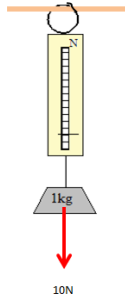


# Forces

## 1: Measuring Forces

Force is measured in newtons (N).  
 A newton meter is used to measure the size of a force.  
 Arrows are added to diagrams to show the size and direction of the force.



## 2: Changing shape

When an unbalanced force acts on an object its shape can change. This is like pulling on a spring.  
 To investigate how adding mass to a spring affects its extension.

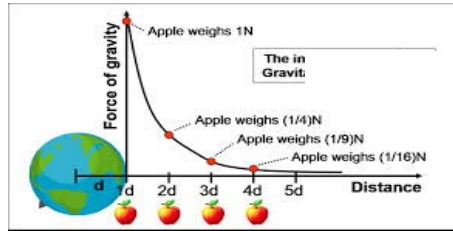
Add a 10 g mass holder to a suspended spring and record the spring length.  
 Add another 10 g mass and record the new spring length.  
 Take away the previous spring length from the new length to calculate the extension (the difference).  
 Repeat by adding 10 g masses until 100 g is reached.

**Contact forces:** interactions between objects that touch

	Thrust/Applied		Magnetic
	Tension		Electro-static
	Drag and air resistance		Weight /Gravity
	Friction		
	Normal/reaction		

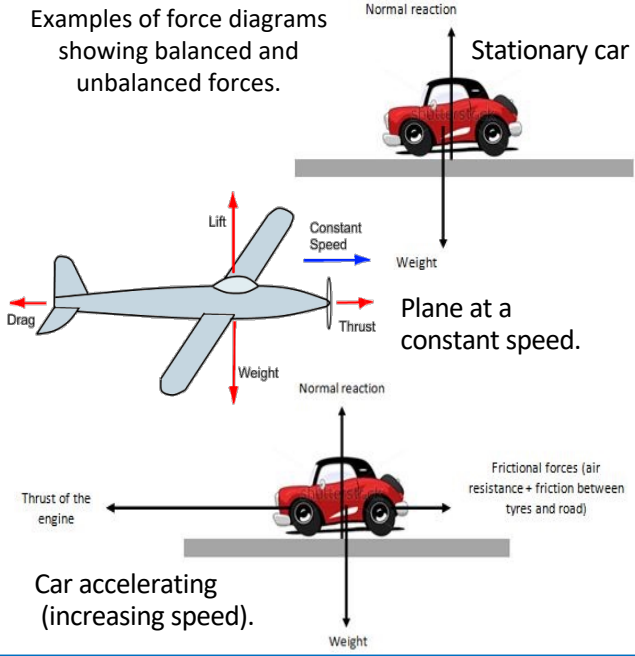
## 4. Weight and Gravity

Gravity is an attraction towards the centre of mass. It is caused by any object with mass. The greater the mass the greater the gravity.  
 As you move further from an object its gravity decreases.



The force called weight is calculated using the following equation:  
 $weight = mass \times gravity$   
 Mass is the amount of stuff you are made of. If you went to the Moon, your mass would stay the same, but your weight would change.

Examples of force diagrams showing balanced and unbalanced forces.



## 3. Friction

Whenever an object moves against another object, it feels frictional forces. These forces act in the opposite direction to the movement. Friction makes it more difficult for things to move.

### Air resistance

Bikes, cars and other moving objects experience air resistance as they move. Air resistance is caused by the frictional forces of the air against the vehicle. The faster the vehicle moves, the bigger the air resistance becomes. The top speed of a vehicle is reached when the force from the cyclist or engine is balanced by air resistance.

### Streamlining

Streamlining reduces air resistance. Racing cyclists crouch down low on their bikes to reduce the air resistance on them. This helps them to cycle faster. They also wear streamlined helmets. These have special, smooth shapes that allow the air to flow over the cyclist more easily.

## 5. Balanced and unbalanced forces.

Forces interact in pairs. Where there is a push there is also a pull. e.g. Weight pulls you down but the reaction force from the floor pushes you back up.

When you apply more thrust to run faster the air resistance increases pulling you back more. Forces can be balanced or unbalanced. When forces are balanced everything stays the same.

However when objects are unbalanced a resultant force is created. When there is a resultant force three things can happen to an object. It will either:

- 1) change shape. (like stamping on a can or stretching a spring)
- 2) change speed (like increasing the thrust in a car engine)
- 3) change direction (like hitting a tennis ball back over the net).

