

Numerical Values of Constants and Coefficients

Symbol	Description	Magnitude
c	speed of light in vacuum	$2.998 \times 10^8 \text{ m s}^{-1}$
c_{wv}^*	saturation concentration of water vapor (i.e., at 100% relative humidity)	See pp. 548–550 for values from -30°C to 60°C .
C_p^{water}	volumetric heat capacity of water at constant pressure (1 atmosphere, 0.1013 MPa)	$4.217 \text{ MJ m}^{-3} \text{ }^\circ\text{C}^{-1}$ at 0°C $4.175 \text{ MJ m}^{-3} \text{ }^\circ\text{C}^{-1}$ at 20°C $4.146 \text{ MJ m}^{-3} \text{ }^\circ\text{C}^{-1}$ at 40°C
C_p^{air}	volumetric heat capacity of dry air at constant pressure (1 atmosphere)	$1.300 \text{ kJ m}^{-3} \text{ }^\circ\text{C}^{-1}$ at 0°C $1.212 \text{ kJ m}^{-3} \text{ }^\circ\text{C}^{-1}$ at 20°C $1.136 \text{ kJ m}^{-3} \text{ }^\circ\text{C}^{-1}$ at 40°C
D_{CO_2}	diffusion coefficient of CO_2 in air (1 atmosphere, 0.1013 MPa)	$1.33 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 0°C $1.42 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 10°C $1.51 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 20°C $1.60 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 30°C $1.70 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 40°C
D_{O_2}	diffusion coefficient of O_2 in air (1 atmosphere, 0.1013 MPa)	$1.95 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 20°C
D_{wv}	diffusion coefficient of water vapor in air (1 atmosphere, 0.1013 MPa)	$2.13 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 0°C $2.27 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 10°C $2.42 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 20°C $2.57 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 30°C $2.72 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 40°C
e	base for natural logarithm	2.71828 ($1/e = 0.368$)
	electronic charge	$1.602 \times 10^{-19} \text{ C}$
F	Faraday's constant	$9.649 \times 10^4 \text{ coulomb mol}^{-1}$ $9.649 \times 10^4 \text{ J mol}^{-1} \text{ V}^{-1}$ $2.306 \times 10^4 \text{ cal mol}^{-1} \text{ V}^{-1}$ $23.06 \text{ kcal mol}^{-1} \text{ V}^{-1}$

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Symbol	Description	Magnitude
g	gravitational acceleration	9.780 m s ⁻² (sea level ¹ , 0° latitude)
		9.807 m s ⁻² (sea level ¹ , 45° latitude)
		9.832 m s ⁻² (sea level ¹ , 90° latitude)
		978.0 cm s ⁻² (sea level ¹ , 0° latitude)
		980.7 cm s ⁻² (sea level ¹ , 45° latitude)
		983.2 cm s ⁻² (sea level ¹ , 90° latitude)
h	Planck's constant	6.626 × 10 ⁻³⁴ J s
		6.626 × 10 ⁻²⁷ erg s
		0.4136 × 10 ⁻¹⁴ eV s
		1.584 × 10 ⁻³⁷ kcal s
hc		1.986 × 10 ⁻²⁵ J m
		1 240 eV nm
H_{sub}	heat of sublimation of water	51.37 kJ mol ⁻¹ (2.847 MJ kg ⁻¹) at -10°C
		51.17 kJ mol ⁻¹ (2.835 MJ kg ⁻¹) at -5°C
		51.00 kJ mol ⁻¹ (2.826 MJ kg ⁻¹) at 0°C
		12.27 kcal mol ⁻¹ (680 cal g ⁻¹) at -10°C
		12.22 kcal mol ⁻¹ (677 cal g ⁻¹) at -5°C
		12.18 kcal mol ⁻¹ (675 cal g ⁻¹) at 0°C
H_{vap}	heat of vaporization of water	45.06 kJ mol ⁻¹ (2.501 MJ kg ⁻¹) at 0°C
		44.63 kJ mol ⁻¹ (2.477 MJ kg ⁻¹) at 10°C
		44.21 kJ mol ⁻¹ (2.454 MJ kg ⁻¹) at 20°C
		44.00 kJ mol ⁻¹ (2.442 MJ kg ⁻¹) at 25°C
		43.78 kJ mol ⁻¹ (2.430 MJ kg ⁻¹) at 30°C
		43.35 kJ mol ⁻¹ (2.406 MJ kg ⁻¹) at 40°C
		42.91 kJ mol ⁻¹ (2.382 MJ kg ⁻¹) at 50°C
		40.68 kJ mol ⁻¹ (2.258 MJ kg ⁻¹) at 100°C
k	Boltzmann's constant	1.381 × 10 ⁻²³ J molecule ⁻¹ K ⁻¹
		1.381 × 10 ⁻¹⁶ erg molecule ⁻¹ K ⁻¹
		8.617 × 10 ⁻⁵ eV molecule ⁻¹ K ⁻¹
kT		0.02354 eV molecule ⁻¹ at 0°C
		0.02526 eV molecule ⁻¹ at 20°C
		0.02569 eV molecule ⁻¹ at 25°C
		0.02699 eV molecule ⁻¹ at 40°C
K^{air}	thermal conductivity coefficient of dry air (1 atmosphere) ²	0.0237 W m ⁻¹ °C ⁻¹ at -10°C
		0.0243 W m ⁻¹ °C ⁻¹ at 0°C
		0.0250 W m ⁻¹ °C ⁻¹ at 10°C
		0.0257 W m ⁻¹ °C ⁻¹ at 20°C
		0.0264 W m ⁻¹ °C ⁻¹ at 30°C
		0.0270 W m ⁻¹ °C ⁻¹ at 40°C
		0.0277 W m ⁻¹ °C ⁻¹ at 50°C

