

Appendix II

Important Physical Constants for Physiology

Avogadro's Number:

$$N = 6.02 \times 10^{23} \text{ particles mol}^{-1}$$

The Faraday:

$$\mathfrak{F} = 96,489 \text{ C mol}^{-1}$$

$$1 \text{ C} = 6.24 \times 10^{18} \text{ electrons}$$

$$1 \text{ electron} = 1.6 \times 10^{-19} \text{ C}$$

Electrical Permittivity of the Vacuum:

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ J}^{-1} \text{ m}^{-1}$$

Energy Units, Interconversions:

$$1 \text{ J} = 0.239 \text{ cal}$$

$$1 \text{ cal} = 4.186 \text{ cal}$$

$$1 \text{ J} = 1 \text{ N m}$$

$$1 \text{ J} = 1 \text{ V} \times \text{C}$$

Pressure Units, Interconversions:

$$1 \text{ atm} = 760 \text{ mmHg}$$

$$1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$$

$$1 \text{ Pa} = 1 \text{ N m}^{-2}$$

$$1 \text{ mmHg} = 133.3 \text{ Pa}$$

Gas Constant, Values:

$$R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

$$R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$R = 1.987 \text{ cal mol}^{-1} \text{ K}^{-1}$$

Boltzmann's Constant:

$$k = R/N = 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$$

Viscosity Units:

Viscosity is in units of Pa s, where $1 \text{ Pa} = 1 \text{ N m}^{-2}$.
An alternate archaic unit is the poise = $1 \text{ dyne cm}^{-2} \text{ s}$.
The interconversion is $1 \text{ Pa s} = 10 \text{ poise}$.

Planck's Constant:

$$h = 6.625 \times 10^{-34} \text{ J s}$$

It relates the energy of a photon of light to its frequency: $E = h\nu$.