



Try This at Home Science: Binary Code Bracelets

Activity Overview:

Use binary code to encode your name into beads that you can wear as jewelry!

Materials:

- Binary Capital Letters Guide (attached)
- Blank sheet of paper
- Writing Utensil
- Beads (2 different colors)
- Pipe Cleaners or String

Try this!

1. Open the Binary Capital Letters Guide.
2. Designate one bead color to represent 0 and the other bead color to represent 1.
3. Write down the initial for your first and last name on the blank sheet of paper.
4. Using the Worksheet, write the set of 8 digits that match each letter of your first and last initials. (Hint: When you are finished, you should have a total of 16 numbers)
5. Lay out your beads to match the binary translation for your initials.
6. Add the pattern of beads to your pipe cleaner or string.
7. Twist or tie off the end of your bracelet, and enjoy!

What's happening?

Computer programmers use a special language to program computers and robots. This language of 0's and 1's is called binary code; binary, meaning "two numbers". Coding is a step by step guide for a computer to accomplish a task.

Binary coding uses millions of patterns of 0's and 1's to signal off and on switches for electrical signals inside the computer, allowing the computer to perform different functions.

In this code, each letter is represented by a set of eight digits. Each digit is called a bit. Each set of eight digits is called a byte. Your bracelet contains 16 bits, or 2 bytes of data. You may have heard of bytes before, as in gigabytes or megabytes. For example, a standard cell phone can contain 288,000,000,000

Letter	Binary	Letter	Binary
A	0100 1000	N	1101 1000
B	0100 0101	O	1101 0100
C	0100 0011	P	1101 0011
D	0100 0110	Q	1101 0110
E	0100 0111	R	1101 0101
F	0100 0101	S	1101 0011
G	0100 0111	T	1101 0100
H	0100 1000	U	1101 0100
I	0100 0011	V	1101 0100
J	0100 0101	W	1101 0100
K	0100 0101	X	1101 0100
L	0100 0101	Y	1101 0100
M	0100 0101	Z	1101 0100

Depiction of ASCII Encoder Card

bits or 36,000,000,000 bytes used for storage of photos, videos, and apps. Since computers and smart phones don't understand human language, it isn't necessary for them to decode written messages written in alphabetical characters. Instead, they are able to encode immense amounts of data in a series of just two numbers, 0 and 1.

How does this apply to real life?

If you own a cell phone, you send and receive immense amounts of bytes every day. To understand the amount of data that we use on cell phones every day, we'll need to get familiar with the units used to describe amounts of data.

Abbreviation	Unit	Value	Size (in bytes)
b	bit	0 or 1	1/8 of a byte
B	bytes	8 bits	1 byte
KB	kilobytes	1,000 bytes	1,000 bytes
MB	megabyte	1,000 ² bytes	1,000,000 bytes
GB	gigabyte	1,000 ³ bytes	1,000,000,000 bytes
TB	terabyte	1,000 ⁴ bytes	1,000,000,000,000 bytes
PB	petabyte	1,000 ⁵ bytes	1,000,000,000,000,000 bytes
EB	exabyte	1,000 ⁶ bytes	1,000,000,000,000,000,000 bytes
ZB	zettabyte	1,000 ⁷ bytes	1,000,000,000,000,000,000,000 bytes
YB	yottabyte	1,000 ⁸ bytes	1,000,000,000,000,000,000,000,000 bytes

Modern day computers are a marvel of technological innovation and advancement. You carry a tiny, powerful computer in your pocket every day! Today's smartphones can hold up to 256 gigabytes of data. However, cell phones aren't the only computer you may be familiar with. It's estimated that 4 terabytes of data are produced a connected car. It's estimated that by the end of 2020, 28 petabytes of data will be generated from wearable devices like smartwatches. By 2025, it's estimated that 463 exabytes of data will be created every day!

Now try...

- Giving your friend the worksheet and see if they can figure out which letters you used.
- Writing a word in binary. See if your family or friends can decode your message!
- Using candy to create a binary code. Which candy combinations are best for representing 0's and 1s?

BINARY ALPHABET

A	01000001	N	01001110
B	01000010	O	01001111
C	01000011	P	01010000
D	01000100	Q	01010001
E	01000101	R	01010010
F	01000110	S	01010011
G	01000111	T	01010100
H	01001000	U	01010101
I	01001001	V	01010110
J	01001010	W	01010111
K	01001011	X	01011000
L	01001100	Y	01011001
M	01001101	Z	01011010

First Initial: _ _ _ _ _

Last Initial: _ _ _ _ _