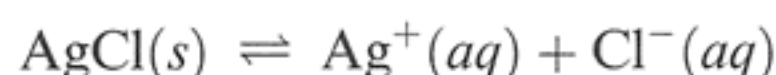


- 8.6 A conductance cell consists of two electrodes, each with an area of $4.2 \times 10^{-4} \text{ m}^2$, separated by 0.020 m. The resistance of the cell when filled with a $6.3 \times 10^{-4} \text{ M}$ KNO_3 solution is 26.7Ω . What is the molar conductivity of the solution?
- 8.7 Referring to Figure 8.4, explain why the slope of conductance versus volume of NaOH added rises right at the start if the acid employed in the titration is weak.

Solubility

- 8.8 Calculate the solubility of BaSO_4 (in g L^{-1}) in (a) water and (b) a $6.5 \times 10^{-5} \text{ M}$ MgSO_4 solution. The solubility product of BaSO_4 is 1.1×10^{-10} . Assume ideal behavior.
- 8.9 The thermodynamic solubility product of AgCl is 1.6×10^{-10} . What is $[\text{Ag}^+]$ in (a) a 0.020 M KNO_3 solution and (b) a 0.020 M KCl solution?
- 8.10 Referring to Problem 8.9, calculate the value of ΔG° for the process



to yield a saturated solution at 298 K. (*Hint:* Use the well-known equation $\Delta G^\circ = -RT \ln K$.)

- 8.11 The apparent solubility products of CdS and CaF_2 at 25°C are 3.8×10^{-29} and 4.0×10^{-11} , respectively. Calculate the solubility ($\text{g}/100 \text{ g}$ of solution) of these compounds.
- 8.12 Oxalic acid, $(\text{COOH})_2$, is a poisonous compound present in many plants and vegetables, including spinach. Calcium oxalate is only slightly soluble in water ($K_{\text{sp}} = 3.0 \times 10^{-9}$ at 25°C) and its ingestion can result in kidney stones. Calculate (a) the apparent and thermodynamic solubility of calcium oxalate in water, and (b) the concentrations of calcium and oxalate ions in a 0.010 M $\text{Ca}(\text{NO}_3)_2$ solution. Assume ideal behavior in (b).

Ionic Activity

- 8.13 Express the mean activity, mean activity coefficient, and mean molality in terms of the individual ionic quantities (a_+ , a_- , γ_+ , γ_- , m_+ , and m_-) for the following electrolytes: KI , SrSO_4 , CaCl_2 , Li_2CO_3 , $\text{K}_3\text{Fe}(\text{CN})_6$, and $\text{K}_4\text{Fe}(\text{CN})_6$.
- 8.14 Calculate the ionic strength and the mean activity coefficient for the following solutions at 298 K: (a) 0.10 m NaCl , (b) 0.010 m MgCl_2 , and (c) 0.10 m $\text{K}_4\text{Fe}(\text{CN})_6$.
- 8.15 The mean activity coefficient of a 0.010 m H_2SO_4 solution is 0.544. What is its mean ionic activity?
- 8.16 A 0.20 m $\text{Mg}(\text{NO}_3)_2$ solution has a mean ionic activity coefficient of 0.13 at 25°C . Calculate the mean molality, the mean ionic activity, and the activity of the compound.

Debye–Hückel Limiting Law

- 8.17 The Debye–Hückel limiting law is more reliable for 1 : 1 electrolytes than for 2 : 2 electrolytes. Explain.
- 8.18 In theory, the size of the ionic atmosphere is $1/\kappa$, called the Debye radius, and κ is given by

$$\kappa = \left(\frac{e^2 N_A}{\epsilon_0 \epsilon k_B T} \right)^{1/2} \sqrt{I}$$

where e is the electronic charge, N_A Avogadro's constant, ϵ_0 the permittivity of vacuum ($8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$), ϵ the dielectric constant of the solvent, k_B the Boltzmann constant, T the absolute temperature, and I the ionic strength (see the physical chemistry texts listed in Chapter 1). Calculate the Debye radius in a 0.010 m aqueous Na_2SO_4 solution at 25°C .

- 8.19 Explain why it is preferable to take the geometric mean rather than the arithmetic mean when defining mean activity, mean molality, and mean activity coefficient.