On a Scale of 0 to 1, TEN is not "10"

Introduction:

This is a laboratory experience that attempts to explain to students how some computers store information. At the middle school level, students will use the concept of magnetism to deliver "coded" messages to each other; at the high school level, students will do the same thing, but with the option of learning binary.

Potential Science Content Covered:

<u>Grades 5-12 Appropriate:</u>
Magnetism, Applications of Magnetism

<u>Grades 10-12 Appropriate:</u>
Counting by using different base numbers, Binary, Computer Storage: Hard Disks, CD's/DVD's

Potential Wisconsin State Science Standards Covered:

Grade 8: C.8.1, G.8.2, G.8.3

Grade 12: A.12.3, G.12.4

Lesson Plan:
(This Basic Plan is suited for any classroom, grades 5-12)

Engaging Phase:

To grab the students' attention, there are a couple of demonstrations that can be done that any grade level would find stimulating:

A.) Drop a magnet (Neodymium) through a one to four foot piece of copper tubing and compare its drop time to the drop time of a non-magnetic piece of metal of the same mass through the copper tubing.

B.) Use an overhead projector and a "transparency" to pour iron filings over a bar magnet so that students can "see" the magnetic field created. (The transparency is placed between the bar magnet and the filings for easy cleanup.)

In addition, students in grades 8-12 might find the following activity stimulating:

1.) Arrange students in pairs or groups and have them develop a step-by-step procedure of how to "count" numbers. (This task is usually one that the students find mundane and senseless, but it actually stimulates great discussion and debate among the students and is much harder than they think).
2.) After the students have finished their procedure, have them use their procedure to "count" using a different base number….like base 5.

Exploration Phase:

Students will now perform the Activity:

1.) Put students into groups or pairs (pairs work best); give each group a 4” X 4” metal plate with 40 magnets and a magnetic stir bar marked and labeled on one end with some tape. (Magnets can be purchased from: www.kjmagnetics.com.)
2.) Students will use the enclosed ASCII table to “code” a 5 letter word with the 40 magnets given.
3.) Each letter will require 8 magnets or “bits” of information. Each bit will either attract (a “0”) the unmarked side of the magnetic stir bars or repel (a “1”) the unmarked side of the magnetic stir bars. Be sure that the students always hold the MARKED side of the magnetic stir bar.
4.) Students will now create their coded word. 8 “bits” of information make a “byte”—so each letter requires a “byte” of information. When the task is complete, have the student groups exchange words and “decode” them. This activity goes faster if the students can convert each byte of information into a decimal number, then look up the decimal number on the ASCII table. (Not required to complete the activity, though)

Concept Development (Explain Phase):

Science and Technology are closely linked in our society, but often times we have trouble relating the two to “real” Science in the classroom. Students should be allowed to draw their own conclusions as to why magnetic properties were used to create the first computers. A further discussion of CD/DVD’s can be brought up as an extension to the discussion. In CD/DVD’s light is used to detect the presence of “pits” etched into the surface of the disk—the pits, or lack thereof, account for the ‘zeroes and ones’.

NOTES/ OBSERVATIONS: