

## Conversion Factors and Formulas

### Weight

|                                       |        |        |
|---------------------------------------|--------|--------|
| 1 U.S. Gallon of freshwater .....     | 8.33   | Pounds |
| 1 U.S. Gallon of seawater .....       | 8.547  | Pounds |
| 1 Imperial Gallon of freshwater ..... | 10.005 | Pounds |
| 1 Imperial Gallon of seawater .....   | 10.266 | Pounds |
| 1 Cubic foot of freshwater .....      | 62.355 | Pounds |

### Volume

|                           |         |                  |
|---------------------------|---------|------------------|
| 1 U.S. Gallon = .....     | 231.0   | Cubic Inches     |
|                           | 0.137   | Cubic Foot       |
|                           | 3.785   | Liters           |
|                           | 0.00379 | Cubic Meter      |
|                           | 0.833   | Imperial Gallons |
| 1 Imperial gallon = ..... | 1.2     | U.S. Gallons     |
|                           | 277.274 | Cubic Inches     |
| 1 Cubic foot = .....      | 1728.0  | Cubic Inches     |
|                           | 7.481   | U.S. Gallons     |
|                           | 0.0283  | Cubic Meter      |
| 1 Litre = .....           | 0.2642  | U.S. Gallon      |
| 1 Cubic Meter = .....     | 35.314  | Cubic Feet       |
|                           | 264.2   | U.S. Gallons     |
| 1 Acre Foot = .....       | 43.56   | Cubic Feet       |
|                           | 325.829 | U.S. Gallons     |
| 1 Acre Inch = .....       | 3.63    | Cubic Feet       |
|                           | 27.1    | U.S. Gallons     |
| 1 Barrel (oil) = .....    | 42.0    | U.S. Gallons     |

### Head

|                                       |       |                   |
|---------------------------------------|-------|-------------------|
| 1 Pound Per Square Inch (PSI) = ..... | 2.31  | Feet of Water     |
|                                       | 2.04  | Inches of Mercury |
| 1 Foot of Water = .....               | 0.433 | Lb. Per Sq. Inch  |
|                                       | 0.885 | Inches of Mercury |
| 1 Inch of Mercury = .....             | 1.132 | Feet of Water     |
| 1 Kilogram Per Square Cm = .....      | 14.22 | Lbs. Per Sq. Inch |
| 1 Atmosphere (at sea level) = .....   | 14.7  | Lbs. Per Sq. Inch |
|                                       | 33.9  | Feet of Water     |
|                                       | 10.35 | Meters of Water   |
| 1 Meter of Water = .....              | 3.28  | Feet of Water     |

### Length

|                 |        |             |
|-----------------|--------|-------------|
| 1 Inch = .....  | 2.54   | Centimeters |
| 1 Meter = ..... | 39.37  | Inches      |
|                 | 3.28   | Feet        |
| 1 Rod = .....   | 16.5   | Feet        |
| 1 Mile = .....  | 5280.0 | Feet        |
|                 | 1.61   | Kilometers  |

### Power

|                           |        |                      |
|---------------------------|--------|----------------------|
| 1 Horsepower (HP) = ..... | 746.0  | Watts                |
|                           | 0.746  | Kilowatt             |
|                           | 33.0   | Foot lbs. per minute |
|                           | 550.0  | Foot lbs. per second |
| Kilowatt (Kw) = .....     | 1000.0 | Watts                |
|                           | 1.341  | Horsepower           |
|                           | 44.24  | Foot lbs. per minute |

### Operating Cost

|                  |  |
|------------------|--|
| C = .....        | Cost in Dollars Per 1000 Gallons       |
| C' = .....       | Cost in Dollars Per Acre Inch          |
| r = .....        | Power Rate Per Kilowatt Hour (dollars) |
| Kw Input = ..... | Kilowatts (measured at the meter)      |
| GPH = .....      | Gallons Per Hour Discharged by Pump    |
| GPM = .....      | Gallons Per Minute Discharged by Pump  |

