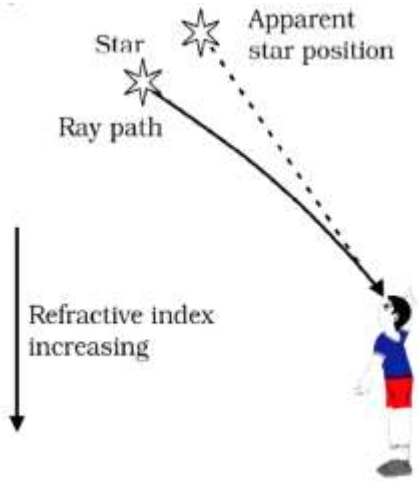
Class 10 Human Eye and Colourful word 2020 Part 02 Topic : Colourful Word

1. Explain, why do the stars twinkle?

Ans. When the rays of light coming from a distant star, pass through layers of air with different densities, they refract and bend towards the normal and apparent position is formed. As the different layers of air are not stationary, but continuously intermix with each other. This results in a shift in the apparent position of the star which produce twinkling effect of the stars.



2. Explain, why the planets do not twinkle?

Ans. Compared to stars, the planets are very close to us. The light coming from the planets on passing through atmosphere does suffer refraction, with the result the apparent position of the planets change. Hence, the planets do not appear to twinkle.

3. Why does the sun appear reddish early in the morning?

Ans. During sunrise, the light rays coming from the Sun have to travel a greater distance in the earth's atmosphere before reaching our eyes. In this journey, the shorter wavelengths of lights are scattered out and only longer wavelengths are able to reach our eyes. Since blue colour has a shorter wavelength and red colour has a longer wavelength, the red colour is able to reach our eyes after the atmospheric scattering of light. Therefore, the Sun appears reddish early in the morning.

4. Why does the sky appear dark, instead of blue, to an astronaut? Ans. The sky will appear blue only, if there is an atmosphere around the spaceship. As there is complete vacuum around the spaceship, therefore, no scattering of light takes place. Thus, the space around the spaceship (sky) appears dark.

1. Name the component of white light that deviates the least and the component that deviates the most while passing through a glass prism. Ans. Red deviates the least and violet deviates the most.

5. Why is the refractive index of atmosphere different at different altitudes?

Ans. The refractive index of atmosphere different at different altitudes because the physical conditions of the refracting medium (air) are not stationary,

6. When a light ray passes obliquely through the atmosphere in an upward direction, how does its path generally change?

Ans. In an upward direction of the atmosphere, the optical density is decreasing continuously, so when light ray passes in such direction it bends away from the normal[denser to rare].

7. What will be the observed colour of the sky on a planet where there is no atmosphere? Why?

Ans. Black. Because there is no scattering of colour of light. 12. A mixture of yellow and orange light is dispersed through a prism. Which colour will deviate least?

Ans. The yellow colour will deviate least.

8. What is an impure spectrum? Ans. A spectrum in which the bands of different colour don't have sharp boundaries, is called impure spectrum.

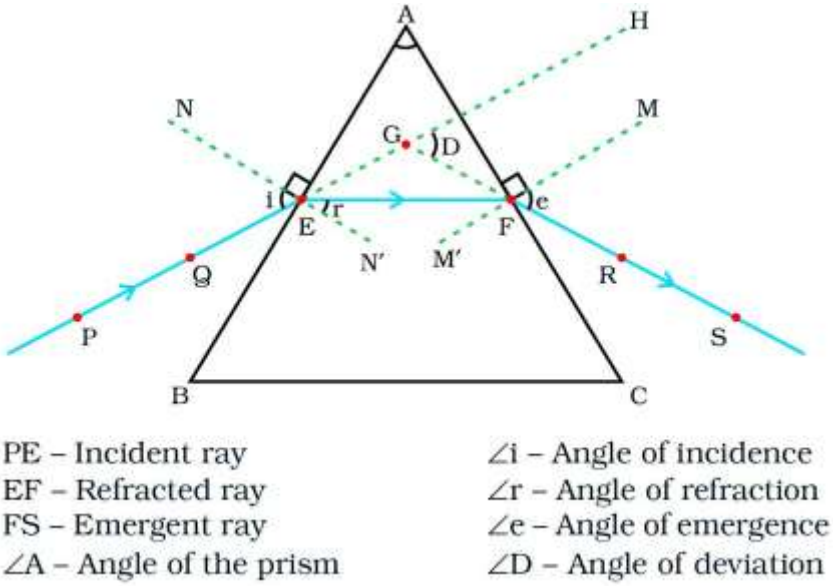
9. How the dispersed colours of white light can be recombined?

