

## FORMULAS

### 1. Area

a. Rectangular tank

$$A = \text{length} \times \text{width} = L \times W$$

b. Circular tank (area of the water surface in the tank)

$$A = \pi \times r^2 \quad \text{or} \quad A = \pi \times \frac{D^2}{4} \quad (\pi = 3.1416)$$

c. Circular tank (area of the sides of the tank)

$$A = \text{circumference} \times \text{height} = \pi \times D \times H$$

### 2. Volume

a. Rectangular tank

$$V = L \times W \times H$$

b. Circular tank (with flat top and bottom)

$$V = \pi \times r^2 \times H \quad \text{or} \quad \pi \times \frac{D^2}{4} \times H$$

c. Spherical tank

$$V = \frac{4}{3} \times \pi \times r^3$$

d. Conical tank

$$V = \frac{1}{3} \times \pi \times r^2 \times H$$

### 3. Flow

$$\frac{\text{gal}}{\text{day}} \text{ (gpd)} = \frac{\text{gal}}{\text{min}} \text{ (gpm)} \times 1440 \frac{\text{min}}{\text{day}}$$

$$\frac{\text{gal}}{\text{day}} \text{ (gpd)} = \frac{\text{gal}}{\text{hr}} \text{ (gph)} \times 24 \frac{\text{hr}}{\text{day}}$$

Flow in a pipe

$$Q = A \times V$$

$$Q = \text{flow} \left( \frac{\text{ft}^3}{\text{sec}} \right)$$

$$A = \text{cross-sectional area of pipe (ft}^2\text{)}$$

$$V = \text{velocity of water} \left( \frac{\text{ft}}{\text{sec}} \right)$$

### 4. Dose

$$\text{lb} = \text{mg/L} \times \text{MG} \times 8.34 \frac{\text{lb/gal}}{\text{mg/L}}$$

$$\text{mg/L} = \frac{\text{lb}}{\text{MG} \times 8.34} \quad (\text{MG} = \text{million gallons})$$

### 5. Surface settling rate

$$\text{SSR} = \frac{\text{total gallons/day}}{\text{ft}^2 \text{ surface area of tank}}$$

### 6. Filtration rate (from drop test)

$$\text{FR in } \frac{\text{gpm}}{\text{ft}^2} = \frac{\text{ft}^2 \text{ W.S. area} \times \text{ft drop}}{\text{min. of test} \times \text{ft}^2 \text{ filter area}} \times 7.48 \frac{\text{gal}}{\text{ft}^3}$$

### 7. Solutions

$$(Q_1 \times C_1) + (Q_2 \times C_2) = (Q_1 + Q_2) \times C_t$$

## *EQUIVALENTS*

Area:	1 foot = 12 inches 1 yard = 36 inches = 3 feet 1 square foot (ft <sup>2</sup> ) = 144 square inches (in <sup>2</sup> ) 1 square yard (yd <sup>2</sup> ) = 9 ft <sup>2</sup> 1 acre = 43,560 ft <sup>2</sup>
Volume:	1 cubic foot (ft <sup>3</sup> ) = 1728 cubic inches (in <sup>3</sup> ) 1 cubic yard (yd <sup>3</sup> ) = 27 ft <sup>3</sup> 1 ft <sup>3</sup> of water = 7.48 gallons 1 gallon (gal) = 3.785 liters (L) = 3785 milliliters (mL) 1 liter (L) = 1000 mL
Weight: (gr)	1 pound (lb) = 16 ounces (oz) = 453.6 grams (gm) = 7000 grains  1 kilogram (kg) = 1000 gm 1 gm = 1000 milligrams (mg) = 15.43 gr 1 gal of water weighs 8.34 lb 1 ft <sup>3</sup> of water weighs 62.4 lb
Time: seconds (sec)	1 day (d) = 24 hours (hr) = 1440 minutes (min) = 86,400
Flow: (gpm)	1 million gallons per day (MGD) = 694 gallons per minute  1 MGD = 1.545 cubic feet per sec (ft <sup>3</sup> /sec or cfs) 1 cfs = 448.8 gal/min or gpm
Dosage:  gallons	1 grain per gallon (gpg) = 17.1 parts per million (ppm) 1 gpg = 143 pounds per million gallons 1 milligram per liter (mg/L) = 1 ppm = 8.34 pounds per million  1 ppm = 1 pound in 1 million pounds
Pressure:	1 pound per square inch (psi) = 2.31 feet of water (head) 1 ft of head = 0.433 psi
Temperature:	$^{\circ}\text{F} = (9/5 \text{ } ^{\circ}\text{C}) + 32$ $^{\circ}\text{C} = 5/9 (\text{ } ^{\circ}\text{F} - 32)$
Power: lb/min	1 horsepower (hp) = 550 foot-pounds per sec = 33,000 ft-lb/min  1 hp = 746 watts (w) 1 kilowatt (kw) = 1000 w = 0.746 hp
Miscellaneous:	Average water usage: 100 gallons per capita per day (gpcd) Average persons per single family residence: 3.7 Equivalent residential connection (ERC): 400 gal/day