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Pre-Lab Questions: Determination of an Equivalent Mass by Electrolysis

1. In an electrolysis cell similar to the one employed in this experiment, a student observed that his unknown metal anode lost 0.233 g while a total volume of 94.50 mL of H₂ was being produced. The temperature in the laboratory was 25 °C, and the barometric pressure was 740 mm Hg. At 25 °C, the vapor pressure of water is 23.8 mm Hg. To find the equivalent mass of his metal, the student filled in the blanks below:

$$P_{\text{hydrogen gas}} = P_{\text{bar}} - VP_{\text{water}} = \text{_____ mm Hg} = \text{_____ atm}$$

$$V_{\text{hydrogen gas}} = \text{_____ mL} = \text{_____ L}$$

$$T = \text{_____ K}$$

$$n_{\text{hydrogen gas}} = \text{_____ moles}$$

$$1 \text{ mol H}_2 \text{ requires passage of _____ faradays}$$

$$\text{Faradays passed (moles of electrons)} = \text{_____}$$

$$\text{Loss of mass of metal anode} = \text{_____ g}$$

$$\text{Grams of metal lost per faraday passed} = \text{grams lost/faradays passed} =$$

$$\text{_____ g} = \text{GEM}$$

The student was told that the identity of the metal anode is copper.

$$\text{MM Cu} = \text{_____ g. The charge } n \text{ on the Cu ion is _____}. \text{ (Eq. 3)}$$

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Data and Calculations: Determination of an Equivalent Mass by Electrolysis

Mass of metal anode _____ g

Mass of anode after first electrolysis _____ g

Mass of anode after second electrolysis _____ g

Initial buret reading _____ mL

Buret reading after first electrolysis _____ mL

Initial buret reading for the second electrolysis _____ mL

Buret reading after second electrolysis _____ mL

Barometric pressure _____ mmHg

Temperature T _____ °C

Vapor pressure of H₂O at T _____ mmHg

Total volume of H₂ produced, V _____ mL

Temperature T _____ K

Pressure exerted by dry H₂: $P = P_{\text{bar}} - VP_{\text{water}}$
(ignore any pressure effect due to liquid levels in the buret) _____ mmHg

Moles of H₂ produced, n _____ moles

Faradays passed (moles of electrons) _____

Loss in mass by anode _____ g

Equivalent mass of metal (GEM = g lost / faradays passed) _____ g

Unknown metal number _____

Metal _____

MM _____ g

Charge n on cation (equation 3) _____

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Pre-Lab Questions: Determination of an Equivalent Mass by Electrolysis

1. In ordinary units, the faraday is equal to 96,485 coulombs. A coulomb is the amount of electricity passed when a current of one ampere flows for one second. Given the charge on an electron, 1.6022×10^{-19} coulombs, calculate a value for Avogadro's number.

2. Consider the electrolysis of $\text{Na}_2\text{SO}_4(\text{aq})$. Write the overall net ionic equation that occurs for this electrolysis. Note: Consider all the possible reactions; the oxidation of water or sulfate ions, the reduction of water or sodium ions. Determine which is more likely to occur.
