

Canadian ABC Formula/Conversion Table
for Water Treatment, Distribution and Laboratory Exams

$$\text{Alkalinity, as mg CaCO}_3/\text{L} = \frac{(\text{Titrant Volume, mL})(\text{Acid Normality})(50,000)}{\text{Sample Volume, mL}}$$

$$\text{Amps} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{Area of Circle} = (0.785) (\text{Diameter}^2) \text{ or } (\Pi) (\text{Radius}^2)$$

$$\text{Area of Cone (lateral area)} = (\Pi) (\text{Radius}) \sqrt{\text{Radius}^2 + \text{Height}^2}$$

$$\text{Area of Cone (total surface area)} = (\Pi) (\text{Radius}) (\text{Radius} + \sqrt{\text{Radius}^2 + \text{Height}^2})$$

$$\text{Area of Cylinder (total outside surface area)} = [\text{Surface Area of End \#1}] + [\text{Surface Area of End \#2}] + [(\Pi) (\text{Diameter}) (\text{Height or Depth})]$$

$$\text{Area of Rectangle} = (\text{Length}) (\text{Width})$$

$$\text{Area of a Right Triangle} = \frac{(\text{Base})(\text{Height})}{2}$$

$$\text{Average (arithmetic mean)} = \frac{\text{Sum of All Terms}}{\text{Number of Terms}}$$

$$\text{Average (geometric mean)} = [(X_1) (X_2) (X_3) (X_4) (X_n)]^{1/n} \text{ The } n\text{th root of the product of } n \text{ numbers}$$

$$\text{Chemical Feed Pump Setting, \% Stroke} = \frac{(\text{Desired Flow})(100\%)}{\text{Maximum Flow}}$$

$$\text{Chemical Feed Pump Setting, mL/min} = \frac{(\text{Flow, m}^3/\text{day}) (\text{Dose, mg/L})}{(\text{Chemical Feed Density, g/cm}^3) (\text{Active Chemical, \%})(1,440)}$$

$$\text{Circumference of Circle} = (\Pi) (\text{Diameter})$$

$$\text{Composite Sample Single Portion} = \frac{(\text{Instantaneous Flow}) (\text{Total Sample Volume})}{(\text{Number of Portions}) (\text{Average Flow})}$$

$$\text{Degrees Celsius} = [(\text{Degrees Fahrenheit} - 32) (5/9)] \text{ or } \frac{(\text{F} - 32)}{1.8}$$

$$\text{Degrees Fahrenheit} = [(\text{Degrees Celsius}) (9/5) + 32] \text{ or } [(\text{Degrees Celsius}) (1.8) + 32]$$

$$\text{Detention Time} = \frac{\text{Volume}}{\text{Flow}} \quad \text{Note: Units must be compatible.}$$

$$\text{Electromotive Force (E.M.F), volts} = (\text{Current, amps}) (\text{Resistance, ohms}) \text{ or } E = IR$$

$$\text{Feed Rate, kg/day} = \frac{(\text{Dosage, mg/L})(\text{Flow Rate, m}^3/\text{day})}{(\text{Purity, Decimal Percentage}) 1,000}$$

$$\text{Feed Rate, litre/min (Fluoride Saturator)} = \frac{(\text{Plant capacity, litre/min})(\text{Dosage, mg/L})}{(18,000 \text{ mg/L})}$$

$$\text{Filter Backwash Rise Rate, cm/min} = \frac{\text{Water Rise, cm}}{\text{Time, minute}}$$

$$\text{Filter Drop Test Velocity, meter/min} = \frac{\text{Water Drop, m}}{\text{Time of Drop, minute}}$$

$$\text{Filter Flow Rate or Backwash Rate, L/m}^2 \text{ sec} = \frac{\text{Flow, L/sec}}{\text{Filter Area, m}^2}$$

$$\text{Filter Yield, kg/m}^2 \text{ hr} = \frac{(\text{Solids Concentration, \%})(\text{Sludge Feed Rate, L/hr})(10)}{(\text{Surface Area of Filter, m}^2)}$$

$$\text{Flow Rate, m}^3/\text{sec} = (\text{Area, m}^2) (\text{Velocity, m/sec}) \text{ or } Q = AV \text{ where: } Q = \text{flow rate, } A = \text{area, } V = \text{velocity}$$

$$\text{Force, Newton} = (\text{Pressure, pascals}) (\text{Area, m}^2)$$

$$\text{Litres/Capita/Day} = \frac{\text{Volume of Water Produced, L/day}}{\text{Population}}$$

$$\text{Hardness, as mg CaCO}_3/\text{L} = \frac{(\text{Titrant Volume, mL})(1,000)}{\text{Sample Volume, mL}} \text{ Only when the titration factor is 1.00 of EDTA}$$

$$\text{Horsepower, Brake (bhp)} = \frac{(\text{Flow, gpm})(\text{Head, ft})}{(3,960)(\text{Decimal Pump Efficiency})}$$

$$\text{Horsepower, Motor (mhp)} = \frac{(\text{Flow, gpm})(\text{Head, ft})}{(3,960)(\text{Decimal Pump Efficiency})(\text{Decimal Motor Efficiency})}$$

$$\text{Horsepower, Water (whp)} = \frac{(\text{Flow, gpm})(\text{Head, ft})}{3,960}$$

$$\text{Hydraulic Loading Rate, m}^3/\text{m}^2 \text{ day} = \frac{\text{Total Flow Applied, m}^3/\text{day}}{\text{Area, m}^2}$$

