X

xanthates Salts or esters containing the group –SCS(OR), where R is an organic group. Cellulose xanthate is an intermediate in the manufacture of *rayon by the viscose process.

xanthene A heterocyclic compound having three fused rings with one oxygen atom, $C_{13}H_{10}O$; m.p. 101–102°C b.p. 310–312°C. The ring structure is present in a class of **xanthene dyes**.

xanthine A purine base, $C_5H_4N_4O_2$, found in many organisms. *See* METHYLXANTHINES.

xanthophyll A member of a class of oxygen-containing *carotenoid pigments, which provide the characteristic yellow and brown colours of autumn leaves.

X chromosome *See* SEX CHROMOSOME.

xenobiotic Any substance foreign to living systems. Xenobiotics include drugs, pesticides, and carcinogens. *Detoxification of such substances occurs mainly in the liver.

xenolith A piece of pre-existing rock that occurs as an inclusion within an igneous *intrusion. Often it is a fragment of the country rock surrounding the inclusion, although it may have been modified to a hybrid rock by the intense heat of the intruding magma.

xenon Symbol Xe. A colourless odourless gas belonging to group 18 of the periodic table (*see* NOBLE GASES); a.n. 54; r.a.m. 131.30; d. 5.887 g dm^{-3}; m.p. –111.9°C; b.p. –107.1°C. It is present in the atmosphere (0.00087%) from which it is extracted by distillation of liquid air. There are nine natural isotopes with mass numbers 124, 126, 128–132, 134, and 136. Seven radioactive isotopes are also known. The element is used in fluorescent lamps and bubble chambers. Liquid xenon in a supercritical state at high temperatures is used as a solvent for infrared spectroscopy and for chemical reactions. The compound $Xe^+PtF_6^-$ was the first noble-gas compound to be synthesized. Several other compounds of xenon are known, including XeF_2, XeF_4, $XeSiF_6$, XeO_2F_2, and XeO_3. Recently, compounds have been isolated that contain xenon–carbon bonds, such as $[C_6H_5Xe][B(C_6H_5)_3F]$ (pentafluorophenylxenon fluoroborate), which is stable under normal conditions. The element was discovered in 1898 by Ramsey and Travers.

SEE WEB LINKS

- Information from the WebElements site

xeric Denoting conditions characterized by an inadequate supply of water. Xeric conditions exist in arid habitats, extremely cold habitats, and in salt marshes. Certain plants are adapted to live in such conditions. *See* HALOPHYTE; XEROPHYTE.

xeromorphic Describing the structural modifications of certain plants (*xerophytes) that enable them to reduce water loss, particularly from their leaves and stems.

xerophyte A plant that is adapted to live in conditions in which there is either a scarcity of water in the soil, or the atmosphere is dry enough to provoke excessive transpiration, or both. Xerophytes have special structural (**xeromorphic**) and functional modifications, including swollen water-storing stems or leaves (*see* SUCCULENT) and specialized leaves that may be hairy, rolled, or reduced to spines or have a thick cuticle to lower the rate of transpiration. Examples of xerophytes are desert cacti and many species that grow on sand dunes and exposed moorlands. Some *halophytes have xeromorphic features. *Compare* MESOPHYTE; HYDROPHYTE.

XML Extensible mark-up language: a metalanguage used to define the syntax of textual mark-up languages. Closely based on *SGML (Standard Generalized Mark-up Language), it removes much of SGML's complexity while extending its facilities in immediately useful ways. XML was released in 1998 and has spread rapidly in the computing world.

All languages defined by XML share a common mark-up system: their content is held as human-readable text using the *Unicode character set; and their logical structure is indicated by named **tags** embedded in the data. Such tags are always paired, marking the beginning and end of the content they apply to; and they always occur in

the form <tag_name>&e</tag_name>. An opening tag, its paired closing tag, and the content they enclose is called an **element**. For example, in this dictionary's data cross-references are indicated by xr elements, and so part of the first sentence of this paragraph is held like this: &etext using the <xr>Unicode</xr> character set &e Data relating to an element may also be stored as key–value pairs (**attributes**) within the element's opening tag. Elements may be nested inside other elements, and the element structure of a document may be validated against a normative structure specified in a *DTD or *XML schema.

This seemingly simple scheme offers great power and flexibility while maintaining firm underlying standards. As well as storing dictionary data and other structured text, applications of XML are used for such different purposes as computer-to-computer protocols (e.g. *SOAP) and graphics-file formats. Yet the data in all these document types can be manipulated according to standard models, such as the *Document Object Model and *XSL, often using publicly available utilities. Such standardization and ease of manipulation is increasingly important, especially on the Internet, and XML's rise looks set to continue.

SEE WEB LINKS

- The W3C's XML page

XML schema A formalized description of the structure of an XML document. XML schemas serve the same purpose as *DTDs but are much more powerful and flexible. For example, a single document may use namespaces to take element definitions from more than one schema, with each element being validated against the appropriate schema. Schemas also allow element content to be restricted to specified data types (string, boolean, decimal number, etc.). Although the World Wide Web Consortium has issued a specification for XML schemas, other schema languages are also used.

SEE WEB LINKS

- The W3C's XML schema page

XPath A language for addressing parts of an *XML document, selecting nodes (elements, attributes, character data, etc.) by their name, their value, and/or their location relative to specified other nodes in a tree view of the document's structure. XPath is used within other XML standards, for example XQuery and *XSL; indeed, XPath version 2, released in 2007, is a subset of XQuery.

SEE WEB LINKS

- The XPath (version 2.0) specification
- The XPath (version 1.0) specification (still very widely used)

X-ray astronomy The study of *X-ray sources by rockets and balloons in the earth's atmosphere and by satellites beyond it. The first nonsolar X-ray source was detected during a rocket flight in 1962, and this observation heralded an entirely new branch of astronomy which developed rapidly with the availability of satellites from 1970 onward. The latest in a long line of increasingly sophisticated satellites have included NASA's Chandra X-ray Observatory and the European Space Agency's XMM-Newton Observatory, both launched in 1999.

X-ray crystallography The use of *X-ray diffraction to determine the structure of crystals or molecules, such as nucleic acids. The technique involves directing a beam of X-rays at a crystalline sample and recording the diffracted X-rays on a photographic plate. The diffraction pattern consists of a pattern of spots on the plate, and the crystal structure can be worked out from the positions and intensities of the diffraction spots. X-rays are diffracted by the electrons in the molecules and if molecular crystals of a compound are used, the electron density distribution in the molecule can be determined. *See also* NEUTRON DIFFRACTION.

SEE WEB LINKS

- An illustrated introduction to the principles of X-ray crystallography, compiled by Randy Read, University of Cambridge

X-ray diffraction The diffraction of X-rays by a crystal. The wavelengths of X-rays are comparable in size to the distances between atoms in most crystals, and the repeated pattern of the crystal lattice acts like a diffraction grating for X-rays. Thus, a crystal of suitable type can be used to disperse X-rays in a spectrometer. X-ray diffraction is also the basis of X-ray crystallography. *See also* BRAGG'S LAW.

X-ray fluorescence The emission of *X-rays from excited atoms produced by the impact of high-energy electrons, other particles, or a primary beam of other X-rays. The wavelengths of the fluorescent X-rays can be measured by an X-ray spectrometer as a means of chemical analysis. X-ray fluores-

cence is used in such techniques as *electron probe microanalysis.

