6. Colours of light

Let us Assess

1. Question

Which is the phenomenon responsible for dispersion of light?

A. Reflection

B. Refraction

C. Tyndal effect

D. Scattering

Answer

Refraction is the correct reason responsible for the dispersion of light. Dispersion of light is defined as the phenomena of splitting up of composite light into its constituent colours.

The refraction is the phenomena in which light is deviated from its original path due to the difference in refractive indexes or we can say difference in densities of the medium through which light is travelling.

Now each part of the composite light deviate differently according to its wavelength. The deviation of light from its original path is called refraction and the refraction of different component of composite light differently, causes dispersion of light.

While there is no role of reflection, tyndal effect and scattering here. So, all other options are wrong.

2. Question

During dispersion, different colors deviate differently. Explain the reason for it.

Answer

Dispersion of light is defined as the phenomena of splitting up of composite light into its constituent colours or it is deviation of different constituent parts of a composite light when the light passes through a prism.

The important point here is that the different colour deviate differently and the reason behind is that, dispersion is based on refraction of the composite light and refraction is a phenomenon based on the incident and refractive angles and refractive indices.

The deviation/refraction is find out from the Snell's law which states that the ratio of the sines of the angles of incidence and refraction of a wave are constant when it passes between two given media.

That is mathematically,

$$\rightarrow \frac{\sin i}{\sin r} = \frac{n_1}{n_2}$$

where n_1 and n_2 are refractive indexes of the medium.

The refractive index of the medium is dependent on wavelength of the light used.

So, the series go on like this,

Wavelength ->	Refractive index ->	Deviation Angle

Hence different colour light have different wavelengths resulting in different deviation angle of components of a single composite light.

Also, violet colour light has minimum wavelength while have maximum deviation this implies that wavelength is inversely proportional to the deviation angle.

3. Question

Green and red colors are allowed to fall on a white cricket ball simultaneously. What will be the color of the ball? Justify your answer.

Answer

The colour of an opaque object is the colour which it reflects when white light is fallen on it. The object absorbs all the different colours and will reflect only its true colour.

So, to find the true colour of the object we use white light because it consists all the colours.

According to this when white light is fallen on a white object it will reflect all the light which show that white object reflects all the colour and don't absorb anything because white light is consisted of all the colour.

So, when red light is allowed to fall on a white object it will reflect all the red light and will appear as a red object because white objects reflect all the colour.

Hence from this we can say that when red and green lights are allowed on a white ball the ball will appear red and green respectively.

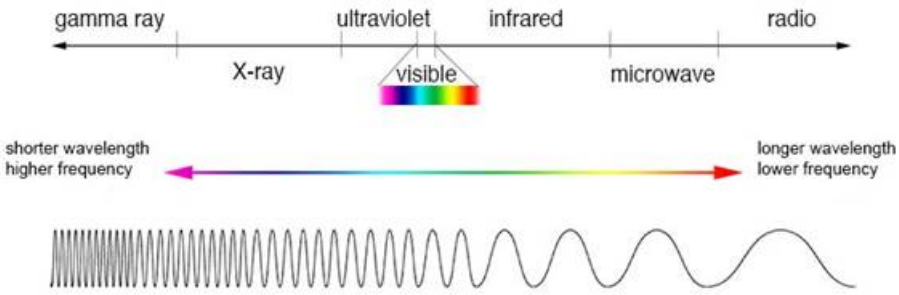
4. Question

What do you mean by electromagnetic spectrum?

Answer

An electromagnetic wave is defined as a wave which has electric as well as magnetic components and which travels at the speed of the light. Hence, the visible light which has both electric and magnetic components falls under the category of electromagnetic wave. In fact there are many type of light/waves/radiation are present which has electric as well as magnetic component like X-rays, microwave, radio waves etc.

The distribution or arrangement of these different types of electromagnetic waves upon the basis of frequency or wavelength is electromagnetic spectrum.



In the figure the electromagnetic spectrum is shown in which on the left side there is highest frequency wave while on the right side there is lowest frequency wave. So, from going left to right the frequency of the electromagnetic waves decreases. While their exact opposite in the case of wavelength.

5. Question

The telescope ‘Chandra’ is placed in the space. What is the advantage of placing it there? Explain with reference to the scattering of light in the atmosphere.

Answer

Scattering of light is the phenomena in which light is irregularly or partially reflected by very small particles into different direction.

In simple words it is like a collision between light particles and very small atmospheric particles {which has size compared to the wavelength of the light}; the collision results in the particular colour of the particles according to their size.

Now, when we want to observe outer space and the celestial bodies present in it, we observe the light coming from them and determine their different properties. But due to atmospheric particles the light coming from those celestial bodies got scattered and destroy all the information. We cannot determine any properties because of atmospheric scattering.

So, to solve this atmospheric scattering problem the satellite Chandra is placed into space which almost neglect all the scattering and will give us useful information. For this main advantage the satellite Chandra is placed into space.

6. Question

If a plant with green leaves and red flowers is kept in light with the following colours, what will be the observed colours of leaves and flowers?

1. Green

2. Yellow

3. Red

4. Blue

Answer

The principal to solve these types of question is that "The objects reflects its true colour and will absorb any other colour light".

1.Green

When green light falls on the green leaves and red flower, green leaves will reflect green light because there true colour is green and will appear as green leaves while red flower will absorb green light because its true colour is red and will appear as a black object.

2.Yellow

This is a tricky question, as yellow colour is mixture of red and green hence we can say that yellow light has both red as well as green light.

So, when a yellow light falls upon a red flower it will absorb the green part and will reflect red light part. And will appear as a red flower.

Also, when yellow light falls upon green leaves it will reflect green part but will absorb red light part. Hence so showing its true colour that is green.

3.Red

When red light falls on the green leaves and red flower, green leaves will absorb red light because there true colour is green and will appear as black leaves while red flower will absorb red light because its true colour is red and will appear as red flowers.

4.Blue

When blue light falls on the green leaves and red flower, green leaves and red flower will both absorb the blue light and will appear as a black object. Because there true colour is red and green while the light is blue.

Extended Activities

1. Question

White light is allowed to fall on the bright side of a compact disc (CD). The reflected light is allowed to fall on a white wall. Observe the colors available in the spectrum and write them down in the science diary.

Answer

The colours observed on the white wall are:

•Violet

•Indigo

•Blue

•Green

•Yellow

•Orange

•Red

That is all the colour which consist white light can be observed because we know that CD is made up of thousands of pits arranged in the form of spiral tracks. When visible light is incident on the pits, each pit diffracts light in all directions, they separate a composite white light into its constituents. Thus, rainbow colours are formed.

Hence the observation of the rainbow colour is due to the diffraction of white light into its components.

2. Question

Observe the colours of light coming out of the CD through filters of different colours and record your observations in your science diary.

Answer

The principal behind this type of phenomena is that the filters only allow certain colour to pass and block the others. For example, the red filter will only allow the red colour to pass through it and will block the other colour. One more example is of yellow filter, in this case the filter will allow yellow as well as red and green colour light because red and green are constituents of yellow colour.

FILTER COLOUR	COLOUR OBSERVED
Violet	Red, Blue
Indigo	Red, Blue
Blue	Blue
Green	Green
Yellow	Yellow, Red, Green
Orange	Orange, Red, Yellow, Green
Red	Red

All the colour observed are same as of filter colour or its constituents.