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1.  
   b) In **linear-scan voltammetry**, the applied potential takes the form of a linear ramp and current is measured at regular intervals. In **pulse voltammetry**, the applied potential consists of a linear ramp with superimposed voltage pulses and the current is measured before and at the end of each pulse.

   c) In **differential pulse voltammetry**, the applied potential consists of a linear ramp with superimposed voltage pulses. The difference in the current measured just before and at the end of each pulse is recorded. For **square-wave voltammetry**, the applied potential consists of a staircase signal with superimposed square-wave pulses. The current is measured during the forward pulse and the reverse pulse and the difference is noted.

   d) The rotating disk electrode (RDE) usually consists of a single disk electrode surface. A ring-disk electrode contains a second ring-shaped electrode that is electrically isolated from the center disk. After an electroactive species is generated at the disk, it is then swept past the ring where it undergoes a second electrochemical reaction.

   f) **Limiting current** is the maximum current observed for an electroactive species, limited by concentration polarization. **Diffusion current** is the difference between the limiting current and the residual current.

   h) The **standard electrode potential** is the half-reaction potential at standard conditions (unit activities and 25°C). The **half-wave potential** is the applied potential at which the current level is at half that of the diffusion current.

3. A high supporting electrolyte concentration is used to minimize the effects of migration to the electrode surface by electrostatic attraction and to reduce the cell resistance which decreases the *IR* drop.

4. The reference electrode is placed near the working electrode to minimize the *IR* drop that can distort voltammograms.

5. Most organic electrode processes involve hydrogen ions. Unless buffered solutions are used, marked pH changes can occur at the electrode surface as the reaction proceeds.

6. Stripping methods are more sensitive because the analyte is first preconcentrated by electrochemical deposition at the electrode before the electrochemical analysis. All the analyte that has been deposited can then be rapidly oxidized or reduced, producing a large current.
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7. The purpose of the electrodeposition step in stripping analysis is to concentrate the analyte on the surface of the working electrode.

8. Mercury film electrode vs. Pt or carbon microelectrode

ADVANTAGES of mercury film
- has high overvoltage for H\(^+\) reduction
- greater ability to detect metal ions that are reduced at cathodic potentials

DISADVANTAGES of mercury film
- Hg is easily oxidized which limits anodic potential range
- has significant charging current

9. A plot of \(E_{\text{appl}}\) vs. \(\log(i/(i_l - I))\) should yield a straight line with a slope equal to \(-0.0592/n\). Thus, \(n\) is readily obtained from the slope.

13. Let \(i_1 = kc_u\) where \(i_1 = 1.78 \mu A\) and \(c_u\) is the concentration of the unknown solution then

\[
l_2 = k(c_u + c_{std}) = k \left( \frac{\text{mol unk} + \text{mol std}}{\text{total volume}} \right) = k \left( \frac{0.02500 L c_u + 0.500 L (2.25 \times 10^{-3} \text{ mol/L})}{0.02500 L + 0.00500 L} \right) = 4.48 \mu A
\]

From the first equation, \(k = 1.78 \mu A/c_u\). Substituting this into the second equation and solving for \(c_u\) gives \(c_u = 2.23 \times 10^{-4} \text{ M}\).

16. a) Advantages of ultramicroelectrodes
- require simpler instrumentation (no need to compensate for IR drop)
- have insignificant charging currents
- currents are established rapidly, allowing for high-speed measurements
- can probe very small samples

b) Currents become very small as electrode size decreases and may become too difficult to measure accurately.