Group–2 elements

Be
Mg
Ca
Sr
Ba ↓

1. Reactivity increase
2. m.p decrease
3. density increase
4. Reducing power increase
5. Electro positivity increase
6. Ionisation energy decrease.
7. Rate of reaction with water increase.

Solubility of the Gr-2 hydroxide

$Be(OH)_2$
$Mg(OH)_2$
$Ca(OH)_2$
$Sr(OH)_2$
$Ba(OH)_2$ ↓

Solubility increase

Solubility of the Gr-2 sulfates

$BeSO_4$
$MgSO_4$
$CaSO_4$

Solubility decrease

$SrSO_4$
$BaSO_4$ ↓

Solubility of the Gr-2 carbonates

* All Gr-2 carbonates are insoluble in H_2O

Solubility of the Gr-2 nitrates

* All nitrates are soluble in H_2O

Solubility of the Gr-2 oxide

BeO
MgO
CaO
SrO
BaO ↓

Solubility increase

Thermal stability of the Grp-2 carbonates

$BeCO_3$
$MgCO_3$
$CaCO_3$
$SrCO_3$

⊖ Thermal stability increase

⊖ More heat is needed to decompose

$BaCO_3 \downarrow$

Thermal stability of the Grp-2 nitrates

$Be(NO_3)_2$
$Mg(NO_3)_2$
$Ca(NO_3)_2$
$Sr(NO_3)_2$
$Ba(NO_3)_2$

⊖ Thermal stability increase
⊖ More heat is needed to decompose

Reaction: $Ca(NO_3)_2 \xrightarrow{\text{heat}} CaO + NO_2 + O_2$

Flame color

Li → red
Na → yellow / golden yellow
K → lilac

Mg → Bright white
Ba → Green
Ca → red
Sr → red

Periodicity

Na Mg Al Si P S Cl Ar

Reactions of the third period elements with oxygen

$4Na + O_2 \xrightarrow{heat} 2Na_2O$ Burns with yellow/golden yellow flame

$2Mg + O_2 \xrightarrow{heat} 2MgO$ Burns with bright white flame

$4Al + 3O_2 \xrightarrow{heat} 2Al_2O_3$ Burns with bright white flame

$Si + O_2 \xrightarrow{heat} SiO_2$

$4P + 3O_2 \xrightarrow{heat} 2P_2O_3$

$4P + 5O_2 \xrightarrow{heat} 2P_2O_5$

$S + O_2 \xrightarrow{heat} SO_2$ (Blue flame)

$P_4 + 5O_2 \xrightarrow{heat} P_4O_{10}$

$P_4 + 3O_2 \xrightarrow{heat} P_4O_6$

Reactions of the third period oxides with water

$Na_2O + H_2O \rightarrow NaOH$

$MgO + H_2O \rightarrow Mg(OH)_2$

$Al_2O_3 + H_2O \rightarrow$ No reaction

$SiO_2 + H_2O \rightarrow$ No reaction

$P_2O_3 + H_2O \rightarrow H_3PO_3$

$P_4O_6 + H_2O \rightarrow H_3PO_3$

$P_2O_5 + H_2O \rightarrow H_3PO_4$

$P_4O_{10} + H_2O \rightarrow H_3PO_4$

$SO_2 + H_2O \rightarrow H_2SO_3$

$SO_3 + H_2O \rightarrow H_2SO_4$

$Cl_2O_7 + H_2O \rightarrow HClO_4$

per chloric acid

Reactions of the third period oxides with $NaOH_{(aq)}$

$Na_2O + NaOH \longrightarrow$ no reaction

$MgO + NaOH \longrightarrow$ no reaction

$Al_2O_3 + NaOH \longrightarrow NaAlO_2 + H_2O$

$Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2NaAl(OH)_4$

$SiO_2 + NaOH \longrightarrow Na_2SiO_3 + H_2O$ (only in hot concentrated)

$P_2O_3 + NaOH \rightarrow Na_2HPO_3 + H_2O$

$P_4O_6 + NaOH \rightarrow Na_2HPO_3 + H_2O$

$P_2O_5 + NaOH \longrightarrow Na_2HPO_3 + H_2O$

$P_4O_{10} + NaOH \longrightarrow Na_3PO_4 + H_2O$

$SO_2 + NaOH \longrightarrow Na_2SO_3 + H_2O$

$SO_3 + NaOH \longrightarrow Na_2SO_4 + H_2O$

$Cl_2O_7 + NaOH \rightarrow NaClO_4 + H_2O$

Reactions of the third period elements with Chlorine

$Na + Cl_2 \rightarrow NaCl$

$Mg + Cl_2 \rightarrow MgCl_2$

$Al + Cl_2 \rightarrow AlCl_3$

$Si + Cl_2 \rightarrow SiCl_4$ (colorless fuming liquid)

