

## U1/Ch1/L8b: Encoding Using Hexidecimal (15pts.)

**Purpose:** Students will learn how to encode using a hexadecimal notation for larger groupings of binary digits.

**Vocabulary:** Hexadecimal

**Explanation:** Hexadecimal is used to represent large numbers with fewer digits. In this system there are 16 symbols or possible digit values from 0 to 9, followed by six alphabetic characters -- A, B, C, D, E and F (view Hex Chart below). Although it can be used with any large binary number system, it is seen most representing colors.

Video: [Understanding Hexadecimal](#)

### Hexadecimal Chart:

NUMBER	BINARY	HEX
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

**Code.org - Return to Color Pixelation Widget #7 (U1Ch1L8)** and just like you did above, recreate Red/Green/Blue. Here is the encoding scheme:

**Image File Format**

Width: 1 byte  
Height: 1 byte  
Bits per Pixel: 1 byte  
n bits of pixel data  
n = Width \* Height \* Bits per Pixel

Image Width: 4  
Image Height: 4  
Bits Per Pixel: 12

Binary  Hexadecimal

0000 0100  
0000 0100  
0000 1100  
111100000000 000011110000 000000001111

Now, select Hexadecimal.

**Image File Format**

Width: 1 byte
Height: 1 byte
Bits per Pixel: 1 byte
n bits of pixel data n = Width * Height * Bits per Pixel

Image Width: 4  
Image Height: 4  
Bits Per Pixel: 12

Binary  Hexadecimal

04  
04  
0C  
F00 0F0 00F

View the coding scheme on the image and then view the Hexidecimal Chart above and notice how the conversion is made from Binary to Hex...and the colors remain the same.

On the Hex Chart, "F" represents darker shades and "0" represents lighter shades. So, "F00" (in an RGB format) shows red 'On' and Green and Blue are 'Off'.

What if I want a less vibrant shade of Red...remove 'F' and insert '7'. Notice the change.

**Image File Format**

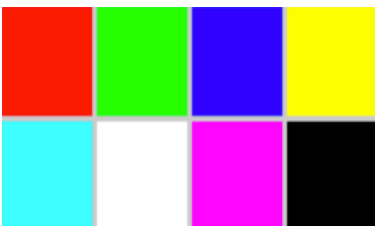
Width: 1 byte
Height: 1 byte
Bits per Pixel: 1 byte
n bits of pixel data n = Width * Height * Bits per Pixel

Image Width: 4  
Image Height: 4  
Bits Per Pixel: 12

Binary  Hexadecimal

04  
04  
0C  
700 0F0 00F

**Activity #1:** Recreate this image that you previously made, but you have to use a Hexadecimal encoding scheme - using 12 bits per pixel. (Use the Color Pixelation Widget #7 (U1Ch1L8). (5pts.)



Professionals use a 24 bit encoding scheme instead of the 12 bits you have been using here. The numbers for each color are doubled up. This means there are 8bits for Red, 8bits for Green and 8bits for Blue. This doubles the variety of colors that you can be used.

**Activity #2:** Now, create Red/Green/Blue using 24 bits. (5pts.)

**Image File Format**


Width: 1 byte
Height: 1 byte
Bits per Pixel: 1 byte
n bits of pixel data n = Width * Height * Bits per Pixel

Image Width

Image Height

Bits Per Pixel

Binary  Hexadecimal



```

04
04
18
FF0000| 00FF00 0000FF
```

**Activity #3:** Take a look at this [Hex Coding Chart!](#)

Fill in the rest of this 4x4 grid by adding in colors of your choice from the Hexadecimal Coding Chart. (5pts.)



```

04
04
18
FF0000 00FF00 0000FF 29006B
FF8429 E0E0E0 FFE7C6 FFFFFFFF
D6C610 CE007B 31B5D6 218429
000000 840000 08215A FFFF10
```

**End Of Unit 1:**

**Review Video Encoding Data For Computers:** [How Computers Work: Binary & Data.](#)