

Appendix II

Important Physical Constants for Physiology

Avogadro's Number:

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

The Faraday:

$$\begin{aligned}\mathfrak{F} &= 96,489 \text{ C mol}^{-1} \\ 1 \text{ C} &= 6.24 \times 10^{18} \text{ electrons} \\ 1 \text{ electron} &= 1.6 \times 10^{-19} \text{ C}\end{aligned}$$

Electrical Permittivity of the Vacuum:

$$\varepsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ J}^{-1} \text{ m}^{-1}$$

Energy Units, Interconversions:

$$\begin{aligned}1 \text{ J} &= 0.239 \text{ cal} \\ 1 \text{ cal} &= 4.186 \text{ cal} \\ 1 \text{ J} &= 1 \text{ N m} \\ 1 \text{ J} &= 1 \text{ V} \times \text{C}\end{aligned}$$

Pressure Units, Interconversions:

$$\begin{aligned}1 \text{ atm} &= 760 \text{ mmHg} \\ 1 \text{ atm} &= 1.013 \times 10^5 \text{ Pa} \\ 1 \text{ Pa} &= 1 \text{ N m}^{-2} \\ 1 \text{ mmHg} &= 133.3 \text{ Pa}\end{aligned}$$

Gas Constant, Values:

$$\begin{aligned}R &= 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1} \\ R &= 8.314 \text{ J mol}^{-1} \text{ K}^{-1} \\ R &= 1.987 \text{ cal mol}^{-1} \text{ K}^{-1}\end{aligned}$$

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 dyne cm $^{-2}$ 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: $E = h\nu$.