Cost per 1000 Gallons =  $\frac{C \times Kw \text{ Input} \times r}{GPH}$

Cost Per Acre Inch =  $\frac{C' = 451 \times r \times Kw \text{ in.}}{GPM}$

### Formulas

|                               |   |
|-------------------------------|---|
| Pipe Velocity (Ft. Sec.) =    | $\frac{.408 \times GPM}{(\text{Pipe Diameter})^2} = \frac{.321 \times GPM}{\text{Pipe Area}}$         |
| Velocity Head (Feet) =        | $\frac{(\text{Pipe Velocity, Ft. Per Sec.})^2}{64.4}$   |
| Water Horsepower =            | $\frac{GPM \times \text{Head In Feet} \times \text{Specific Gravity}}{3960}$                          |
| Brake Horsepower (Pump) =     | $\frac{GPM \times \text{Head in Feet} \times \text{Spec. Grav.}}{3960 \times \text{Pump Efficiency}}$ |
| Brake Horsepower (Motor) =    | $\frac{\text{Watts Input} \times \text{Motor Efficiency}}{746}$                                       |
| Efficiency (Pump) =           | $\frac{GPM \times \text{Head in Feet} \times \text{Specific Gravity}}{3960 \times \text{BHP}}$        |
|                               | $\frac{\text{Water Horsepower}}{\text{Brake Horsepower}}$   |
| Pressure (Lbs. Per Sq. In.) = | $\frac{\text{Head In Feet} \times \text{Specific Gravity}}{2.31}$                                     |
|                               | $\text{Head In Feet} \times \text{Spec. Grav.} \times .434$   |
| Head in Feet =                | $\frac{\text{Pounds Per Square Inch} \times 2.31}{\text{Specific Gravity}}$                           |
| Area of a circle =            | $(\text{Diameter})^2 \times .7854$  |
| Circumference of a Circle =   | $\text{Diameter} \times 3.1416$   |
| Volume of a Cylinder =        | $(\text{Diameter})^2 \times .7854 \times \text{Height of a Cylinder}$                                 |
| Efficiency (Motor) =          | $\frac{\text{HP Output}}{\text{Kw Input} \times 1.34}$  |

### Electric Power

|                              |  |
|------------------------------|--|
| AC = .....                   | Alternating Current                                    |
| DC = .....                   | Direct Current   |
| E = .....                    | Volts = Electrical Pressure (Similar to Head)          |
| I = .....                    | Amperes = Electrical Current (Similar to Rate of Flow) |
| W = .....                    | Watts = Electrical Power (Similar to Head Capacity)    |
| Kw = .....                   | Kilowatts = 1000 Watts                                 |
| Apparent Power = .....       | Volts x Amperes = Voltamperes                          |
| Apparent Power = .....       | EI   |
| Useful Power = .....         | W = EI x PF  |
| Power Factor = .....         | Ratio of useful power to apparent power                |
| Power Factor = .....         | PF = $\frac{W}{EI}$                                    |
| Kw Hr. = .....               | Kilowatt Hour  |
| Single Phase Power W = ..... | E x I x PF   |
| 3 Phase Power W = .....      | 1.73 x E x I x PF                                      |
| Where E = .....              | Average voltage between phases                         |
| I = .....                    | Average current in each phase                          |

### Measurement of Electric Power

For DC power use DC voltmeter and DC ammeter:

|                  |                                  |
|------------------|----------------------------------|
| Power W = .....  | E x I;                           |
| HP Input = ..... | $\frac{W = Kw \times 1.34}{746}$ |

#### AC Power:

|               |   |
|---------------|---|
| 1 Phase ..... | Use single phase wattmeter;                 |
|               | HP Input = $\frac{W = Kw \times 1.34}{746}$ |

|               |   |
|---------------|---|
| 3 Phase ..... | A) One 3 phase wattmeter                    |
|               | B) Two single phase wattmeters              |
|               | C) Power Co. revolving disc watt hour meter |

Method for calculating power for a revolving disc watt hour meter:

Kilowatts Input =  $Kw \text{ in} = \frac{K \times R \times 3.60}{t}$

HP Input =  $\frac{K \times R \times 3600}{746 \times t} = \frac{4.83 \times K \times R}{t}$

|                   |  |
|-------------------|--|
| HP Output = ..... | HP Input x Motor Efficiency                              |
| K* = .....        | Constant = Watts for one revolution of revolving disc    |
| K .....           | is usually found on meter nameplate or on revolving disc |
| R = .....         | Number of revolutions of disc.                           |
| t = .....         | Second for R revolutions.                                |

\* Where current transformers are used, multiply meter constant by current transformer ratio.

