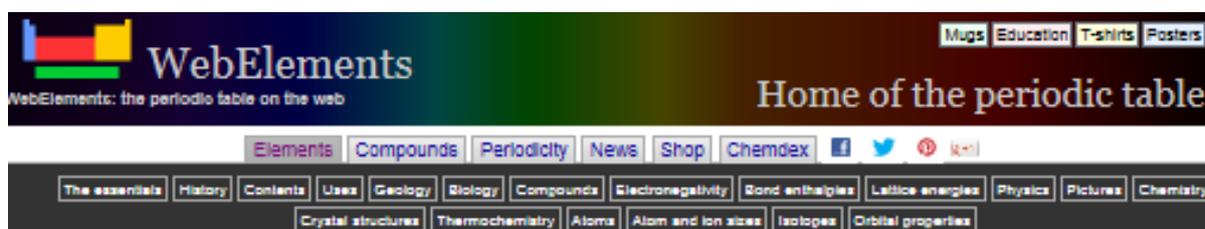


Atomic Structure and the Periodic Table

Matter is made up of around 118 distinct elements. Each element is made up of atoms. Each atom is made up protons and neutrons in the nucleus and electrons in the space orbiting the nucleus. The protons are positively charged, the electrons are negatively charged and the neutrons have no charge.

The periodic table is a tabular arrangement of the elements of matter. The periodic table below is taken from the WebElements website¹. The elements are arranged firstly in a sequence from the element with the smallest atom (hydrogen (H)) in the top left hand corner and then to the right He (Helium), the second smallest atom, in the top right hand corner. Then the third and fourth elements, lithium (Li) and beryllium (Be) are found on the next row or *period*, on the left hand side. The next elements boron (B), carbon (C) and so on follow on the right hand side. The WebElements¹ website gives the properties of each element by clicking on it.



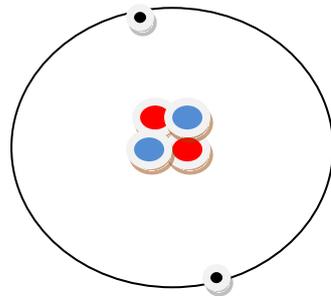
Explore key information about the chemical elements through this periodic table

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period 1	1 H 1.008																	2 He 4.0026
Period 2	3 Li 6.94	4 Be 9.0122											5 B 10.81	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
Period 3	11 Na 22.990	12 Mg 24.305											13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.06	17 Cl 35.45	18 Ar 39.948
Period 4	19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.63	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.798
Period 5	37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc [97.91]	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.6	53 I 126.90	54 Xe 131.29
Period 6	55 Cs 132.91	56 Ba 137.33	71 Lu 174.97	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po [209]	85 At [209]	86 Rn [222]
Period 7	87 Fr [223]	88 Ra [226]	103 Lr [262]	104 Rf [261]	105 Db [262]	106 Sg [263]	107 Bh [264]	108 Hs [265]	109 Mt [266]	110 Ds [267]	111 Rg [268]	112 Cn [269]	113 Uut [270]	114 Fl [271]	115 Uup [272]	116 Lv [273]	117 Uus [274]	118 Uuo [276]
Lanthanoids			57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm [144.91]	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05		
Actinoids			89 Ac [227]	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]		

¹ www.webelements.com

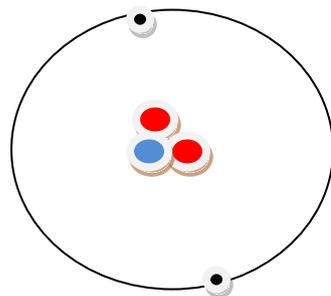
The number above the symbol is the *atomic number* or the number of protons. The number below the symbol is the *atomic weight*. The atomic weight is the sum of the number of protons and neutrons. However, the number of neutrons in atoms of a particular element varies and the value for this is a weighted average.

For example helium (He) mostly occurs in nature with two neutrons. Its atomic structure may be symbolised as follows, with two protons symbolised in red, two neutrons symbolised in blue and two electrons symbolised in black.



Atomic structure of ${}^4\text{He}$.

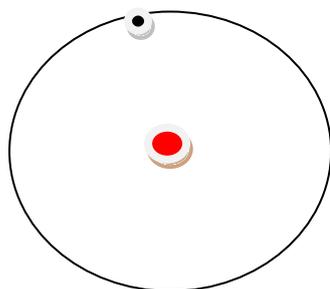
However, 0.000137% of helium occurs in the following form



Atomic structure of ${}^3\text{He}$.

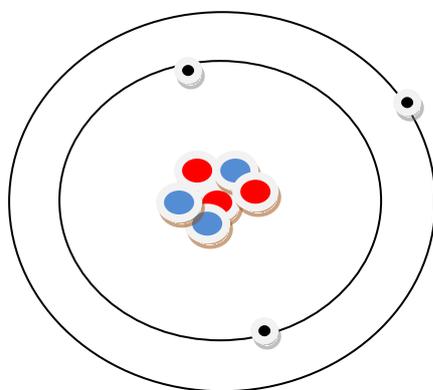
The number of protons determines the element; both have two protons so both are helium atoms. The two different atomic structures are called *isotopes*. Elements on the right hand column of the periodic table, such as helium, have complete electron shells; the two electrons in the only electron shell of helium completes the shell.

Moving back to hydrogen, ${}^1\text{H}$ has the following structure



Atomic structure of ${}^1\text{H}$.

We note that hydrogen has an 'incomplete' shell of electrons. If we now move up the table to lithium, ${}^6\text{Li}$ has the following atomic structure



Atomic structure of ${}^6\text{Li}$.

Lithium lies at the start of a new row or period of the periodic table and this means that a new electron shell is initiated. This electron shell has up to eight elements and is complete when the element neon (Ne) is reached. Then for the next element, sodium (Na), a third shell is initiated and the pattern continues.

Placing the elements in columns or groups is also useful since we find that elements in the same group have similar properties.

