



Drexel-SDP GK-12 ACTIVITY

Activity

Subject Area(s): Computers, Communication, Computation, Conversion, Analysis

Associated Unit: *Nanotechnology and Electricity*

Associated Lesson: *Powered by Fruit, Battery Charge, Ohm's, Moore's*

Activity Title: *Binary Code: Magic of "1" and "0"*

Grade Level: (6-8)

Time Required: 60 minutes

Group Size: Classroom

Summary: *Students develop an understanding of the binary code used in computers by converting normal, decimal-type numbers into binary code and its converse.*

Engineering Connection: *It is important that the students realize why binary is used in today's technologies. As page two of the handouts suggest, binary acts as a means for gates to open or close, each combination of gates telling the computer to do something different. This would be extremely difficult in the decimal system. Since there is only ON and OFF, there are only two combinations at each bit. For example, the 1's and 0's open up sets of*

Keywords: Computers, Communication, Computation, Conversion, Analysis

Educational Standards: [PA] 2.1.8AFG, 2.2.8A, 2.7.8A, 3.1.7AC, 3.6.7B, 3.7.7C

Learning Objectives: After this lesson, students should be able to decipher simple 8-bit binary codes into ordinary numbers.

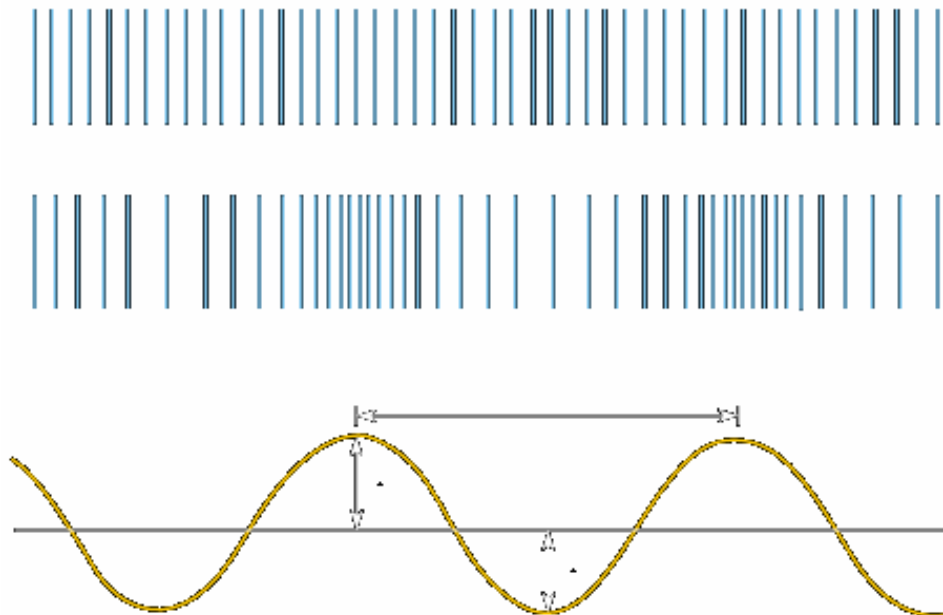
Materials List: Calculator, Binary Worksheet

Introduction/Motivation:

128, 64, 32, 16, 8, 4, 1...these are the possible on/off states at each bit. Number 3 below shows [1 1 1 0 1 0 0 0] which is [128+64+32+8=232]. The students



This figure below shows a sound wave on the bottom, a set of compressed lines in air w/o sound (on top) and one with sound (in the middle). You can use sound (or mp3) is used to compress a sound wave into small segments, which then can be coded into binary for use in an iPod or the such. Same goes for video games.



Methods and Procedure:

1. Most is explained above, however it is necessary to spend some time going over how many digits there are in decimal for each allowable slot (10 of course), and then how simplified binary helps computers perform their functions.

2. What I found useful was having the kids write the numbers for ON states above the blocks and those in the OFF states below the blocks. This helps them add up only the numbers they need to in order to get the correct answer.

Extended Activities: If there is access to a computer and some of the class is done, a cool website is <http://nickciske.com/tools/binary.php>, which can take any keystroke and convert it into binary. Things like "Hello, my name is Stephen." are converted into

```
0100100001100101011011000110110001101111001011000010000001101101011110
0100100000011011100110000101101101011001010010000001101001011100110010
00000101001101110100011001010111000001101000011001010110111000101110.
```

Assessment: The last page of the binary magic worksheet possesses three questions to evaluate the students' understanding of binary code deciphering.

Attachments: **Binary Worksheet**

References: <http://www.kidsdomain.com/brain/computer/lesson.html>

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Computers: Inside & Out - Bits & Bytes Bytes Worksheet

Each rectangle below represents one byte made up of 8 bits (smaller rectangles). Label the byte by assigning **1** to each **on** bit, and **0** to each **off** bit. **On** bits are white and **off** bits are black.



1. _____ 2. _____

Number: _____

Number: _____



3. _____ 4. _____

Number: _____

Number: _____



5. _____ 6. _____

Number: _____

Number: _____



7. _____ 8. _____

Number: _____

Number: _____



9. _____ 10. _____

Number: _____

Number: _____



11. _____ 12. _____

Number: _____

Number: _____

Below is an image of the planets visited by the spacecraft Jupiter (front to back Neptune, Uranus, Saturn and Jupiter). Underneath the image is the actual data in binary code sent from the spacecraft back to earth.



```
10011010110111110001100111101101
01010010111010100100100000001100
00011001111001100010111010100111
11100110001011101000110001011101
00100110001010011000101110111011
00110001011101101000110101000110
00010111010010010111010100100100
01001011101010010010000011010100
11010100011011000101110111000101
11001100010111010001111111001100
00100110001010011000101110111011
00110001011101101000110101000110
```

betterNano

Give the binary form of the following numbers:

1. Your age: _____

2. The combined age of everyone at your table: _____

3. This year: _____
