Coordinated Phosphate: Sodium-to-Phosphate Molar Ratio

Sodium-to-phosphate molar ratio of boiler water from sodium and phosphate analyses, for coordinated or congruent phosphate treatment control.

Method: Molar ratio from IUPAC atomic masses; control band set by the plant's chemistry programme (trisodium phosphate is 3.0)

Input parameters

Unit system: SI

Parameter	Value	Unit
Sodium	6.5000	mg/L
Phosphate as PO_4	9.0000	mg/L

Calculated results

Parameter	Value	Unit
Molar ratio	2.9834	
Sodium	0.28273	mmol/L
Phosphate	0.094767	mmol/L

Formula and method

$$n_{Na} = \frac{c_{Na}}{M_{Na}}, \quad n_{PO_4} = \frac{c_{PO_4}}{M_{PO_4}}, \quad M_{PO_4} = M_P + 4M_O, \quad \frac{Na}{PO_4} = \frac{n_{Na}}{n_{PO_4}}$$

Variables

c_{Na}	Sodium	kg/m³
c_{PO_4}	Phosphate as PO_4	kg/m³
$Na : PO_4$	Molar ratio	-
n_{Na}	Sodium	mol/m³
n_{PO_4}	Phosphate	mol/m³
M_{Na}	Atomic mass of sodium (IUPAC)	kg/kmol
M_{PO_4}	Molar mass of phosphate	kg/kmol
M_P	Atomic mass of phosphorus (IUPAC)	kg/kmol
M_O	Atomic mass of oxygen (IUPAC)	kg/kmol

Method and standards

Molar ratio.

Assumptions and limits

- Same sample. With concentrations in kg/m³ and molar masses in kg/kmol the amounts come out in kmol/m³; they are shown in mmol/L (= mol/m³).
- All sodium is taken as phosphate-associated. Sodium from other salts (chloride, sulphate) raises the ratio and can trigger the free-caustic note falsely.
- The note below 2.2 is a general screening flag, not a code limit; the control band is the one your chemistry programme sets.

References

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Report details

Report reference	FCC-BA4K-BFEX (the same inputs always give the same reference)
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Calculator	Coordinated Phosphate: Sodium-to-Phosphate Molar Ratio
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/water-treatment/coordinated-phosphate-ratio

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.