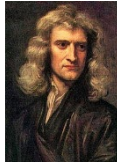


### 1. Forces

A force is a **push** or a **pull** that changes the **shape, speed** or **direction** of an object. You cannot see forces, but you can see the effects of them.



The unit of force is the **Newton (N)** named after Sir Isaac Newton. We measure force using a piece of equipment called a Newton metre.



### 4. Unbalanced Forces

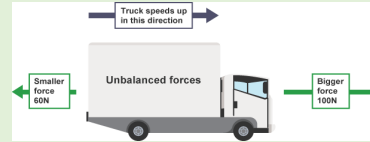
If the forces are unbalanced on an object there are two things that could happen:

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

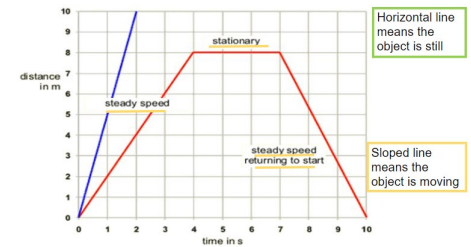


Hot air balloon rising

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



### 6. Distance-Time Graphs



Speed can be calculated from a distance-time graph. In the first 4 seconds, this object travelled 8m. Its speed was  $8 / 4 = 2\text{m/s}$

### 2. Types of Force

Forces can be divided into two types: contact and non-contact.

**1. Contact forces** (e.g. push) are caused when two objects are in contact.

**2. Non-contact forces** (e.g. magnetism) do not require the objects to be in contact for the force to occur.

Examples of forces include **push, pull, friction, air resistance, water resistance, thrust, upthrust, reaction, weight, magnetism, gravity, lift and tension.**



## KS3 Science Forces and Motion

### 7. Reducing forces for the better

Friction opposes the direction of motion, making it more difficult to move.



**This can be helpful:**

- ✓ Your shoes and the floor to stop you slipping
- ✓ Tyres and the road to prevent skidding
- ✓ Brakes and the wheel to slow you down

**This can be unhelpful:**

- ✗ If you do not lubricate your bike chain using oils, friction between the chain and the axles make it difficult to pedal.

Like friction, air resistance and water resistance forces can also be reduced. This is known as streamlining.

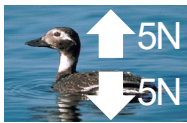
### 3. Balanced Forces

When the forces acting in opposite directions are the same magnitude (size) we say the forces are **balanced**. The resultant force (overall force) is 0N.

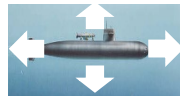
This means one of two things:

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

For example, the vertical resultant force acting on the duck is  $5\text{N} - 5\text{N} = 0\text{N}$



Floating duck



Submarine at constant speed and depth

### 5. Speed, Distance and Time

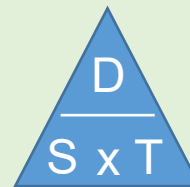
How do you find the average speed of an object?

- 1) Measure the distance travelled
- 2) Measure the time taken to travel that distance

**speed = distance / time**

Worked example:

Q) A car travels 2000 km in 100 s.  
Calculate its average speed.  
 $2\text{ km} = 2000\text{ m}$   
 $2000\text{ m} / 100\text{ s} = 20\text{ m/s}$



### 8. Investigating Forces

**Scientific Question:** Does wing length affect the time taken to land?

**Independent variable:**

wing length (cm)

**Dependent variable:**

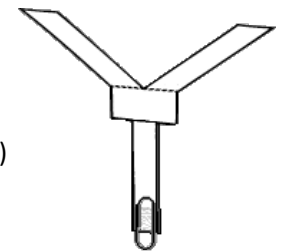
time taken to land (seconds)

**Control variable:**

height dropped from (cm)

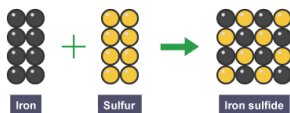
mass of helicopter (g)

**Conclusion:** The longer the wings, the greater the force of air resistance.



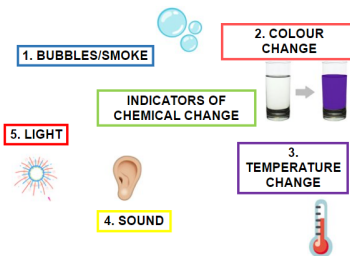
### 1. Chemical Reactions

Atoms are rearranged in a chemical reaction.



Their changes are **irreversible**.

There are 5 indicators of **chemical change**.



### 2. Chemical Equations

Changes in a chemical reaction are written as a chemical equation.

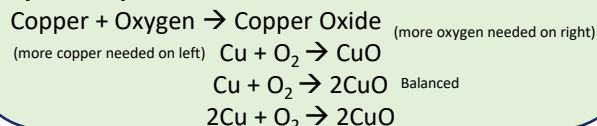
**Word equation:**

**CHEMICAL EQUATION**  
Magnesium + oxygen → magnesium oxide

REACTANTS

PRODUCT

**Symbol equation:**

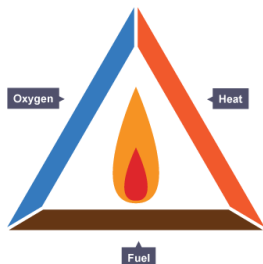


### 3. Combustion

**Combustion** is the scientific term for burning. There are 3 things that are needed for a fire: oxygen, fuel and heat, shown by the fire triangle.

**Complete combustion**

occurs when there is good supply of oxygen. The general equation is:  
Fuel + oxygen → carbon dioxide + water



### 4. Incomplete combustion

Combustion **without** enough oxygen.

The general **equation** is:

Fuel → carbon monoxide + water + carbon (soot)

**Problems with incomplete combustion**

- X Carbon monoxide, CO, a colourless toxic gas which can kill.
- X Particles of carbon, which appear as soot and smoke, and which cause breathing problems.



## KS3 Science Chemical Reactions

### 5. Oxidation

Combustion is an example of a type of reaction called **oxidation**. In an oxidation reaction, a substance **gains oxygen**.

**Metal + oxygen → metal oxide**  
*magnesium + oxygen → magnesium oxide*

**Non-metal + oxygen → non-metal oxide**  
*Carbon + oxygen → carbon dioxide*

Rusting is an example of oxidation.



### 6. Thermal Decomposition

**Thermal decomposition**  
HEAT BROKEN DOWN

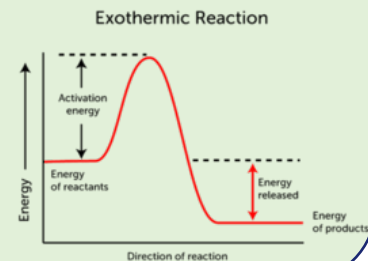
Thermal decomposition is a **chemical reaction that happens when a compound breaks down when heated**. Thermal decomposition reactions happen at high temperatures. The reactants absorb lots of energy before breaking down into the products. Thermal decomposition is an example of an **endothermic** reaction.

### 7. Exothermic Reactions

**EXOTHERMIC**  
exit heat

Energy is **released to the surroundings**, indicated by a temperature increase.

This means that the **reactants** produce both **heat energy** and **products** in the reaction. The **energy level diagram** shows the lower energy in the products.



### 8. Endothermic Reactions

**ENDOTHERMIC**  
in heat

Energy is **absorbed from the surroundings**, indicated by a temperature decrease.

This means that the **reactants** combined with **heat energy** produce **products** in the reaction. The **energy level diagram** shows the higher energy in the products.

