**Potentially Useful Formulas**

# Solute Flux

**Fick’s First Law of Diffusion**

# Non-Dimensional Parameters

Let be a characteristic velocity, be a characteristic length, be kinematic viscosity,

Further, let be diffusion coefficient.

Let be the mass transfer coefficient.

# General Mass Transport Equation (Fick’s Second Law)

In Cartesian coordinates

In cylindrical coordinates

In spherical coordinates

# Boundary Layer Development

Pipe flow, fully developed momentum boundary layer .

Pipe flow, fully developed concentration boundary layer .

Flat plate, laminar boundary layer .

Cylinder, laminar flow .

# Constants and Conversions

Avogadro’s Number:

Faraday’s Constant:

Universal Gas Constant:

Henry’s Constant for Oxygen in Blood:

Centigrade to Kelvin: Degrees Kelvin 273.15 Degrees Centigrade

Viscosity of water: 0.76 cP Viscosity of plasma: 1.2 cP

1 cP = 1 mPa s

1 atm = 101,325 Pa = 760 mmHg

# Sherwood Numbers

|  |  |
| --- | --- |
| Condition | Sh |
| Sphere in a stagnant fluid | 2 |
| Forced convection over a sphere |  |
| Laminar flow over a flat plate |  |
| Laminar flow in a cylindrical tube, short contact time |  |
| Laminar flow in a cylindrical tube, fully developed flow and concentration profiles | 3.66 |
| Turbulent flow through a circular tube |  |
| Spinning Disk |  |
| Falling Film, Average |  |

# Diffusion in Random Matrix – Brinkman equation

**Ogston equation**

**Diffusion in Tissue – Maxwell Equation**

**Riley et al. Monte Carlo simulation**

# Oxygen Concentrations

Henry’s Law

Sphere

Planar Bioartificial Organ

**Krogh Tissue Cylinder Model**

**Krogh Cylinder model with constant surface concentration assumption**

**Filtration from hollow fiber**

**Oie-Tozer equation**

(Approximation (volume in L) for 70-kg male)

**Pharmacokinetic Models**

**One-compartment**

**Rapid IV injection:**

**Continuous Perfusion**

**Drug Absorption**

**Two-compartment**

**Rapid IV injection:**

**Drug Absorption**