HUMAN EYE AND COLORFUL WORLD

RAINBOW

A rainbow is a spectacular phenomenon we witness in nature. It is a multi-coloured arc formed by light. When the sunlight enters the water droplet, it undergoes refraction at the surface. When these rays hit the other end of the droplet, they get internally reflected, dispersing into seven colours. Therefore, we can say that the formation of a rainbow is the combination of various phenomena like internal reflection, refraction, and dispersion.

Formation of Rainbow

- Light rays reach the drop near its top level.
- Refraction takes place when the light strikes the water droplet.
- Dispersion of white light into colours of a different wavelength occurs after refraction..
- The order of dispersion of colours is violet, indigo, blue, green, yellow, orange, and red (VIBGYOR).
- Violet is the most deviated colour, and red is the least deviated colour..
- Reaching the opposite side of the drop, each colour is refracted back into the drop due to the complete internal reflection that hits the drop surface.
- Every colour is again refracted into the air.
- The light is bent at different angles.
- This electromagnetic spectrum is composed of different wavelengths of light reflected at various angles.
- When the light is reflected twice on the inside of the droplet before leaving it, a double rainbow is formed. A second arc is seen outside the primary arc. In the double rainbow, the order of its colours is reversed, where the red colour appears on the inner side of the arc.

1. Can we obtain a rainbow using a prism?

Ans Yes we can obtain a rainbow using a prism. When the white light moves through the two faces of the prism, it produces different colours of light that bend at different angles like a rainbow.

2 The rainbow is observed in the direction _____.

Opposite of the Moon

Opposite of the Sun

As the Sun

None of the options

Ans b) Opposite of the Sun

Explanation: The formation of the rainbow takes place in the direction opposite the Sun.

3 In the double rainbow condition, how many times is the light being reflected?

One

Two

Three

Four

Ans b) Two

Explanation: In the double rainbow condition, light is reflected twice.

4 What is the critical angle of a rainbow?

20 degrees

30 degrees

35 degrees

48 degrees

Ans d) 48 degrees

Explanation: The critical angle of a rainbow is 48 degrees.

5 Fill in the blanks: Stars twinkle due to the _____

Atmospheric reflection

Atmospheric scattering

Atmospheric refraction

None of the options

Ans c) Atmospheric refraction

Explanation: Stars appear higher than they actually are and twinkle due to the atmospheric refraction.

6 Choose the least deviated colour.

Violet

Blue

Red

Green

Ans c) Red

Explanation: Red is the least deviated colour in the rainbow spectrum.

7 Which is the most deviated colour?

Violet

Blue

Red

Green

Ans a) Violet

Explanation: Violet is the most deviated colour in the rainbow spectrum.

8 Rainbow occurs due to which phenomena?

Reflection

Dispersion

Refraction

All of the above options

Ans d) All of the above options

Explanation: Reflection, refraction, and dispersion are the phenomena responsible for the formation of the rainbow.

9 State TRUE or FALSE: When the starlight enters the Earth's atmosphere, they bend.

TRUE

FALSE

Ans a) TRUE

Explanation: This happens due to atmospheric refraction.

10 Fill in the blanks: Refractive index of seawater is _____ rainwater.

same as

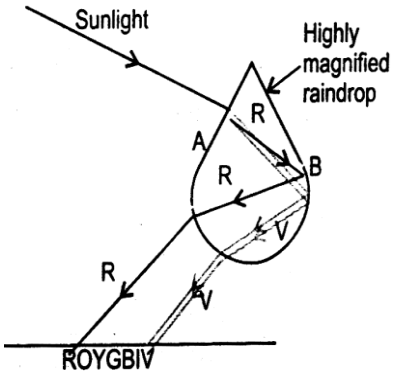
higher than

lower than

none of the options

Ans b) higher than

Explanation: The refractive index of seawater is higher than rainwater. Therefore, the radius of the true rainbow is more than the rainbow in sea spray.



Formation of rainbow

The suspended tiny droplets of water act as innumerable small prisms. When the sunlight is incident on the side A of the tiny droplet of water, it gets refracted as well as dispersed. The dispersed rays on striking the surface B of the tiny water drop suffer total internal reflection, and hence, moves on towards surface A. At the surface A, the ray further suffer refraction and emerge out in the form of band of colours in the form of a circular arc along the horizon. The red color appears on the upper arc of rainbow and violet colour on the innermost arc.

Illustration

What happens to a white light ray when it passes through two prisms kept in inverted position with respect to each other?

Solution

A white light ray, on passing through two prism kept in inverted position with respect to each other, emerges as a white light.