A04-135S-Y03

Deluxe Color Mixer Apparatus

Experiment purpose:

Use the three primary colors to mix various colors and observe the different when the light goes through mask.

Experiment item：

Content

Experiment device:

Experiment list					
No.	**Name of device**	**qty**	**No.**	**Name of device**	**qty**
1	RGB experiment box	**1**	2	circle hole mask board-with magnetic	1
3	triangular prism-with magnetic	**1**	4	Disc steady rack-with magnetic	1
5	disc(red、blue、green、yellow、black、white)	3	6	subtractive mixture of colors filter-with magnetic(Cyan、Magenta、yellow)	1
7	mask bar-with magnetic	1	8	color test film	1

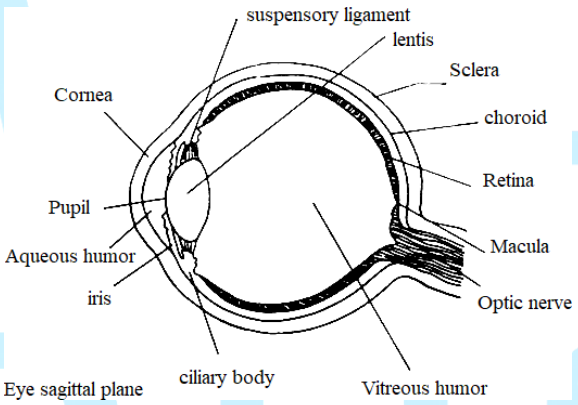
The first Experiment、Visible spectrum

1. **Purpose：**

To understand that the white light is not one color, and it is all of color gathering.

2. **Theory：**

People have a sense with light by eyes as strong, weak, bright, dark and any kinds of colors. People's eyes have three different colors of sensitometer, so the range of the colors are usually presented by three basics of colors. We call this color as three primary colors. Colors that people can observe are related to the light of the object that is absorption and reflection.



Retina:

The retina is in the back of eye including cell that can response light. These special cells that we call photoreceptor. There are two photoreceptors: rod cell and cone cell.

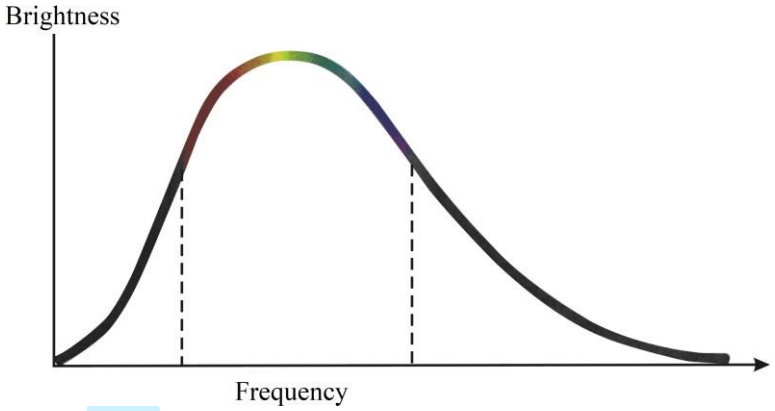
Rod cell is sensitive about dark, bright, shape and movement of the light and only has one light sensitive pigment. Rod cell is not sensitive at color. In a dark room, we use rod cell mostly so we are like color blindness. Around retina, there are much more rod cell than cone cell. There are about 120 million rod cell in people's retina.

Cone cell is not as sensitive to light as rod cell. However, cone cell is sensitive to three colors (green, red, and blue). Cone cell sends messages to brain, and these messages will turn to color concept. Cone cell can only work under bright, so we won't see clearly when we are in dark. Cone cell can recognize color and detect any details. There are about six million cone cells in people's retina.

There is a part in retina without photoreceptor cells. We call blind spot. If any images enter this spot, then we won't see it.

