


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.



WebElements

WebElements: the periodic table on the web

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Group

Period

1

2

3

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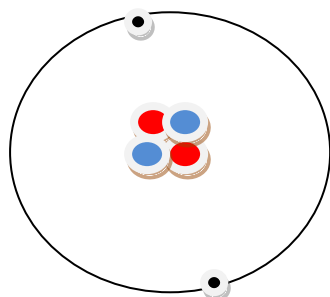
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1	2											2						
1	H																	He
	1.008																	4.0026
2	3	4											5	6	7	8	9	10
	Li	Be											B	C	N	O	F	Ne
	6.94	9.0122											10.81	12.011	14.007	15.999	18.998	20.180
3	11	12											13	14	15	16	17	18
	Na	Mg											Al	Si	P	S	Cl	Ar
	22.990	24.305											26.982	28.086	30.974	32.06	35.45	39.948
4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
	39.098	40.078	44.956	47.867	50.942	51.996	54.938	55.845	58.933	58.693	63.546	65.38	69.723	72.63	74.922	78.96	79.904	83.798
5	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
	85.468	87.62	88.906	91.224	92.906	95.94	[97.91]	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121.76	127.60	126.90	131.29
6	55	56	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
	132.91	137.33	174.97	178.49	180.95	183.84	186.21	190.23	192.22	195.08	196.97	200.59	204.38	207.2	208.98	[209]	[210]	[222]
7	87	88	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Uup	Lv	Uus	Uuo
	[223]	[226]	[260]	[261]	[262]	[266]	[264]	[277]	[276]	[281]	[282]	[285]	[284]	[289]	[288]	[293]	[294]	[294]
Lanthanoids			57	58	59	60	61	62	63	64	65	66	67	68	69	70		
			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb		
			138.91	140.12	140.91	144.24	[144.91]	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.05		
Actinoids			89	90	91	92	93	94	95	96	97	98	99	100	101	102		
			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		
			[227]	232.04	231.04	238.03	[237]	[244]	[243]	[247]	[247]	[251]	[252]	[257]	[258]	[259]		

¹ www.webelements.com

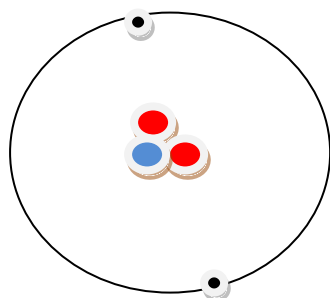
The number above the symbol is the *atomic number* or the number of protons. The number below the symbol is the *atomic weight*. The atomic weight is the sum of the number of protons and neutrons. However, the number of neutrons in atoms of a particular element varies and the value for this is a weighted 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 ^4He .

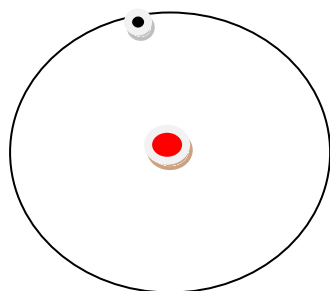
However, 0.000137% of helium occurs in the following form



Atomic structure of ^3He .

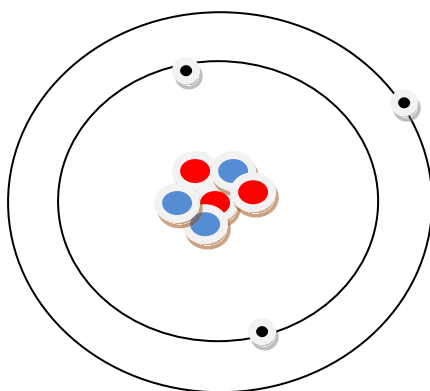
The number of protons determines the element; both have two protons so both are helium atoms. The two different atomic structures are called *isotopes*. Elements on the right hand column of the periodic table, such as helium, have complete electron shells; the two electrons in the only electron shell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

Moving back to hydrogen, ^1H has the following structure



Atomic structure of ^1H .

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



Atomic structure of ^6Li .

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.

