

問題8 解答

8-1. (a) 微粒子の体積 =  $(4 \times 3.14/3)(0.5 \times 10^{-6}/2)^3 [\text{m}^3] = 6.54 \times 10^{-14} [\text{cm}^3]$

有効質量  $m = (6.54 \times 10^{-14})(1.10 - 1.00 [\text{g}/\text{cm}^3]) = 6.54 \times 10^{-15} \text{ g}$

(b)  $mg(h-h_0)/k_B T = 1$  であるので

$k_B = (6.54 \times 10^{-18} [\text{kg}])(9.81 [\text{m s}^{-2}])(6.40 \times 10^{-5} [\text{m}])/293.15 [\text{K}] = 1.40 \times 10^{-23} [\text{J K}^{-1}]$

(c) アボガドロ数 =  $R/k_B = (8.314 [\text{J mol}^{-1} \text{K}^{-1}])/(1.40 \times 10^{-23} [\text{J K}^{-1}]) = 5.94 \times 10^{23} [\text{mol}^{-1}]$

8-2.

単位胞 (ユニットセル) の一辺の長さ =  $2 \times 2.819 \times 10^{-8} [\text{cm}] = 5.638 \times 10^{-8} [\text{cm}]$

ユニットセル体積 =  $(5.638 \times 10^{-8} [\text{cm}])^3 = 1.792 \times 10^{-22} [\text{cm}^3]$

ナトリウムイオンと塩化物イオン辺りの体積 =  $1.792 \times 10^{-22} [\text{cm}^3] / 4 = 4.480 \times 10^{-23} [\text{cm}^3]$

NaCl の分子量 =  $26.99 + 35.45 = 58.44$

その結晶のモル体積 =  $58.44 \text{ g} / 2.165 [\text{g cm}^{-3}] = 26.99 [\text{cm}^3]$

アボガドロ数 =  $(26.99 [\text{cm}^3]) / (4.480 \times 10^{-23} [\text{cm}^3]) = 6.025 \times 10^{23}$

8-3. アボガドロ数 =  $96496 [\text{C}] / 1.593 \times 10^{-19} [\text{C}] = 6.058 \times 10^{23}$