Example 2-5: Testing for ion balance Tests for common ions are run on a sample of water and the results are shown below. If a 10 percent error in the balance is acceptable, should the analysis be considered complete?

Constituents

$$Ca^{2+} = 55 \text{ mg/L} \qquad HCO_3^- = 250 \text{ mg/L}$$
$$Mg^{2+} = 18 \text{ mg/L} \qquad SO_4^{2-} = 60 \text{ mg/L}$$
$$Na^+ = 98 \text{ mg/L} \qquad Cl^- = 89 \text{ mg/L}$$

SOLUTION

1. Convert the concentrations of cations and anions from milligrams per liter to milli-equivalents per liter and sum them.

Ion	Cations			Ion	Anions		
	Conc, mg/L	Equiv, mg/mequiv	Equiv conc, meq/L		Conc, mg/L	Equiv, mg/mequiv	Equiv conc, mequiv/L
Ca^{2+}	55	40/2	2.75	HCO_3^-	250	61/1	4.10
Mg^{2+}	18	24.3/2	1.48	SO_4^{2-}	60	96/2	1.25
Na^+	98	23/1	4.26	Cl^-	89	35.5/1	2.51
Total ions			8.49				7.86

2. Calculate percent of error.

$$\frac{8.49 - 7.86}{7.86} \, 100 = 8\%$$

$$8\% < 10\%$$

Therefore, accept analysis.

A common ion balance can be displayed conveniently in the form of a bar diagram. A bar diagram for the water in Example 2-5 can be drawn as shown below.

mequiv/L   0   2.75   4.23   8.49

| Ca^{2+} | Mg^{2+} | Na^+ |
| HCO_3^- | SO_4^{2-} | Cl^- |

mequiv/L   0   4.10   5.35   7.86

Bc - 4

4