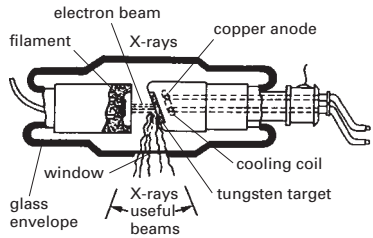
X-rays Electromagnetic radiation of shorter wavelength than ultraviolet radiation produced by bombardment of atoms by high-quantum-energy particles. The range of wavelengths is 10^{-11} m to 10^{-9} m. Atoms of all the elements emit a characteristic **X-ray spectrum** when they are bombarded by electrons. The X-ray photons are emitted when the incident electrons knock an inner orbital electron out of an atom. When this happens an outer electron falls into the inner shell to replace it, losing potential energy (ΔE) in doing so. The wavelength λ of the emitted photon will then be given by $\lambda = ch/\Delta E$, where c is the speed of light and h is the Planck constant. *See also* BREMSSTRAHLUNG.

X-rays can pass through many forms of matter and they are therefore used medically and industrially to examine internal structures. X-rays are produced for these purposes by an *X-ray tube.

X-ray sources Sources of X-radiation from outside the solar system. Some 100 sources within the Galaxy have been observed as objects that emit most of their energy in the X-ray region of the electromagnetic spectrum and only a relatively small proportion of their energy in the visible spectrum. Many of these X-ray sources appear to be members of a binary system, consisting of one optically visible star and one very compact object; it is thought that the latter is either a *neutron star or (if very massive) a *black hole. Owing to the absorption of X-rays by the earth's atmosphere these X-ray sources are only visible by **X-ray telescopes** carried by space probes and satellites, although some high-energy X-rays can penetrate the upper atmosphere and are detectable by X-ray telescopes mounted on balloons.

X-ray spectrum *See* X-RAYS.

X-ray tube A device for generating *X-rays by accelerating electrons to a high energy by an electrostatic field and making them strike a metal target either in a tube containing a low-pressure gas or, as in modern tubes, in a high vacuum. The target is made from a heavy metal, usually tungsten, and is backed by a massive metal anode to conduct the heat away (see illustration showing a liquid-cooled copper anode). The electron beam is produced by heating the cathode by means of a white-hot tungsten filament. A transformer supplies the high voltage, often 100 kV, the tube acting as its own rectifier. On the half-cycles when the target is negative nothing happens. When the target becomes positive, the electrons bombarding it generate X-rays.



X-ray tube.

XSL Extensible stylesheet language: two related languages for restructuring and formatting *XML data. **XSLT** (**XSL Transformations**) allow rules to be specified that restructure XML data, while **XSL-FO** (XSL Formatting Objects) specify formatting details for presentation in print or on screen. Both languages are themselves applications of XML, and both use *XPath as a sublanguage for the identification of those nodes (elements, attributes, character data, etc.) subject to each rule. Although they were intended to be used together, in practice XSLT is far more widely used than XSL-FO. Its abilities exactly fulfilled a widespread need for a standard and convenient method of transforming XML data, whereas formatting on web browsers was already adequately addressed by the less sophisticated but widely established CSS.

SEE WEB LINKS

- The XSLT (version 2.0) specification
- The XSLT (version 1.0) specification (still very widely used)
- The XSL-FO (version 1.1) specification

XSLT *See* XSL.

xylem A tissue that transports water and dissolved mineral nutrients in vascular plants. In flowering plants it consists of hollow **vessels** that are formed from cells (*vessel elements) joined end to end. The end walls of the vessel elements are perforated to allow the passage of water. In less advanced vascular plants, such as conifers and ferns, the constituent cells of the xylem are called *tracheids. In young plants and at the shoot and root tips of older plants the xylem is

formed by the apical meristems. In plants showing secondary growth this xylem is replaced in most of the plant by secondary xylem, formed by the vascular *cambium. The walls of the xylem cells are thickened with lignin, the extent of this thickening being greatest in secondary xylem. Xylem contributes greatly to the mechanical strength of the plant: *wood is mostly made up of secondary xylem. *See also* FIBRE. *Compare* PHLOEM.

xylenes *See* DIMETHYLBENZENES.