The periodic table

The periodic table arranges elements in ***ascending order of proton number(atomic number)*** *and can be* ***used to predict properties of elements****.*

There is a change ***from metallic character to non-metallic character going from left to right across the periodic table.****The periodic table is made up of* ***rows called periods and columns called groups.***

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9			Key: atomic number / atomic symbol / name / relative atomic mass								5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Periods

Across a period the atoms of the elements have the ***same number of shells***

If an element is in ***period 3*** *(eg: sodium),* ***this means it has 3 shells of electrons***

Period 1 from ***hydrogen to helium*** *(1 electron shell)*
Period 2 from ***lithium to neon*** *(2 electron shells)*
Period 3 from ***sodium to argon*** *(3 electron shells)*

Groups

*The group number tells us the **number of valence electrons in an atom**.Elements in the same group have similar **chemical properties** and therefore **react similarly**.Going down a group, the **number of shells increases**, but the number of **valence electrons remains constant**.*

*Elements in the same group react similarly because they have the **same number of valence electrons** , and it is these electrons only which are involved in **chemical reactions**.They lose, gain or share the **same number of electrons** in order to have a full outer shell therefore they have the **same chemical properties.***

- **All elements in same group have same chemical properties as they have same number of outer most electrons(valence electrons)**

3 Li lithium 7	**2,1**
11 Na sodium 23	**2,8,1**
19 K potassium 39	**2,8,8,1**

Electronic configuration ends with 1 electron so they all belong to group 1

Trends in periodic table:

1. **Metallic property: How quickly any atom lose its electron means it has more metallic character.**
   Metallic character increases down the group and decreases across the period.

Metallic Character increases down the group .Across the period from left to right it decreases.

Reason: Going down the group the size of atom increases so the outer shell electron is far from the nucleus so less attractive force between nucleus to outermost electron so it can be removed easily.

- **Only metals lose electrons**

2. **Size of an atom increases down the group as number of shells increases as we go down the group.**

Size of an atom decreases as we go across the period from left to right as more valence electrons available in the same number of shells so more force of attraction between nucleus to outermost electrons which reduce the radii of an atom.

Group 1 (Alkali Metals)

Physical properties of group 1 metals

- ***Good*** *conductors of electricity as there* ***are mobile valence electrons***
- *Melting point and boiling point* ***decrease down the group***
- *Density* ***increases*** *down the group*
- *Li,Na and K are* ***less dense*** *than water and so float*
- *Are very soft and can be* ***cut with a knife***

Why does melting and boiling point decrease down the group?

Going down the group, the ***number of shells increases, so the electrostatic forces of attraction between the nucleus and the electrons becomes weaker****, so* ***less energy is required*** *to overcome these forces of attraction causing them to have a* ***lower melting point****.*

Order of reactivity increases as we go down group 1.

Alkali metals are highly reactive so store in oil.

Reactions of group 1 metals:

1. Reactions of the Group I metals and water

ELEMENT	REACTION
LITHIUM	$2Li(s) + 2H_2O(l) \rightarrow 2LiOH(aq) + H_2(g)$ – REACTION SLOWER THAN WITH SODIUM – BUBBLES OF HYDROGEN GAS – LITHIUM'S MELTING POINT IS HIGHER AND HEAT ISN'T PRODUCED SO QUICKLY, SO THE LITHIUM DOESN'T MELT.
SODIUM	$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$ – BUBBLES OF HYDROGEN GAS – MELTS INTO A SHINY BALL THAT DASHES AROUND THE SURFACE – FLOATS ON WATER BECAUSE IT IS LESS DENSE – MELTS BECAUSE SODIUM HAS A LOW MELTING POINT AND A LOT OF HEAT IS MADE IN THE REACTION – HYDROGEN IS EVOLVED WHICH CAUSES THE BALL OF SODIUM TO MOVE AROUND THE SURFACE OF THE WATER. – WHITE TRAIL OF SODIUM HYDROXIDE PRODUCED WHICH DISSOLVES IN THE WATER PRODUCING A HIGHLY ALKALINE SOLUTION.
POTASSIUM	$2K(s) + 2H_2O(l) \rightarrow 2KOH(aq) + H_2(g)$ – REACTS MORE VIOLENTLY THAN SODIUM – BUBBLES OF GAS – MELTS INTO A SHINY BALL THAT DASHES AROUND THE SURFACE – ENOUGH HEAT PRODUCED SO HYDROGEN BURNS WITH A LILAC – COLOURED FLAME

Observations when group 1 metals react with water:

1.Bubbles can be seen

2.Floats on water.

3. Flame can be seen.

4. Dissolves in water

5. Movement of metal can be seen.

2. Alkali metals form ionic compounds. All compounds of alkali metals are soluble.
   Eg Sodium+ chlorine ⟶ Sodium chloride

   (table salt is soluble in water)

Transition metals

Physical properties of transition metals:

1. High melting point

2.High density

3.Malleable

4.Hard

Chemical properties of transition metals:

1. It forms coloured compounds.

2.It has variable oxidation states.

3. It is used as a catalyst.

Properties which all metals share whether group 1 or transition metals:

1.All metals are malleable

2. All metals conduct electricity

3. All metals are shiny

How group 1 physical properties are different from transition metals:

Group 1 metals have low melting point than transition metals.

Group 1 metals have low density than transition metals.

Flame tests of metals:

Flame tests for metal ions

metal ion	flame colour
lithium, Li^+	red
sodium, Na^+	yellow
potassium, K^+	lilac
calcium, Ca^{2+}	orange-red
barium, Ba^{2+}	light green
copper(II), Cu^{2+}	blue-green