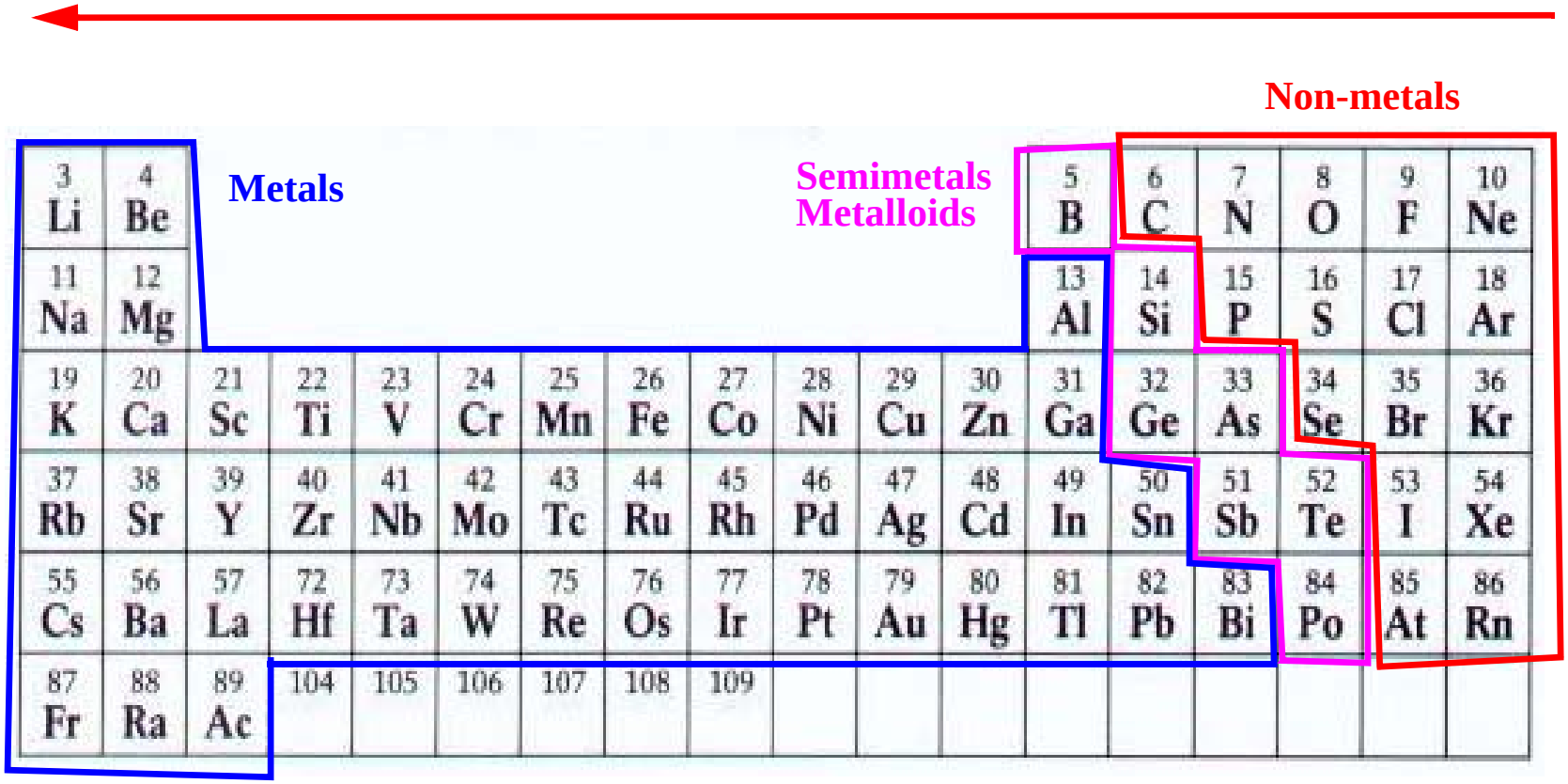
Metals

More metalic



More metalic

Electrical conductivity

how well a material can conduct electricity

EC =0

non-metals have no conductivity

EC

Smaller conductivity going down a group

EC

Semimetals
Metalloids

Transistion metals

3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac															

Alkali metals

alkaline earth metals

Periods **Overall decrease across periods**

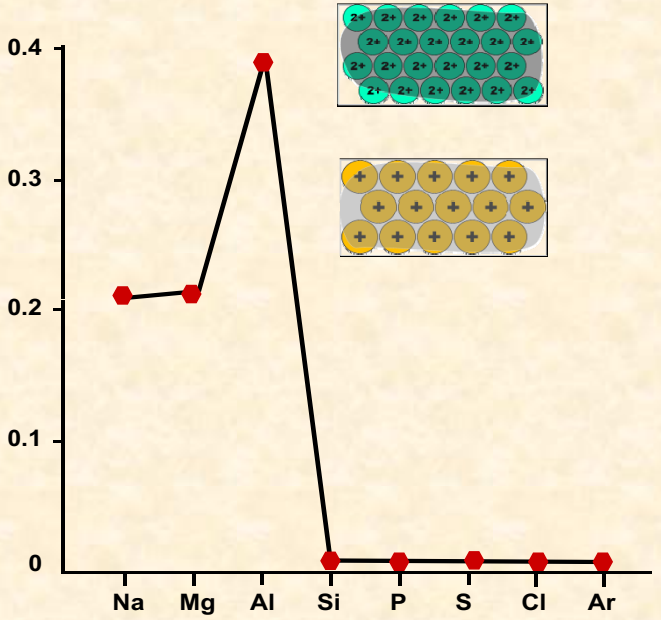
