

# The Periodic Table of the Elements

The periodic table is a table which contains all the elements that have been discovered, which are arranged in the increasing order of atomic number.

The vertical columns of elements with similar properties are called Groups.

The horizontal rows of elements are called Periods.

The periodic table can also be used to predict the properties of elements, whether chemical or physical.

The groups show the number of electrons in that element in this group. E.g. in group 5, Nitrogen has 5 electrons in its outer shell.

The elements get smaller less metallic as going to the right.

Atoms getting smaller, less metallic

Metals getting more reactive

Densities and melting points increase down any group

Atoms getting larger, more metallic

Non-metals getting more reactive

I	II				III	IV	V	VI	VII	VIII	IX	X			
				1 H Hydrogen 1											
7 Li Lithium	9 Be Beryllium 4									12 C Carbon	14 N Nitrogen	16 O Oxygen	19 F Fluorine		
23 Na Sodium	24 Mg Magnesium 12									28 Si Silicon	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17		
39 K Potassium	40 Ca Calcium 20	45 Sc Scandium 21			52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	73 Ge Germanium 33	75 As Arsenic 34	79 Se Selenium 34	80 Br Bromine 35
85 Rb Rubidium	88 Sr Strontium 38	89 Y Yttrium 39			96 Mo Molybdenum 42	96 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	119 Sn Tin 51	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53
133 Cs Caesium	137 Ba Barium 56	139 La Lanthanum 57			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	207 Pb Lead 83	209 Bi Bismuth 83	209 Po Polonium 84	209 At Astatine 85
	226 Ra Radium 88	Actinoid series													
	88-90 Lanthanoid series														
	90-103 Actinoid series														
	90 Ce Cerium	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Pm Promethium 61	152 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		
	232 Th Thorium 90	238 Pa Protactinium 91	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103	

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

## The Group I elements (The reactive alkali metals):

Group 1 elements are called the alkali metals because they react with water forming alkaline solutions.

Electron arrangement in Group I:

Element	Symbol	Atomic Number	Electron Config.	Reactivity	Density	M.P & B.P
Lithium	Li	3	2.1	Increases DOWNWARDS	Increases DOWNWARDS	Increases DOWNWARDS
Sodium	Na	11	2.8.1			
Potassium	K	19	2.8.8.1			

Properties of Group I elements:

Chemical Properties:

- They have one electron in their outer shell.
- They have similar chemical properties.
- They lose their outer shell electron making positive ions.
- Their reactivity increases downwards, because their outer shell electron get further away as the size of the atom increases, so it gets easier for it to be removed.
- Very reactive.
- Burn forming oxides
- React violently with water forming hydroxides

Physical Properties:

- Their melting and boiling points increase downwards.
- Their densities increase downwards.
- They are solids at room temperature.
- When freshly cut, they have a shiny metallic surface.
- Good conductors of electricity.
- Relatively soft

Chemical reactions:

- Form hydroxides when put in water
- Form oxides when burnt in air
- React with acids to make metal salt and hydrogen gas

### The transition metals:

The transition metals are found between Group II & Group III at periods 4, 5 and 6.

First row: Scandium to Zinc

Second row: Yttrium to Cadmium

Third row: Lanthanum to Mercury

The electron arrangement of some transition metals in the first row:

Element	Symbol	Atomic Number	Electron Config.
Scandium	Sc	21	2.8.9.2
Iron	Fe	26	2.8.14.2

All the transition elements in the first row have 2 electrons in their outer shell, the fourth shell. The difference is in the number of electrons in the third shell.

The chemical properties of these elements depend on the electrons in the outer shell, which are the ones most likely to be gained and lost in chemical reactions.

Properties of transition metals:

Chemical properties:

- They are less reactive than Group I elements.
- They have the ability to form ions with different oxidation states.
- Their compounds are highly coloured.
- They and their compounds are used as catalysts in some reactions.

Physical Properties:

- These have high densities.
- These have high melting and boiling points.
- These are hard, shiny metals.
- They are very good conductors of electricity and heat.

- Group VII (7) elements (Halogens):

These elements are called halogens because they react with metals forming salts.

Electron arrangement in Group VII:

Element	Symbol	Atomic Number	Electron Config.	Reactivity
Fluorine	F	9	2.7	Decreases DOWNWARDS
Chlorine	Cl	17	2.8.7	
Bromine	Br	35	2.8.18.7	

Going DOWN the group:

- The atoms get BIGGER
- LESS reactive
- DARKER in colour
- GAS to SOLID
- Melting and boiling points become HIGHER

Fluorine and Chlorine → GASES

Bromine → Liquid

Iodine → Solid

Properties:

Chemical properties:

- They are the reactive non-metals
- Do both covalent and ionic compounds
- They displace less reactive halogens from their compounds
- They react with metals making halide salts
- They are diatomic
- They can displace other less reactive halides from their salts

Physical properties:

- Poisonous
- They have a pungent smell
- Don't conduct electricity
- Colour gets darker as going down the group

Group 0 the noble Gases:

It is often called group 0.

Element	Symbol	Atomic Number	Electron Arrangement	State (at r.t.p)
Helium	He	2	2	Gas
Neon	Ne	10	2.8	Gas
Argon	Ar	18	2.8.8	Gas

The noble gases are a set of non-metallic elements, which make up 1% of air.

They are monoatomic gases with no smell or colour.

They are chemically unreactive and exist as single atoms because of a full outer shell.

Properties:

- Inert
- Colourless, monoatomic gases
- Exist as single atoms

Uses:

- Helium is used for filling balloons and airships.
- Neon is used in neon lights
- Argon is used to fill argon filament bulbs