Battery Data

Here are some conservative power ratings for good quality alkaline-manganese dioxide batteries available at the local grocery store.

Battery Type	Capacity (mAh)	Typical Drain
D	12000	200 mA
C	6000	100 mA
AA	2000	50 mA
AAA	1000	10 mA
N	650	10 mA
9 Volt	500	15 mA
6 Volt Lantern	11000	300 mA

The battery capacity will be better with lower drain currents. To determine the battery life, divide the capacity by the actual load current to get the hours of life. A circuit that draws 10 ma powered by a 9 volt rectangular battery will operate about 50 hours:

500 mAh /10 mA = 50 hours

The cell voltage of alkaline cells steadily drops with usage from 1.54 volts to about 1 volt when discharged. The voltage is near 1.25 volts at the 50% discharge point. Alkaline cells exhibit a slightly increased capacity when warmed and the capacity drops significantly at temperatures below freezing.

Mercury and silver oxide batteries have nearly twice the capacity as alkaline batteries of the same size but the current ratings are significantly lower. Alkaline batteries also have good shelf life making them ideal for home-made electronic projects.

Rechargeable batteries have less capacity than primary cells as shown in the following chart. This chart shows the capacity as a percentage of the capacity of an alkaline battery with the same dimensions.

Battery Type	% Capacity
Lead-acid	35
Nickel-cadmium	30
Silver-zinc	85

A new type of rechargeable alkaline battery is coming on the market at the time of this writing and may offer better price/performance than ni-cads.

Ni-cad cells have a nominal voltage of 1.2 volts and are usually charged at 1/10 the amp-hour rating. The recharging takes longer than 10 hours as this charging rate might inply due to charging inefficiency. Full charging usually taking at least 14 hours. Special ni-cad cells can tolerate charging rates approaching the amp-hour rating

but special chargers that cut back the charging current when the battery becomes warm are required.

Lead-acid cells have a nominal voltage of 2 volts and may be charged at a high rate, typically above the amp-hour rate. The charger may be a simple current-limited voltage source supplying 2.33 volts per cell at room temperature with a -4 mv/ °C temperature coefficient.