$P + Cl_2 \rightarrow PCl_3$ (liquid)

$P + Cl_2 \rightarrow PCl_5$ (solid)

$S + Cl_2 \rightarrow SCl_2$ (liquid)

Reactions of the third period chlorides with water

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* $NaCl_{(s)} + (aq) \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$ pH = 7
* $MgCl_{2(s)} + (aq) \rightarrow Mg^{2+}_{(aq)} + 2Cl^-_{(aq)}$ pH = 6.9
* $AlCl_3 + 6H_2O \rightarrow [Al(H_2O)_5(OH)]^{+2} + H^+ + 3Cl^-$ pH = 1 - 3

$SiCl_4 + 2H_2O \rightarrow SiO_2 + 4HCl$

$SiCl_4 + H_2O \rightarrow Si(OH)_4 + HCl$

$SiCl_4 + 2H_2O \rightarrow SiO_2 + 4H^+ + 4Cl^-$ pH = 1 - 3

$PCl_5 + H_2O \rightarrow H_3PO_4 + HCl$

$PCl_3 + H_2O \rightarrow H_3PO_3 + HCl$

$SCl_2 + H_2O \rightarrow S + SO_2 + HCl$

} pH = 1 - 3

Formula of chloride	$NaCl$	$MgCl_2$	$AlCl_3$	PCl_3	SCl_2
Oxidation					

number of elements in the chloride	+1	+2	+3	+3	+2

By considering the electronic configuration of elements, explain the variation in oxidation number

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Na to Al

- loss of valence electrons to give electronic configuration of Ne

- Si to S

- Gain or sharing of outer electrons to give electronic configuration of Ar.

Metal hydride

Metal hydride + water → metal hydroxide + hydrogen gas

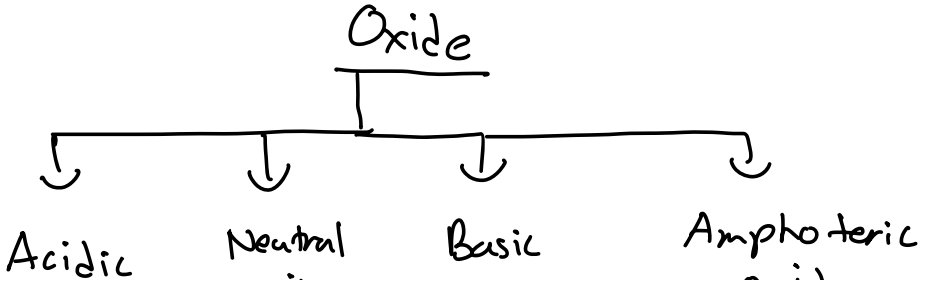
$NaH + H_2O \rightarrow NaOH + H_2$

Metal Nitrides

Metal nitride + water → metal hydroxide + Ammonia

$$Mg_3N_2 + H_2O \rightarrow Mg(OH)_2 + NH_3$$

Period 3 oxides	Na_2O	MgO	Al_2O_3	SiO_2	P_4O_{10} P_2O_5	SO_2 SO_3
Acidic / Basic	Basic	Basic	Amphoteric	Acidic	Acidic	Acidic
Relative m.p	high	high	high	high	low	low
Electrical conductivity in molten state	conductor	conductor	conductor	non conductor	non conductor	non conductor
Chemical bonding	ionic	ionic	ionic	covalent	covalent	covalent
Structure	giant ionic	giant ionic	giant ionic	giant covalent	simple covalent	simple covalent



Oxide Oxide Oxide Oxide

- Oxides are binary compounds.
- One of the elements in oxygen.

Acidic Oxide

- Non metallic oxides which can react with bases only are called acidic oxides.

- Non-metallic oxides react with water to make acidic solution.
  (Exception: SiO_2 is an acidic oxide but cannot react with water.)

SO_2 CO_2
NO_2 Cl_2O_7
P_2O_5 SO_3

Neutral oxides

Non-metallic oxides which can not react with acids and bases are called neutral oxides.

H_2O, CO, NO, N_2O

Ampoteric oxides

⊖ Metallic oxides which can react with both acids and bases are called amphoteric oxides. Al_2O_3, ZnO, PbO, Ga_2O_3

Basic Oxide

Metallic oxides which can react with acids only are called basic oxides.

Na_2O, MgO