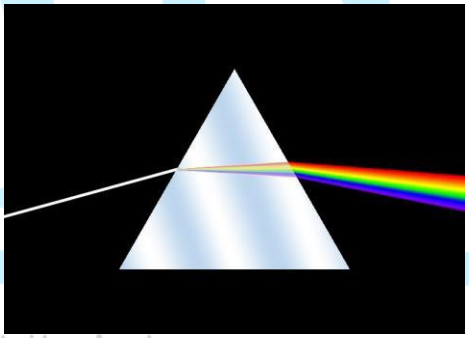
Optical spectrum is when multiple colors pass dispersion system and decomposes light,

according to single light frequency length (or wave length) place a pattern sequentially. The part that people's eyes can see is visible spectrum. In experiment, we use white light to pass through triangular prism and disperse to different light in color. It usually is red, orange, yellow, green, blue, navy, and purple seven colors as below image.



Range of visible spectrum

White light passes through if the medium is changed then it will have refraction, and different frequency (wavelength) has different rate of refraction. When the different light refracts, it will deflect to different angle and will develop dispersion phenomenon as below image.



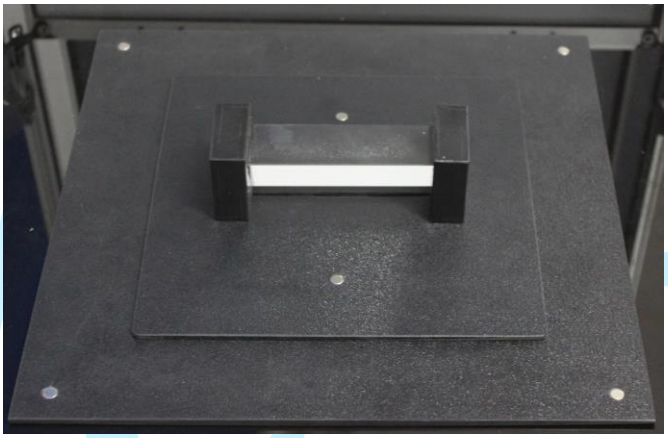
triangular prism dispersion phenomenon

Light of green and yellow is the brightest under the sun. However these various color light can compose of three basics of color lights that is red, green and blue. We call that is primary colors.

3. Experiment device：

visible spectrum experiment list					
No.	**Name of device**	**Qty**	**No.**	**Name of device**	**Qty**
1	Primary colors experiment box	1	2	Circle hole mask with magnetic	1
3	triangular prism with magnetic	**1**			

visible spectrum experiment device image



4. Experiment process

① Sequentially place circle hole mask and triangular prism on experiment box.

② Sequentially we turn on red, blue, green, and white light. We can find dispersion phenomenon when the light goes through triangular prism, and we mark in circle according to the same color light on experiment recording chart.

(When triangular prism inside of box, dispersion phenomenon will project on the screen of the box for observation.)

5. Recording experiment result

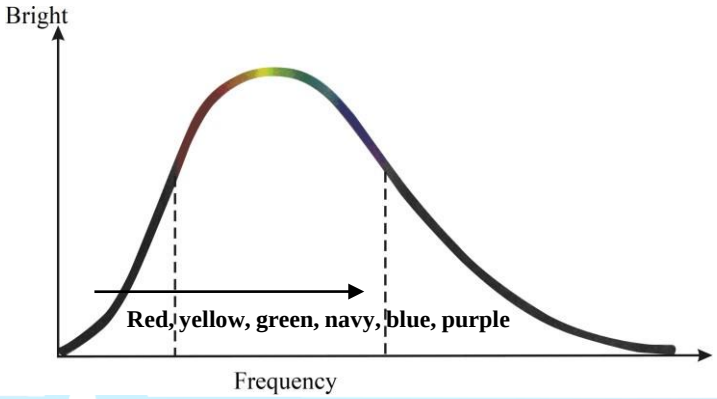
visible spectrum experiment chart(one)						
source\color light	**red**	**orange**	**yellow**	**green**	**blue**	**purple**
Red	○	×	×	×	×	×
Blue	×	×	×	×	○	×
Green	×	×	×	○	×	×
white	○	○	○	○	○	○

triangular prism dispersion phenomenon of white light

6. Question and discussion

1. What does it present after the white light goes through triangular prism? Explain the color of rainbow is fixed in order.

ANS：The white light goes through triangular prism. The color light is in order as below image.



Range of visible spectrum

We can know the red frequency is smaller. The wavelength is the longest, so the angle of the refraction is smallest when going through medium. Other angles of the refraction in different color is orange, yellow, green, blue, navy, and purple sequentially from small to large, so the color of rainbow is fixed sequentially when we see.

2. Try to compare the different of red, blue, green, and white light after going through triangular prism.

ANS： Due to red, blue, and green are all monochromatic lights, so cannot refract via triangular prism. However, white light is including all the color lights so it can present the white light. Therefore, the white light can disperse all different colors.

3. Why is the sky color in blue?

ANS：There are small particles in the sky to scatter high frequency light wave. Beside of this, as like cloud in the sky, the drips have different sizes so they will disperse different color of light. Thereby, it is white color.

4. Why the sunset color is red?

ANS：When sunset, the sunlight goes through atmosphere for a longer distance than midday. This makes blue light be dispersed more. The sunset is red because there is only low frequency light that can be transmitted.

The second experiment、mixed color light

1. Purpose：

2-1 What is white, what is black.

2-2 Color and refraction

2-3 Color and transmission

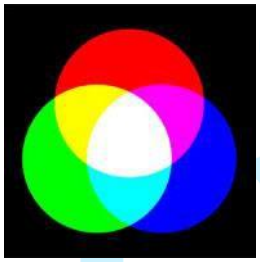
2-4 Mixed color light, additive mixture of colors

2-5 What are complementary colors.

2-6 Pigment mixed, subtractive mixture of colors.

2. Theory：

Three primary colors are red, green and blue. We use additive (A light + B light = C light) so we can almost blend all colors. Thereby, we call additive mixture of three primary colors as below image.



additive mixture of three primary colors

we project three primary colors on white screen and due to the feature of additive we know:

- Red + Green = Yellow
- Red + Blue = Magenta
- Blue + Green = Cyan
- Red + Blue + Green = White

By red, green, and blue additive mixture of three primary colors result in diverse color light, we call RGB model.

When two color light mix and result in white light, we call complementary colors. According to additive mixture of three primary colors chart:

- Yellow + Blue = white light, then yellow and blue is complementary colors.
- Magenta + Green = white color, then magenta and green is complementary colors.
- Cyan + Red = white color, then cyan and red is complementary colors.

From white light subtractive (absorb) one color, and result in color that is a complementary color of being absorbed. For example, projects white light to absorbing blue pigment, and it presents

yellow; oppositely, white light projects to absorbing yellow pigment and it presents blue.

- White – Blue = Yellow, then yellow and blue are complementary colors.
- White – Green = Magenta, then magenta and green are complementary colors.
- White – Red = Cyan, then cyan and red are complementary colors.

3. Experiment device

List of three primary colors experiment device					
No.	**Name of device**	**Qty.**	**No.**	**Name of device**	**Qty.**
1	Three primary colors experiment box.	1	2	circle hole mask-with magnetic	1
4	color board rack-with magnetic	1	5	Color board (red, blue, green, yellow, black, and white)	3

4. Experiment process

①Display circle hole mask-with magnetic in three primary colors experiment box.

② According to additive mixture of experiment recording char (one), we control color light by controlling switch in three primary colors box to make the color overlapping, and record result to prove additive feature.

additive mixture experiment of three primary color

③By fixing color board with color board rack in the experiment box, we control three primary colors and find out yellow light. According to complementary color experiment chart (two), we control three primary experiment to record what color makes white light when overlapping with yellow light. Then, the color is a complementary color with yellow light. Repeating the same process finds Magenta, Cyan and other complementary colors.

Effect of color light reflection

④We change color board and fix in the experiment box. According to complementary record chard (Three), we change color board sequentially and change three primary colors switch to observe changed color and record the result.

Atis Scientific Instruments Co.,Ltd
Address：1F., No.18, Nanming St., South Dist.,
Tainan City 702, Taiwan (R.O.C.)
E-mail:atis@atissi.com.tw
Tel: (886) -6-2925201
Fax: (886)-6- 2611476
Mobile:+886-9-8006-1128
Website: www.atis.com.tw