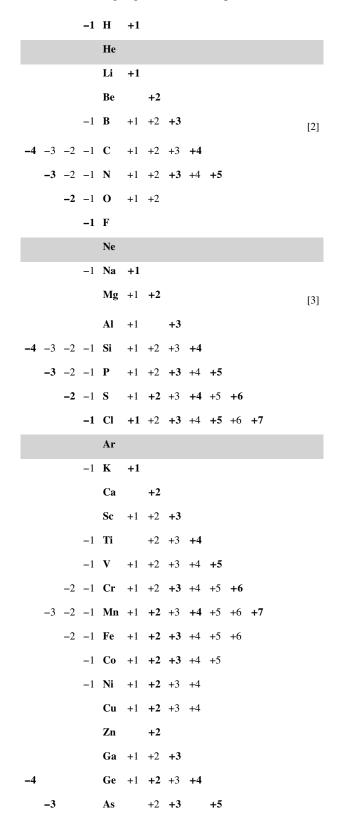
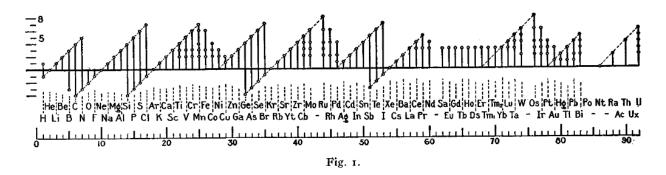
List of oxidation states of the elements

This is a list of all the known oxidation states of the chemical elements, excluding nonintegral values. The most common oxidation states are in bold. This table is based on Greenwood's, with all additions noted. Oxidation state 0, which is found for all elements, is implied by the column with the element's symbol. The format of the table, based on one devised by Mendeleev in 1889, highlights some of the periodic trends.



A figure with a similar format (shown below) was used by Irving Langmuir in 1919 in one of the early papers about the octet rule. [9] The periodicity of the oxidation states was one of the pieces of evidence that led Langmuir to adopt the rule.



References and notes

- [1] Greenwood, Norman N.; Earnshaw, Alan. (1997), *Chemistry of the Elements* (2nd ed.), Oxford: Butterworth-Heinemann, ISBN 0080379419, p. 28.
- [2] The compound magnesium diboride, a known superconductor, is an example of boron in its -1 oxidation state.
- [3] Low-valent magnesium compounds with Mg(I) have been obtained using bulky ligands; see Green, S. P.; Jones C.; Stasch A. (December 2007). "Stable Magnesium(I) Compounds with Mg-Mg Bonds". *Science* 318 (5857): 1754–1757. doi:10.1126/science.1150856. PMID 17991827.
- [4] "Yttrium: yttrium(II) hydride compound data" (http://www.webelements.com/webelements/compounds/text/Y/H2Y1-13598351.html). WebElements.com. . Retrieved 2007-12-10.
- [5] "Yttrium: yttrium(I) bromide compound data" (http://www.openmopac.net/data_normal/yttrium(i) bromide_jmol.html). OpenMOPAC.net. . Retrieved 2007-12-10.
- [6] Ir(-3) has been observed in Ir(CO)₃³⁻; see Greenwood, Norman N.; Earnshaw, Alan. (1997), *Chemistry of the Elements* (2nd ed.), Oxford: Butterworth-Heinemann, ISBN 0080379419 p.1117
- [7] Hg⁴⁺ has been observed in mercury tetrafluoride; see Xuefang Wang; Lester Andrews; Sebastian Riedel; and Martin Kaupp (2007). "Mercury Is a Transition Metal: The First Experimental Evidence for HgF₄.". Angew. Chem. Int. Ed. 46 (44): 8371–8375. doi:10.1002/anie.200703710. PMID 17899620..
- [8] Rn²⁺ has been observed in radon difluoride; see Stein, L. (1970). "Ionic Radon Solution". *Science* 168 (3929): 362. doi:10.1126/science.168.3929.362. PMID 17809133. and Kenneth S. Pitzer (1975). "Fluorides of radon and element 118". *J. Chem. Soc.*, *Chem. Commun.*, (18): 760b 761. doi:10.1039/C3975000760b.
- [9] Irving Langmuir. The arrangement of electrons in atoms and molecules. J. Am. Chem. Soc. 1919, 41, 868-934. doi:10.1021/ja02227a002

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