$$\text{Hypochlorite Strength, \%} = \frac{(\text{Chlorine Required, Kg})(100)}{(\text{Hypochlorite Solution Needed, Kg})}$$

$$\text{Leakage, Lpd} = \frac{\text{Volume, L}}{\text{Time, days}}$$

$$\text{Mass, kg} = \frac{(\text{Volume, m}^3)(\text{Concentration, mg/L})}{1,000}$$

$$\text{Mass Flux, kg/day} = \frac{(\text{Volume, m}^3 / \text{day})(\text{Concentration, mg/L})}{1,000}$$

$$\text{Milliequivalent} = (\text{mL})(\text{Normality})$$

$$\text{Molarity} = \frac{\text{Moles of Solute}}{\text{Litres of Solution}}$$

$$\text{Normality} = \frac{\text{Number of Equivalent Weights of Solute}}{\text{Litres of Solution}}$$

$$\text{Number of Equivalent Weights} = \frac{\text{Total Weight}}{\text{Equivalent Weight}}$$

$$\text{Number of Moles} = \frac{\text{Total Weight}}{\text{Molecular Weight}}$$

$$\text{Power, kW} = \frac{(\text{Flow, L/sec})(\text{Head, m})(9.8)}{1,000}$$

$$\text{Reduction in Flow, \%} = \frac{(\text{Original Flow} - \text{Reduced Flow})(100\%)}{\text{Original Flow}}$$

$$\text{Removal, \%} = \frac{(\text{In} - \text{Out})(100)}{\text{In}}$$

$$\text{Slope, \%} = \frac{\text{Drop or Rise}}{\text{Distance}} \times 100$$

$$\text{Solids, mg/L} = \frac{(\text{Dry Solids, grams})(1,000,000)}{\text{Sample Volume, mL}}$$

$$\text{Solids Concentration, mg/L} = \frac{\text{Weight, mg}}{\text{Volume, L}}$$

$$\text{Specific Gravity} = \frac{\text{Specific Weight of Substance, kg/L}}{\text{Specific Weight of Water, kg/L}}$$

$$\text{Surface Loading Rate, Lpd/m}^2 = \frac{\text{Flow, Lpd}}{\text{Area, m}^2}$$

$$\text{Three Normal Equation} = (N_1 \times V_1) + (N_2 \times V_2) = (N_3 \times V_3), \text{ where } V_1 + V_2 = V_3$$

$$\text{Two Normal Equation} = N_1 \times V_1 = N_2 \times V_2, \text{ where } N = \text{concentration (normality)}, V = \text{volume or flow}$$

$$\text{Velocity, m/second} = \frac{\text{Flow Rate, m}^3 / \text{sec}}{\text{Area, m}^2} \text{ or } \frac{\text{Distance, m}}{\text{Time, second}}$$

$$\text{Volume of Cone} = (1/3)(0.785)(\text{Diameter}^2)(\text{Height})$$

$$\text{Volume of Cylinder} = (0.785)(\text{Diameter}^2)(\text{Height})$$

$$\text{Volume of Rectangular Tank} = (\text{Length})(\text{Width})(\text{Height})$$

$$\text{Watts (DC circuit)} = (\text{Volts})(\text{Amps})$$

$$\text{Watts (AC circuit)} = (\text{Volts})(\text{Amps})(\text{Power Factor})$$

$$\text{Weir Overflow Rate, Lpd/m} = \frac{\text{Flow, Lpd}}{\text{Weir Length, m}}$$

$$\text{Wire-to-Water Efficiency, \%} = \frac{\text{Water Horsepower, HP}}{\text{Power Input, HP or Motor HP}} \times 100$$

$$\text{Wire-to-Water Efficiency, \%} = \frac{(\text{Flow, gpm})(\text{Total Dynamic Head, ft})(0.746 \text{ kw/hp})(100)}{(3,960)(\text{Electrical Demand, kilowatts})}$$

Alkalinity Relationships:

Result of Titration	Alkalinity, mg/L as CaCO ₃		
	Hydroxide Alkalinity as CaCO ₃	Carbonate Alkalinity as CaCO ₃	Bicarbonate Concentration as CaCO ₃
P = 0	0	0	T
P < ½T	0	2P	T - 2P
P = ½T	0	2P	0
P > ½T	2P - T	2(T - P)	0
P = T	T	0	0

*Key: P – phenolphthalein alkalinity; T – total alkalinity

Conversion Factors:

1 acre = 4046.9 square metres
 1 cubic metre = 1,000 kilograms
 1 cubic metre = 1,000 litres
 1 cubic metre = 219.97 Imperial gallons
 1 cubic metre per second = 19.01 MIGD
 1 foot = 0.305 metre
 1 gallon = 3.79 litres
 1 hectare = 10,000 square metres
 1 horsepower = 0.746 kW or 33,000 foot-pounds/min
 1 metre head = 9.8 kPa
 1 pound = 0.454 kilograms
 1 pound per square inch = 6.89 kPa
 1 square metre = 1.19 square yards
 1% = 10,000 mg/L
 Π or pi = 3.14159

Abbreviations:

cm	centimetres	mL	millilitre
DO	dissolved oxygen	MLD	million litres per day
g	grams	ppb	parts per billion
kPa	kilopascals	ppm	parts per million
kg	kilograms	psi	pounds per square inch
kW	kilowatt	Q	flow
L	litres	SS	settleable solids
Lpd	litres per day	TTHM	Total trihalomethanes
Lpm	litres per minute	TOC	total organic carbon
m	metres	TSS	total suspended solids
mg/L	milligrams per litre	VS	volatile solids
MIGD	million Imperial gallons per day		