# CHAPTER 2

## SOME WAYS TO PRODUCE AND USE ELECTRICITY

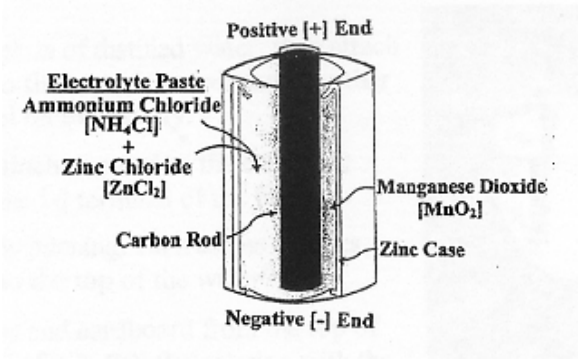
### DRY CELL "BATTERIES"

A ***dry cell*** is a tiny chemical factory that produces an electric current via the use of chemical elements, (such as **carbon** [C] and **zinc** [Zn] ), and compounds, (such as **zinc chloride** [$ZnCl_2$] and **manganese dioxide** [$MnO_2$] ). And, despite its name, *dry* cells are *moist* rather than dry. The *chemical reactions* that take place inside the battery when it is in use work best in a moist environment.

If you were to tear apart the *lantern battery* used for the *Electrolysis of Brine* on page 8, you would find that it contains 4 individual *dry cells* wired together to produce 6 volts. Each dry cell, therefore, produces 1.5 volts, which is the voltage produced by single batteries labeled AAA, AA, C and D. All of them use ***chemical substances*** in *paste-like* form that react when a device, such as a portable CD player or radio, is turned on, producing an ***electric current*** that lasts until one or more of the chemicals is used up. The type of current they produce is called *direct current* [DC] because it flows in just one direction. A lantern and some dry cell batteries:


### THE COMPOSITION OF DRY CELL BATTERIES

An ordinary dry cell has these parts:




The word ***electrolyte*** means the moist paste can conduct electricity. The **positive** [+] terminal [*end*] of the battery is in contact with the carbon rod. The rod is immersed in a paste made of the chemicals **ammonium chloride** [$NH_4Cl$], **zinc chloride** [$ZnCl_2$] and **manganese dioxide** [$MnO_2$].
A *zinc* container surrounds the rod and paste. The bottom of it is the **negative** [-] terminal.

## OHM'S LAW

An electric circuit is the path traveled by an electric current. More than 100 years ago, a German Physicist, Georg Ohm, determined the *mathematical* relationship between an electric ***current*** [***amperage***], ***electromotive force*** [***volts***] and ***resistance*** [***ohms***], which is known as **Ohm's Law**. The law is expressed as a *mathematical equation* this way:

**OHM'S LAW**

**Volts = Amperage x Resistance**

***E*** **=** ***I*** **x** ***R***

Keep in mind that, in a mathematical formula such as the one above, the letters stand for numbers. So, the formula is no more complicated than saying 6 = 2 x 3. In fact, it is possible for a 6 ***volt*** circuit [ ***E*** ] with a ***resistance*** of 3 ohms [ ***R*** ] to have 2 ***amps*** [ ***I*** ] of electricity moving through it. If you want to find the amount of ***current*** being used in an electrical device that has a ***resistance*** of 3 ohms and is hooked up to a 6 ***volt*** battery, you can use Ohm's Law this way:

| | | | | |
|---|---|---|---|---|
| | ***E*** | = | ***I*** | **x** ***R*** |
| If | 6 | = | ***I*** | x 3 |
| Then | 6 | = | 2 | x 3 |

So, ***I*** = 2 amps, ans.

Remember, another name for *volts* [***E***] is *electromotive* ***force***. It's this ***force*** or *pressure* that ***pushes*** an electric current through wires. The ***amount*** *of electric current* being pushed through a circuit is the *amperage* [ ***I*** ]. Lastly, since different-sized wires, and any attached devices, such as bulbs and toasters, offer different resistances, their ***resistances*** must be taken into account. The total resistance may be calculated using Ohm's Law, if you know the voltage and the amperage. In fact, any *one* of the three "variables," voltage, amperage or resistance, may be found if *any two of them are known*.

Look at the above equation. Basically, you have a product [6] and 2 factors [2 and 3]. If you divide a product by one factor, you get the other one. If the *resistance* [R] is the *unknown* factor, dividing the product 6 by the factor 2 gives you the other factor, 3. Many important formulas in science and mathematics are based upon the ***Factor-Factor-Product*** relationship. Note these:

**Einstein's Formula**

Energy = Mass x The Speed of Light Squared

E = $m$ x $c^2$

**Newton's Second aw of Motion**

Force = Mass x Acceleration

F = $m$ x $a$

**Distance Formula**

Distance = Rate of Speed x Time

D = $r$ x $t$

**Area of a Rectangle Formula**

Area = Length x Width

A = $l$ x $w$