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**USEFUL EQUATIONS and CONVERSION FACTORS for the QEP and GES EXAMINATIONS**

The following equations and conversion factors will be available on the computer used to take the QEP and/or the GES exam. No assurance is given that this list is complete or that the proper use of this information will assure the successful completion of either examination. No attempt has been made to standardize variables. There may be information on this sheet that is not reflected in the GES or QEP exams.

1. **Constants and Conversion Factors**

°F=9/5(°C)+32

K=°C+273.15

Molar volume at 25°C, 1 atm=24.45L

1ft3=28.32L

1 ft3=7.481 U.S. gal

1L=1.0567 qt [RAV comment: 1.0567 qt]

1 inch=2.54 cm

12 inches=1 foot

1 lb=453.6 grams

1 gram=15.43 grains

1 atm=14.7 psi=760mm Hg=29.92 in Hg=33.93 ft water=1013.25 mbar=101,325 pascals

1 BTU=1054.8 joules=0.293 watt hr

1cal=4.184 joules

Avogadro’s number=6.024x 1023

gas constant, R=8.314 J/mole K=0.082 L atm/mole K

density of air=1.29 g/L at atm, 0°C

g=981 cm/sec2=32 ft/sec2

1 gallon of water = 8.34 pounds

pi =  π = 3.142

1. **COMMON ENVIRONMENTAL FORMULAS**
	1. **General/Cross Discipline**

**Area**

Rectangle or Square: A = L x W

Circle: A= 0.785 x $D^{2}$

Triangle: A= $\frac{B x H}{2}$

Area of an open-ended cylinder = 2πrh + πr2

Area of a close-ended cylinder= 2πrh +2πr2

**Volume**

Rectangle: Volume = Area x Height

 Volume = L x W x H

Cylinder: Volume = Area x Height

 Volume = 0.785 x $D^{2}$x H

Cone: Volume = $\frac{ Area x Height }{3}$

 Volume = $\frac{ 0.785 x D^{2}x H }{3}$

**Velocity**

Velocity*=* $\frac{Distance traveled}{Time}$

Velocity= $\frac{Flow rate}{Area}$

**Other**

pH = -log[H₃O⁺]

$$S^{2}=\frac{∑\left(x\_{i}-\overbar{x}\right)^{2}}{n-1}$$

$$t=\frac{\overbar{x\_{1}}-\overbar{x\_{2}}}{√\left(\frac{S\_{1}^{2}}{n\_{1}}+\frac{S\_{2}^{2}}{n\_{2}}\right)}$$

$$UCL\_{ 1-α}=\overbar{x}+t\_{α\_{,}n-1}s∕\sqrt{n}$$

* 1. **Water-Related**

QsCs + QdCd = QrCr

DTWc = DTWm - (PT \* Rho)

Top of Water Table Depression from Overlaying Liquid = Apparent Thickness x Density

CEW = **Σ** (Ci/di) / **Σ** (1/di)

* 1. **Air-Related**

Note: AE (mass), E (mass/energy), HI (energy/time), T (time), Cd=concentration (dry)

Qd=flow rate (dry), Cw=concentration (wet), Qw=flow rate (wet), M% = moisture (%)

AE [Air emissions] = E \* HI \* T \* Capacity Factor

E = K\* Cw\*Qw

Cd = Cw\*/(1-M%/100%)

Qd = Qw\*/(1-M%/100%)

K = 2.596x10-9 \*(MW) (lb/dscf)/ppm

$$\sum\_{\frac{\begin{array}{c}\\i=1\end{array}}{n}}^{n}E\_{1}=\frac{E\_{1}+E\_{2}…+E\_{n}}{n}$$

$E=$