# CONVERSIONS / FORMULAS / LAWS FOR CHEMISTRY

| | | | | |
|---|---|---|---|---|
| 1 oz. | = | 28.34 grams | | |
| 1 lb. | = | 454 grams | | |
| 1 gram | = | 1 cc | | |
| 1 gallon | = | 3.785 liters | | |
| 1 cu.ft. | = | 7.48 gallons | | |
| 1 liter | = | 1000 grams | = | 1000 cc |
| 1cc | = | 1 ml | | |
| 1 gram | = | 1 cc | | |
| 1 cu. ft. | = | 28.2 liters | | |
| 1 $m^3$ | = | 35.3 cu.ft. | | |
| 1 gallon | = | 8.34 lbs. $H_2O$ | | |
| 1 cu.ft. | = | .075 lbs. air | | |
| 1 cu.ft. | = | 62.4 lbs. $H_2O$ | | |

**Temperature**
°C = °F - 32 (5/9)
°F = °C (9/5) +32

**AbsoluteTemperature**
°C + 273 °K = °K
°F + 460 °R = °R

**Air Pressure**
1 atmosphere = 760 torr = 760 mm Hg = 29.92" Hg = 101. kPa = " water
psia = psig + 14.7 psia

**Water Pressure**
.433 psi / ft. of height
62.4 lbs. / cubic foot of water

**Density**
The ratio of an objects mass to it's volume
density ($\rho$) = mass / volume (g/ml or g/cc)
Water is the reference, it weighs exactly 1 gram / ml @ 20 deg. C.

**SpecificGravity**
The ratio of an object's density to the density of water. There are no units.
Not all liquids weigh the same.
If a chemical has a s.g. of .70, it means that 1 ml weighs 0.7 grams. It is 30% lighter than water.

**GasLaws**
$PV = nRT$ (R = 0.0821 atmosphere liter / mole °K)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Boyle's Law - At constant temperature a fixed mass of gas occupies a volume inversely proportional to the pressure exerted upon it.

$$P_1 V_1 = P_2 V_2 \quad \text{Boyle's Law}$$

Charles Law - At constant pressure the volume occupied by a fixed mass of gas is directly proportional to the absolute temperature.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$ Charles Law

Avagadro Principle - An equal volume of gas at the same temperature and pressure contains an equal number of molecules (or atoms) per mole of gas.

1 mole of gas = $6.023 \times 10^{23}$ molecules (atoms)

$PV = nRT$ (combining the gas laws and Avagadro's principle)

Gas density law - relate density of gas to it's pressure and temp.

$$\frac{\rho_1 T_1}{P_1} = \frac{\rho_2 T_2}{P_2}$$ $\rho_1$ = (gms/cc or gm/ml)

Dalton's Law of Partial Pressure

$$P_{total} = \sum_{i=1}^{n} P_i = P_1 + P_2 + P_3 + ..... + P_n$$

**Standard and Normal Temp. & Press.**

STP = Standard Temp. and Pressure (273 °K = 0 °C = 32 °F , 1 atm.)
NTP = Normal Temp. and Pressure (298 °K = 25 °C = 77 °F, 1 atm.)
Engineer's STP = (293 °K = 20 °C = 68 °F, 1 atm.)

**Volume**

Parts per million (ppm) = 1 part / $10^6$ parts

$$ppm = \frac{(mg / m^3)(24.45)}{\text{molec. wt. (grams / mole)}}$$

ppm = mg / liter

$$ppm = \frac{\text{volume gas}}{\text{volume air}} \times 10^6$$

$$ppm = \frac{\text{mm Hg gas}}{760 \text{ mm Hg}} \times 10^6$$