> 물리화학2 숙제 1 2008. 9. 18
> (2008년 9월 25일 수업전 제출)

1. (1) Derive that root mean square distance is given by $\sqrt{2 D t}$.
(2) What is the diffusion distance in the x direction of a source molecule due to its Brownian motion in one minute in water at $20^{\circ} \mathrm{C}$ ? ( $\mathrm{D}=4.65 \times 10^{10} \mathrm{~m}^{2} / \mathrm{s}$ )
(3) There is an analogy between D and a (thermal diffusivity $=\frac{\kappa}{\rho C p}$ ). Estimate the thermal conduction distance of solid in a minute (thermal conductivity $=10^{-5}$, density $=3$, heat capacity $=4$ in SI units.)
2. (1) Provide a molecular interpretation for the observation that the viscosity of a gas increases with temperature, whereas the viscosity of a liquid decreases with increasing temperature.
(2) Use the Maxwell distribution of speeds to estimate the fraction of $\mathrm{CO}_{2}$ molecules at 300 K that have speeds in the range 200 to $250 \mathrm{~m} / \mathrm{s}$
3. (1) Draw rough sketches of $\mathrm{f}\left(\nu_{\mathrm{x}}\right)$ vs. $\nu_{\mathrm{x}}$ for $\mathrm{O}_{2}$ at 100,300 , and 1000 K .
(2) Draw rough sketches of $\mathrm{f}(\nu)$ vs. $\nu$ for $\mathrm{O}_{2}$ at 100,300 , and 1000K.
(3) The electric conductivity $\kappa$ of pure water is $5.5 \times 10^{-6} \Omega^{-1} \mathrm{~m}^{-1}$ at $25^{\circ} \mathrm{C}$. what is value of the product $\mathrm{K}_{\mathrm{w}}=\left[\mathrm{H}^{+}\right]\left[\mathrm{OH}^{-}\right]$?
4. The diffusivity of a $\mathrm{CH}_{3} \mathrm{CO}_{2}{ }^{-}$ion in aqueous solution at $25^{\circ} \mathrm{C}$ is $1.09 \times 10^{-9} \mathrm{~m}^{2} / \mathrm{s}$
(1) Calculate the mobility in water at $25^{\circ} \mathrm{C}$.
(2) Estimate the time required for a $\mathrm{CH}_{3} \mathrm{CO}_{2}{ }^{-}$ion to have a root mean square displacement in 3 -dimension of 1 cm .
(3) Estimate the effective hydration radius. The viscosity of water is 1.0 cP .
5. Derive the following equations.
(1) 식 21.94
(2) 식 21.97
