

## Laws in science

There are many **laws** in science – sometimes known as '*laws of nature*'.

The term '*law*' is normally used for a *regular pattern* that has been observed, and which is believed to be a reliable finding, i.e. something that always happens. (Laws must be 'obeyed').

Often laws are described in terms of mathematical relationships – so that they can be easily represented in formula and graphs.

### *Laws are not really the same as facts*

'Pure water always boils at 100°C at atmospheric pressure.'

'Salt dissolves in water'

Although these statements are general – they are always expected to apply – they refer to *specific examples* (water, salt), where laws normally refer to more *general classes* (e.g. all gases, all planets etc.)

### *Laws are similar to principles*

Some scientific ideas are described as principles, and these are general ideas. They are often quite similar to laws, in that describe relationships that are thought to always apply:

- an object floating in a fluid displaces its own weight of the fluid (Archimedes' principle)
- during any collision the total momentum of the colliding bodies remains constant (principle of conservation of momentum)

### *Laws are not really the same as theories*

Theories may be closely linked to laws, but normally a theory is an explanation, whereas a law just describes the pattern.

## Some examples of laws in science:

**Hooke's law:** *the extension of a loaded spring or wire is directly proportional to the applied load (up to a certain point)*

Hooke's law can be explained in terms of theories about the forces between the particles considered to make up the metal.

**Ohm's law:** *the current passing through a metallic conductor is directly proportional to the p.d. across the conductor (if other conditions are kept constant)*

Ohm's law can be explained in terms of theories about the effects of electrical fields, the structure of metals, the nature of electrical current in metals.

The gas laws:

**Boyle's law:** *the product of the pressure and volume ( $P \times V$ ) of a fixed mass of gas at constant temperature is constant;*

**Charles' law:** *the volume of a fixed mass of a gas at constant pressure is increased by the same amount for each degree increase in its temperature;*

**The pressure law:** *the pressure of a fixed mass of a gas of fixed volume is increased by the same amount for each degree increase in its temperature*

The gas laws may be explained through kinetic theory, in terms of the properties of gas molecules

**The periodic law:** *if the chemical elements are arranged in atomic number, then similar chemical properties are found in elements separated by the same number of places.*

The periodic law is explained by atomic theory, and quantum theory, which relate the structures of atoms to the way they interact in forming molecules etc.

**Coulomb's law:** *the force between two charged particles is directly proportional to the product of the masses, and inversely proportional to the square of the distance between them*