Na, Mg, Al — **metallic bonding with delocalised electrons**

Si, P, S, Cl — **covalently bonded - no electrons are free to move**

Ar — **monatomic - electrons are held very tightly**

Groups

Where there is any electrical conductivity, it decreases down a group.

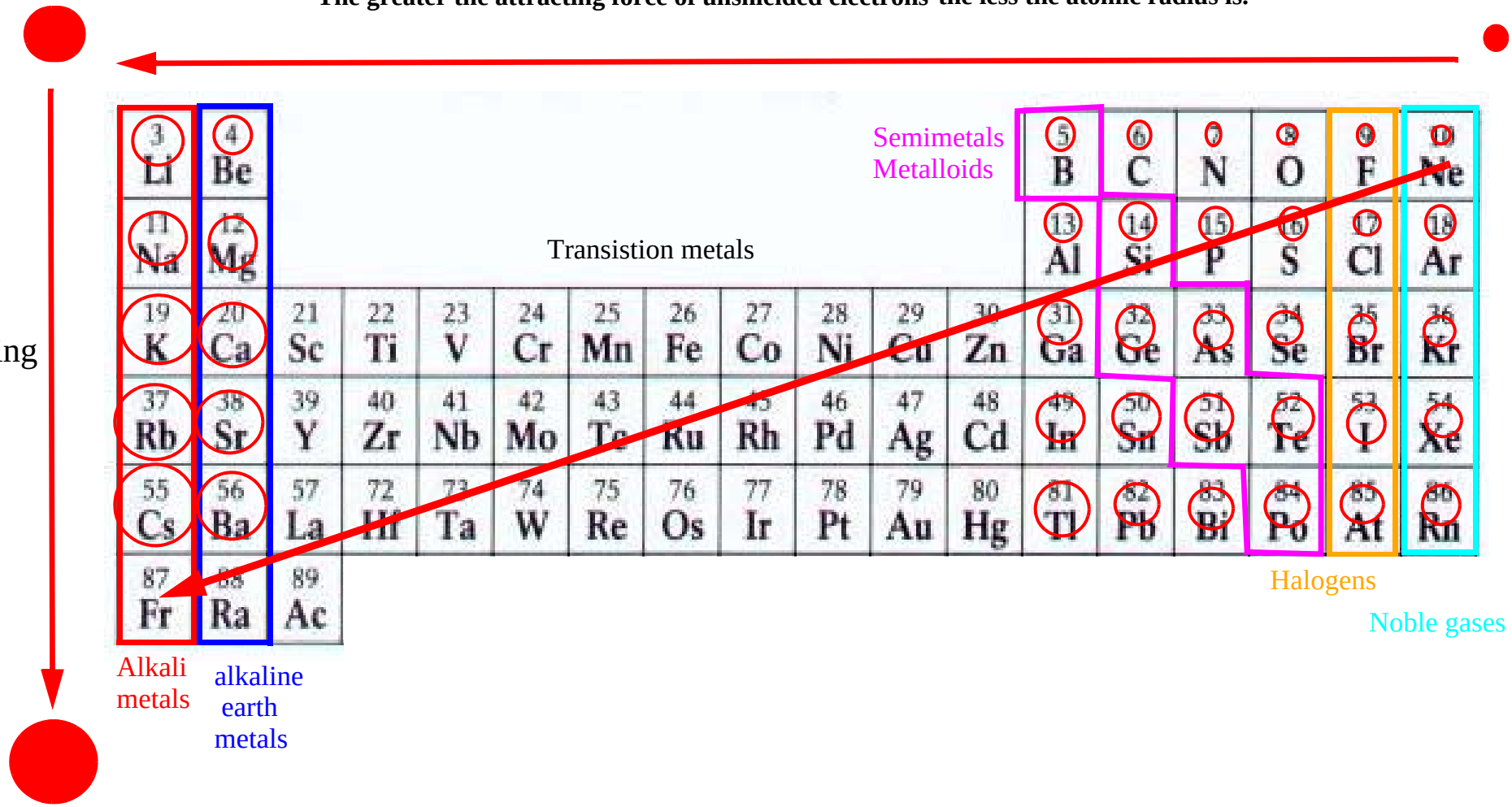


Atomic Radius

More protons makes greater attraction of electrons which makes smaller radius

The greater the attracting force of unshielded electrons the less the atomic radius is.

