Experiment 8

DRY CELL

A dry cell is constructed based on the same reaction as commercial alkaline batteries.

EQUIPMENT
- 1 slice of packing foam
- alligator clips
- pH/mV meter
- large digital display
- 1 large beaker
- pieces of string (optional)

REAGENTS
- powdered manganese dioxide, MnO₂ (3-4 g)
- ammonium chloride, NH₄Cl (4 M, 100 mL)
- zinc foil (1 piece)

PREPARATION
Prepare the ammonium chloride solution by dissolving ammonium chloride (21.4 g) in water (100 mL).

PROCEDURE
- Cover the surface of the demonstration bench.
- Pour the ammonium chloride solution into the large beaker and moisten the packing foam in the bottom of the beaker.
- Squeeze the foam so that it is damp but not dripping; then sprinkle over the manganese dioxide.
- Roll the sprinkled foam around the carbon rod.
- Next wrap the foam in the zinc foil, ensuring that the zinc does not touch the carbon rod. (Tie the assembly together with string.)
- Connect one alligator clip from the pH/mV meter to the graphite rod, and the other to the zinc foil.

RESULTS
A voltage of about 1.3 volts should be observed.

\[
\begin{align*}
\text{Zn(s)} & \rightarrow \text{Zn}^{2+}(aq) + 2e^- & E^* = +0.76 \text{ V} \\
2\text{MnO}_2(s) + 2\text{H}_2\text{O}(l) + 2e^- & \rightarrow 2\text{MnO(OH)}(s) + 2\text{OH}^-(aq) & E^* = +0.57 \text{ V}
\end{align*}
\]

\[
\text{Zn(s)} + 2\text{MnO}_2(s) + 2\text{H}_2\text{O}(l) \rightarrow 2\text{MnO(OH)}(s) + \text{Zn}^{2+}(aq) + 2\text{OH}^-(aq) & \quad E^*_{\text{cell}} = +1.33 \text{ V}
\]

The zinc foil may be rinsed, air dried and reused until it is too corroded to bend.