Composition of Dry Air at Sea Level

Component	Mole Per Cent	Molar Mass
N_2	78.084	28.013
O_2	20.948	31.998
Ar	0.934	29.948
CO_2	0.0314	44.010
Ne	0.001818	20.183
He	0.000524	4.003
CH_4	0.002	16.043
Kr	0.000114	83.80
H_2	0.00005	2.016
N_2O	0.00005	44.013
Xe	0.0000087	131.30

Metric System Prefixes

Prefix	Abbreviation	Power of 10
Tera-	T	1×10^{12}
Giga-	G	1×10^{9}
Mega-	M	1×10^{6}
Kilo-	k	1×10^{3}
(Base)	(gram, meter, liter,etc.)	1×10^{0}
Deci-	d	1×10^{-1}
Centi-	c	1×10^{-2}
Milli-	m	1×10^{-3}
Micro-	μ	1×10^{-6}
Nano-	n	1×10^{-9}
Pico-	p	1×10^{-12}
Femto-	f	1×10^{-15}

Length Conversion Factors

1 inch (in) = 2.54 centimeter (cm)
1 meter (m) = 39.37 inch (in) = 1.094 yard (yd)
1 mile = 1.61 kilometer (km) = 5280 ft

Mass Conversion Factors

1 kilogram (kg) = 2.2046 pound (lb)
1 ounce = 28.35 gram
1 ton = 2000 lb = 907.185 kilogram (kg)
1 metric ton = 1000 kg = 2204.6 lbs

Volume Conversion Factors

1 cubic cm (cm^3) = 1 milliter (mL)
1 cubic inch (in^3) = 16.387 cubic cm (cm^3)
1 cubic meter (m^3) = 35.315 cubic foot (ft^3)
1 cubic meter (m^3) = 1.308 cubic yard (yd^3)
1 gallon (gal) = 3.7854 liter
1 cubic meter (m^3) = 264.172 gallon (gal)
1 fluid ounce (fl oz) = 29.57 milliliters (mL)
1 cubic foot = 28.317 L (1000 cm^3)
1 dram = 3.697 mL

Vapor Pressure Data for H_2O

Temp(°C)	kPa	Temp(°C)	kPa
0	0.61129	50	12.344
1	0.65716	51	12.97
2	0.70605	52	13.623
3	0.75813	53	14.303
4	0.81359	54	15.012
5	0.8726	55	15.752
6	0.93537	56	16.522
7	1.0021	57	17.324
8	1.073	58	18.159
9	1.1482	59	19.028
10	1.2281	60	19.932
11	1.3129	61	20.873
12	1.4027	62	21.851
13	1.4979	63	22.868
14	1.5988	64	23.925
15	1.7056	65	25.022
16	1.8185	66	26.163
17	1.938	67	27.347
18	2.0644	68	28.576
19	2.1978	69	29.852
20	2.3388	70	31.176
21	2.4877	71	32.549
22	2.6447	72	33.972
23	2.8104	73	35.448
24	2.985	74	36.978
25	3.169	75	38.563
26	3.3629	76	40.205
27	3.567	77	41.905
28	3.7818	78	43.665
29	4.0078	79	45.487
30	4.2455	80	47.373
31	4.4953	81	49.324
32	4.7578	82	51.342
33	5.0335	83	53.428
34	5.3229	84	55.585
35	5.6267	85	57.815
36	5.9453	86	60.119
37	6.2795	87	62.499
38	6.6398	88	64.958
39	6.9969	89	67.496
40	7.3814	90	70.117
41	7.784	91	72.823
42	8.2054	92	75.614
43	8.6463	93	78.494
44	9.1075	94	81.465
45	9.5895	95	84.529
46	10.094	96	87.688
47	10.62	97	90.945
48	11.171	98	94.301
49	11.745	99	97.759

Gas Pressure Conversions

1 Pascals (Pa) = 1 N/m^2
1 atmosphere (atm) = 14.70 psi = 29.92 in. Hg
1 atm = 2117 lbs/ft^2 = 101325 Pa = 760.0 mmHg
1 atm = 760 torr = 1.103 bar = 1013 mbar
1 mmHg = 1 torr
1 bar = 100.0 kPa = 0.9869 atm
1 lbs/in^2 (psi) = 144 lbs/ft^2
1 lbs/in^2 (psi) = 6895 Pascals

Force Conversion Factors

1 kilogram (kg) = 2.2046 pound (lb)
1 pound (lb) = 4.448 newton (N)
1 N = 1 kg m/s^2

Area Conversion Factors

1 square inch (in^2) = 6.452 square centimeter (cm^2)
1 square meter (m^2) = 10.76 square foot (ft^2)
1 square meter (m^2) = 1.196 square yard (yd^2)
1 hectare (ha) = 2.471 acre (ac)
1 acre = 4047 m^2
1 square mile = 2.590 km^2