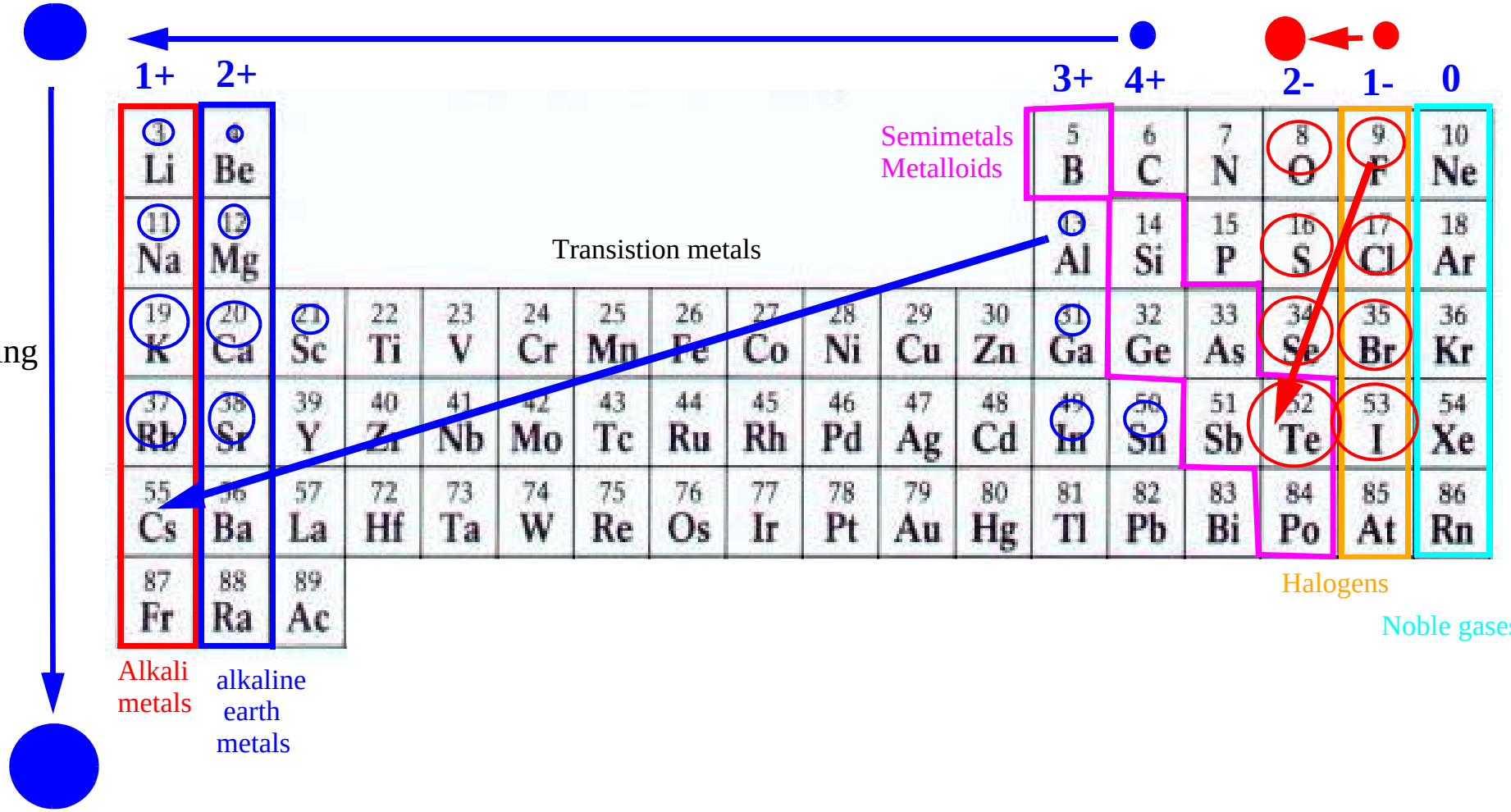
More shells give more electron shielding gives larger radius