## Weights and Measures

### Cubic Measure

|                       |                        |
|-----------------------|------------------------|
| 1,728 cubic inches    | 1 cubic foot           |
| 27 cubic feet         | 1 cubic yard           |
| 128 cubic feet        | 1 cord (wood)          |
| 2,150.42 cubic inches | 1 standard bushel      |
| 231 cubic inches      | 1 U.S. standard gallon |

### Dry Measure

|          |          |
|----------|----------|
| 2 pints  | 1 quart  |
| 8 quarts | 1 peck   |
| 4 pecks  | 1 bushel |

### Liquid Measure

|                |          |
|----------------|----------|
| 4 gills        | 1 pint   |
| 2 pints        | 1 quart  |
| 4 quarts       | 1 gallon |
| 31-1/2 gallons | 1 barrel |

### Imperial Liquid Measure

|                   |                       |
|-------------------|-----------------------|
| 1 U.S. gallon     | 0.833 Imperial gallon |
| 1 U.S. gallon     | 3.785 liters          |
| 1 Imperial gallon | 1.201 U.S. gallons    |
| 1 Imperial gallon | 4.546 liters          |
| 1 Liter           | 0.264 U.S. gallon     |

### Long Measure

|              |                |
|--------------|----------------|
| 12 inches    | 1 foot         |
| 3 feet       | 1 yard         |
| 5-1/2 yards  | 1 rod          |
| 40 rods      | 1 furlong      |
| 8 furlongs   | 1 statute mile |
| 3 land miles | 1 league       |

### Mariners' Measure

|               |                 |
|---------------|-----------------|
| 6 feet        | 1 fathom        |
| 120 fathoms   | 1 cable length  |
| 5,280 feet    | 1 statute mile  |
| 6,076.11 feet | 1 nautical mile |

### Square Measure

|                     |               |
|---------------------|---------------|
| 144 square inches   | 1 square foot |
| 9 square feet       | 1 square yard |
| 30-1/4 square yards | 1 square rod  |
| 640 acres           | 1 square mile |

### Metric Equivalents

#### Linear Measure

|              |                  |
|--------------|------------------|
| 1 centimeter | 0.3937 inch      |
| 1 inch       | 2.54 centimeters |
| 1 foot       | 0.3048 meter     |
| 1 meter      | 39.37 inches     |
| 1 meter      | 1.0936 yards     |
| 1 yard       | 0.9144 meter     |
| 1 rod        | 5.029 meters     |
| 1 kilometer  | 0.621 mile       |
| 1 mile       | 1.609 kilometers |

#### Square Measure

|                     |                          |
|---------------------|--------------------------|
| 1 square centimeter | 0.1550 square inch       |
| 1 square inch       | 6.452 square centimeters |
| 1 square foot       | 0.0929 square meter      |
| 1 square meter      | 1.196 square yards       |
| 1 square yard       | 0.8361 square meter      |
| 1 hectare           | 2.47 acres               |
| 1 acre              | 0.4047 hectare           |
| 1 square kilometer  | 0.386 square mile        |
| 1 square mile       | 2.59 square kilometers   |

#### Weights

|               |                     |
|---------------|---------------------|
| 1 gram        | 0.03527 ounce       |
| 1 ounce       | 28.35 grams         |
| 1 kilogram    | 2.2046 pounds       |
| 1 pound       | 0.4536 kilogram     |
| 1 metric ton  | 0.98421 English ton |
| 1 English ton | 1.016 metric tons   |

#### Measure of Volume

|                    |                         |
|--------------------|-------------------------|
| 1 cubic centimeter | 0.061 cubic inch        |
| 1 cubic inch       | 16.39 cubic centimeters |
| 1 cubic foot       | 0.0283 cubic meter      |
| 1 cubic meter      | 1.308 cubic yards       |
| 1 cubic yard       | 0.7646 cubic meter      |
| 1 liter            | 1.0567 quarts liquid    |
| 1 quart dry        | 1.101 liters            |
| 1 quart liquid     | 0.9463 liter            |
| 1 liter            | 1.0567 quarts           |
| 1 gallon           | 3.78541 liters          |
| 1 peck             | 8.810 liters            |
| 1 hectoliter       | 2.8375 bushels          |

## Temperature Conversions

A Fahrenheit degree is smaller than a Celsius (Centigrade) degree, one Fahrenheit degree being 5/9 of a Celsius degree.

To convert Fahrenheit degrees into Celsius, subtract 32, multiply by 5, and divide by 9.

To convert Celsius into Fahrenheit, multiply by 9, divide by 5, and add 32.

The freezing point of water is 32° F., 0° C. The boiling point is 212° F., 100° C.