Examples for application

a) Decontamination of soil by washing may not have the expected effect because molecular diffusion of pollutants out of soil aggregates (in which the water does not move) is the kinetically limiting step (see illustrative example).

b) Phase exchange can be accelerated by increasing the interfacial area (e.g. lung) and by decreasing the critical diffusion path length (e.g. decreasing the thickness of the liquid laminar layer by stirring). ½ path length => ¼ time

c) For GC analysis the analyte must have enough time to equilibrate with the stationary phase before it is transported further along the column by the carrier gas. A typical column is 30 m long; the stationary phase has a coating thickness between 0.25 and 0.5 μm and a linear gas phase velocity of about 50 cm/min. A rough calculation of the time needed for diffusion into the coating can show whether this equilibrium requirement can be fulfilled under such conditions. If we assume a D of 10^{-6} cm^2/sec in the stationary phase (a liquid polymer at elevated temperatures, 80 - 250 °C) we get:
$t = x^2 / 2\,D \Rightarrow (0.5\ 10^{-4}\ cm)^2 / (2\ 10^{-6}\ cm^2/sec) = 1.25\ 10^{-3}$ sec.
Within this very short time that is needed to establish equilibrium, the injected analyte will hardly move forward within the column so that the equilibrium requirement should certainly be fulfilled.