Viewed in Another Light

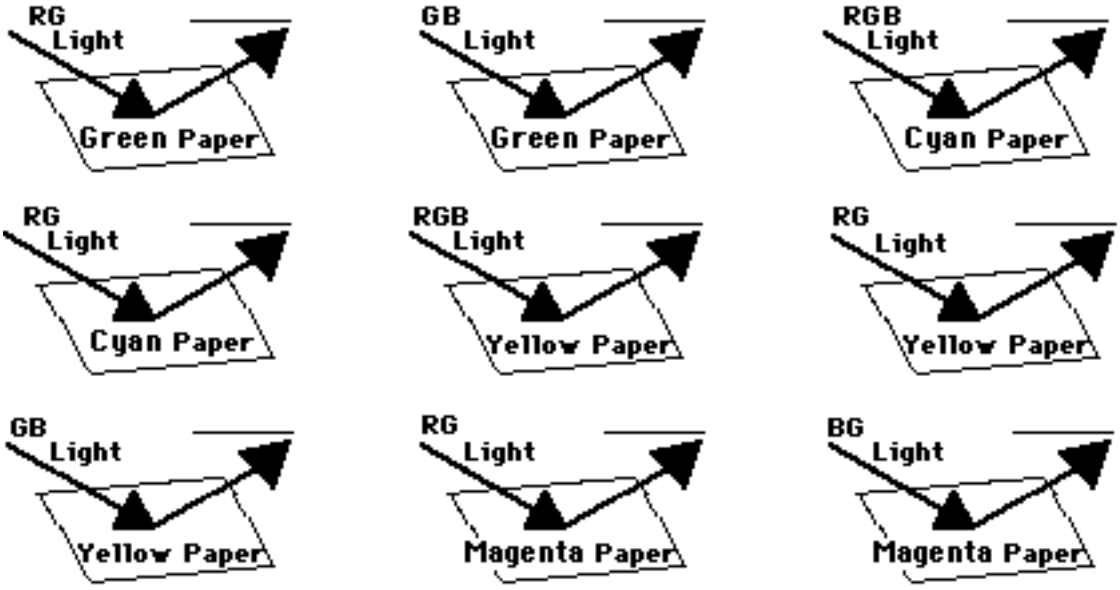
Read from **Lesson 2** of the **Light Waves and Color** chapter at **The Physics Classroom:**

http://www.physicsclassroom.com/Class/light/u12l2d.html
http://www.physicsclassroom.com/Class/light/u12l2e.html

MOP Connection: Light and Color: sublevel 5

We are accustomed to viewing the world in *white* light. In effect, the light incident upon the objects we normally view can be simplified as a mixture of red, green and blue light (RGB). But the rules of color addition and subtraction are not limited by the restriction that white light is incident upon the object being viewed. After all, an object is often times illuminated by light other than white light. For example, theaters and concerts often illuminate the stage with red light or cyan light or any combination of two or more light colors. Determining the color appearance of such objects demands that you first identify what color(s) of incident light will be *subtracted* (i.e., absorbed), and then deduct the appearance of the object from those colors which are reflected.

1. In the diagrams below, several sheets of paper are illuminated by different primary colors of light (**R** for red, **B** for blue, and **G** for green). Indicate what <u>primary</u> colors of light will be reflected. (Note that *red paper* is defined as paper that appears red when viewed under white light.)



2. Different color light sources are shone on different colored sheets of paper. Consider which colors of light would reflect off the paper in order to determine the color that is observed.

	Light color	Paper color	Color observed
a.	Yellow	Green	
b.	Magenta	Blue	
c.	Cyan	Red	
d.	Yellow	Cyan	
e.	Magenta	Green	
f.	Cyan	Magenta	

As is obvious from the previous questions, the color appearance of an object is dependent upon the colors of light that are incident upon it. The color of an object is not actually within the object itself; rather, the color is in the light which shines upon it is ultimately reflected by it to our eyes. A *yellow object* does not always appear yellow. Suppose we were to restrict the discussion to some combination of red, green and blue primary light colors being incident upon the yellow object. As such, the yellow object only appears yellow when it reflects red and green light to our eyes. If either red or green light is NOT incident upon it, then the shirt will not appear yellow. Express your understanding of this by answering the following questions.

3. Name possible colors that a red shirt could appear when viewed under various combinations of red, green and blue spotlights.

4. Name possible colors that a yellow shirt could appear when viewed under various combinations of red, green and blue spotlights.

5. Name possible colors that a magenta shirt could appear when viewed under various combinations of red, green and blue spotlights.

6. Name possible colors that a cyan shirt could appear when viewed under various combinations of red, green and blue spotlights.

Three colored spotlights - red, green and blue - with equal intensities are turned ON and OFF to illuminate a shirt with different colors of light. A shirt that appears _____**(A)**_____ when viewed in white light is placed under the spotlights and appears ____**(B)**_____ This is conclusive evidence that the _____**(C)**_____ spotlights are turned on and the ____**(D)**____ spotlights are turned off.

	A Appearance in white light	**B** Appearance under unknown lights	**C** Spotlights which are ON	**D** Spotlights which are OFF
7.	Red	Red		
8.	Green	Green		
9.	Green	Black		
10.	Yellow	Red		
11.	Yellow	Green		
12.	Cyan	Cyan		
13.	Cyan	Blue		
14.	Magenta	Red		
15.	Magenta	Black		

16. If suddenly you were given a chemical that impaired the nerves in your eyes that detect red light, what color would a U.S. flag appear? Show this in the diagram by labeling the different parts.