CONVERSIONS & FORMULAS

1. **Area Formulas**
   a. 1 square ft. = 144 square inches
   b. 1 square yd. = 9 square ft.
   c. 1 cubic yd. = 27 cubic ft.

   **Square or Rectangle Area =**
   d. Length x Width = ft² (square feet)
   e. Length x width x height = ft³ (cubic feet)

   **Cubic Area =**
   f. 0.785 x Diameter² or
      3.14 x Radius² (π x R²) (π = 3.14)

2. **Horsepower (hp) Formulas**
   a. horsepower = 550 foot-pounds/second
      = 33,000 foot-pounds/minute
      = 1,980,000 foot-pounds/hour
   b. Brake Horsepower = Water Horsepower
      Pump Efficiency
   c. Efficiency:
      % Efficiency = \[ \frac{\text{out power}}{\text{input power}} \]
   d. Kilowatts (kW) = 0.746 x Motor Horsepower
   e. Motor Horsepower = Brake Horsepower
      Motor Efficiency
   f. Water Horsepower = \( Q \times \text{flow gal/min.} \times H \times \text{Head in ft.} \)
      3960
   g. Wire to Water Efficiency:
      Overall Efficiency = \( \frac{\text{Water Horsepower} \times 100}{\text{Electrical Horsepower}} \)

3. **Treatment Formulas**
   a. Filtration Rate (gpm/ft²) = \( \frac{\text{Flow (gal/min)}}{\text{Surface Area (ft²)}} \)
   b. Percent Strength by Weight = \( \frac{\text{Weight of Solute} \times 100}{\text{Weight of Solution}} \)
   c. Specific Capacity = \( \frac{\text{Flow (gallons per minute)}}{\text{Well Drawdown (feet)}} \)
   d. Surface Loading, GPD/ sq. ft. = \( \frac{\text{Flow (gal/day)}}{\text{Surface Area (sq ft)}} \)
   e. Surface Overflow Rate = \( \frac{\text{gal/day}}{\text{ft²}} \)

4. **Other Formulas**
   a. Chemical Dosage:
      These formulas require to be divided by % of strength.
      Flow—Chemical by weight:
      a. lbs/ day = MGD x mg/L x 8.34
      b. lbs/ day = gal/min x mg/L x 0.012
   b. Circumference:
      a. 3.14 X Diameter (π x Diameter)
      c. 3.14 X Diameter² or
         3.14 X Radius² (π x R²) (π = 3.14)
   c. Concentration:
      d. 1 part per million (ppm) = 1 milligram per liter
         = 0.0584 grains per gallon
         = 8.34 Pounds per MG
      e. 1 pound of weight per million pounds
      f. 1 part per billion = 1 ug/L (microgram/Liter)
      g. 1 part per million = 1 mg/L (milligram/Liter)
   d. Water Horsepower:
      Q (flow gal/min.) x H (Head in ft.)
      3960
   e. CT = Chlorine Concentration (mg/L) x Time (min)
   f. Detention time = \( \frac{\text{Tank Volume (gallons)}}{\text{Flow (gpm or gpd or gph)}} \)
   g. Flows:
      g. 1 gallons per minute = 1,440 gallons/day
      h. 1 cubic foot per second (cfs) = 646,272 gallons/day
         = 448.8 gallons per minute
      i. 1 million gallons per day = 1.55 cubic ft/sec. =
         694.4 gallons per minute
      j. Flow Rate =
      \( Q \times \text{flow ft³/sec.)} \times V \times \text{velocity ft/sec.} \times A \times \text{area ft²} \)
   k. Force = Pressure (psi) x Area (inches²)
   l. Hydraulics:
      2.31 Head Feet = 1 Psi
      0.433 PSI = 1.0 Feet of Head
   m. Per Capita Water Use =
      Water used (gal/day)/ total number of people
   n. Percent = \( \frac{\text{Part}}{\text{Whole}} \times 100 \)
   o. Specific Gravity =
      Solution weight (lbs/gal)
      Weight of Water (8.34 lbs/gal)
5. Common Conversions

**Volume and Capacity:**

- **a.** 1 cubic ft. = 7.48 gallons
- **b.** 1 cubic yd. = 27 cubic ft.
- **c.** 1 quart = 2 pints = 32 fluid ounces
- **d.** 1 liter = 1000 milliliters = 1.06 quarts = 1000 cubic centimeters
- **e.** 1 gallon (gal) = 8 pints = 231 cubic inches = 3.785 liters = 3,785 milliliters
- **f.** 1 acre foot (ac. ft.) = 43,560 cubic feet = 325,851 gallons

**Lengths:**

- **m.** 1 foot = 12 inches
- **n.** 1 yd. = 3 ft. = 36 inches
- **o.** 1 mile = 5,280 ft.

**Time:**

- **h.** 1 minute = 60 seconds
- **i.** 1 hour = 60 minutes = 3600 seconds
- **j.** 1 day = 24 hours = 1,440 minutes = 86,400 seconds
- **k.** 1 week = 7 days
- **l.** 1 yr. = 12 months = 52 weeks = 365 days

**Temperature:**

- **p.** Degree Fahrenheit = Degree C x 9/5 + 32
- **q.** Degree Centigrade = (Degree F - 32) x 5/9

**Weight:**

- **r.** 1 pound = 16 ounces = 7000 grains = 453.6 grams = .454 kilograms
- **s.** 1 kilogram = 1,000 gm = 2.205 pounds
- **t.** 1 ton = 2,000 pounds
- **u.** 1 gallon of water = 8.34 pounds
- **v.** 1 cubic ft. of water = 62.4 pounds
- **w.** 1 liter of water = 1 kilogram = 1000 grams
- **x.** 1 milliliter of water = 1 gram
- **y.** Density of water = 1gm/ml or 1gm/cc
- **z.** Specific gravity of water = 1.00
- **aa.** Weight of Solution = Weight of Solute + Weight of Solvent

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**PIE WHEELS**

- To find the quantity above the horizontal line: multiply the pie wedges below the line together.
- To solve for one of the pie wedges below the horizontal line: cover that pie wedge, then divide the remaining pie wedge(s) into the quantity above the horizontal line.