

Development of the Periodic Table

The Early Periodic Table

By the early 19th century, scientists had discovered around 50 different elements. They began to organise and classify them. Many scientists had different ideas about how this should be done.

Before the discovery of subatomic particles, scientists were able to measure the atomic weight of elements, although not always accurately. Early attempts to organise elements involved placing them in order of atomic weight.

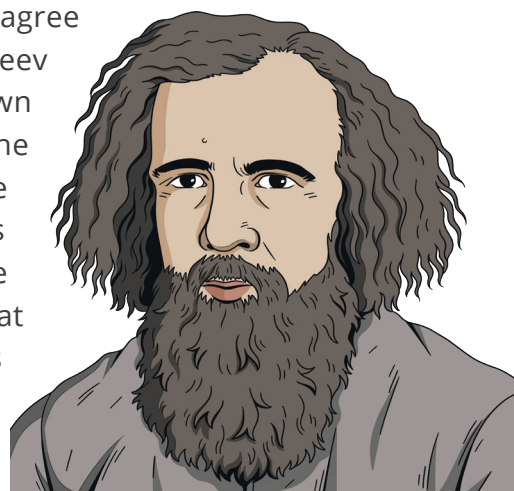
In 1865, a scientist named John Newlands noticed that when elements were arranged in order of atomic weight, there was a pattern in their properties that repeated at every eighth element. Newlands developed an early version of the periodic table that worked well for the first 20 elements, but it had some problems. In Newlands' table, copper was placed in the same group as lithium, sodium and potassium, but copper has very different properties to the other metals. In order to make some elements fit into his table, Newlands placed some elements together in a single space on his table if they had similar properties.

John Newlands' Periodic Table (1865)

H	1	F	8	Cl	15	Co & Ni	22	Br	29	Pd	36	I	42	Pt & Ir	50
Li	2	Na	9	K	16	Cu	23	Rb	30	Ag	37	Cs	44	Tl	53
G	3	Mg	10	Ca	17	Zn	25	Sr	31	Bd	38	Ba & V	45	Pb	54
Bo	4	Al	11	Cr	19	Y	24	Ce & La	33	U	40	Ta	46	Th	56
C	5	Si	12	Ti	18	In	26	Zr	32	Sn	39	W	47	Hg	52
N	6	P	13	Mn	20	As	27	Di & Mo	34	Sb	41	Nb	48	Bi	55
O	7	S	14	Fe	21	Se	28	Ro & Ru	35	Te	43	Au	49	Os	51

Dmitri Mendeleev's Periodic Table

Many scientists, including Dmitri Mendeleev, did not agree with John Newlands' arrangement of elements. Mendeleev was a Russian chemist and in 1869 he published his own version of the periodic table. Mendeleev also placed the elements in order of atomic weight. However, if he found that an element did not fit the pattern, he was not afraid to move it around. Gaps were left in the table because Mendeleev believed there were elements that had not yet been discovered. This enabled elements with similar properties to stay in the same group. Mendeleev thought he could predict the properties of these undiscovered elements.





The Modern Periodic Table

Many more elements have been discovered and we now know of more than 100 elements. Many of Mendeleev's predictions have been proven correct.

Since the discovery of protons, neutrons and electrons in the early 20th century, we now understand the structure of atoms. We also have knowledge of isotopes which helps to explain why the order based on atomic weights was not always correct.

Today, elements in the periodic table are arranged in order of atomic (proton) number and elements with similar properties are in columns, known as groups. Elements in the same group in the periodic table have the same number of electrons in their outer shell and this gives them similar chemical properties.

	1	2											3	4	5	6	7	0																
1																	1 H hydrogen 1																	2 He helium 2
2	3 Li lithium 3	4 Be beryllium 4											5 B boron 5	6 C carbon 6	7 N nitrogen 7	8 O oxygen 8	9 F fluorine 9	10 Ne neon 10																
3	11 Na sodium 11	12 Mg magnesium 12											13 Al aluminium 13	14 Si silicon 14	15 P phosphorus 15	16 S sulfur 16	17 Cl chlorine 17	18 Ar argon 18																
4	19 K potassium 19	20 Ca calcium 20	21 Sc scandium 21	22 Ti titanium 22	23 V vanadium 23	24 Cr chromium 24	25 Mn manganese 25	26 Fe iron 26	27 Co cobalt 27	28 Ni nickel 28	29 Cu copper 29	30 Zn zinc 30	31 Ga gallium 31	32 Ge germanium 32	33 As arsenic 33	34 Se selenium 34	35 Br bromine 35	36 Kr krypton 36																
5	37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	[97] Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Sn tin 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54																
6	55 Cs caesium 55	56 Ba barium 56	57-71	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86																
7	[223] Fr francium 87	[226] Ra radium 88	89-103	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og oganesson 118																
	Lanthanide Series		57 La lanthanum	58 Ce cerium	59 Pr praseodymium	60 Nd neodymium	61 Pm promethium	62 Sm samarium	63 Eu europium	64 Gd gadolinium	65 Tb terbium	66 Dy dysprosium	67 Ho holmium	68 Er erbium	69 Tm thulium	70 Yb ytterbium	71 Lu lutetium																	
	Actinide Series		[227] Ac actinium	232 Th thorium	231 Pa protactinium	238 U uranium	[237] Np neptunium	[244] Pu plutonium	[243] Am americium	[247] Cm curium	[247] Bk berkelium	[251] Cf californium	[252] Es einsteinium	[257] Fm fermium	[258] Md mendelevium	[259] No nobelium	[262] Lr lawrencium																	

