

PREVIOUS YEAR QUESTIONS

(Chapter wise)

CHAPTER NAME: SPECTRUM

SUMMARY POINTS

Concept	Key Points	Applications/Examples	Formula/Notes
Electromagnetic Spectrum	- UV has shorter wavelengths than microwaves, hence scatters more.	- Infrared used in warfare (signals).	- $\nu = c/\lambda$ (frequency-wavelength relation).
Dispersion & Refraction	- Splitting of light into colors due to wavelength-dependent refractive index. - Violet deviates most; red deviates least.	- Formation of a spectrum in a prism. - Visible range: 400 nm (violet) to 800 nm (red).	- $n = c/v$ (refractive index).
Speed of Light	- All colors travel at same speed in vacuum ($c = 3 \times 10^8$ m/s). - In denser media, red travels faster than blue.	- Blue light refracts more in glass than red.	- Red: Lower frequency, higher wavelength. - Blue: Higher frequency, shorter wavelength.
Scattering & Color Perception	- Scattering $\propto 1/\lambda^4$. - Blue light scatters more than red. - Larger particles scatter all colors equally (white appearance).	- Sky appears blue. - Clouds appear white. - Sun appears red at sunrise/sunset due to longer atmospheric path.	- Rayleigh's Law: $I \propto 1/\lambda^4$.
Gamma Rays	- Shortest wavelength, highest energy.	- Used for crystal structure studies and cancer treatment.	
Infrared Radiation	- Longer wavelength, less scattering. - Can penetrate fog.	- Used in warfare (signals). - Detected by thermopiles.	

		Microwaves - Long wavelength compared to visible light. - Used in communication and radar systems.	
		Ultraviolet Light - Shorter wavelength than visible light. - Used in sterilization and fluorescence.	
		Red Light for Danger Signals - Longest wavelength in visible light, least scattering, remains visible over long distances. - Used in traffic lights and danger signals.	
		Wavelength-Frequency Relation - Wavelength and frequency are inversely proportional. - Shorter wavelength means higher frequency (e.g., violet).	- $\lambda \times \nu = c$.
		Scattering by Particles - Larger particles scatter all wavelengths equally (white appearance). - Smaller particles scatter shorter wavelengths more. - Smoke appears white due to large particles. - Blue sky due to smaller air molecules.	
		Devices - Quartz Prism: Used for ultraviolet light. - Thermopile: Detects infrared radiation. - Quartz prism for UV spectrum. - Thermopile for infrared detection.	

