The 'algebra' of color[λ]

Key:

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

White = W (or **R + G + B**) Black = Blk

LIGHT: (additive properties)

R + G + B **= White (W)**
R + B = Magenta (M) same as: M = White (R + B + **G**) – **G**
G + B = Cyan (C) C = White (B + G + **R**) – **R**
R + G = Yellow (Y) Y = White (G + R + **B**) – **B**

¶ So what would Yellow plus (and) Cyan look like?

Yellow (G + R) + Cyan (G + B) = G + R + G + B
= G + {**R + G + B**}
= G + White = **a green-ish White**

§ Give these a try…

a) Yellow plus Magenta

b) Magenta plus Cyan

c) Yellow plus Cyan plus Magenta

PIGMENT: (subtractive properties)

Red = White Illuminating light **minus** Green and Blue (actually all colors EXCEPT RED!)
Green = White Illuminating light **minus** Red and Blue (all colors EXCEPT GREEN)
Blue = White Illuminating light **minus** Red and Green (all colors EXCEPT BLUE)

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NOTE: The **illuminating light** is usually white, but can be a different color (RED, BLUE, or GREEN, etc…). We have an activity called "What color is this?" using various colored foam rectangles illuminated with a RED light.

What would Red pigment + Green pigment look like illuminated with White light?

Red + Green = ???

Red (remove Greens and Blues) + Green (remove Reds and Blues)
Red (- G - B) + Green (- R - B)

So: Red + Green pigments in white light would be…

Red + Green pigments = White light (- G - B) + White light (- R - B)
= White light - (R + G + B) - B*
= (Illuminating) White light - White - B*
(* cannot take B away if there is no light remaining, can you?)
= No light or Blk (**Black)**

Red + Green = **No light reflected or Black**
(depending on how good the Red and Green pigments are!)

Because pigments are 'subtractive' (that is, they absorb the other colors), when (many) pigments are added/mixed together you usually end up with something that is dark and very **un**colorful.

¶ Questions, comments, and suggestions please email tien@ligo-la.caltech.edu

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