Ans. This can be achieved by placing another prism in an inverted position in the path of dispersed light.

10. Define prism.

Ans. Prism is a piece of glass or any other transparent material, bounded by two triangular and three rectangular surfaces. The rectangular surface of the prism is called refracting surface. The line along which two refracting surfaces

of a prism meet is called refracting edge of the prism. The angle between the two refracting surfaces of a prism is called refracting angle of the prism.



11. What is a rainbow?

Ans. An arc of seven colours formed in the sky, just after the rain during the day time, is called rainbow. Rainbow is formed just after the rain during day time due to the dispersion of light and internal reflection by tiny droplets of water suspended in air. A rainbow is always formed in a direction opposite to that of the Sun.

12. What do you understand by the term scattering of light and Tyndall effect?

Ans. The phenomenon due to which an incident ray of light whose wavelength is less than particle on which it is incident, is absorbed by the particle and then radiated out in all directions, is called scattering of light. The phenomenon due to which colloidal solutions scatter blue colour of the white light is called Tyndall effect.

13. What is the cause of dispersion of white light passing through a prism? Which colour of light deviates the - (i) most; (ii) least

Ans. White light is a combination of seven colors having different wavelengths. The colour which have smallest wavelength deviates most and that having largest wavelength deviates least. This is cause of dispersion of white light passing through a prism.

(i) Violet colour deviates most. (ii) Red colour deviates least.

14. Why does the clear sky appear blue? How would the sky appear in the absence of earth's atmosphere?

Ans. Blue colour of light has smaller wavelength, so it scatters more in upper layer of atmosphere, in comparison to the other colours. Thus sky appears blue. The sky will appear dark in the absence of earth's atmosphere due to absence of disperssion.

15. Why do we observe difference in colours of the Sun during sunrise, sunset and noon?

Ans. Red colour of light has largest wavelength, so it scatters least in comparison to the other colours. Due to least scattering of red light, sun appears red during sunrise and sunset. While at the time of noon scattering is least, almost all of the colours reach to the eye of observer and sun appears as of its original colour (white).

16. Explain, why sun appears white when it is over head at Noon?

Ans. When sun is overlead at Noon, the sunlight travels least distance through atmosphere and scattered least and colours of sunlight reach to the eyes, hence sun appears white.

17. Explain, why sky appears dark on the surface of Moon?

Ans. The sky will appear blue only, if there is an atmosphere around the heavenly body. As there is no atmosphere around the Moon, therefore, no scattering of lights takes place, and hence, sky appears dark

18. Why does the smoke coming out of coal fired chimney appear blue on a misty day?

Ans. The tiny particles of carbon and moisture in the smoke scatter blue colour of white light in all possible directions. When this scattered blue light reaches our eyes, the smoke appears blue.

19. Why is red light used as universal danger signal?

Ans. The red light has the longest wavelength amongst the spectral colours and hence is least scattered by the atmosphere. Thus, red light can easily pass through fog or mist, without getting scattered and hence is visible from a long distance. Thus, it is used as universal danger signal

20. (i) When white light is incident on a glass prism surface it splits into constituent colours, Why?

(ii)Write the colours in the order as they appear in the spectrum.

(iii) Draw a ray diagram to show dispersion of white light as it passes through a glass prism.

Ans. (i) The refractive index of the material of prism is different for different colours of light, therefore when white light incident on a glass prism surface, it splits into its constituent colours.

(ii) The colours in the order from bottom to top as they appear in the spectrum are violet, indigo, blue, green, yellow, orange and red respectively

21. The given diagram shows the path of a ray of light through an equilateral prism. Answer the following questions :

(i) Which is the refracted ray?

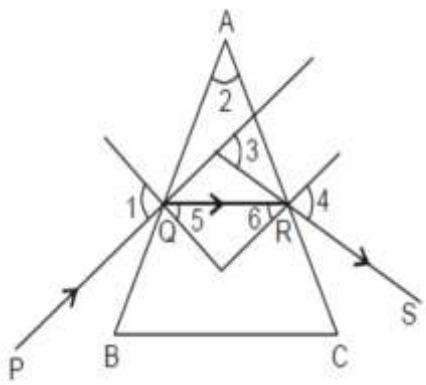
(ii) Which is the emergent ray?

