AQA C1b Atomic structure and the periodic table
Triple Chemistry

The periodic table

Alkali metals: 1 2 — Halogens: 7 — Noble gases: 0

1	2											3	4	5	6	7	0
H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	?	?	?						

Transition metals

Metals to the left of the dark line, non-metals to the right

metals	Form positive ions. Conductors, high melting and boiling points, ductile, malleable
non-metals	Form negative ions. Insulators, low melting and boiling points

Group 7 – the halogens

Halogens are made of molecules. Each molecule contains a pair of atoms.		Halogen atoms have 7 electrons in their outer shells. They form -1 ions
Melting and boiling points increase down the group (gas at the top, then liquid, then solid)		The atomic mass of the halogens gets heavier as you go down
reactivity decreases down the group		As the atoms get bigger, the nucleus is further from the outer shell so has less pull on electrons
with metals: forms a metal halide	metal + halogen → metal halide e.g. sodium + chlorine → sodium chloride	e.g. $2Na + Cl_2 \rightarrow 2NaCl$
with hydrogen: forms a hydrogen halide	hydrogen + halogen → hydrogen halide e.g. hydrogen + bromine → hydrogen bromide	e.g. $Cl_2 + H_2 \rightarrow 2HCl$
with solutions of halides: A more reactive halogen will displace the less reactive halogen from the salt	chlorine + potassium bromide → potassium chloride + bromine	e.g. $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$

Important families of elements in the Periodic Table

Development of the Periodic table

Before the discovery of protons	Elements used to be arranged in order of atomic weight	Early periodic tables were incomplete. Some elements were placed in inappropriate groups if the strict order of atomic weights was followed
What did Mendeleev do?	Mendeleev left gaps for elements that hadn't been discovered yet	Elements with properties predicted by Mendeleev were discovered and filled in the gaps. Knowledge of isotopes explained why order based on atomic weights was not always correct
Now, elements are arranged in order of atomic number	Elements with similar properties are in columns called groups	Elements in the same group have the same number of outer shell electrons and elements in the same period (row) have the same number of electron shells

Group 1 - alkali metals

They are very reactive with oxygen, water and chlorine		They only have 1 electron in their outer shell. They form +1 ions
The reactivity of Group 1 elements increases as you go down the group		As you go down the group the atoms get bigger. This means that the negative outer electron is further from the positive nucleus so it is more easily lost
with oxygen: forms a metal oxide	metal + oxygen → metal oxide	e.g. $4Na + O_2 \rightarrow 2Na_2O$
with water: forms a metal hydroxide and hydrogen	metal + water → metal hydroxide + hydrogen	e.g. $2Na + 2H_2O \rightarrow 2NaOH + H_2$
with chlorine: forms a metal chloride	metal + chlorine → metal chloride	e.g. $2Na + Cl_2 \rightarrow 2NaCl$

Group 0 - noble gases

They are very unreactive and don't form molecules.	They are unreactive because they already have full outer shells of electrons.
They are all gases but their boiling points increase as you go down the group.	The atomic mass increases as you go down the group. The atoms get heavier and more energy is needed to make the element boil.

Transition metals (GCSE Chemistry only)

Compared to Group 1 metals, the transition metals are less reactive, harder, denser and have higher melting points	Cu^{2+} is blue Ni^{2+} is pale green and is a catalyst for the hydrogenation of fats when making margarine Fe^{2+} is green and is a catalyst in the Haber process Fe^{3+} is reddish brown Mn^{2+} is pale pink
Some special properties of transition metals include: forming ions with different charges; acting as catalysts; forming coloured compounds	