Mass Number	Symbol	Element Name	Atomic Number
		alkali metal	
		alkaline earth metal	
		transition metal	
		post transition metal	
		metalloid	
		non-metal	
		halogen	
		noble gas	
		lanthanide	
		actinide	



Development of the Periodic Table **Timeline**

Date

Development

A vertical timeline arrow pointing downwards, with horizontal lines extending to the right for notes.

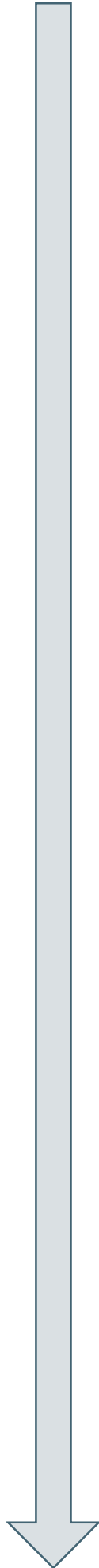




Development of the Periodic Table **Timeline**

Date

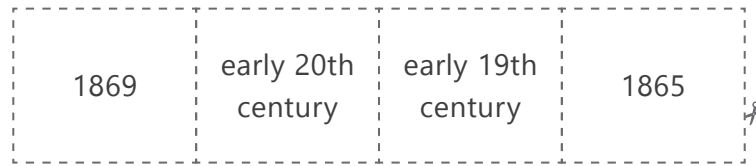
Development





Cut out the boxes below and arrange them on the timeline to describe the development of the periodic table.

Some of the dates given below may have more than one corresponding event.



Dmitri Mendeleev also arranged elements mainly in order of atomic weight. However, he did not stick rigidly to this order and swapped the order of elements if the properties of a certain element were more similar to a different group.

Mendeleev also left gaps in his table for elements that had not yet been discovered and he predicted the properties that these elements would have.

Since the discovery of protons, neutrons and electrons, elements are arranged in order of atomic number (number of protons) and are placed in groups according to the number of electrons in their outer energy shell.

Before the discovery of subatomic particles, scientists could only measure the atomic weight of elements. Early attempts to organise and classify elements involved placing them in order of increasing atomic weight.

A version of the periodic table was proposed with elements arranged by atomic weight and organised into eight groups. However, there were problems with this version of the periodic table. For example, copper was in the same group as lithium, sodium and potassium, despite copper having very different properties to the other metals.

A scientist named John Newlands noticed that when elements were arranged in order of atomic weight, there was a pattern in their properties that repeated at every eighth element.



Development of the Periodic Table Timeline

Answers

Date

early 19th
century

1865

1869

early 20th
century

Development

Before the discovery of subatomic particles, scientists could only measure the atomic weight of elements. Early attempts to organise and classify elements involved placing them in order of increasing atomic weight.

A scientist named John Newlands noticed that when elements were arranged in order of atomic weight, there was a pattern in their properties that repeated at every eighth element.

A version of the periodic table was proposed with elements arranged by atomic weight and organised into eight groups. However, there were problems with this version of the periodic table. For example, copper was in the same group as lithium, sodium and potassium, despite copper having very different properties to the other metals.

Dmitri Mendeleev also arranged elements mainly in order of atomic weight. However, he did not stick rigidly to this order and swapped the order of elements if the properties of a certain element were more similar to a different group.

Mendeleev also left gaps in his table for elements that had not yet been discovered and he predicted the properties that these elements would have.

Since the discovery of protons, neutrons and electrons, elements are arranged in order of atomic number (number of protons) and are placed in groups according to the number of electrons in their outer energy shell.

