

OPERATOR CERTIFICATION MATH SHEET

◆ Equivalents ◆

1 cubic foot	= 7.48 gallons
1 cubic yard	= 27 cubic feet
1 gallon of water	= 8.34 pounds
1 p.s.i.	= 2.31 feet of water
1 horsepower	= 0.746 kilowatts
1 acre	= 43,560 square feet
1 mile	= 5,280 feet

1 mg/L	= 1ppm
1 MGD	= 694 gpm
π (Pi)	= 3.1416
Radius of circle	= diameter \div 2
Circumference of circle	= π x diameter
Temp. °Centigrade	= (°Fahrenheit - 32°) x 0.55
Temp. °Fahrenheit	= (°Centigrade x 1.8) + 32°F

◆ Area and Volume Formulas ◆

Rectangles:

Area, sq. ft. = length, ft. x width, ft.
 Volume, cu. ft. = length, ft. x width, ft. x height, ft.

Circles/Cylinders:

Area, sq. ft. = π x radius, ft. x radius, ft.
 Volume, cu. ft. = π x radius, ft. x radius, ft. x height, ft.

Cone:

Volume, cu. ft. = $1/3 \times \pi$ x radius, ft. x radius, ft. x height, ft.

◆ General Formulas ◆

Detention Time, hr. = $\frac{\text{volume, gal.} \times 24 \text{ hr./day}}{\text{flow, gal/day}}$

Weir Overflow Rate, gpd/ft. = $\frac{\text{flow rate, gpd}}{\text{length of weir, ft.}}$

Velocity, ft./sec. = $\frac{\text{flow, cu. ft./sec.}}{\text{area, sq. ft.}}$

Surface Loading Rate, gpd/sq.ft. = $\frac{\text{flow rate, gpd}}{\text{area, sq. ft.}}$

Velocity, ft./sec. = $\frac{\text{distance, ft.}}{\text{time, sec.}}$

Solids Loading, lbs/day/sq.ft. = $\frac{\text{solids applied, lbs/day}}{\text{surface area, sq. ft.}}$

Water HP = $\frac{\text{gpm} \times \text{head, ft.}}{3960}$

% Stroke Setting = $\frac{\text{required feed, gpd}}{\text{maximum feed, gpd}} \times 100$

Pump HP = $\frac{\text{water horsepower}}{\text{pump efficiency}}$

% Removal = $\frac{(\text{in} - \text{out})}{\text{in}} \times 100$

Motor HP = $\frac{\text{pump horsepower}}{\text{motor efficiency}}$

Screening Removed = $\frac{\text{screenings, cu. ft.}}{\text{flow, mgd}}$

Motor HP = $\frac{\text{water horsepower}}{(\text{pump} \times \text{motor efficiency})}$

Day's supply = $\frac{\text{total chemical in inventory, lbs.}}{\text{average use, lbs/day}}$

Flow, cu. ft./sec. = area, sq. ft. x velocity, ft./sec.

\$ Cost per day = hp x 0.746 x \$ rate x hours/day

Solids Applied, lbs./day = flow, mgd x conc., mg/L x 8.34 lbs./gal

◆ Chlorine Formulas ◆

Chemical Feed, lbs./day = flow, mgd x dose, mg/L x 8.34 lbs./gal.

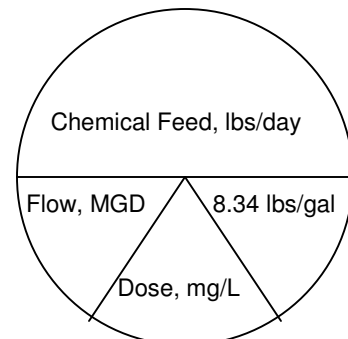
Chlorine Dose, mg/L = $\frac{\text{chemical feed, lbs./day}}{\text{flow, mgd} \times 8.34 \text{ lbs./gal}}$

Chlorine Dose, mg/L = chlorine demand, mg/L + chlorine residual, mg/L

Chlorine Residual, mg/L = chlorine dose, mg/L – chlorine demand, mg/L

Chlorine Demand, mg/L = chlorine dose, mg/L – chlorine residual, mg/L

Pounds of HTH = $\frac{\text{lbs. chlorine needed} \times 100}{\% \text{ chlorine of HTH}}$



◆ Water Math ◆

$$\text{Filtration Rate, gpm/sq.ft.} = \frac{\text{flow, gpm}}{\text{surface area, sq. ft.}}$$

$$\text{Backwash Rate, gpm/sq.ft.} = \frac{\text{backwash flow, gpm}}{\text{surface area, sq. ft.}}$$

$$\text{Backwash \%} = \frac{(\text{backwash water, gal.})(100\%)}{\text{water filtered, gal.}}$$

$$\text{Wash Water, gpm} = \frac{\text{area, sq. ft.} \times \text{rise, ft.} \times 7.48}{\text{minutes}}$$

$$\text{Reservoir Volume, gal.} = \text{volume, ac-ft} \times 43,560 \text{ sq. ft./ac.} \times 7.48 \text{ gal./cu.ft.}$$

$$\text{Reservoir Volume, ac./ft.} = \frac{\text{reservoir volume, cu. ft.}}{43,560 \text{ sq. ft./ac.}}$$

$$\text{Surface Area, ac.} = \frac{\text{surface area, sq. ft.}}{43,560 \text{ sq. ft./ac.}}$$

$$\text{Chemical Feed, lbs.} = \text{surface area, ac.} \times \text{dose, lbs./ac.}$$

$$\text{Mean or Average} = \frac{\text{sum of values or measurements}}{\text{number of values or measurements}}$$

Median = middle value of a group of data

◆ Wastewater Math ◆

$$\text{Pond Area, acres} = \frac{\text{avg. width, ft.} \times \text{avg. length, ft.}}{43,560 \text{ sq. ft./acre}}$$

$$\text{Pond, Detention Time, Days} = \frac{\text{pond volume, ac-ft}}{\text{flow rate, ac-ft/day}}$$

$$\text{Pond, Population Loading, Number of Persons/Acre} = \frac{\text{population served, persons}}{\text{pond area, acres}}$$

$$\text{Pond, Hydraulic Loading, Inches Per Day} = \frac{\text{depth of pond, inches}}{\text{detention time, days}}$$

$$\text{Pond, Organic Loading, lbs. BOD/day/ac.} = \frac{\text{BOD, mg/L} \times \text{flow, mgd} \times 8.34 \text{ lbs./gal.}}{\text{area, ac.}}$$

$$\text{Trickling Filter, Organic Loading, Lbs. BOD/day 1,000 cu. ft.} = \frac{\text{BOD applied, lbs./day}}{\text{volume of media, 1,000 cu. ft.}}$$

$$\text{Sludge Age (in days)} = \frac{\text{MLSS, mg/L} \times \text{tank volume, mg} \times 8.34 \text{ lbs./gal.}}{\text{SS in primary effluent, mg/L} \times \text{flow, mgd} \times 8.34 \text{ lbs./gal.}}$$

$$\text{Sludge Volume Index} = \frac{\text{settleable solids, \%} \times 10,000}{\text{MLSS, mg/L}}$$

$$\text{Grit Removed, cu. ft./MG} = \frac{\text{volume of grit, cu. ft.}}{\text{volume of flow, MG}}$$

$$\text{Slope} = \frac{\text{fall, ft.}}{\text{length, ft.}}$$

$$\text{Grade, ft./ft.} = \frac{\text{rise, ft.}}{\text{run, ft.}}$$