Ionic radius

As a non-metal gains electrons to form an ion the radius grows

As a metal loses electrons to form an ion the radius shrinks



More shells give more electron shielding gives larger radius

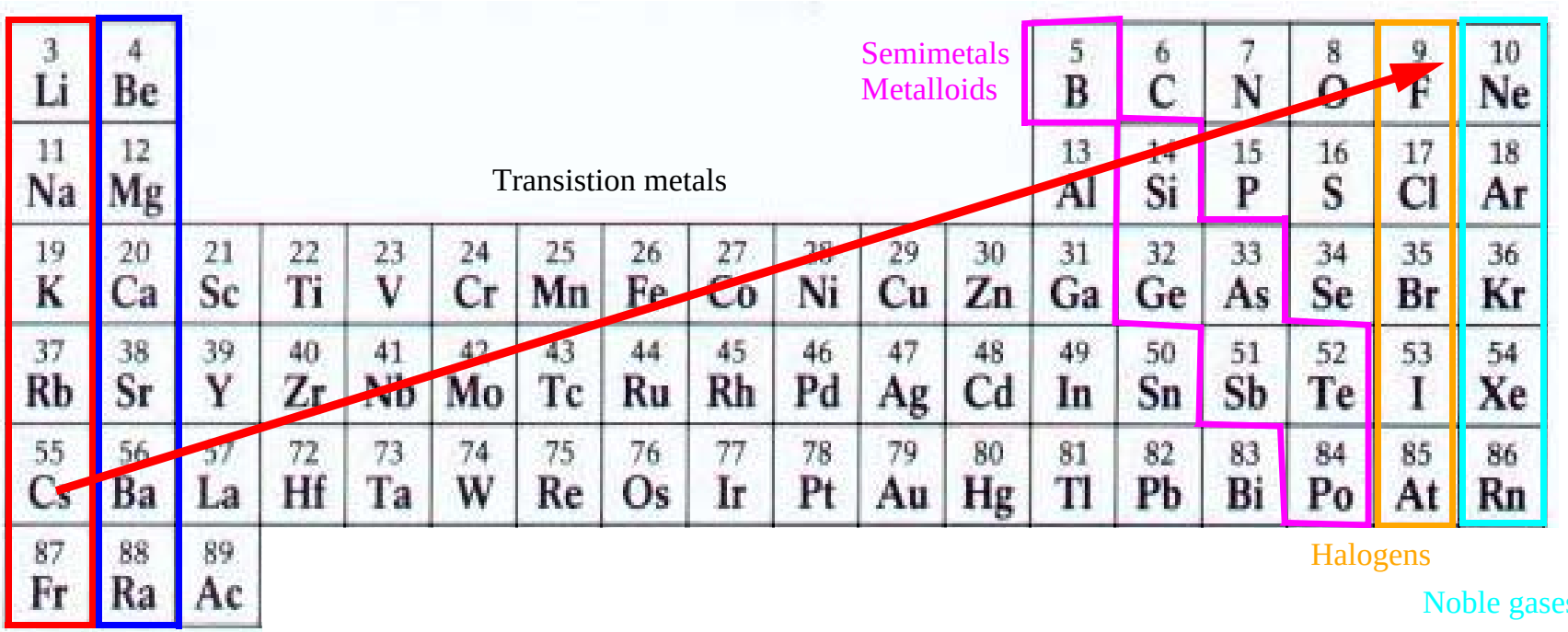
Ionisation energy the energy necessary to remove an electron from the neutral atom.

More protons makes greater attraction of electrons which makes ionisation energy larger

E_{ion} → E_{ion}

More shells give more electron shielding gives smaller ionisation energy

E_{ion}



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87 Fr	88 Ra	89 Ac															

Electronegativity

the measure of the tendency of an atom to attract (a bonding pair of) electrons.

More unshielded protons makes greater attraction of electrons which makes electronegativity larger

