

WATER TREATMENT AND DISTRIBUTION OPERATOR CHEMISTRY REFERENCE SHEET

Frequently used formulas and conversions



1 H 1.0079																	2 He 4.0026
3 Li 6.941	4 Be 9.0122											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
11 Na 22.990	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.409	31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.798
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57-71 * #	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89-103 #	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (281)	111 Uuu (272)	112 Uub (285)	113 Uut (284)	114 Uuq (289)	115 Uup (288)	116 Uuh (289)	117 Uus (293)	118 Uuo (293)

*Lanthanide series	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
#Actinide series	89 Ac (227)	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

NOTE: For elements with no stable nuclides, the mass of the longest-lived isotope is in parentheses.

Periodic Table of Elements

KEY FORMULAS FOR CHEMISTRY

$$\text{mg total suspended solids/L} = \frac{(A - B) \times 1,000}{\text{sample volume, mL}}$$

A = weight of filter + dry residue sample, mg

B = weight of filter, mg

Dilutions

$$\text{concentration 1} \times \text{volume 1} = \text{concentration 2} \times \text{volume 2}$$

$$\text{concentration 1} = \frac{\text{concentration 2} \times \text{volume 2}}{\text{volume 1}}$$

$$\text{volume 1} = \frac{\text{concentration 2} \times \text{volume 2}}{\text{concentration 1}}$$

concentration = mg/L

volume = L

CONDUCTIVITY AND DISSOLVED SOLIDS

Electrical conductivity is the ability of a solution to conduct an electric current and it can be used as an indirect measure of the total dissolved solids (TDS) in a water sample.

The unit of measure commonly used is siemens per centimeter (S/cm). The conductivity of water is usually expressed as micro-siemens per centimeter ($\mu\text{S/cm}$) which is 10^{-6} S/cm. The relationship between conductivity and dissolved solids is approximately:

$$2 \mu\text{S/cm} = 1 \text{ ppm (which is the same as 1 mg/L)}$$

The conductivity of water from various sources is

Absolutely pure water	=	0.055 $\mu\text{S/cm}$
Distilled water	=	0.5 $\mu\text{S/cm}$
Mountain water	=	1.0 $\mu\text{S/cm}$
Most drinking water sources	=	500 to 800 $\mu\text{S/cm}$
Seawater	=	56 mS/cm
Maximum for potable water	=	1,055 $\mu\text{S/cm}$

Some common conductivity conversion factors are

mS/cm	×	1,000	=	$\mu\text{S/cm}$
$\mu\text{S/cm}$	×	0.001	=	mS/cm
$\mu\text{S/cm}$	×	1	=	$\mu\text{mhos/cm}$
$\mu\text{S/cm}$	×	0.5	=	mg/L of TDS
mS/cm	×	0.5	=	g/L of TDS
mg/L TDS	×	0.001	=	g/L of TDS
mg/L TDS	×	0.05842	=	gpg TDS

Densities of Various Substances

Substance	Density	
	lb/ft ³	lb/gal
Solids		
Activated carbon*†	8–28 (avg. 12)	
Lime*†	20–50	
Dry alum*†	60–75	
Aluminum (at 20°C)	168.5	
Steel (at 20°C)	486.7	
Copper (at 20°C)	555.4	
Liquids		
Propane (–44.5°C)	36.5	4.88
Gasoline†	43.7	5.84
Water (4°C)	62.4	8.34
Fluosilicic acid (30%, –8.1°C)	77.8–79.2	10.4–10.6
Liquid alum (36°Bé, 15.6°C)	83.0	11.09
Liquid chlorine (–33.6°C)	97.3	13.01
Sulfuric acid (18°C)	114.2	15.3
Gases		
Methane (0°C, 14.7 psia)	0.0344	
Air (20°C, 14.7 psia)	0.075	
Oxygen (0°C, 14.7 psia)	0.089	
Hydrogen sulfide†	0.089	
Carbon dioxide†	0.115	
Chlorine gas (0°C, 14.7 psia)	0.1870	

* Bulk density of substance.

† Temperature and/or pressure not given.

**NO OPERATOR
NO WATER™**

 American Water Works Association

AWWA Water Operator Field Guide, Second Edition

Handy information resource for water treatment plant operators and water distribution operators. This ready-to-use guide is packed with all the day-to-day information you need in a flash, in a compact guide.

AWWA Catalog No: 20560-2E



American Water Works Association

Dedicated to the World's Most Important Resource®

AWWA Headquarters
6666 West Quincy Avenue
Denver, CO 80235-3098 USA
Phone: 303.794.7711
Toll-free: 800.926.7337
Fax: 303.347.0804
service@awwa.org

Government Affairs Office
1300 Eye Street NW
Suite 701W
Washington, DC 20005 USA
Phone: 202.628.8303
Fax: 202.628.2846
www.awwa.org

AWWAIndia
Mumbai, India
www.awwa.org/india