1. The correction for height above sea level is -3.09×10^{-6} m s⁻² per m of altitude.

2. The pressure sensitivity is very slight, K^{air} increasing only about 0.0001 W m⁻¹ °C⁻¹ per atmosphere (0.1013 MPa) increase in pressure.

Symbol	Description	Magnitude
	thermal conductivity coefficient of moist air (100% relative humidity, 1 atmosphere)	0.0242 W m ⁻¹ °C ⁻¹ at 0°C 0.0255 W m ⁻¹ °C ⁻¹ at 20°C 0.0264 W m ⁻¹ °C ⁻¹ at 40°C
K^{water}	thermal conductivity coefficient of water	0.565 W m ⁻¹ °C ⁻¹ at 0°C 0.599 W m ⁻¹ °C ⁻¹ at 20°C 0.627 W m ⁻¹ °C ⁻¹ at 40°C
$\ln 2$		0.6931
N	Avogadro's number	6.0220×10^{23} entities mol ⁻¹
Nhc		0.1196 J mol ⁻¹ m 119 600 kJ mol ⁻¹ nm 28.60 kcal mol ⁻¹ μm 28 600 kcal mol ⁻¹ nm
N_{wv}^*	saturation mole fraction of water vapor (i.e., at 100% relative humidity) at 1 atmosphere (0.1013 MPa)	See pp. 548–550 for values from –30°C to 60°C.
P_{wv}^*	saturation vapor pressure of water	See pp. 548–500 for values from –30°C to 60°C.
	protonic charge	1.602×10^{-19} C
R	gas constant	8.314 J mol ⁻¹ K ⁻¹ 1.987 cal mol ⁻¹ K ⁻¹ 8.314 m ³ Pa mol ⁻¹ K ⁻¹ 8.314×10^{-6} m ³ MPa mol ⁻¹ K ⁻¹ 0.08205 litre atmosphere mol ⁻¹ K ⁻¹ 0.08314 litre bar mol ⁻¹ K ⁻¹ 83.14 cm ³ bar mol ⁻¹ K ⁻¹
RT		2.271 × 10 ³ J mol ⁻¹ (m ³ Pa mol ⁻¹) at 0°C 2.437 × 10 ³ J mol ⁻¹ (m ³ Pa mol ⁻¹) at 20°C 2.479 × 10 ³ J mol ⁻¹ (m ³ Pa mol ⁻¹) at 25°C 2.271 × 10 ⁻³ m ³ MPa mol ⁻¹ at 0°C 2.437 × 10 ⁻³ m ³ MPa mol ⁻¹ at 20°C 2.479 × 10 ⁻³ m ³ MPa mol ⁻¹ at 25°C 542.4 cal mol ⁻¹ at 0°C 582.2 cal mol ⁻¹ at 20°C 2.271 litre MPa mol ⁻¹ at 0°C 2.437 litre MPa mol ⁻¹ at 20°C 22.71 litre bar mol ⁻¹ at 0°C 24.37 litre bar mol ⁻¹ at 20°C 22 710 cm ³ bar mol ⁻¹ at 0°C 24 370 cm ³ bar mol ⁻¹ at 20°C 22.41 litre atmosphere mol ⁻¹ at 0°C 24.05 litre atmosphere mol ⁻¹ at 20°C
2.303 RT		5.612 kJ mol ⁻¹ at 20°C 5.708 kJ mol ⁻¹ at 25°C 1.342 kcal mol ⁻¹ at 20°C 1.364 kcal mol ⁻¹ at 25°C 56 120 cm ³ bar mol ⁻¹ at 20°C