EN → EN

More shells give more electron shielding gives smaller electronegativity

EN

Semimetals
Metalloids

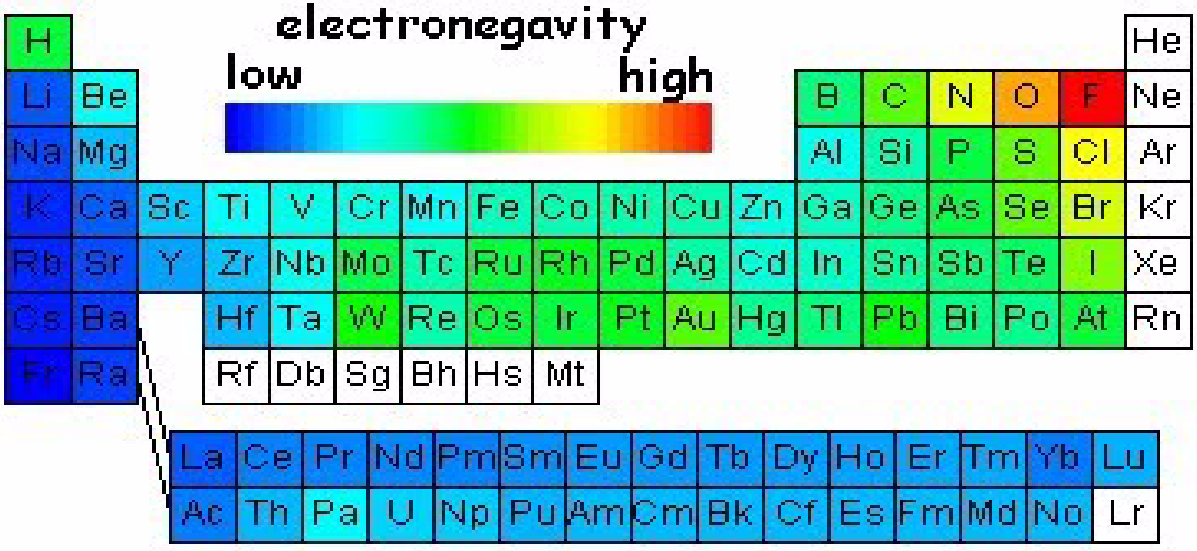
Transistion metals

Halogens

Noble gases

Alkali metals

alkaline earth metals



Melting/Boiling point

Temp.

Temp.

Temp.

Temp.

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87 Fr	88 Ra	89 Ac															

Semimetals
Metalloids

Transistion metals

Halogens

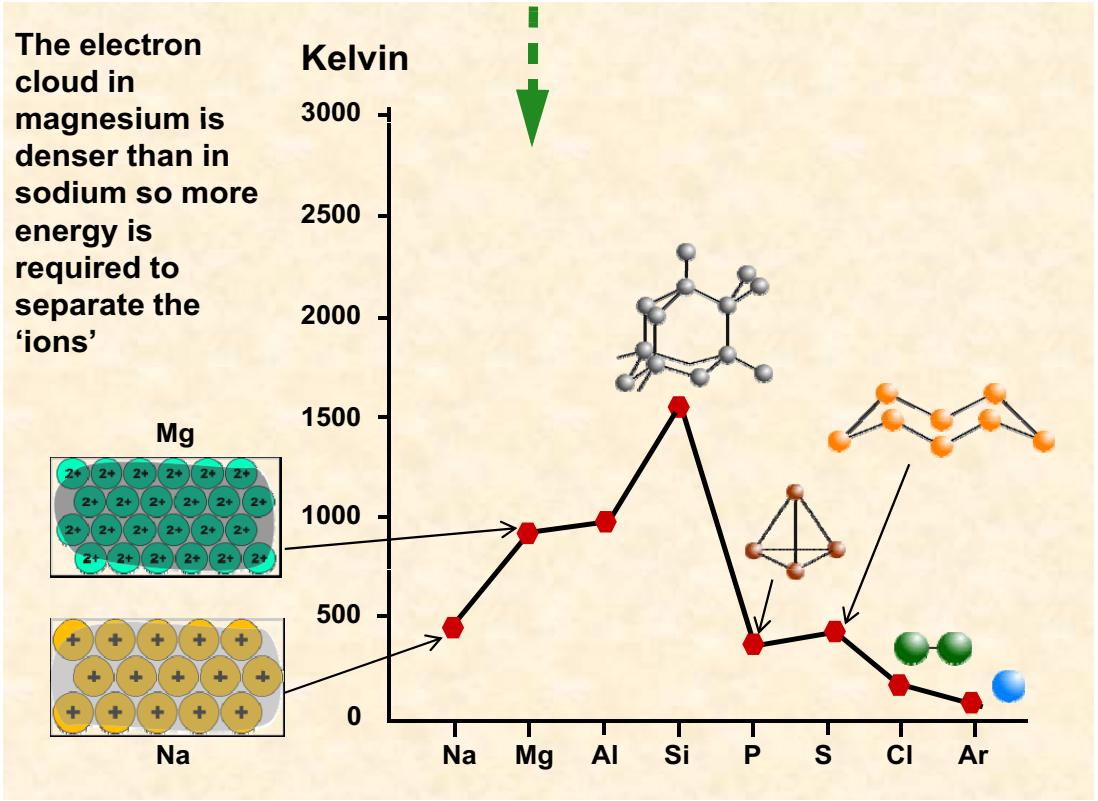
Alkali metals

alkaline earth metals

More shells give more electron shielding gives smaller melting point

More electrons in outer shell gives larger melting point

The electron cloud in magnesium is denser than in sodium so more energy is required to separate the 'ions'