Temperature Conversion Equations

Celsius (T_C) → Fahrenheit (T_F) $T_F = 1.8 \cdot T_C + 32$
Fahrenheit (T_F) → Celsius (T_C) $T_C = (T_F - 32) / 1.8$
Celsius → Kelvin (T_K) $T_K = T_C + 273.15$

Energy and heat Factors

1 calorie (cal) = 4.184 Joule (J)
1 Joule (J) = 1 N· m = 1 $kg \cdot m^2/s^2$
1 electron-volt (eV) = 1.602 x 10^{-19} joule (J)
1 British thermal unit (Btu) = 1055.06 joule (J)

Power Conversion Factors

1 Watt (W) = 1 J/s
1 horsepower (hp) = 745.69 watt (W)

Constants & Equations

1 amu = 1.6605 x 10^{-24} g
Proton's mass = 1.0072765 amu
Neutron's mass = 1.008649 amu
Electron's mass = 5.485799 x 10^{-4} amu

$c = \lambda * \nu$
c = speed of light = 2.9979 x 10^8 m/s

$E = h * \nu$
h = Planck's constant = 6.626 x 10^{-34} J

$E = (-R_H)(1/n^2)$

$\nu = (R_H / h)(1/n_i^2 - 1/n_f^2)$
R = Rydberg's Constant = 2.18 x 10^{-18} J
n = energy level (integers; n=1,2,3,…)

$\lambda = h/m\nu$ (matter waves of particle with mass (m))

e^- per n = $2n^2$

$Z_{eff} = Z - \sigma$
σ = shielding effect of electrons

Lattice Energy = $k (q_a * q_c / d)$
k = 8.99 x 10^9 Jm/C^2

$VSEPR = AX_mLP_n$

covalent bonds = (e^-wanted – e^- available) / 2

Dipole moment: $\mu = Q*r$
$Q = q_a * q_c$, measured in *e* (electron charge)
1*e* = 1.602 x 10^{-19} C
r = distance between q_a&q_c

Bond order = (bonding e^- - nonbonding e^-) / 2

Density = Mass/Volume
Density of water @4 °C = 1 g/mL

Atomic Mass = Σ ($\%_{c1} * M_{n1}$) + ($\%_{c2} * M_{n2}$) + …..
$\%_c$ – percent occurrence of the isotope
M_n – mass number (specific for isotope)

Pressure = Force / Area

Boyle's Law: $P_1V_1 = P_2V_2$
Charles' Law: $V_1/T_1 = V_2/T_2$
Gay-Lussac's Law: $P_1/T_1 = P_2/T_2$
Avogadro's Law: $V_1/n_1 = V_2/n_2$
"Diver's" Law: $P_1/n_1 = P_2/n_2$
Combined Gas Law: $(P_1V_1)/T_1 = (P_2V_2)/T_2$
Ideal Gas Law $PV = nRT$
R = Ideal Gas Law Constant = 0.0821 Latm/molK

Gas Density @ STP = Molar mass / Molar Volume
@ any T,P,V: d = PM/RT (M is molar mass)

Dalton's Law of Partial Pressure : $P_T = \rho_1 + \rho_2 + \rho 3 + ...$

Root Mean Square Speed: $\mu = (3RT/M)^{½}$

Graham's Law: $\mu_1/\mu_2 = (M_2/M_1)^{½}$

Molarity = moles of solute / liters of solution
Molality = moles of solute / kg of solvent
Normality = Molarity * equivalence
% Composition = mass of component / mass of sample *100

Rauolt's Law = $X_A P^o_A$
X_A = Mole faction of A
P^o_A = Vapor pressure of pure solvent

Boiling Point Elevation: $\Delta T_b = K_b m$
K_b = molal boiling-point-elevation constant
m = molality

Freezing Point Depression: $\Delta T_f = K_f m$
K_f = molal freezing-point-depression constant

Rate = d[P]/dt = -d[R]/dt
Rate Law: $R = k[A]^n$
k = rate law constant

Half-Life (1st order) : $t_{½} = 0.693/k$

$K_{eq} = [P]/[R]$ for equilibrium for R ↔ P

pH = $-\log[H_3O^+]$ pOH = $-\log[OH^-]$

$K_w = [OH^-] * [H_3O^+] = 1.0 \times 10^{-14}$

Henderson-Hasselbalch: pH = pKa + log ([base]/[acid])

Percent Yield = actual yield / theoretical yield

$KE = ½ mv^2$

$\Delta G = \Delta H + T\Delta S$

$\Delta H = m * c * \Delta T$
c for water = 1 cal/gC^o

$\Delta H = m * L_f$
L_f for water = 80 cal/g = 6.01 kJ/mol

$\Delta H = m * L_v$
L_v for water = 540 cal/g = 40.67 kJ/mol