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

Alkalinity, as mg $CaCO_3$/L $= \dfrac{\text{(Titrant Volume, mL)(Acid Normality)(50,000)}}{\text{Sample Volume, mL}}$

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

Area of Circle $=$ (0.785) (Diameter^2) or (Π) (Radius^2)

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

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

Area of Cylinder (total outside surface area) = [Surface Area of End #1] + [Surface Area of End #2] + [(Π) (Diameter) (Height or Depth)]

Area of Rectangle $=$ (Length) (Width)

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

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

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

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

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

Circumference of Circle $=$ (Π) (Diameter)

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

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

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

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

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

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

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

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

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

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

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

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

Force, Newton = (Pressure, pascals) (Area, m^2)

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

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

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

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

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

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

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

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

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

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

Milliequivalent = (mL) (Normality)

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

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

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

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

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

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

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

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

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

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

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

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

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

Two Normal Equation = N1 x $V_1 = N_2 \text{ x } V_2$, where N = concentration (normality), V = volume or flow

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

Volume of Cone = (1/3) (0.785) (Diameter^2) (Height)

Volume of Cylinder = (0.785) (Diameter^2) (Height)

Volume of Rectangular Tank = (Length) (Width) (Height)

Watts (DC circuit) = (Volts) (Amps)

Watts (AC circuit) = (Volts) (Amps) (Power Factor)

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

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

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

Alkalinity Relationships:

	Alkalinity, mg/L as $CaCO_3$		
Result of Titration	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
DO	dissolved oxygen
g	grams
kPa	kilopascals
kg	kilograms
kW	kilowatt
L	litres
Lpd	litres per day
Lpm	litres per minute
m	metres
mg/L	milligrams per litre
MIGD	million Imperial gallons per day
mL	millilitre
MLD	million litres per day
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
Q	flow
SS	settleable solids
TTHM	Total trihalomethanes
TOC	total organic carbon
TSS	total suspended solids
VS	volatile solids