10.5: Concentration Cells

The generation of an electrostatic potential difference is dependent on the creation of a difference in chemical potential between two half-cells. One important manner in which this can be created is by creating a concentration difference. Using the Nernst equation, the potential difference for a concentration cell (one in which both half-cells involve the same half-reaction) can be expressed

$$E = -\frac{RT}{nF}\ln\frac{[\text{oxdizing}]}{[\text{reducing}]}$$

Example 10.5.1

Calculate the cell potential (at 25 °C) for the concentration cell defined by

$$Cu(s)|Cu^{2+}(aq,\ 0.00100\ M)||Cu^{2+}(aq,\ 0.100\ M)|Cu(s)$$

Solution

Since the oxidation and reduction half-reactions are the same,

$$E^o_{cell} = 0\ V$$

The cell potential at 25 °C is calculated using the Nernst equation:

$$E = -\frac{RT}{nF}\ln Q$$

Substituting the values from the problem:

$$E_{cell} = -\frac{(8.314\ J/(mol\ K)(298\ K)}{2(96484\ C)}\ln\left(\frac{0.00100\ M}{0.100\ M}\right)$$

$$= 0.059\ V$$