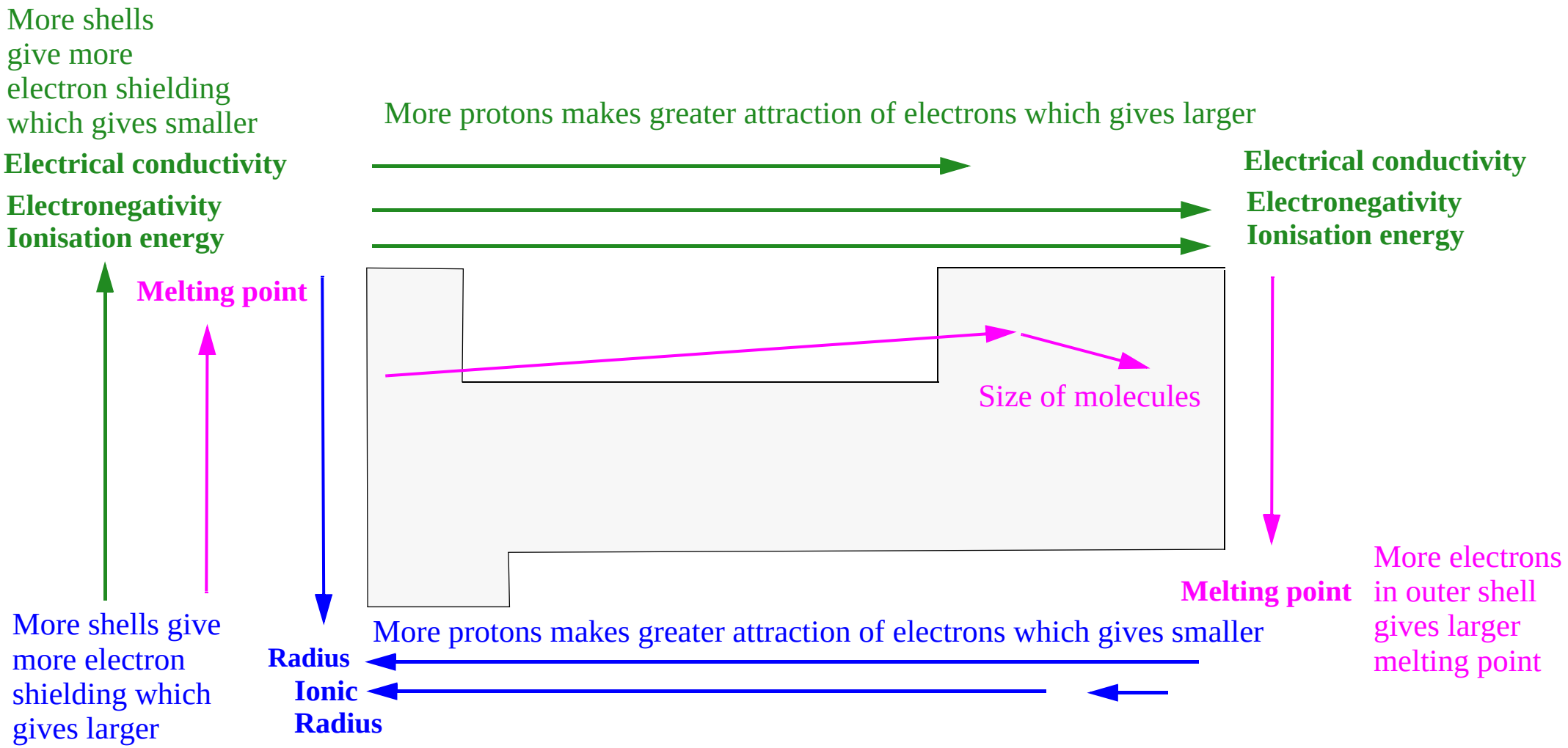


SUMMARY

Electrical conductivity how well a material can conduct electricity

Ionisation energy the energy necessary to remove an electron from the neutral atom.

Electronegativity the measure of the tendency of an atom to attract (a bonding pair of) electrons.



reactivity

Alkali Metals
Li, Na, K

Because the ionisation energy goes down as the number of shells increases

Water H_2O = Hydroxide strong alkali

$2Li + 2H_2O \rightarrow 2LiOH + H_2 + heat$ Lithiumhydroxide

$2Na + 2H_2O \rightarrow 2NaOH + H_2 + heat$ Sodiumhydroxide

$2K + 2H_2O \rightarrow 2KOH + H_2 + heat$ Potasiumhydroxide

$K^+ + OH^-$

Halogens F_2 Cl_2 Br_2 = Halides salts

$2Na + Cl_2 \rightarrow 2NaCl$ Sodiumchloride

$Na^+ + Cl^-$

Li or K | F or Br | Li or K | F_2 or Br_2

The strongest reactions are between the elements that are the most apart in the periodic table.