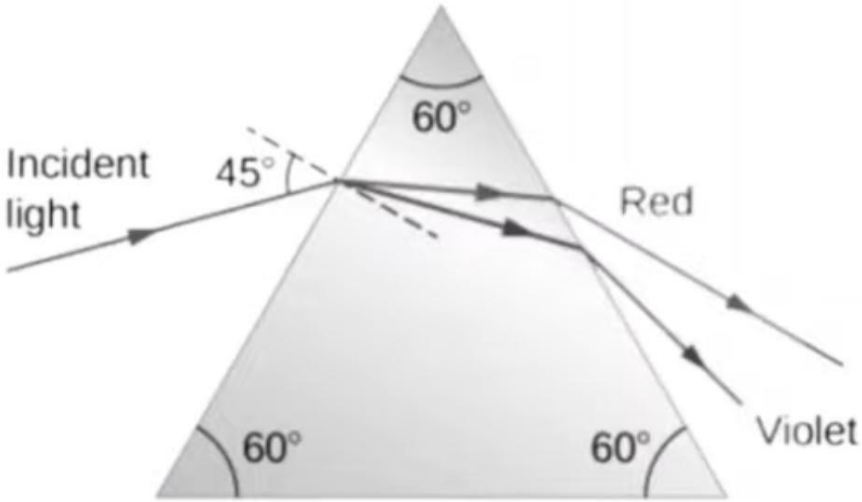
Q.NO.: 1	Assertion (A): Ultraviolet radiations are scattered more as compared to the microwave radiations. Reason (R): Wavelength of ultraviolet radiation is more than the wavelength of microwave radiation. (a) Both A and R are true. (b) A is true but R is false. (c) A is false but R is true. (d) Both A and R are false.	YEAR [2024]
ANS.:	(b) A is true but R is false.	
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Q.NO.: 2	Below is an incomplete table showing the arrangement of electromagnetic spectrum in the increasing order of their wavelength. Complete the table.	YEAR [2024]
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	Gamma rays X rays UV rays Visible rays Infrared A Radio waves (a) Identify the radiation A. (b) Name the radiation used to detect fracture in bones. (c) Name one property common to both A and Radio waves.	
ANS.:	(a) Microwaves. (b) X-rays (c) They both travel at the speed of light in a vacuum.	
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Q.NO.: 3	Infrared radiations are used in warfare. Explain with reason, why.	YEAR [2023]
ANS.:	Infrared radiations are used for signals during war because they are not visible. Also, their wavelength is longer, so they scatter less and are not absorbed much in the medium	
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Q.NO.: 4	A ray of light is incident at 45° on an equilateral prism in the diagram	YEAR [2023]
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	 (i) Name the phenomenon exhibited by the ray of light when it enters and emerges out of the prism. (ii) State the cause of the above phenomenon mentioned by you.	
ANS.:	(i) Dispersion. Refraction also occurs when the light emerges. (ii) The main cause is that different colors have different speeds in different mediums, and they have different wavelengths. When white light passes through a glass prism, its constituent colors travel at different speeds because each color has a different wavelength.	
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Q.NO.: 5	The wave length range of visible light is: (a) 40 nm to 80 nm (b) 4000 nm to 8000 nm (c) 4 nm to 8 nm (d) 400 nm to 800 nm	YEAR [2021]
ANS.:	(d) 400 nm to 800 nm	
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Q.NO.: 6	The colour of white light which is deviated least by a prism is: (a) Green (b) yellow (c) red (d) violet	YEAR [2021]
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ANS.:	(c) red	
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Q.NO.: 7	The wave lengths for the light of red and blue colours are nearly 7.8×10^{-7} m and 4.8×10^{-7} m respectively. (i) Which colour has the greater speed in a vacuum? (ii) Which colour has a greater speed in glass?	YEAR [2020]
ANS.:	(i) The speed is the same for both colors in a vacuum. (ii) Red light has a greater speed in glass.	
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Q.NO.: 8	Give reasons for the following: [3] During the day: (i) Clouds appear white. (ii) Sky appears blue.	YEAR [2020]
ANS.:	(i) Clouds are composed of water molecules and dust particles that are larger than the wavelengths of visible light, which causes them to scatter all colors of white light equally. The mixture of all colors appears white. (ii) Air molecules in the atmosphere scatter blue light, which has a shorter wavelength, much more than the colors on the red end of the spectrum. So, the light reaching our eyes is rich in blue color.	
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Q.NO.: 9	An electromagnetic radiation is used for photography in fog. (i) Identify the radiation. (ii) Why is this radiation mentioned by you, ideal for this purpose?	YEAR [2019]
ANS.:	(i) Infrared radiation (ii) Infrared rays have long wavelengths, are less scattered, and can travel through fog.	
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Q.NO.: 10	Why is the ratio of the velocities of light of wavelengths 4000Å and 8000A in vacuum 1:1? (i) Why is the ratio of the velocities of light of wavelengths 4000 angstroms and 8000 angstroms in a vacuum 1:1? (ii) Which of the above wavelengths has a higher frequency?	YEAR [2018]
ANS.:	(i) Light is an electromagnetic wave, and all electromagnetic waves travel at the same speed in a vacuum, which is 3×10^8 m/s. (ii) The 4000 angstrom wavelength has a higher frequency.	
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Q.NO.: 11	(i) Define scattering. (ii) The smoke from a fire looks white. Which of the following statements is true? I. Molecules of the smoke are bigger than the wavelength of light. II. Molecules of the smoke are smaller than the wavelength of light.	YEAR [2018]
ANS.:	(i) Scattering of light is when light enters the Earth's atmosphere, it is spread in all directions by dust particles, water, and gases. (ii) Statement 1 is true.	
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Q.NO.: 12	(i) Name the radiations which are absorbed by greenhouse gases in the earth's atmosphere. (ii) A radiation X is focused by a particular device on the bulb of a thermometer and mercury in the thermometer shows a rapid increase. Name the radiation X.	YEAR [2017]
ANS.:	(i) Infrared radiation. (ii) Infrared radiation.	
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Q.NO.: 13	A boy uses blue colour of light to find the refractive index of glass. He then repeats the experiment using red colour of light. Will the refractive index be the same or different in the two cases? Give a reason to support your answer.	YEAR [2016]
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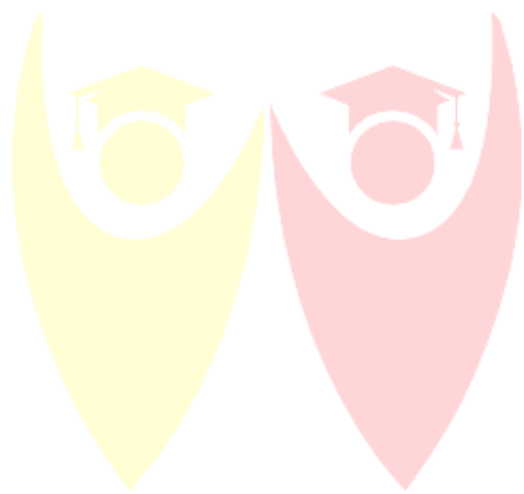
ANS.:	The refractive index will be different. This is because the angle of refraction and speed of light in glass differ for different colors.	
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Q.NO.: 14	(i) Name the high energetic invisible electromagnetic waves which help in the study of the structure of crystals. (ii) State an additional use of the waves mentioned in part (i).	YEAR [2015]
ANS.:	(i) X-rays (ii) X-rays are used to detect bone fractures.	
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Q.NO.: 15	(i) Why does the Sun appear red at sunrise? (ii) Name the subjective property of light related to its wavelength.	YEAR [2015]
ANS.:	(i) At sunrise, light has to travel a long distance in the atmosphere, so the blue light is scattered and lost. The red light, having a longer wavelength, is able to reach our eyes. (ii) Color	
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Q.NO.: 16	(i) Name a prism required for obtaining a spectrum of Ultraviolet light. (ii) Name the radiations which can be detected by a thermopile.	YEAR [2014]
ANS.:	(i) Quartz prism (ii) Infrared radiations	
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Q.NO.: 17	Why is the colour red used as a sign of danger?	YEAR [2014]
ANS.:	The wavelength of red light is the maximum in the visible light spectrum and is scattered the least by air molecules, so it can reach longer distances.	
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Students Point

Let's Result Speak