BATTERY CHARACTERISTICS

The objective of this experiment is to determine the voltage/current characteristics of carbon-zinc and nickel-iron batteries.

Laboratory Equipment:

This lab will make use of:

1) 6 V, 5500 mAh carbon-zinc lantern battery
2) 6 V, 200 Ah, wet-cell nickel-iron battery (Eagle-Picher NIF-200-5)
3) dc milliamp meter
4) dc volt meter
5) 0-100 Ω resistance box
6) 0.2 Ω power resistor

Procedure – PART 1

1) Construct a circuit to measure the 6 V lantern battery's voltage/current characteristics. Use the circuit from the prelab as a guide.

2) Starting at an open circuit and working to large r loads (smaller resistances), record Resistance, Voltage, and Current. Record a range of current values from 0 A to approximately the max discharge rate if possible. Do not overload the resistance boxes (10 W)! Do not let the battery voltage drop to below 3.6 V (0.9 V/cell)! Record enough data in order to make an accurate graph. Work quickly – if you leave the load attached longer than needed for each measurement, the battery’s state of charge will drop and your results may not be consistent. After recording the highest current measurement, immediately measure and record the open circuit voltage.

3) Measure the discharge characteristic of the Ni-Fe battery. Connect the Ni-Fe battery to the 0.2 Ω resistance load through one of the 30 A breakers on the instrument connection panel. Connect the blue HP digital voltmeter directly to the battery. Use the TekMeter in the meter mode and the current probe to measure the current. Be sure to zero the current probe.

4) Record the initial voltage. Turn the breaker on. Measure the voltage, current, and time for 1/2 hour as the battery discharges. Take measurements quickly at first, at least several times a minute (the voltage will drop quickly). Once the rate of voltage drop has slowed, you can record data once a minute. Caution: the load bank will become HOT!

5) Turn the breaker off. Continue recording the voltage and time for 10 minutes. Take measurements quickly at first.

6) Now that it’s had a chance to recover, measure and record the open circuit voltage of the 6 V lantern battery used in part 2.

7) Clean up your lab station. Place any bad leads in the “Bad Lead” box at the front of the lab. Report any instrumentation or equipment problems to your lab instructor so it can be fixed prior to the next lab.
Report Questions – PART 1

1) Make a sketch of the internal place and electrolyte of the Zn-C battery. Provide the plate reactions and the overall cell reaction.

2) Plot the Zn-C battery terminal voltage versus load current.

3) Calculate the internal resistance of the Zn-C battery.

4) Comment on the 3 measured values of the open circuit voltage of the Zn-C battery. To what do you attribute the difference? Explain.

5) Make a sketch of the internal place and electrolyte of the Ni-Fe battery. Provide the plate reactions and the overall cell reaction.

6) Plot the voltage of the Ni-Fe battery versus time as it discharges. Plot the voltage of the Ni-Fe battery versus time after the load is removed.

7) Calculate the internal resistance of the Ni-Fe battery at two points. For the first point, use the initial open circuit voltage and the voltage-current value for the first loading point. For the second point use the final current in Part 4 and the first voltage measured in Part 5 (immediately after turning the breaker off).

8) How much energy was removed from the Ni-Fe battery? Compare this to the rated capacity of 200 Ah. Comment on the voltage at the end of the discharge cycle and after 10 minutes. Is this what you expected?

As a minimum, in the conclusions of the report, point out your main findings, explain any deviations from expected behaviors, and make recommendations as to applications for each of these types of cells.