

## Three Circles of Pigments

*Learn about color subtraction with Cyan, Yellow and Magenta*

### **Introduction:**

By overlapping the three primary colors of pigments, one can see how all other colors are made.

### **Materials:**

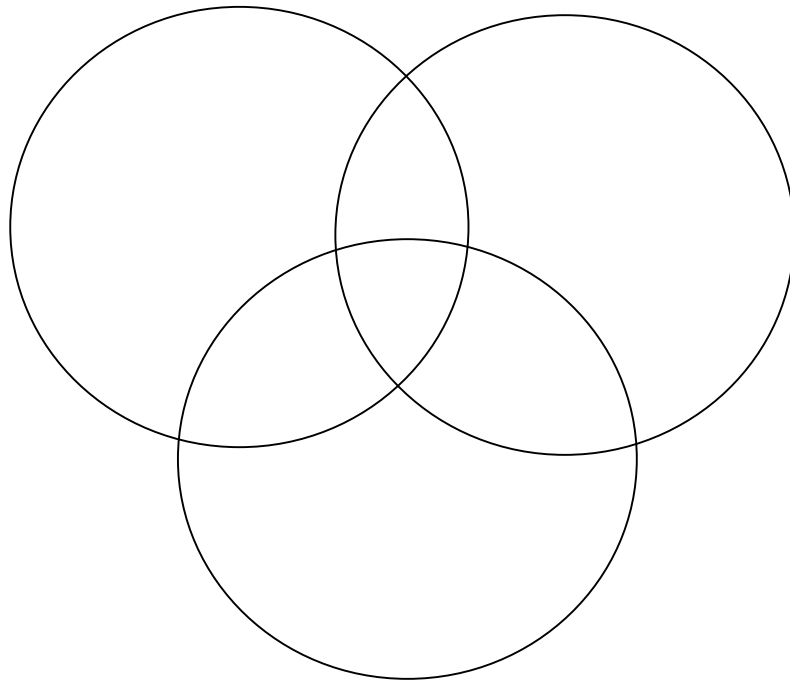
1 – Cyan water color marker pen (Mr. Sketch brands seems to work best)

1 – Yellow water color marker pen (Mr. Sketch brands seems to work best)

1 – Magenta water color marker pen (Mr. Sketch brands seems to work best)

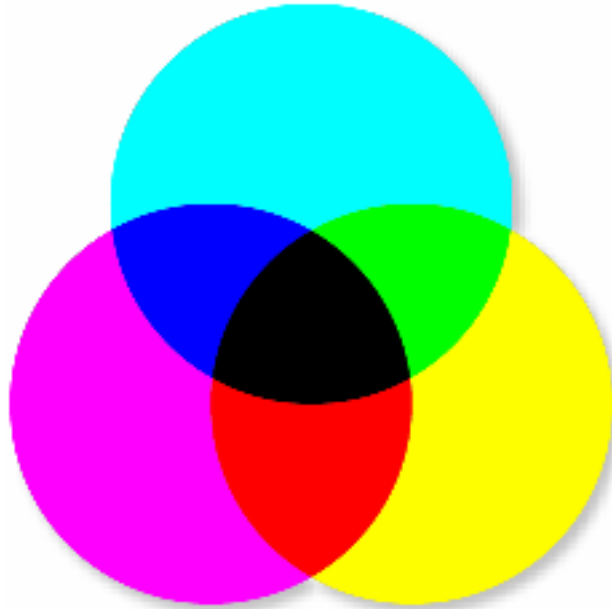
To do and notice:

Fill in the circles below with the colored pens. Use one color for each circle. It is best for the pens if you fill the yellow circle in first.



### What's going on?

Is this what you saw? The circles are Cyan, Yellow and Magenta. The intersections of two colors are Green, Red and Blue. The intersection of all three colors is Black.



These seven colors can be explained by the subtraction of colors of light. White light is the combination of all colors, but since the human eye only sees Red, Green and Blue light, we only need to consider Red, Green and Blue light.

White = W  
Red = R  
Green = G  
Blue = B  
Cyan = C  
Yellow = Y  
Magenta = M

So we can say White light is:

$$W = R + B + G$$

We see Cyan because Cyan pigment absorbs Red light from White light and allows Blue and Green light to be reflected to our eyes. So we can say Cyan is:

$$C = G + B \quad \text{or} \quad C = -R$$

We see Yellow because Yellow pigment absorbs Blue light from White light and allows Red and Green light to be reflected to our eyes. So we can say Yellow is:

$$Y = R + G \quad \text{or} \quad Y = -B$$

We see Magenta because Magenta pigment absorbs Green light from White light and allows Red and Blue light to be reflected to our eyes. So we can say Magenta is:

$$M = R + B \text{ or } M = -G$$

The intersection of the Cyan and Yellow pigments is where both Red and Blue light is absorbed from white light and all that is left is Green light to be reflected. So we can say:

$$(R + B + G) - R - B = G$$

The intersection of Yellow and Magenta is:

$$(R + B + G) - B - G = R$$

The intersection of Magenta and Cyan is:

$$(R + B + G) - G - R = B$$

The intersection of all three colors is:

$$(R + B + G) - R - B - G = 0$$

No light reflected. This is black.