



The Periodic Table

What is an Element?

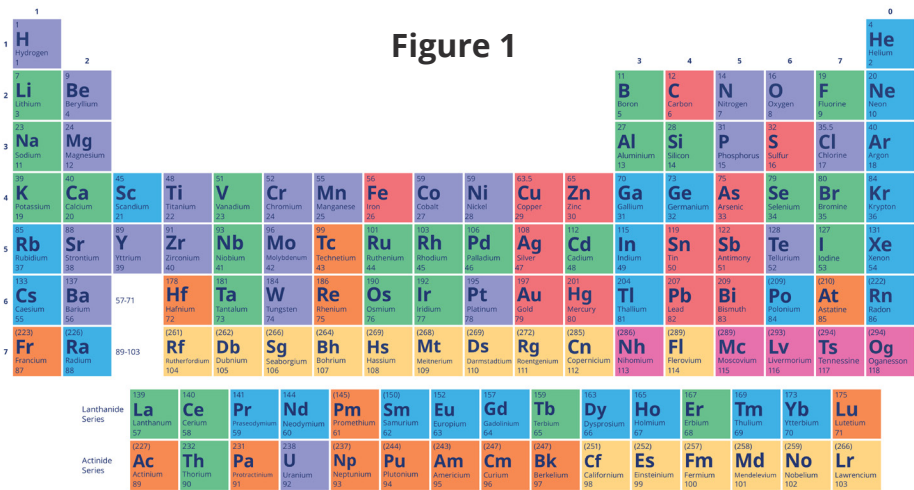
An element is a substance made of only one type of atom. Elements cannot be broken down into other substances.

Each element is represented by a symbol. The symbol comes from the first letter or letters of its name. For elements discovered early on, the symbol usually comes from its Latin or Greek name. For example, the symbol for sodium is Na, which comes from the Latin ‘natrium’.

The first letter of the symbol is always capitalised. Any following letters are lower case. The symbol for each element can be found on the periodic table.

Name	Symbol	Origin
bromine	Br	Greek <i>bromos</i> meaning ‘stench’.
gold	Au	Latin <i>arum</i> meaning ‘shining dawn’.
helium	He	Greek <i>helios</i> meaning ‘the sun’ (where helium was first found).
lead	Pb	<i>Plumbum</i> , the Latin word for lead. The Romans used lead for making pipes so this is where the word ‘plumber’ comes from too.
oxygen	O	Greek <i>oxys</i> meaning ‘acid’ and <i>genes</i> meaning ‘forming’.

There are 92 naturally occurring elements, as well as some unstable synthetic elements that have been created by humans. **Figure 1** shows when each element was first discovered.



Antiquity to Middle Ages	Middle Ages-1799	1800-1849	1850-1899	1900-1949	1950-1999	Since 2000
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Developing the Periodic Table

Scientists needed a way to make sense of the chemical and physical properties of the different elements. The earliest attempt to classify the elements was made in 1789. This was followed by several other attempts over the next few decades. The version on which the modern periodic table is based was created in 1869.

Scientists at this time were attempting to group the elements when not all of them had been discovered, as shown in **Figure 1**. This meant that early versions of the periodic table were incomplete.

Dimitri Mendeleev overcame this problem by leaving gaps for elements that he thought had not yet been discovered (**Figure 2**). Elements with properties predicted by Mendeleev were later identified and filled in the gaps (**Figure 3**).

[illegible]

Figure 2: Mendeleev's periodic table including gaps.

	H 1.01																
He 4.00	Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0										
Ne 20.2	Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5										
Ar 40.0	K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7							
	Cu 63.5	Zn 65.4	Ga 69.7	Ge 72.6	As 74.9	Se 79.0	Br 79.9										
Kr 83.8	Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc (98)	Ru 101	Rh 103	Pd 106							
	Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127										
Xe 131	Ce 133	Ba 137	La 139	Hf 179	Ta 181	W 184	Re 186	Os 194	Ir 192	Pt 195							
	Au 197	Hg 201	Ti 208	Pb 207	Bi 209	Po (210)	At 210										
Rn (222)	Fr (223)	Ra (246)	Ac (227)	Th 232	Pa (231)	U 238											

Figure 3: Elements discovered later filled the gaps.

As of January 2021, scientists have identified 118 elements. These elements are organised in the periodic table based on their properties. Grouping elements in this way helps scientists to identify trends in the elements and understand which elements behave in similar ways.

The Structure of the Periodic Table

A row in the periodic table is called a **period**. There are 7 periods in the periodic table. The atomic number increases as you move from left to right across a period. The radius of an atom decreases as you move from left to right.

The elements in the lanthanide series and actinide series belong to periods 6 and 7. They are positioned underneath the rest of the periodic table, as shown in **Figure 4**.

Figure 4

[illegible]



The middle section is not included in this group system because the elements here behave differently to those in the labelled groups.

1	2																	3	4	5	6	7	0
		<div>1 H Hydrogen 1</div>																		<div>4 He Helium 2</div>			
7 Li Lithium 3	9 Be Beryllium 4																	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12																	27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36						
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54						
133 Cs Cesium 55	137 Ba Barium 56	57-71	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	(209) Po Polonium 84	(210) At Astatine 85	(222) Rn Radon 86						
(223) Fr Francium 87	(226) Ra Radium 88	89-103	(261) Rf Rutherfordium 104	(262) Db Dubnium 105	(266) Sg Seaborgium 106	(264) Bh Bohrium 107	(269) Hs Hassium 108	(268) Mt Meitnerium 109	(269) Ds Darmstadtium 110	(272) Rg Roentgenium 111	(285) Cn Copernicium 112	(286) Nh Nihonium 113	(289) Fl Flerovium 114	(289) Mc Moscovium 115	(293) Lv Livermorium 116	(294) Ts Tennessine 117	(294) Og Oganesson 118						
Lanthanide Series		139 La Lanthanum 57	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	(145) Pm Promethium 61	(150) Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	163 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71							
Actinide Series		(227) Ac Actinium 89	232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	(237) Np Neptunium 93	(244) Pu Plutonium 94	(243) Am Americium 95	(247) Cm Curium 96	(247) Bk Berkelium 97	(251) Cf Californium 98	(252) Es Einsteinium 99	(257) Fm Fermium 100	(258) Md Mendelevium 101	(259) No Nobelium 102	(266) Lr Lawrencium 103							

Group 0 (noble gases)

- solids at room temperature
- very reactive
- good conductors of heat and electricity
- soft
- shiny when cut
- low density for metals

- some solids, a liquid and some gases at room temperature
- very reactive
- poor conductors of heat and electricity
- solids are brittle
- low density

- gases at room temperature
- colourless
- unreactive
- poor conductors of heat and electricity
- low density

The stepped line shown in **Figure 6** divides the metal and non-metal elements. The elements on the left of the stepped line are metals and those on the right are non-metals. The highlighted elements are known as the metalloids: these are elements which have some properties of metals and some of non-metals.

Figure 6

metals																		non-metals									