(iii) What name is given to angle 1?

(iv) What name is given to angle 3?

(v) What name is given to angle 5?

(vi) What is the relation between angles 1, 2, 3 and 4?



Ans. (i) QR is the refracted ray. (ii) RS is the emergent ray. (iii) Angle 1 is called angle of incidence.

(iv) Angle 3 is called angle of deviation. (v) Angle 5 is the angle of refraction on face AB. (vi) < 2 + < 3 = <1 + <4 .

22. Why does sun appear bigger during sunset or sunrise?

Ans. The atmosphere consists of a number of layers of air of varying densities, such that the densest layer is close the surface of earth and rarest layer far away from the surface of the earth.The rays of light coming from the heavenly bodies such as Sun, Moon and stars on passing through the atmosphere, bend towards the normal and hence when they reach the eye, then the heavenly bodies appear at some other point than their actual position and also closer to the earth.

During sunset or sunrise, the rays coming from the Sun pass through maximum depth of atmosphere and hence suffer maximum refraction. Thus, the apparent image of the Sun is formed very close to the earth. Thus, the Sun appears bigger, during sunrise or sunset.

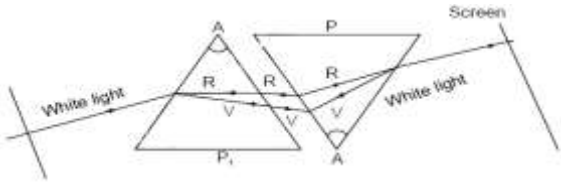
23. Why do the distant hills covered with trees appear blue?

Ans. In the thick growth of trees on the hills there is always present tiny droplets of water in air. When the white light passes through moisture laden air, the blue light is scattered. When this scattered blue light reaches our eyes, the hills appear blue.

24. Why do motorists use orange lights, rather than normal white light on a foggy day?

Ans. If a motorist uses normal white light while driving in fog, then tiny droplets of water in air scatter large amount of blue light. This scattered blue light on reaching the eyes, decreases visibility and hence driving becomes extremely difficult. However, when orange lights are used, they do not get scattered on account of their longer wavelengths. Thus, the driver can see clearly in the fog.

25. How will you use two identical prisms so that a narrow beam of white light incident on one prism emerges out of the second prism as white light? Draw the diagram.



Ans. By using two identical prisms, one placed inverted with respect to the other.

26. By giving reasons state your observations when a parallel beam of white light :

(i) is passed through by hypo-solution and then focussed on a white screen

(ii) is passed through hypo-solution (to which few drops of sulphuric acid is added) and then focussed on a white screen.

Ans. (i) The path of white light is not visible in the hypo-solution. The beam focuses on the white screen as a bright white spot.

Reason: The white light does not get scattered because the size of particles in the hyposolution is too small compared to the wavelengths in white light.

(ii) (a) In 2-3 minutes, after the addition of sulphuric acid, the sides of container start emiting blue light.

(b) The light coming out of the container is initially orange, then red and focusses on the screen. This light gradually changes to crimson red.

Reason : The sulphuric acid reacts with hypo solution to form colloidal sulphur. Initially these sulphur particles are very small and hence scatter blue light. Thus, the deficient light passing out of the container is orange in colour. However, as the reaction proceeds, more and more colloidal particles of sulphur are formed. These sulphur particles then join to form bigger Sulphur particles. These bigger particles scatter red colour and hence the light coming out of the container is crimson red.

27. State two factors on which the lateral displacement of the emergent ray in a rectangular glass slab depends for an oblique incident ray on the opposite face

Ans: The thickness of the glass slab and the optical density of the glass slab affect the lateral displacement of the emergent ray.

28. What is meant by 'total internal reflection'? State two essential conditions for total internal reflection to take place. With the help of a ray diagram, illustrate an application of total internal reflection.

Ans: When light passes from one medium to other, it bends from its path which is called refraction. When a light ray passes from denser to rarer medium, at some angle of incidence it does not go out of the denser medium but just grazes along the boundary (i.e. angle of refraction = 90^0). This angle of incidence is called critical angle.

