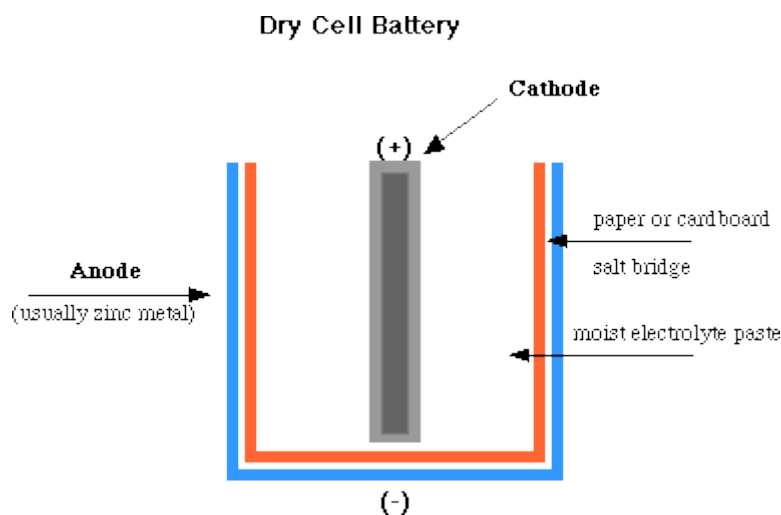
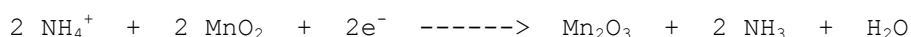


# The "Dry-Cell" Battery

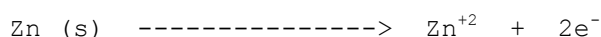
The most common type of battery used today is the "dry cell" battery. There are many different types of batteries ranging from the relatively large "flashlight" batteries to the minaturized versions used for wristwatches or calculators. Although they vary widely in composition and form, they all work on the same principle. A "dry-cell" battery is essentially comprised of a metal electrode or graphite rod (elemental carbon) surrounded by a moist electrolyte paste enclosed in a metal cylinder as shown below.



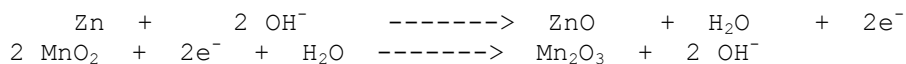
In the most common type of dry cell battery, the cathode is composed of a form of elemental carbon called **graphite**, which serves as a solid support for the reduction half-reaction. In an acidic dry cell, the reduction reaction occurs within the moist paste comprised of ammonium chloride ( $\text{NH}_4\text{Cl}$ ) and manganese dioxide ( $\text{MnO}_2$ ):



A thin zinc cylinder serves as the anode and it undergoes oxidation:



This dry cell "couple" produces about 1.5 volts. ( These "dry cells" can also be linked in series to boost the voltage produced). In the **alkaline** version or "**alkaline battery**", the ammonium chloride is replaced by KOH or NaOH and the half-cell reactions are:



The alkaline dry cell lasts much longer as the zinc anode corrodes less rapidly under basic conditions than under acidic conditions.

Other types of dry cell batteries are the **silver battery** in which silver metal serves as an inert cathode to support the reduction of silver oxide ( $\text{Ag}_2\text{O}$ ) and the oxidation of zinc (anode) in a basic medium. The type of battery commonly used for calculators is the **mercury** cell. In this type of battery,  $\text{HgO}$  serves as the oxidizing agent (cathode) in a basic medium, while zinc metal serves as the anode. Another type of battery is the **nickel/cadmium** battery, in which

cadmium metal serves as the anode and nickel oxide serves as the cathode in an alkaline medium. Unlike the other types of dry cells described above, the nickel/cadmium cell can be recharged like the lead-acid battery.

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