

**magma**

The subterranean molten mass from which igneous rocks may later form, or lavas be erupted.

**magnetic lines of force**

Lines indicating the direction of a magnetic field in space, such as would be mapped by a magnetic needle.

**maser**

An acronym for *microwave amplification by stimulated emission of radiation*, whereby the natural oscillations of an atom or a molecule are used for amplifying electromagnetic radiation in the microwave band (1 mm to 30 cm wavelengths).

**moment of inertia**

A measure of the resistance of a body to a change in its rotation.

**muon**

Originally known as the  $\mu$ -meson, this is an atomic particle which seems to be like an electron but with 207 times its mass.

**neutrino ( $\nu$ )**

A nuclear particle with no electric charge and no mass, but with angular momentum or spin. It carries away energy in nuclear reactions.

**neutron (n)**

A nuclear particle with no electric charge, and a mass ( $1.6749 \times 10^{-27}$  kg) rather larger than that of the proton. A free neutron decays after a half-life of 10.6 minutes into a proton, an electron, and an antineutrino (a neutrino with the opposite spin to a neutrino). In the nucleus of an atom neutrons and protons form a stable combination.

**newton**

The force required to give a mass of one kilogram an acceleration of one metre per second every second.

**nucleus, atomic**

The positively charged core of an atom, consisting of protons and neutrons and containing the major portion of the atom's mass.

**optical continuum**

The continuous spectrum in optical (visual) wavelengths (400 nanometres or  $4 \times 10^{-7}$  m, to just over 700 nm or  $7 \times 10^{-7}$  m).

**parabolic orbit**

An open orbit where the eccentricity is exactly equal to 1. Very unlikely to occur in nature, it is frequently used for computational purposes.

**perturbation**

The disturbance of the orbit of a body by some outside force or forces.

**photo-ionization**

The ionization of an atom or molecule caused by absorbing an high-speed (i.e. high energy) photon.

**photon ( $\gamma$ )**

A quantum or discrete quantity of electromagnetic energy.

**pion**

An unstable nuclear particle, sometimes called a  $\pi$ -meson, with a mass which lies between that of an electron and a proton. (Positive or negative pions have a mass 273 times that of

an electron, zero charged pions a mass 264 times that of an electron). A charged pion decays into a muon and a neutrino: an uncharged pion into two  $\gamma$ -rays. Pions are probably exchanged between protons and neutrons and have to do with the strong force binding together the particles of an atomic nucleus.

**plasma**

A completely ionized gas in which the temperature is too high for atoms to exist as such; it consists of free electrons and free atomic nuclei.

**positron ( $e^+$ )**

The antiparticle to the electron, having the same mass but opposite electric charge to the electron.

**polarization**

In a theoretical description, the propagation of light involves a wave oscillation at right-angles or sideways to the direction of motion. Ordinary *unpolarized* light has an equal mixture of oscillations in all possible sideways directions. In *plane polarized* light all the oscillations are in the same sideways direction. Light is said to be, for example, 30 per cent polarized if it is a mixture of 30 per cent plane polarized and 70 per cent unpolarized light. Other electromagnetic radiation besides light may also be polarized.

**potential difference**

The difference in electrical states between two points in an electric circuit; it causes an electrical current to flow between the points. Potential difference is measured in volts.

**potential energy**

Energy which is stored in the relative positions of bodies, as distinct from kinetic energy which is their energy of motion. For an isolated system the total energy, which is the sum of kinetic and potential energies, is constant. When two bodies move closer, their potential energy decreases and as they move faster the kinetic energy increases. By definition, the potential energy in a stable binary system is a negative number; for a stable system of smaller separation, the potential energy is a larger negative number.

**proton (p)**

A positively charged nuclear particle with a mass 1836 times that of an electron and is found in all atomic nuclei. The number of protons in the nucleus defines the atomic number,  $Z$ , of the element. The mass of the proton may also be expressed in energy units and equals 938 million electron volts (938 MeV).

**quantum theory**

The theory that radiation is emitted only in discrete units or quanta.

**radian**

A unit of angular measure; it is the angle subtended at the centre of a circle by a section of the circumference equal in length to the radius. There are  $2\pi$  radians in a circle ( $360^\circ$ ), so 1 radian =  $57^\circ.2957795131$ .

**radioisotope dating**

From a knowledge of the rate at which radioactive decay occurs, and measurements of the relative amounts of the initial and final elements present, the age of material samples may be estimated.

**radioactive decay**

The spontaneous break-up or fission of the atomic nuclei of certain chemical elements into lighter, more stable, nuclei. It is usually accompanied by the emission of charged particles or  $\gamma$ -rays.

**resonance**

The response of an oscillating system to an external effect at the same frequency as the oscillating system's natural frequency. In orbital theory the term is applied to orbits where gravitational interaction has caused the periods to assume a simple ratio, such as 2:1 or 3:2.

**rotational transition**

A small change in the energy of a molecule caused by the rotation of its constituent atoms around their centre of mass.

**sedimentary rocks**

Rocks formed from deposits of sediment laid down under water, or (more rarely) by wind action.

**seismometer**

An instrument for measuring the intensity of waves generated by earthquakes or seismic disturbances.

**shock front**

The boundary of a shock wave, i.e. between the normal pressure, density and temperature of a gas, and the increased values present in a shock wave.

**spectroscopy**

The technique of producing spectra and analyzing their constituent wavelengths to determine such quantities as chemical composition, temperature and density of the emitting region.

**sphere**

A solid figure obtained by rotating a circle around a diameter.

**spheroid**

A solid figure obtained by rotating an ellipse around a diameter. *See* ellipsoid.

**steradian**

The unit of solid angular measure: it is one radian by one radian.

**UTC**

Co-ordinated universal time. The internationally agreed Universal Time (UT), it is equivalent to Greenwich Mean Time (GMT), the regular civil time determined by the motion of a mean fictitious Sun around the Earth, and independent of the seasons.

**Universal Time** *See* UTC.

**Watt**

An internationally adopted unit of power, the rate at which work is performed. It corresponds to a rate of dissipation of energy of one joule per second.

**X-rays**

Electromagnetic waves between the extreme ultraviolet and  $\gamma$ -ray regions, the wavelength range being generally taken as about 50 nm to 0.5 pm.

**Zeeman effect**

The broadening of spectral lines due to the presence of magnetic fields.