Competition Corner: Electron Accounting

g11_u05_w18

Original fictional paper-model challenges. No apparatus or procedure is implied. Use $F = 96\,485\ \mathrm{C\,mol^{-1}\ e^-}$, $M_{\mathrm{Cu}} = 63.55\ \mathrm{g\,mol^{-1}}$, and $M_{\mathrm{Al}} = 26.98\ \mathrm{g\,mol^{-1}}$.

Challenge 21. A fictional allocation card supplies $Q = 5789.1$ C. Exactly 60.0% of the modeled electron amount is assigned to $\mathrm{Cu^{2+} + 2e^- \rightarrow Cu}$; the remaining 40.0% is assigned to $\mathrm{Al^{3+} + 3e^- \rightarrow Al}$. Find the modeled mass of each product and the total modeled mass. State why this allocation is a bookkeeping assumption, not evidence of a mechanism.

Challenge 22. A paper data set reports $I = 0.800 \pm 0.010$ A, $t = 250. \pm 2.$ s, and a modeled copper mass calculated from their product. Estimate the largest relative uncertainty in $Q = It$ by adding the two relative uncertainties. Then name one measurement not supplied that would still prevent an efficiency claim from this calculation alone.