Year 7 - Forces Knowledge organiser

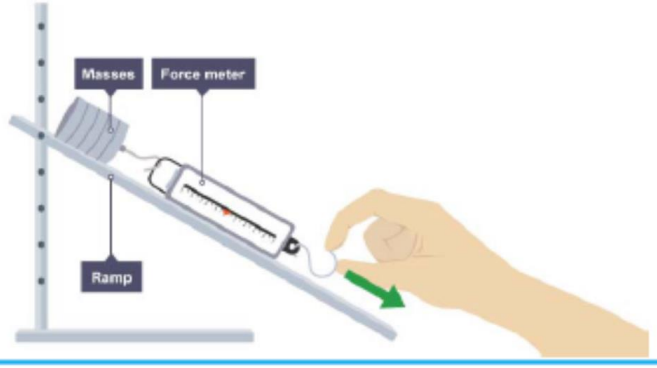
Key Terms	Definitions
Newton	The unit of force
Newton meter	A piece of equipment that can be used to measure the size of the force
Contact Force	A force caused by the contact between two objects
Non Contact Force	A force between two bodies that are not in contact for example gravity
Free body force diagram	A diagram which shows all the forces acting on an object

Measuring the size of forces

To measure the size of frictional forces on different surfaces you can drag some masses along the different surfaces and record how much force is required.

For this experiment :

- Independent variable: Surface
- Dependent variable: Force
- Control variable: Mass



Types of force

In the table below different forces are summarised:

Name of Force	What causes it?	Example
Friction	When two objects rub together	Car tyres moving on a road.
Air resistance	When an object rubs against air particles	A sky diver falling through the air
Reaction	A force that acts in the opposite direction	A book on a desk, the force acting up is a reaction force
Weight	The force an object exerts on the ground due to gravity	You will exert a force on the ground, that is your weight
Thrust	The force that drives on objects with an engine	Thrust moves a plane forwards

A force can be a **push or a pull,** for example when you open a door you can either push it or pull it. You can not see forces, you can only see what they do.

When a force is applied to an object it can lead to a change in the objects

- **Speed**
- **Direction of movement**
- **Shape (think about a rubber band)**

Forces can also be divided into 2 types, contact forces and non contact forces.

1. Contact forces for example friction, are caused when two objects are in contact.
2. Other forces for example gravity, are non contact forces. The two objects do not need to be in contact for the force to occur.

Gravitational forces

People often confuse mass and weight. Remember that weight is a force that acts upon a mass, and is measured in newtons, N. Mass is measured in kilograms, kg.

Mass

The mass of an object is the amount of matter or 'stuff' it contains. The more matter an object contains, the greater its mass. An elephant contains more matter than a mouse, so it has a greater mass.

Mass is measured in kilograms, kg. A 100 kg object has a greater mass than a 5 kg object. An object's mass stays the same wherever it is. So a 5 kg mass on Earth has a 5 kg mass on the Moon.

The force of gravity

Gravity is a force that attracts objects towards each other. Gravity only becomes noticeable when there is a really massive object like a moon, planet or star. We are pulled down towards the ground because of gravity. The gravitational force pulls in the direction towards the centre of any object. So we are pulled towards the centre of the Earth.

Unbalanced Forces

If the forces are unbalanced on an object there are two things that could happen:

1. If the object is stationary then it will move in the direction of the resultant force
2. If the object is moving, then the object will speed up or slow down in the direction of the resultant force.

For example, what is the resultant force on the lorry below?

100N-60N= 40N (to the right)

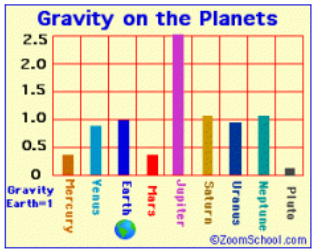
Remember the resultant force does not tell you what direction the lorry is moving in.

- If the resultant force is in the same direction as the movement of the lorry then the lorry will speed up
- If it is in the opposite direction the lorry will slow down

The larger the resultant force the larger the change in movement.

Weight on different Planets

As planets have different masses a person's weight would be different depending which planet they were on. For example, a person's weight on Earth is 1000N. If that same person was on Jupiter their weight would be 2500N.



Speed

The speed of an object tells you how long it takes an object to cover a distance. **The unit for speed is m/s** (metres per second).

Speed is calculated by **dividing distance by the time** (see equation in the box).