Oxygen O_2 = Oxides

$4Na + O_2 \rightarrow 2Na_2O$ Sodiumoxide

Li or K | Li or K

reactivity

Alkaline earth metals
Be, Mg, Ca

Water H_2O = Hydroxide weak alkali

$Be + 2H_2O \rightarrow Be(OH)_2 + H_2$ Berylliumhydroxide

$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$ Magnesiumhydroxide

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ Calciumhydroxide

$Ca^{2+} + OH^- + OH^-$

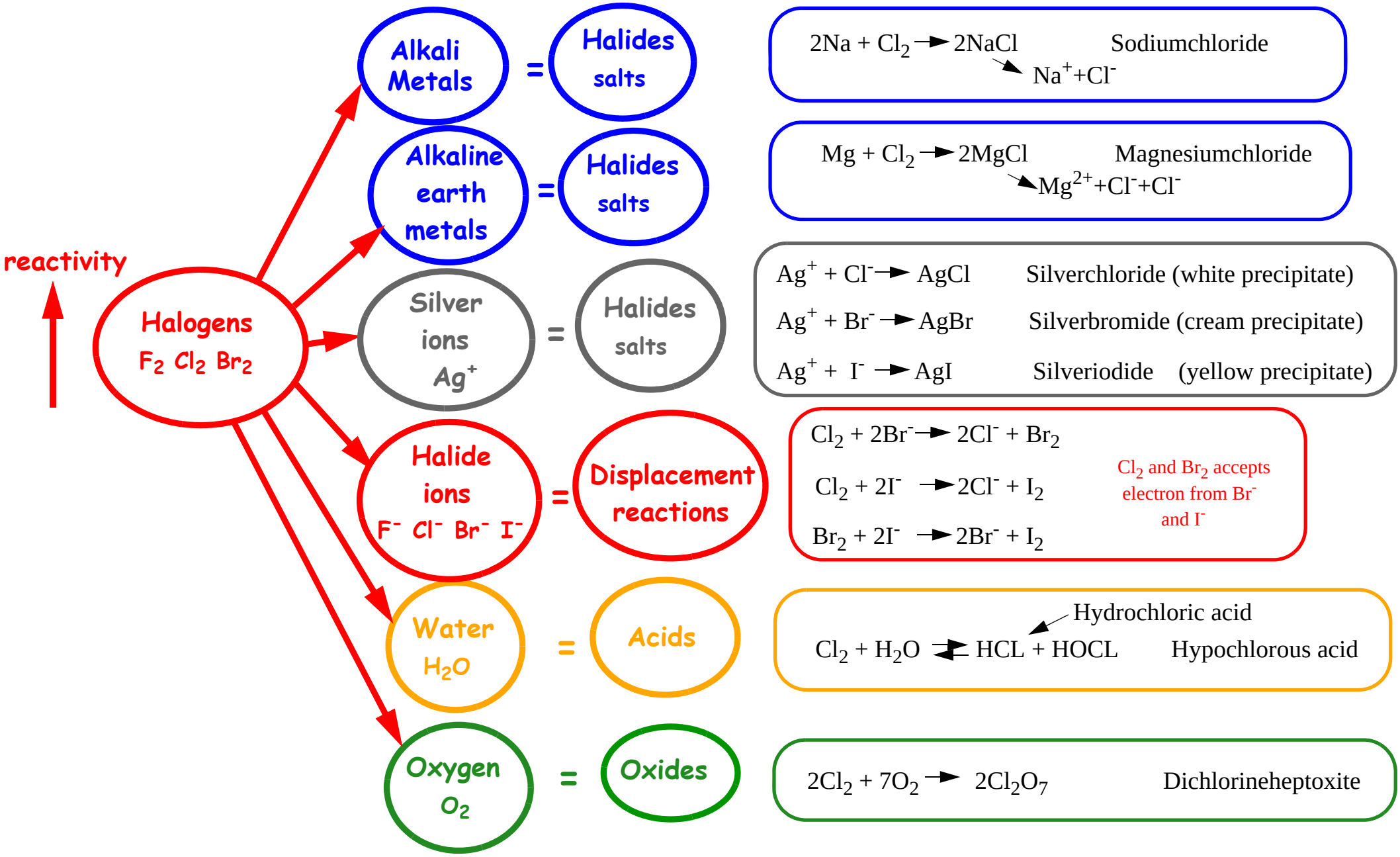
Halogens F_2 Cl_2 Br_2 = Halides salts

$Mg + Cl_2 \rightarrow 2MgCl_2$ Magnesiumchloride

Be or Ca | F_2 or Br_2 | Be or Ca | F_2 or Br_2

Oxygen O_2 = Oxides

$2Mg + O_2 \rightarrow 2MgO$ Magnesiumoxide


reactivity
Halogens
F2 Cl2 Br2
Alkali Metals = Halides salts
2Na + Cl2 → 2NaCl Sodiumchloride
Na+ + Cl-
Alkaline earth metals = Halides salts
Mg + Cl2 → 2MgCl Magnesiumchloride
Mg2+ + Cl- + Cl-
Silver ions Ag+ = Halides salts
Ag+ + Cl- → AgCl Silverchloride (white precipitate)
Ag+ + Br- → AgBr Silverbromide (cream precipitate)
Ag+ + I- → AgI Silveriodide (yellow precipitate)
Halide ions F- Cl- Br- I- = Displacement reactions
Cl2 + 2Br- → 2Cl- + Br2
Cl2 + 2I- → 2Cl- + I2
Br2 + 2I- → 2Br- + I2
Cl2 and Br2 accepts electron from Br- and I-
Water H2O = Acids
Hydrochloric acid
Cl2 + H2O ⇌ HCL + HOCL Hypochlorous acid
Oxygen O2 = Oxides
2Cl2 + 7O2 → 2Cl2O7 Dichlorineheptoxite