Symbol	Description	Magnitude
RT/F		25.3 mV at 20°C 25.7 mV at 25 °C
2.303 RT/F		58.2 mV at 20°C 59.2 mV at 25°C 60.2 mV at 30°C
RT/\bar{V}_w		135.0 MPa at 20°C 137.3 MPa at 25°C 32.31 cal cm ⁻³ at 20°C 135.0 J cm ⁻³ at 20°C 1 350 bars at 20°C 1 330 atmospheres at 20°C
2.303 RT/\bar{V}_w		310.9 MPa at 20°C 316.2 MPa at 25°C 3 063 atmospheres at 20°C 3 109 bars at 20 °C
	solar constant	1 368 W m ⁻² 1.960 cal cm ⁻² min ⁻¹ 1.368 × 10 ⁵ erg cm ⁻² s ⁻¹ 0.1368 W cm ⁻²
	thermal capacity of water (mass basis)	4 218 J kg ⁻¹ °C ⁻¹ at 0°C 4 182 J kg ⁻¹ °C ⁻¹ at 20°C 4 179 J kg ⁻¹ °C ⁻¹ at 40°C 1.0074 cal g ⁻¹ °C ⁻¹ at 0°C 0.9988 cal g ⁻¹ °C ⁻¹ at 20°C 0.9980 cal g ⁻¹ °C ⁻¹ at 40°C
	thermal capacity of water (mole basis)	75.99 J mol ⁻¹ °C ⁻¹ at 0°C 75.34 J mol ⁻¹ °C ⁻¹ at 20°C 75.28 J mol ⁻¹ °C ⁻¹ at 40°C 18.14 cal mol ⁻¹ °C ⁻¹ at 0°C 17.99 cal mol ⁻¹ °C ⁻¹ at 20°C 17.98 cal mol ⁻¹ °C ⁻¹ at 40°C
\bar{V}_w	partial molal volume of water	1.805 × 10 ⁻⁵ m ³ mol ⁻¹ at 20°C 18.05 cm ³ mol ⁻¹ at 20°C
ϵ_0	permittivity of a vacuum	8.854 × 10 ⁻¹² coulomb ² m ⁻² N ⁻¹ 8.854 × 10 ⁻¹² coulomb m ⁻¹ V ⁻¹
η_{air}	viscosity of air	1.716 × 10 ⁻⁵ Pa s at 0°C 1.813 × 10 ⁻⁵ Pa s at 20°C 1.907 × 10 ⁻⁵ Pa s at 40°C
η_w	viscosity of water	1.787 × 10 ⁻³ Pa s at 0°C 1.307 × 10 ⁻³ Pa s at 10°C 1.002 × 10 ⁻³ Pa s at 20°C 0.798 × 10 ⁻³ Pa s at 30°C 0.653 × 10 ⁻³ Pa s at 40°C 0.547 × 10 ⁻³ Pa s at 50°C 0.01002 dyn s cm ⁻² at 20°C 0.01002 poise at 20°C

Symbol	Description	Magnitude
ν_{air}	kinematic viscosity of air (dry, 1 atmosphere)	$1.327 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 0°C
		$1.505 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 20°C
		$1.691 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ at 40°C
ν_w	kinematic viscosity of water	$1.787 \times 10^{-6} \text{ m}^2 \text{ s}^{-1}$ at 0°C
		$1.004 \times 10^{-6} \text{ m}^2 \text{ s}^{-1}$ at 20°C
		$0.658 \times 10^{-6} \text{ m}^2 \text{ s}^{-1}$ at 40°C
π	circumference/diameter of circle	3.14159
ρ_{air}	density of dry air (1 atmosphere, 0.1013 MPa)	1.293 kg m^{-3} at 0°C
		1.205 kg m^{-3} at 20°C
		1.128 kg m^{-3} at 40°C
	density of saturated air (1 atmosphere) ³	1.290 kg m^{-3} at 0°C
		1.194 kg m^{-3} at 20°C
ρ_w	density of water	999.8 kg m^{-3} (0.9998 g cm ⁻³) at 0°C
		$1\,000.0 \text{ kg m}^{-3}$ (1.0000 g cm ⁻³) at 4°C
		999.7 kg m^{-3} (0.9997 g cm ⁻³) at 10°C
		998.2 kg m^{-3} (0.9982 g cm ⁻³) at 20°C
		995.6 kg m^{-3} (0.9956 g cm ⁻³) at 30°C
		992.2 kg m^{-3} (0.9922 g cm ⁻³) at 40°C
		$\rho_w g$
0.0979 bar m ⁻¹ (20°C, sea level, 45° latitude)		
979 dyn cm ⁻³ (20°C, sea level, 45° latitude)		
0.0966 atmosphere m ⁻¹ (20°C, sea level, 45° latitude)		
σ	Stefan-Boltzmann constant	$5.670 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$
		$5.670 \times 10^{-12} \text{ W cm}^{-2} \text{ K}^{-4}$
		$8.130 \times 10^{-11} \text{ cal cm}^{-2} \text{ min}^{-1} \text{ K}^{-4}$
		$5.670 \times 10^{-5} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ K}^{-4}$
σ_w	surface tension of water	0.0756 N m^{-1} (Pa m) at 0°C
		0.0742 N m^{-1} (Pa m) at 10°C
		0.0728 N m^{-1} (Pa m) at 20°C
		0.0712 N m^{-1} (Pa m) at 30°C
		0.0696 N m^{-1} (Pa m) at 40°C
		$7.28 \times 10^{-8} \text{ MPa m}$ at 20°C
		72.8 dyn cm^{-1} at 20°C
$7.18 \times 10^{-5} \text{ atmosphere cm}$ at 20°C		
$7.28 \times 10^{-5} \text{ bar cm}$ at 20°C		

3. Moist air is less dense than dry air at the same temperature and pressure, because the molecular weight of water (18.0) is less than the average for air (29.0).