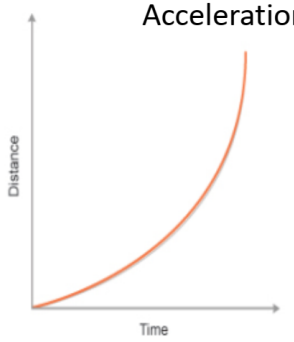
If the speed of an object is increasing, then it is **accelerating.** If the speed is decreasing it is **decelerating.**

Acceleration and Deceleration

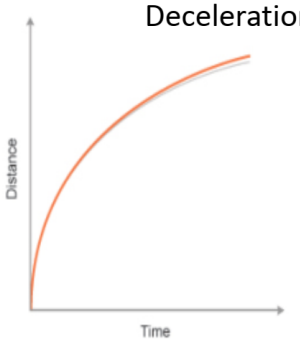
When an object is accelerating, the distance time graph will **curve upwards.**

When an object is slowing down an object will **curve towards the horizontal.**

Acceleration



Deceleration



Key Terms	Definitions
speed	How fast an object is moving, regardless of direction
velocity	How fast an object is moving, taking direction into account as well
Gradient	How steep the line on a graph is.
Stationary	Not moving
x axis	The horizontal axis on a graph
y axis	The vertical axis graph
Acceleration	Speed of an object is increasing
Deceleration	Speed of an object is decreasing

Equation	Meanings of terms in equation
$* s = \frac{d}{t}$	*s = speed* (m/s) *d = distance* (m) *t = time* (s)

Balanced Forces

When we talk about the total force acting on object we call this the **resultant force.** When the forces acting in opposite directions are the same size we say the forces are **balanced.** This means one of two things:

1. The object is stationary (not moving)
2. The object is moving at a constant speed

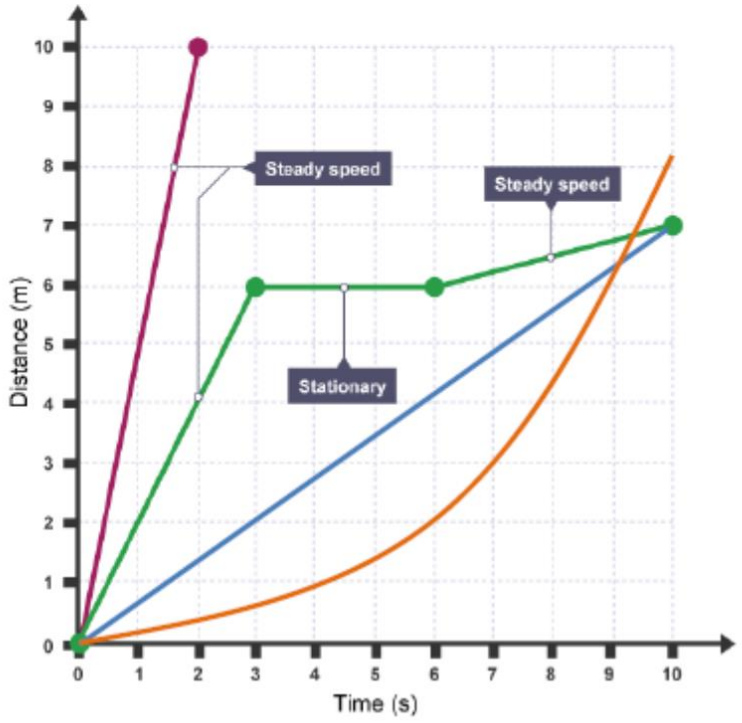
This is known as Newton's first law.

For example, the resultant force acting on this object is 5N-5N=0N

$$speed = \frac{distance}{time}$$

Interpreting Distance-time graphs

- A straight diagonal line of a distance-time graph shows that the object is travelling at a steady/constant speed.
- A straight horizontal line on a distance-time graph shows that the object is not moving (stationary)
- If a curved line were to appear on a distance-time graph (orange line) this shows the object is accelerating.



Distance-time graphs

A distance-time graph shows how far an object has moved from its starting point over time.

Distance travelled is always plotted on the y-axis (vertical)
Time taken is always plotted on the x-axis (horizontal)

You can find the speed of an object from a distance-time graph by finding the gradient of the graph. This is the 'steepness' of the line.

Gradient = Change in y-axis ÷ Change in x-axis

Using the graph opposite we can find the speed of the object represented by the green line between 6 and 10 seconds by:

Gradient = Change in y-axis ÷ Change in x-axis
= (7-6) ÷ (10-6)
= 1 ÷ 4
= 0.25m/s

We can also find the average speed of the green object by drawing a line from the start of its motion to the end of its motion. This is shown opposite by the blue line and how to find the average speed is shown below.

Gradient = Change in y-axis ÷ Change in x-axis
= (7-0) ÷ (10-0)
= 7 ÷ 10
= 0.7m/s