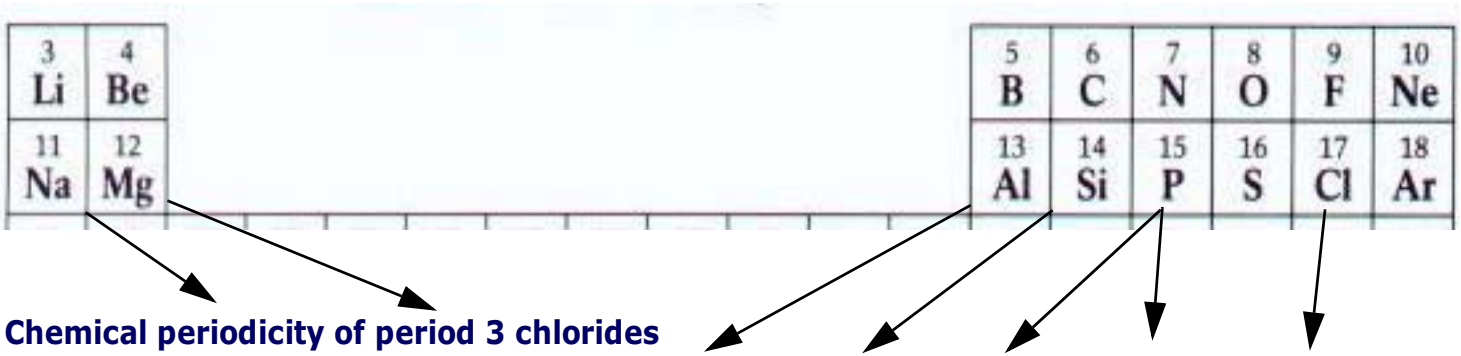
Chemical periodicity of period 3 oxides

Giant ionic structure

Giant covalent structure

Molecular covalent structure

	Na_2O	MgO	Al_2O_3	SiO_2	P_4O_{10} (or P_4O_6)	SO_3 (or SO_2)	Cl_2O_7 Cl_2O
Add H2O	$Na_2O + H_2O \rightarrow 2NaOH$	$MgO + H_2O \rightarrow Mg(OH)_2$	Insoluble	Insoluble	$P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$ $P_4O_6 + 6H_2O \rightarrow 4H_3PO_3$	$SO_3 + H_2O \rightarrow H_2SO_4$ $SO_2 + H_2O \rightarrow H_2SO_3$	$Cl_2O_7 + H_2O \rightarrow 2HClO_4$ $Cl_2O + H_2O \rightarrow 2HOCl$
Add HCl	$Na_2O + H^+ \rightarrow 2Na^+ + H_2O$	$MgO + 2H^+ \rightarrow Mg^{2+} + H_2O$	$Al_2O_3 + 6H^+ \rightarrow 2Al^{3+} + 3H_2O$	No reaction	No reaction	No reaction	No reaction
Add NaOH	No reaction	No reaction	$Al_2O_3 + 2OH^- + 3H_2O \rightarrow 2Al(OH)_4$	$SiO_2 + 2OH^- \rightarrow SiO_3^{2-} + H_2O$	$H_3PO_4 + OH^- \rightarrow H_2PO_4^- + H_2O$ $H_3PO_3 + OH^- \rightarrow H_2PO_3^- + H_2O$	$SO_2 + OH^- \rightarrow HSO_4^-$ $SO_2 + OH^- \rightarrow HSO_3^-$	$HCl_2O_7 + OH^- \rightarrow Cl_2O_7^{2-} + H_2O$ $HOCl + OH^- \rightarrow OCl^- + H_2O$
Nature	Basic Oxide	Basic Oxide	Amphoteric Oxide	Acidic Oxide	Acidic Oxide	Acidic Oxide	Acidic Oxide
Conductivity	Good	Good	Good	None	None	None	None
Melting Point	1275	2852	2027	1610	24	17	-92



Chemical periodicity of period 3 chlorides

	$NaCl$	**$MgCl_2$**	**Al_2Cl_6**	**$SiCl_4$**	**PCl_3**	**PCl_5**	**Cl_2**
Add H_2O	**Dissolves** to give free ions	**Dissolves** to give free ions	**Hydrolysis** to give $[Al(H_2O)_6]^{3+}$ and Cl- ions	**Reacts** to produce HCl and $Si(OH)_4$	**Reacts** to produce H_3PO_3 and HCl	**Reacts** to produce H_3PO_4 and HCl	**Dissociates** to give HOCl and HCl
Nature	ionic	ionic	covalent	covalent	covalent	covalent	covalent
Conductivity	Good	Good	None	None	None	None	None
Melting Point	801	714	178	-70	-112		-101