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

#### Alkalinity, as mg CaCO₃/L

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

#### Amps

\[
\text{Amps} = \frac{\text{Volts}}{\text{Ohms}}
\]

#### Area of Circle

\[
\text{Area of Circle} = (0.785) (\text{Diameter}^2) \text{ or } (\pi) (\text{Radius}^2)
\]

#### Area of Cone (lateral area)

\[
\text{Area of Cone (lateral area)} = (\pi) (\text{Radius}) \sqrt{\text{Radius}^2 + \text{Height}^2}
\]

#### Area of Cone (total surface area)

\[
\text{Area of Cone (total surface area)} = (\pi) (\text{Radius}) (\text{Radius} + \sqrt{\text{Radius}^2 + \text{Height}^2})
\]

#### Area of Cylinder (total outside surface area)

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

#### Area of Rectangle

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

#### Area of a Right Triangle

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

#### Average (arithmetic mean)

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

#### Average (geometric mean)

\[
\text{Average (geometric mean)} = \left(\prod_{i=1}^{n} x_i\right)^{1/n} \text{ The } n\text{th root of the product of } n \text{ numbers}
\]

#### Chemical Feed Pump Setting, % Stroke

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

#### Chemical Feed Pump Setting, mL/min

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

#### Circumference of Circle

\[
\text{Circumference of Circle} = (\pi) (\text{Diameter})
\]

#### Composite Sample Single Portion

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

#### Degrees Celsius

\[
\text{Degrees Celsius} = \frac{1}{1.8} \left(\frac{(\text{Degrees Fahrenheit} - 32)(5/9)}{8.1}\right)
\]

#### Degrees Fahrenheit

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

#### Detention Time

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

#### Electromotive Force (E.M.F), volts

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

#### Feed Rate, kg/day

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

#### Feed Rate, litre/min (Fluoride Saturator)

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

Effective January 12, 2009
Filter Backwash Rise Rate, cm/min = Water Rise, cm 

Time, minute

Filter Drop Test Velocity, meter/min = Water Drop, m 

Time of Drop, minute

Filter Flow Rate or Backwash Rate, L/m² sec = Flow, L/sec 

Filter Area, m²

Filter Yield, kg/m² hr = (Solids Concentration, %)(Sludge Feed Rate, L/hr)(10) 

(Surface Area of Filter, m²)

Flow Rate, m³/sec = (Area, m²) (Velocity, m/sec) or Q = AV where: Q = flow rate, A = area, V= velocity

Force, Newton = (Pressure, pascals) (Area, m²)

Litres/Capita/Day = Volume of Water Produced, L/day 

Population

Hardness, as mg CaCO₃/L = (Titrant Volume, mL) (1,000) 

Sample Volume, mL

Only when the titration factor is 1.00 of EDTA

Horsepower, Brake (bhp) = (Flow, gpm)(Head, ft) 

(3,960) (Decimal Pump Efficiency)

Horsepower, Motor (mhp) = (Flow, gpm)(Head, ft) 

(3,960) (Decimal Pump Efficiency) (Decimal Motor Efficiency)

Horsepower, Water (whp) = (Flow, gpm)(Head, ft) 

3,960

Hydraulic Loading Rate, m³/m² day = Total Flow Applied, m³/day 

Area, m²

Hypochlorite Strength, % = (Chlorine Required, Kg) (100) 

(Hypochlorite Solution Needed, Kg)

Leakage, Lpd = Volume, L 

Time, days

Mass, kg = (Volume, m³)(Concentration, mg/L) 

1,000

Mass Flux, kg/day = (Volume, m³ / day)(Concentration, mg/L) 

1,000

Milliequivalent = (mL) (Normality)

Molarity = Moles of Solute 

Litres of Solution

Effective January 12, 2009
Normality = \frac{\text{Number of Equivalent Weights of Solute}}{\text{Litres of Solution}}

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

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

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

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

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

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

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

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

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

Surface Loading Rate, Lpd/m² = \frac{\text{Flow, Lpd}}{\text{Area, m²}}

Three Normal Equation = (N₁ x V₁) + (N₂ x V₂) = (N₃ x V₃), where V₁ + V₂ = V₃

Two Normal Equation = N₁ x V₁ = N₂ x V₂, where N = concentration (normality), V = volume or flow

Velocity, m/second = \frac{\text{Flow Rate, m³/sec}}{\text{Area, m²}} \text{ or } \frac{\text{Distance, m}}{\text{Time, second}}

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

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

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

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

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

Weir Overflow Rate, Lpd/m = \frac{\text{Flow, Lpd}}{\text{Weir Length, m}}
Effective January 12, 2009

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

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:

<table>
<thead>
<tr>
<th>Result of Titration</th>
<th>Hydroxide Alkalinity as CaCO₃</th>
<th>Carbonate Alkalinity as CaCO₃</th>
<th>Bicarbonate Concentration as CaCO₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = 0</td>
<td>0</td>
<td>0</td>
<td>T</td>
</tr>
<tr>
<td>P &lt; ½T</td>
<td>0</td>
<td>2P</td>
<td>T – 2P</td>
</tr>
<tr>
<td>P = ½T</td>
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<td>2P</td>
<td>0</td>
</tr>
<tr>
<td>P &gt; ½T</td>
<td>2P – T</td>
<td>2(T – P)</td>
<td>0</td>
</tr>
<tr>
<td>P = T</td>
<td>T</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*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
- \( \pi \) 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