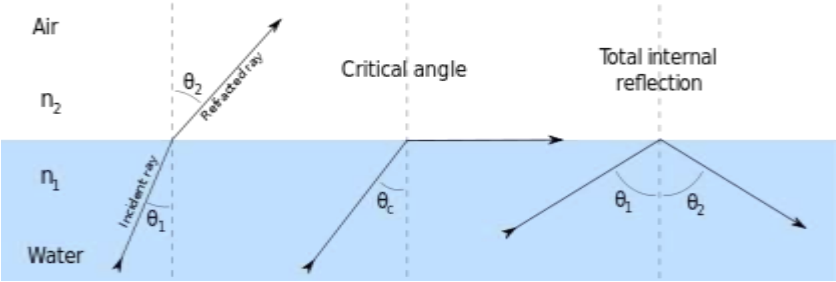
Now, if you increase this angle of incidence, light ray is reflected back into the denser medium, which is called total internal reflection. The light ray is reflected every time it hits the boundary because angle if incidence is equal to angle of reflection, and is not able to come out of the medium. This phenomenon is called total internal reflection.

The conditions for total internal reflection are:

(i) the light ray must be travelling from optically denser medium to rarer medium and

(ii) the angle of incidence must be greater than the critical angle.

Optical fiber communication uses the principle of total internal reflection for transferring data through optical fibers.



29. If a fish inside a pond is viewing a man outside the pond then, how will the image of the man appear?

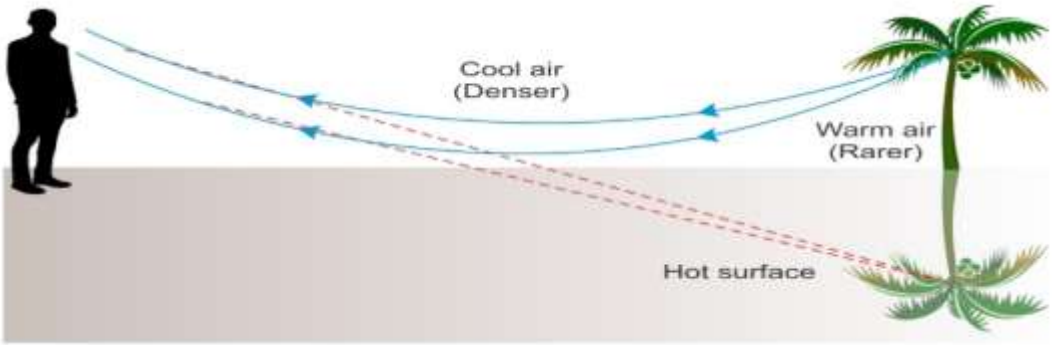
Ans: Due to the refraction of light rays, to the fish, the man would appear to be higher than he actually is.

30. Describe how can we see the sun 2 min. before sunrise and 2 min delayed after sunset?

Answer: Sun can be seen about two minutes before actual sunrise because of refraction of sunlight through the atmosphere. When the sun is just below the horizon, sunlight enters the earth 's atmosphere obliquely and gets refracted through the different layers of the atmosphere. As a result of this, sunlight gets bent and reaches the eyes of an observer. Following the path of the light rays entering the eyes, the observer sees the sun slightly above its actual position. As a result of this, sun can be seen about two minutes before the actual sunrise.

31. What is mirage?

Ans: A mirage is an optical phenomenon that creates the illusion of water and results from the refraction of light through a non-uniform medium. Mirages are most commonly observed on sunny days when driving down a roadway. As you drive down the roadway, there appears to be a puddle of water on the road several yards (maybe one-hundred yards) in front of the car. Of course, when you arrive at the perceived location of the puddle, you recognize that the puddle is not there. Instead, the puddle of water appears to be another one-hundred yards in front of you. You could carefully match the perceived location of the water to a roadside object; but when you arrive at that object, the puddle of water is still not on the roadway. The appearance of the water is simply an illusion.



32. What is Looming?

Ans: Looming: In very cold regions the lower layers of air are cooled so much that its density increases down wards rapidly. Rays from a distant object, bends more and more away from the normal and suffer total reflection. The rays then proceeds downwards depending more and more towards the normal and ultimately appear to an observer to be emanating from an object hanging inverted in the sky.