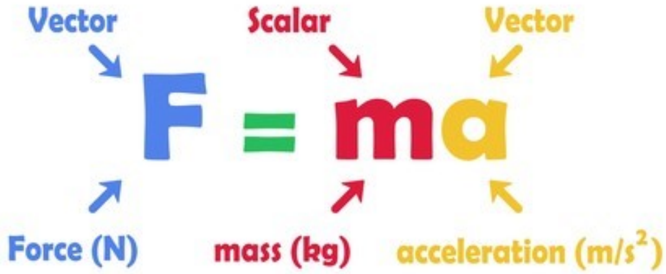
Newton's laws of motion

First	If there is no resultant force acting on an object, then it will remain at a constant velocity.
Second	Resultant force = mass x acceleration
Third	For ever action there is an equal and opposite reaction.

Required practical—Newton's 2nd law

Independent variable	The **force** pulling (the weight stack).
Dependent variable	The **acceleration** of the car / glider.
Control variables	The total mass.

Scalar quantity *magnitude only*	**Vector quantity** *Magnitude and direction*
Distance	Displacement
Speed	Velocity
Time	Acceleration
Mass	Forces



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AQA Physics GCSE

Knowledge organiser Forces Part 2

All objects have **mass**, and anything that has mass has its own **gravitational field**. Yes, even you have your own gravitational field!

The **magnitude** of the gravitational force depends on the **mass** of the object the force is acting on and the **gravitational field strength** at the point the object is located. This force is known as **weight** and can be calculated using the equation:

$$W = mg$$

Key
- W – Weight (N)
- m – mass of object (kg)
- g – gravitational field strength (N/kg)

The force always acts in the **direction** towards the **centre of mass** of the object causing the gravitational field. For Earth, this is always towards Earth's surface.

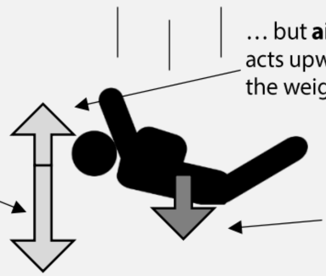
$$p = mv$$

Key
- p – momentum (kg m/s)
- m – mass (kg)
- v – velocity (m/s)

A skydiver is falling through the atmosphere.

The skydiver's **weight** caused by gravity acts downwards…

… but **air resistance** acts upwards, against the weight.



The **resultant force** is the difference between the two.

Using

$$F = m\frac{\Delta v}{\Delta t}$$

ES

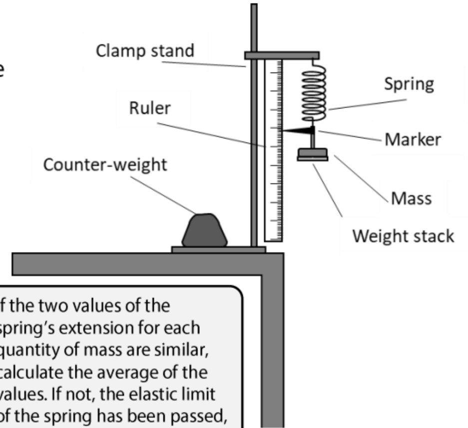
Key
- F – force (N)
- m – mass (kg)
- a – acceleration (m/s^2)
- Δv – change in velocity (m/s)
- Δt – change in time (s)
- Δp – change in momentum (kg m/s)

HT ONLY

Forces may not always act along the same line as each other. To find the resultant force when forces aren't acting in one line, split each force into its **horizontal** and **vertical** components. Then, add the forces in each direction, and use trigonometry to find the resultant force.

Investigating the relationship between force and extension of a spring

Method

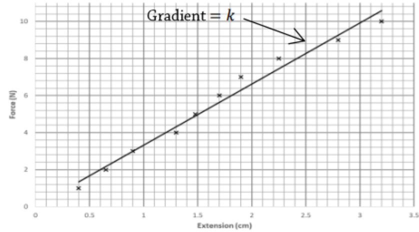


1. With no mass on the weight stack, position the ruler so the top of the spring is at zero. Making sure the marker is horizontal, record the position of the marker, l_0.
2. **Increase the mass** on the weight stack at regular intervals, **recording the position** of the marker each time.
3. Once the maximum amount of mass is added, decrease the mass on the weight stack by the same intervals, again recording the position of the marker.

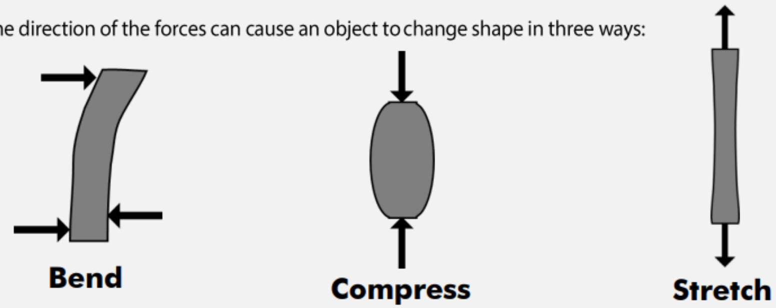
If the two values of the spring's extension for each quantity of mass are similar, calculate the average of the values. If not, the elastic limit of the spring has been passed, so only use the first value.

Analysis

1. For each recorded position value, **subtract** the initial length, $\boldsymbol{l_0}$, to calculate the extension, e.
2. Calculate the force applied to the spring using $\boldsymbol{F = mg}$ where m is the mass on the end of the spring and g is the gravitational field strength.
3. Plot force against extension.



The direction of the forces can cause an object to change shape in three ways:



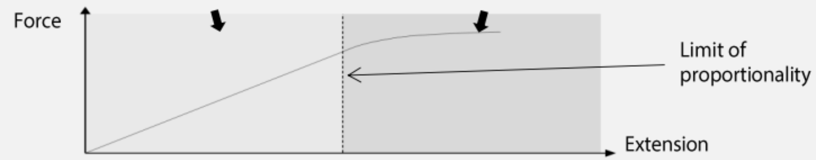
For a **change of shape** to occur, **more than one force** must act.

Elastic deformation

The object's shape **is not permanently** changed. After the force stops acting, the object **returns to its original shape**.

Inelastic deformation

The object's shape **is permanently changed**. After the force stops acting, the object stays in its new shape.



$$stopping\ distance = thinking\ distance + braking\ distance$$

Total distance car moves

Distance car moves while driver reacts

Distance car moves while brakes are applied so car slows down

Factors that affect thinking distance:
- Tiredness
- Alcohol
- Drugs
- Distractions

Factors that affect braking distance:
- Condition of brakes
- Condition of tyres
- Road surface
- Weather
- Size of braking force