dioxide in the positive plates, a spongy form of lead in the negative plates, and a liquid electrolyte composed of sulfuric acid and water.

When the battery terminals are connected externally to an electrical demand, the sulfate in the electrolyte combines with the active material in both types of plates, and the electrons will flow from the negative terminal through the starter to the positive terminal. At the same time, both plates will be accumulating a coating of lead sulfate, which is highly resistant to current flow. As the coating increases, the battery gets weaker until both plates are completely coated, then chemical action ceases and the battery stops working. The phenomena that makes the battery practical is that by reversing the current flow, the entire process works in reverse and recharges the battery, which is one of the jobs performed by the alternator in flight.

Lead Acid Battery Characteristics

The battery, like the human body, reacts differently to varying environmental conditions. During cold weather it does not produce as much voltage because the chemical reaction slows down. Referring to Table 8-1, you will see that it is not uncommon for a lead acid battery to lose as much as 40 percent of its warm weather capacity during winter months in the Snow Belt area. It is also important during winter to change to a lighter grade of oil and to change it often to keep it clean. The colder it gets, the stiffer the oil becomes, and the engine with cold, dirty, heavy-grade oil will be very difficult for the battery to start. Pulling the prop through several times helps break up the oil, but the best course of action is to warm the engine oil with a preheat and perhaps even use a ground power cart for starting.

To determine the state of charge of a battery, it would seem logical to simply put a voltmeter on the battery's terminals and read the open circuit voltage, but remember Murphy's Second Law! Temperature has a very strong effect on cell voltage and there is no convenient way of correcting for it. Determining the specific gravity (SPGR) of the electrolyte is a more reliable method. It is true that temperature also affects SPGR; however it is easily calculated by referring to Table 8-2, which shows that the hotter the electrolyte, the lower its SPGR.

Table 8-1.
Percent of Battery Power Available at Varying Temperatures

Temperature °F	Full Charge	Half Charge
80	100%	46%
32	65%	32%
0	40%	21%