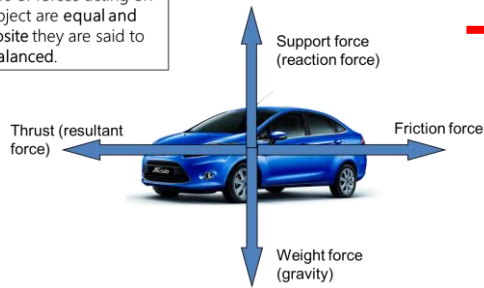


If pairs of forces acting on an object are **equal and opposite** they are said to be **balanced**.



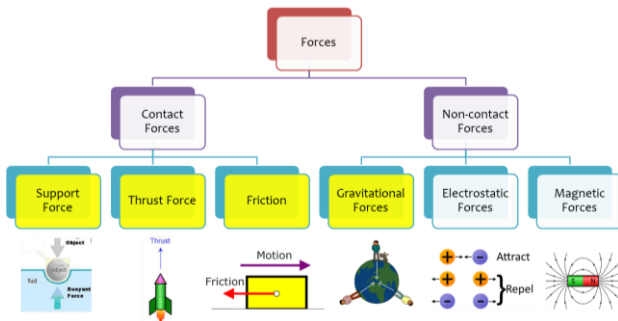
**Equal and opposite** Forces are said to be **balanced**

Situations where Friction is useful		Situations where Friction is unhelpful	
situation	Increased by	situation	decreased by
walking	Having grip on the soles of your shoes	Friction in bearings	Oil around bearings
cycling	Wider tyres with tread	Drag on car	Aerodynamic design to reduce drag
driving	Good tread on tyres. Brake pads	Drag on snowboard	Smooth lacquered surface

**Friction can be helpful and unhelpful**

If an object has no motion then there is no friction. When friction occurs, and one surface moves against another, the movement causes Kinetic energy to be changed into heat energy. Smooth surfaces create less friction than rough surfaces. Friction that occurs between air or water and a solid body is called resistance.

**Friction is a force that opposes motion**



**Forces can be contact or non-contact**



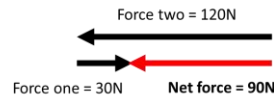
Unbalanced forces will show arrows of different length

Direction of acceleration

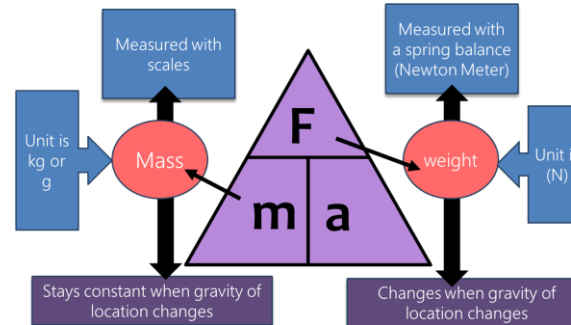
**Unbalanced forces accelerate in direction of largest force**



Note: if there are two or more forces acting in the same direction then they are added



**Net force can be calculated**



mass is a measure of the amount of matter that an object has.

Weight is the downward force due to gravity that an object experiences due to its mass

**A formula can be used to calculate mass and weight**

Quantity	What is it measured in?	Symbol	Equipment used
Force (including weight)	Newton's	N	Spring balance
Mass	kilograms	kg	scales
Velocity / speed	metres per second	ms <sup>-1</sup>	Ticker timer
Acceleration (including gravitational acceleration)	metres per second per second	ms <sup>-2</sup>	Ticker timer

$$a_{ave} = \Delta v / \Delta t$$

a = acceleration (ms<sup>-2</sup>)

v = velocity (ms<sup>-1</sup>)

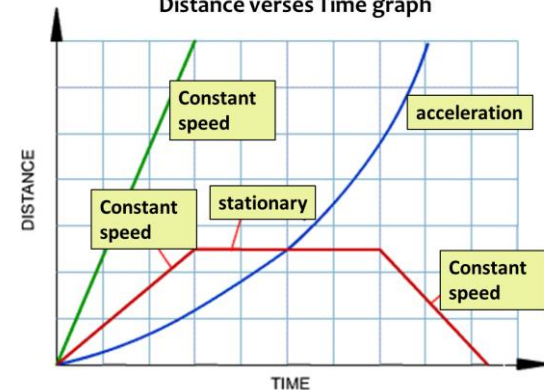
t = time (s)

acceleration =  $\frac{\text{change of velocity}}{\text{change in time taken}}$

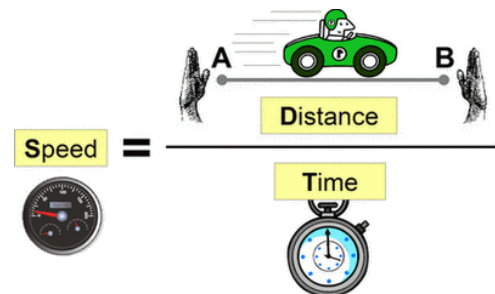
The units for Acceleration depend on what velocity and time are measured in.

If time is measured in seconds (s) and velocity is measured in metres per second (ms<sup>-1</sup>) then the units for acceleration will be metres per second per second (ms<sup>-2</sup>)

**Distance versus Time graph**



**Distance and time can be graphed to show speed**



**Speed is the amount of distance travelled over time**

## Ideas for last minute study sheet

1. **Flash Cards.** Cut up the individual ideas and use as flash cards. Students test each other in pairs.
2. **Concept maps.** Students use the information on the sheet to create a large concept map.
3. **Scaffolded Practice Tests.** Create a short test, either paper or online (i.e. Kahoot, FORMS, Education Perfect), where the students are able to use the sheet to help. Repeat the test (or an alternative) the next day, without the information sheet.
4. **Sticky Notes.** Write summary statements, using information on the sheet, on small post it notes (digital or paper) and find the area of their notes to place it on.
5. **Study notes headers.** Cut up and attach each idea to top of page (paper or digital), and add further notes, practice questions, and diagrams.