

Oxides of the third period (sodium -> argon)

OXIDES OF PERIOD 3 ELEMENTS

The oxides of sodium, magnesium, and aluminium are all ionic. This accounts for their high melting points and electrical conductivity when molten. Silicon dioxide has a diamond-like macromolecular structure with a high boiling point. At the other end of the period the difference in electronegativities between the element and oxygen is small, resulting in simple covalent molecular structures with low melting and boiling points.

The acid-base properties of the oxides are also linked to their structure. The oxides of the electropositive elements are very basic and form solutions that are alkaline.

$$Na_2O(s) + H_2O(l) \rightarrow 2Na^+(aq) + 2OH^-(aq)$$

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

The amphoteric nature of aluminium oxide can be seen from its reactions with hydrochloric acid and sodium hydroxide.

Acting as a base:

$$\mathsf{Al_2O_3(s)} + \mathsf{6HCl(aq)} \rightarrow \mathsf{2AlCl_3(aq)} + \mathsf{3H_2O(l)}$$

Acting as an acid:

$$\mathsf{Al_2O_3(s)} + 2\mathsf{NaOH(aq)} + 3\mathsf{H_2O(l)} \rightarrow 2\mathsf{NaAl(OH)_4(aq)}$$

sodium aluminate

Silicon dioxide behaves as a weak acid. It does not react with water but will form sodium silicate with sodium hydroxide.

$$SiO_2(s) + 2NaOH(aq) \rightarrow Na_2SiO_3(aq) + H_2O(aq)$$

The oxides of phosphorus, sulfur, and chlorine are all strongly acidic.

$$SO_2(g) + H_2O(l) \rightarrow H_2SO_3$$
 sulfurous acid

$$P_4O_{10}(s) + 6H_2O(I) \rightarrow 4H_3PO_4(aq)$$
 phosphoric acid

$$Cl_2O_7(I) + H_2O(I) \rightarrow 2HClO_4(aq)$$
 perchloric acid

Oxides of period 3 elements

Formula Na ₂ C State at 25 °C Solic Melting point / °C Boiling point / °C Electrical conductivity	Solid 2852 3600	Al ₂ O ₃ Solid 2027 2980	SiO ₂ Solid 1610 2230	P ₄ O ₁₀ (P ₄ O ₆) Solid (Solid) 24	SO ₃ (SO ₂) Liquid (Gas)	Cl ₂ O ₇ (Cl ₂ O) Liquid (Gas)	
Melting point / °C 1275 Boiling point / °C – Electrical Good conductivity	3600	2027	1610	(Solid)	(Gas)	(Gas)	
Boiling point / °C – Electrical Good conductivity	3600				17	02	
Electrical Good		2980	2230			Lucia -92	
conductivity	d Good		2230	175	45	80	
		Good	Very poor	None	None	None	
in molten state							
)					
Structure	lonic		Covalent macromolecula	Simp	Simple covalent molecular		
Reaction with water Form NaOH(an alka soluti	aq), Mg(OH line weakl) ₂ , not react y	Does not react	P ₄ O ₁₀ forms H ₃ PO ₄ , an acidic solution	SO ₃ forms H ₂ SO ₄ , a strong acid	Cl ₂ O ₇ forms HClO ₄ , an acidio solution	
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Nature of oxide	Basic	Amphoter	ic	A	cidic		