

Board – ICSE

Class – 10

Topic – Spectrum

- Why does the Sun appear red at sunrise?
 - Name the subjective property of light related to its wavelength.

Ans

- The Sun appears red at sunrise because of the scattering of light by the atmospheric particles. During sunrise, the light from the Sun has to travel a longer distance through the atmosphere to reach the observer. During this, most of the shorter wavelengths present in it are scattered away from our line of sight by the molecules of air and other fine particles in the atmosphere. So, the light reaching us directly from the rising Sun consists mainly of longer wavelength red colour due to which the Sun appears red.
- The subjective property of light related to its wavelength is colour.

- What do you understand by the term 'Scattering of light'? Which colour of white light is scattered the least and why?

Ans

Scattering is the process of absorption and re-emission of light energy.

The red colour of the white light is scattered the least because of its longer wavelength while the violet coloured is scattered the most. Scattering is inversely proportional to the fourth power of the wavelength as per Rayleigh scattering.

- Name the high energetic invisible electromagnetic waves which help in the study of the structure of crystals.
 - State an additional use of the waves mentioned in part (i).

Ans

- X-rays are used in the study of structure of crystals.
- X-rays are used in the detection of fractures in bones and teeth.

4. The smoke from a fire looks white. Which of the following statements is true?

1. Molecules of the smoke are bigger than the wavelength of light.
2. Molecules of the smoke are smaller than the wavelength of light.

Ans

1. Molecules of smoke are bigger than the wavelength of light - True.
2. Molecules of smoke are smaller than the wavelength of light - False.

5. (i) Why is the ratio of the velocities of light of wavelengths 4000 \AA^0 and 8000 \AA^0 in vacuum 1:1?

(ii) Which of the above wavelengths has a higher frequency?

Ans

- (i) Both light of given wavelengths are electromagnetic waves. Electromagnetic waves will travel at the same speed in vacuum irrespective of its wavelength.
- (ii) Speed is the product of frequency and wavelength. Since speed is constant, light of lower wavelength 4000 \AA^0 will have higher frequency

6. Electromagnetic radiation is used for photography in fog.

- (i) Identify the radiation.
- (ii) Why is this radiation mentioned by you, ideal for this purpose?

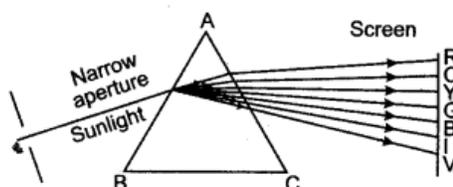
Ans

- (i) Infrared radiation is suitable electromagnetic radiation for photography in fog.
- (ii) It is because these radiations are not much scattered and can penetrate through the fog.

7. Sunlight entering through a narrow aperture falls on a prism. Draw a neat labelled ray diagram to show the formation of spectrum on a screen. Name the colour obtained nearer the base of the prism.

Ans

The labelled ray diagram showing the formation of a spectrum of sunlight on a screen is given below. The colour obtained nearer the base of the prism is violet.



8. What is the wavelength of the wave whose frequency is 10^{12} Hz? Name the electromagnetic waves.

Ans

Frequency of the wave = 10^{12} Hz

Velocity of electromagnetic wave = 3×10^8 m/sec

$$\therefore \text{Wavelength of the wave} = \frac{v}{f} = \frac{3 \times 10^8}{10^{12}} = 3 \times 10^{-4} \text{ m}$$

9. State two properties of infra-red radiations, which differ from visible light.

Ans.

1. Infra-red radiations produce heating effects, but not the visible radiation.
2. Infra-red radiations do not get scattered easily as compared to visible light.

10. Name three properties of ultra-violet radiations which are similar to white light.

Ans.

- (i) Both obey the laws of reflection.
- (ii) Both obey the laws of refraction.
- (iii) Both travel with the speed of 3×10^8 ms⁻¹.

11. Fill in the blank spaces.

- (a) are the waves of highest frequency [Gamma rays / X-rays]
- (b) are used for taking photographs of objects in dark [infra-red rays / ultraviolet rays]
- (c) are electromagnetic waves of wavelength nearly 10^{-8} cm. [cosmic rays/X-rays]

Ans.

- (a) Gamma rays
- (b) Infra-red rays
- (c) X-rays

12. Define the term dispersion of light.

Ans.

The phenomenon due to which white light splits up into seven colours on passing through a prism is called dispersion of light.

13. Explain the cause of dispersion of white light through a prism.

Ans.

White light is made of seven colour bands (VIBGYOR), such that the rays in each band have different wavelengths and different frequencies. When the white light is incident on the refracting face of the prism each coloured ray deviates through a different angle, depending upon its wavelength. The red rays deviate least, whereas the violet rays deviate most. It is this differential deviation of rays, which causes dispersion.

14. The wavelengths for the light of red and blue colours are roughly 7×10^{-7} m and 4×10^{-7} m respectively. Which colour will have greater speed in vacuum? Which colour has greater speed in glass?

Ans.

- (i) In vacuum, both red and blue colours have the same speed.
- (ii) In glass, the speed of red colour is more than blue colour.

15. An electromagnetic wave has a frequency of 500 MHz and a wavelength of 60 cm

- (a) calculate the speed of the wave
- (b) name the medium through which it is travelling

Ans

(a) Frequency = 500 MHz = 500×10^6 Hz

Wavelength = 60 cm = 0.6 m

Velocity of wave = frequency \times wavelength

$$= 500 \times 10^6 \times 0.6 = 3 \times 10^8 \text{ m/s}$$

(b) Electromagnetic wave travel through air.