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Certified Water References

The authority for the absolute refractive index of water is the IAPWS (The International Association for the Properties of Water and Steam, www.iapws.org). For the NIST Scientific and Technical Database based on the IAPWS see www.nist.gov/srd/nist10.htm. The absolute refractive index of air can be calculated using the following formulas found in the American Institute of Physics Handbook (page 6-111 of the 3d edition).

$$(n - 1)10^8 = 6{,}432.8 + (2{,}949{,}810 / 146 - \sigma^2) + (25{,}540 / 41 - \sigma^2)$$

(Note : this formula is for the absolute refractive index of air at 15 °C and 760 mm Hg; $n_{15,760}$ see below)

where σ is the wave number in μm^{-1} (wave number = 10^3 / wavelength in nm)

The change in refractive index with temperature and pressure can be calculated using the following.

$$n_{Tp} - 1 = (n_{15,760} - 1) \times (p(1 + \beta_T)(1 + 15\alpha)) / (760(1 + 760\beta_{15})(1 + \alpha T))$$

where T = temperature (°C)
p = pressure (mm Hg)
$\alpha = 0.00366$
$\beta_T = (1.049 - 0.015^7 T)10^{-6}$
$\beta_{15} = 0.813^5 \times 10^{-6}$

The absolute refractive index, using 589.3 nm light, of Water and Air at 760 mm Hg Air Pressure*

Temperature in °C	Water	Air
10	1.334049	1.000282
15	1.333740	1.000277
20	1.333336	1.000272
23	1.333051	1.000270
25	1.332845	1.000268
30	1.332277	1.000263
35	1.331638	1.000259

* Note : air pressure will affect the refractive index of air. For example: at 25 °C air is 1.000268 at 760 mm Hg (sea level) and 1.000223 at 632 mm Hg (such as at an elevation of 5000 feet)